SUB#

188. Let the original total weight be x. Weight of container $= \frac{25}{100} x = \frac{x}{4}$.

Original weight of fluid $= \left(x - \frac{x}{4}\right) = \frac{3x}{4}$.

New weight of (container + fluid) $= \frac{50}{100} x = \frac{x}{2}$. New weight of fluid $= \left(\frac{x}{2} - \frac{x}{4}\right) = \frac{x}{4}$.

∴ Required fraction $= \frac{\left(\frac{3x}{4} - \frac{x}{4}\right)}{\frac{3x}{4}} = \frac{x}{2} \times \frac{4}{3x} = \frac{2}{3}$.

189. Let total quantity of original milk = 1000 gm.
Milk after first operation = 80% of 1000 = 800 gm.
Milk after second operation = 80% of 800 = 640 gm.
Milk after third operation = 80% of 640 = 512 gm.
∴ Strength of final mixture = 51.2%.

190. Let the capacity of the tank be 100 litres. Then,
Initially : A type petrol = 100 litres.
After first operation :

A type petrol $= \left(\frac{100}{2}\right) = 50$ litres; B type petrol = 50 litres.

After second operation :

A type petrol $= \left(\frac{50}{2} + 50\right) = 75$ litres; B type petrol $= \left(\frac{50}{2}\right) = 25$ litres.

After third operation :

A type petrol $= \left(\frac{75}{2}\right) = 37.5$ litres; B type petrol $= \left(\frac{25}{2} + 50\right) = 62.5$ litres.

∴ Required percentage = 37.5%.

191. Total money = Rs. $\left(600 \times \frac{25}{100} + 1200 \times \frac{50}{100}\right)$ = Rs. 750.

25 paise coins removed $= \left(\frac{12}{100} \times 600\right) = 72$.

50 paise coins removed $= \left(\frac{24}{100} \times 1200\right) = 288$.

Money removed = Rs. $\left(72 \times \frac{25}{100} + 288 \times \frac{50}{100}\right)$ = Rs. 162.

∴ Required percentage $= \left(\frac{162}{750} \times 100\right)\% = 21.6\%$.

192. Let the original price be Rs. 100 per kg.
Money required to buy 49 kg of rice = Rs. (100 × 49) = Rs. 4900.
New price = Rs. 98 per kg.

∴ Quantity of rice bought $= \left(\frac{4900}{98}\right)$ kg = 50 kg.

SUB#

193. Let original price = Rs. x per kg. Reduced price = Rs. $\left(\frac{79x}{100}\right)$ per kg.

$$\therefore \quad \frac{100}{\frac{79x}{100}} - \frac{100}{x} = 10.5 \quad \Leftrightarrow \quad \frac{10000}{79x} - \frac{100}{x} = 10.5$$

$$\Leftrightarrow \quad 10000 - 7900 = 10.5 \times 79x \quad \Leftrightarrow \quad x = \frac{2100}{10.5 \times 79}.$$

$$\therefore \quad \text{Reduced price} = \text{Rs.}\left(\frac{79}{100} \times \frac{2100}{10.5 \times 79}\right) \text{ per kg} = \text{Rs. 2 per kg.}$$

194. Let the original price per egg be Rs. x. Then, increased price = Rs. $\left(\frac{130}{100}x\right)$.

$$\therefore \quad \frac{7.80}{x} - \frac{7.80}{\frac{130}{100}x} = 3 \quad \Leftrightarrow \quad \frac{7.80}{x} - \frac{780}{130x} = 3$$

$$\Leftrightarrow \quad 1014 - 780 = 3 \times 130x \quad \Leftrightarrow \quad 390x = 234 \quad \Leftrightarrow \quad x = 0.6.$$

So, present price per dozen = Rs. $\left(12 \times \frac{130}{100} \times 0.6\right)$ = Rs. 9.36.

195. Let original price = Rs. x per kg. Reduced price = Rs. $\left(\frac{90x}{100}\right)$ per kg.

$$\therefore \quad \frac{279}{\left(\frac{90x}{100}\right)} - \frac{279}{x} = 6.2 \quad \Leftrightarrow \quad \frac{27900}{90x} - \frac{279}{x} = 6.2$$

$$\Leftrightarrow \quad 27900 - 25110 = 6.2 \times 90x$$

$$\Leftrightarrow \quad 558x = 2790 \quad \Leftrightarrow \quad x = 5.$$

$\therefore$ Required difference = 10% of Rs. 5 = Re. 0.50.

196. $n(A) = 34$, $n(B) = 42$, $n(A \cap B) = 20$.

So, $n(A \cup B) = n(A) + n(B) - n(A \cap B) = 34 + 42 - 20 = 56$.

$\therefore$ Percentage failed in either or both the subjects = 56.

Hence, percentage passed = $(100 - 56)\% = 44\%$.

197. $n(A) = 40$, $n(B) = 50$, $n(A \cap B) = 10$.

$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 40 + 50 - 10 = 80$.

$\therefore$ Percentage reading either or both newspapers = 80%.

Hence, percentage reading neither newspaper = $(100 - 80)\% = 20\%$.

198. $n(A) = 325$, $n(B) = 175$, $n(A \cup B) = 450 - 50 = 400$.

Required number = $n(A \cap B) = n(A) + n(B) - n(A \cup B) = 325 + 175 - 400 = 100$.

199. $n(A) = \left(\frac{60}{100} \times 96\right) = \frac{288}{5}$, $n(B) = \left(\frac{30}{100} \times 96\right) = \frac{144}{5}$, $n(A \cap B) = \left(\frac{15}{100} \times 96\right) = \frac{72}{5}$.

$$\therefore \quad n(A \cup B) = n(A) + n(B) - n(A \cap B) = \frac{288}{5} + \frac{144}{5} - \frac{72}{5} = \frac{360}{5} = 72.$$

So, people who had either or both types of lunch = 72.

Hence, people who had neither type of lunch = $(96 - 72) = 24$.

200. $n(A) = \left(\dfrac{75}{100} \times 600\right) = 450, n(B) = \left(\dfrac{45}{100} \times 600\right) = 270, n(A \cup B) = 600.$

∴ $n(A \cap B) = n(A) + n(B) - n(A \cup B) = (450 + 270 - 600) = 120.$

201. Let total number be x. Then,

$n(A) = \dfrac{72}{100} x = \dfrac{18x}{25}, n(B) = \dfrac{44}{100} x = \dfrac{11x}{25}$ and $n(A \cap B) = 40.$

$n(A \cup B) = n(A) + n(B) - n(A \cup B)$

⟹ $x = \dfrac{18x}{25} + \dfrac{11x}{25} - 40 \Rightarrow \dfrac{29x}{25} - x = 40 \Rightarrow \dfrac{4x}{25} = 40 \Rightarrow x = 250.$

202. Let the total number of students be x.

Number passed in one or both is given by :

$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 65\%$ of $x + 60\%$ of $x - 40\%$ of x

$= \left(\dfrac{65}{100} x + \dfrac{60}{100} x - \dfrac{40}{100} x\right) = \dfrac{85}{100} x = \dfrac{17}{20} x.$

Failed in both $= \left(x - \dfrac{17}{20} x\right) = \dfrac{3x}{20}.$

∴ $\dfrac{3x}{20} = 90 \Leftrightarrow x = \left(\dfrac{90 \times 20}{3}\right) = 600.$

203. Failed in 1st subject $= \left(\dfrac{35}{100} \times 2500\right) = 875.$

Failed in 2nd subject $= \left(\dfrac{42}{100} \times 2500\right) = 1050.$

Failed in both $= \left(\dfrac{15}{100} \times 2500\right) = 375.$

Failed in 1st subject only $= (875 - 375) = 500.$

Failed in 2nd subject only $= (1050 - 375) = 675.$

∴ Passed in 2nd only + Passed in 1st only $= (675 + 500) = 1175.$

11. PROFIT AND LOSS

IMPORTANT FACTS

Cost Price : The price at which an article is purchased, is called its *cost price*, abbreviated as *C.P.*

Selling Price : The price at which an article is sold, is called its *selling price*, abbreviated as *S.P.*

Profit or Gain : If S.P. is greater than C.P., the seller is said to have a *profit* or *gain*.

Loss : If S.P. is less than C.P., the seller is said to have incurred a *loss*.

FORMULAE

1. Gain = (S.P.) − (C.P.)
2. Loss = (C.P.) − (S.P.)

3. Loss or gain is always reckoned on C.P.

4. $\text{Gain}\% = \left(\dfrac{\text{Gain} \times 100}{\text{C.P.}}\right)$

5. $\text{Loss}\% = \left(\dfrac{\text{Loss} \times 100}{\text{C.P.}}\right)$

6. $\text{S.P.} = \dfrac{(100 + \text{Gain}\%)}{100} \times \text{C.P.}$

7. $\text{S.P.} = \dfrac{(100 - \text{Loss}\%)}{100} \times \text{C.P.}$

8. $\text{C.P.} = \dfrac{100}{(100 + \text{Gain}\%)} \times \text{S.P.}$

9. $\text{C.P.} = \dfrac{100}{(100 - \text{Loss}\%)} \times \text{S.P.}$

10. If an article is sold at a gain of say, 35%, then S.P. = 135% of C.P.

11. If an article is sold at a loss of say, 35%, then S.P. = 65% of C.P.

12. When a person sells two similar items, one at a gain of say, $x\%$, and the other at a loss of $x\%$, then the seller always incurs a loss given by :

$$\text{Loss}\% = \left(\frac{\text{Common Loss and Gain}\%}{10}\right)^2 = \left(\frac{x}{10}\right)^2.$$

13. If a trader professes to sell his goods at cost price, but uses false weights, then

$$\text{Gain}\% = \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\right]\%.$$

SOLVED EXAMPLES

Ex. 1. *A man buys an article for Rs. 27.50 and sells it for Rs. 28.60. Find his gain percent.*

Sol.   C.P. = Rs. 27.50, S.P. = Rs. 28.60.

So, Gain = Rs. (28.60 − 27.50) = Rs. 1.10.

∴ $\text{Gain}\% = \left(\dfrac{1.10}{27.50} \times 100\right)\% = 4\%.$

Ex. 2. *If a radio is purchased for Rs. 490 and sold for Rs. 465.50, find the loss percent.*

Sol.   C.P. = Rs. 490, S.P. = Rs. 465.50.

Loss = Rs. (490 − 465.50) = Rs. 24.50.

$\therefore$ Loss% = $\left(\dfrac{24.50}{490} \times 100\right)$% = 5%.

Ex. 3. *Find S.P., when*

(i) *C.P. = Rs. 56.25, Gain = 20%*   (ii) *C.P. = Rs. 80.40, Loss = 5%*

Sol.   (i) S.P = 120% of Rs. 56.25 = Rs. $\left(\dfrac{120}{100} \times 56.25\right)$ = Rs. 67.50.

(ii) S.P. = 85% of Rs. 80.40 = Rs. $\left(\dfrac{85}{100} \times 80.40\right)$ = Rs. 68.34.

Ex. 4. *Find C.P., when*

(i) *S.P. = Rs. 40.60, Gain = 16%*   (ii) *S.P. = Rs. 51.70, Loss = 12%*

Sol.   (i) C.P. = Rs. $\left(\dfrac{100}{116} \times 40.60\right)$ = Rs. 35.

(ii) C.P. = Rs. $\left(\dfrac{100}{88} \times 51.70\right)$ = Rs. 58.75.

Ex. 5. *A person incurs 5% loss by selling a watch for Rs. 1140. At what price should the watch be sold to earn 5% profit?*   (R.R.B. 2002)

Sol.   Let the new S.P. be Rs. *x*. Then,

(100 − loss%) : (1st S.P.) = (100 + gain%) : (2nd S.P.)

$\Rightarrow$ $\left(\dfrac{100-5}{1140}\right) = \left(\dfrac{100+5}{x}\right)$ $\Rightarrow$ $x = \left(\dfrac{105 \times 1140}{95}\right)$ = 1260.

$\therefore$ New S.P. = Rs. 1260.

Ex. 6. *A book was sold for Rs. 27.50 with a profit of 10%. If it were sold for Rs. 25.75, then what would have been the percentage of profit or loss?*

(Hotel Management, 2003)

Sol.   S.P. = Rs. 27.50, Profit = 10%.

So, C.P. = Rs. $\left(\dfrac{100}{110} \times 27.50\right)$ = Rs. 25.

When S.P. = Rs. 25.75, profit = Rs. (25.75 − 25) = Re. 0.75.

$\therefore$ Profit% = $\left(\dfrac{0.75}{25} \times 100\right)$% = 3%.

Ex. 7. *If the cost price is 96% of the selling price, then what is the profit percent?*

Sol.   Let S.P. = Rs. 100. Then, C.P. = Rs. 96; Profit = Rs. 4.

$\therefore$ Profit% = $\left(\dfrac{4}{96} \times 100\right)$% = $\dfrac{25}{6}$% = 4.17%.

Ex. 8. *The C.P. of 21 articles is equal to S.P. of 18 articles. Find the gain or loss percent.*

Sol.   Let C.P. of each article be Re. 1.

Then, C.P. of 18 articles = Rs. 18, S.P. of 18 articles = Rs. 21.

$\therefore$ Gain% = $\left(\dfrac{3}{18} \times 100\right)$% = $16\dfrac{2}{3}$%.

Ex. 9. *By selling 33 metres of cloth, one gains the selling price of 11 metres. Find the gain percent.* (Section Officers', 2001)

Sol. (S.P. of 33 m) – (C.P. of 33 m) = Gain = S.P. of 11 m.

∴ S.P. of 22 m = C.P. of 33 m.

Let C.P. of each metre be Re. 1. Then, C.P. of 22 m = Rs. 22, S.P. of 22 m = Rs. 33.

∴ Gain% $= \left(\frac{11}{22} \times 100\right)\% = 50\%$.

Ex. 10. *A vendor bought bananas at 6 for Rs. 10 and sold them at 4 for Rs. 6. Find his gain or loss percent.*

Sol. Suppose, number of bananas bought = L.C.M. of 6 and 4 = 12.

∴ C.P. = Rs. $\left(\frac{10}{6} \times 12\right)$ = Rs. 20; S.P. = Rs. $\left(\frac{6}{4} \times 12\right)$ = Rs. 18.

∴ Loss% $= \left(\frac{2}{20} \times 100\right)\% = 10\%$.

Ex. 11. *A man bought toffees at 3 for a rupee. How many for a rupee must he sell to gain 50%?*

Sol. C.P. of 3 toffees = Re. 1; S.P. of 3 toffees = 150% of Re. 1 = $\frac{3}{2}$.

For Rs. $\frac{3}{2}$, toffees sold = 3. For Re. 1, toffees sold = $\left(3 \times \frac{2}{3}\right)$ = 2.

Ex. 12. *A grocer purchased 80 kg of sugar at Rs. 13.50 per kg and mixed it with 120 kg sugar at Rs. 16 per kg. At what rate should he sell the mixture to gain 16%?*

Sol. C.P. of 200 kg of mixture = Rs. (80 × 13.50 + 120 × 16) = Rs. 3000.

S.P. = 116% of Rs. 3000 = Rs. $\left(\frac{116}{100} \times 3000\right)$ = Rs. 3480.

∴ Rate of S.P. of the mixture = Rs. $\left(\frac{3480}{200}\right)$ per kg = Rs. 17.40 per kg.

Ex. 13. *Pure ghee costs Rs. 100 per kg. After adulterating it with vegetable oil costing Rs. 50 per kg, a shopkeeper sells the mixture at the rate of Rs. 96 per kg, thereby making a profit of 20%. In what ratio does he mix the two?*

Sol. Mean cost price = Rs. $\left(\frac{100}{120} \times 96\right)$ = Rs. 80 per kg.

By the rule of alligation :

C.P. of 1 kg ghee   C.P. of 1 kg oil

100   50

Mean price

80
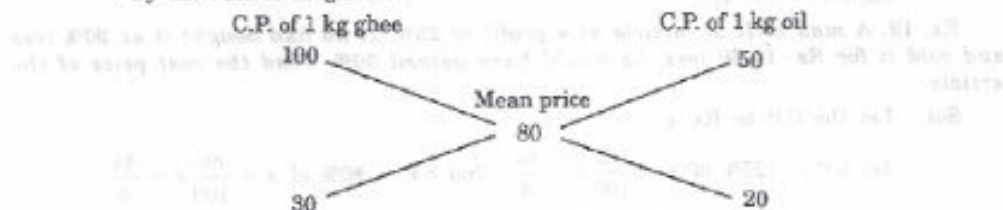
30   20

∴ Required ratio = 30 : 20 = 3 : 2.

Ex. 14. *A dishonest dealer professes to sell his goods at cost price but uses a weight of 960 gms for a kg. weight. Find his gain percent.*

Sol. Gain% $= \left[\frac{\text{Error}}{(\text{True Value}) - (\text{Error})} \times 100\right]\% = \left(\frac{40}{960} \times 100\right)\% = 4\frac{1}{6}\%$.

Ex. 15. *If the manufacturer gains 10%, the wholesale dealer 15% and the retailer 25%, then find the cost of production of a table, the retail price of which is Rs. 1265?*

Sol. Let the cost of production of the table be Rs. x.

Then, 125% of 115% of 110% of $x = 1265$

$\Rightarrow \quad \dfrac{125}{100} \times \dfrac{115}{100} \times \dfrac{110}{100} \times x = 1265 \quad \Rightarrow \quad \dfrac{253}{160} x = 1265 \quad \Rightarrow \quad x = \left(\dfrac{1265 \times 160}{253} \right) = $ Rs. 800.

Ex. 16. *Monika purchased a pressure cooker at $\dfrac{9}{10}$ th of its selling price and sold it at 8% more than its S.P. Find her gain percent.*

Sol. Let the S.P. be Rs. x. Then, C.P. = Rs. $\dfrac{9x}{10}$, Receipt = 108% of Rs. x = Rs. $\dfrac{27x}{25}$.

Gain = Rs. $\left(\dfrac{27x}{25} - \dfrac{9x}{10} \right)$ = Rs. $\left(\dfrac{108x - 90x}{100} \right)$ = Rs. $\dfrac{18x}{100}$.

$\therefore$ Gain% = $\left(\dfrac{18x}{100} \times \dfrac{10}{9x} \times 100 \right)$% = 20%.

Ex. 17. *An article is sold at a certain price. By selling it at $\dfrac{2}{3}$ of that price one loses 10%. Find the gain percent at original price.*

Sol. Let the original S.P. be Rs. x. Then, New S.P. = Rs. $\dfrac{2}{3} x$, Loss = 10%.

So, C.P. = Rs. $\left(\dfrac{100}{90} \times \dfrac{2}{3} x \right)$ = $\dfrac{20x}{27}$.

Now, C.P. = Rs. $\dfrac{20x}{27}$, S.P. = Rs. x. Gain = Rs. $\left(x - \dfrac{20x}{27} \right)$ = Rs. $\dfrac{7x}{27}$.

$\therefore$ Gain% = $\left(\dfrac{7x}{27} \times \dfrac{27}{20x} \times 100 \right)$% = 35%.

Ex. 18. *A tradesman sold an article at a loss of 20%. If the selling price had been increased by Rs. 100, there would have been a gain of 5%. What was the cost price of the article ?*
(S.S.C. 2004)

Sol. Let C.P. be Rs. x. Then, (105% of x) − (80% of x) = 100 or 25% of x = 100

$\therefore \quad \dfrac{x}{4} = 100$ or $x = 400$.

So, C.P. = Rs. 400.

Ex. 19. *A man sells an article at a profit of 25%. If he had bought it at 20% less and sold it for Rs. 10.50 less, he would have gained 30%. Find the cost price of the article.*

Sol. Let the C.P. be Rs. x.

1st S.P. = 125% of x = $\dfrac{125}{100} x = \dfrac{5x}{4}$; 2nd S.P. = 80% of x = $\dfrac{80}{100} x = \dfrac{4x}{5}$.

2nd S.P. = 130% of $\dfrac{4x}{5}$ = $\left(\dfrac{130}{100} \times \dfrac{4x}{5} \right)$ = $\dfrac{26x}{25}$.

$\therefore \quad \dfrac{5x}{4} - \dfrac{26x}{25} = 10.50 \Leftrightarrow \dfrac{21x}{100} = 10.50 \Leftrightarrow x = \left(\dfrac{10.50 \times 100}{21} \right) = 50$.

Hence, C.P. = Rs. 50.

SUB#

Ex. 20. *The price of a jewel, passing through three hands, rises on the whole by 65%. If the first and the second sellers earned 20% and 25% profit respectively, find the percentage profit earned by the third seller.*

Sol. Let the original price of the jewel be Rs. P and let the profit earned by the third seller be $x\%$.

Then, $(100 + x)\%$ of 125% of 120% of P = 165% of P

$\Rightarrow \left[\dfrac{(100 + x)}{100} \times \dfrac{125}{100} \times \dfrac{120}{100} \times P\right] = \left(\dfrac{165}{100} \times P\right)$

$\Rightarrow (100 + x) = \left(\dfrac{165 \times 100 \times 100}{125 \times 120}\right) = 110 \Rightarrow x = 10\%.$

Ex. 21. *A man sold two flats for Rs. 6,75,958 each. On one he gains 16% while on the other he loses 16%. How much does he gain or lose in the whole transaction ?*

Sol. **Remember :** In such a case, there is always a loss. The selling price is immaterial.

$\therefore$ Loss% $= \left(\dfrac{\text{Common Loss and Gain}\%}{10}\right)^2 = \left(\dfrac{16}{10}\right)^2\% = \left(\dfrac{64}{25}\right)\% = 2.56\%.$

Ex. 22. *A dealer sold three-fourth of his articles at a gain of 20% and the remaining at cost price. Find the gain earned by him in the whole transaction.*

Sol. Let C.P. of whole be Rs. x.

C.P. of $\dfrac{3}{4}$th = Rs. $\dfrac{3x}{4}$, C.P. of $\dfrac{1}{4}$th = Rs. $\dfrac{x}{4}$.

$\therefore$ Total S.P. = Rs. $\left[\left(120\% \text{ of } \dfrac{3x}{4}\right) + \dfrac{x}{4}\right]$ = Rs. $\left(\dfrac{9x}{10} + \dfrac{x}{4}\right)$ = Rs. $\dfrac{23x}{20}$.

Gain = Rs. $\left(\dfrac{23x}{20} - x\right)$ = Rs. $\dfrac{3x}{20}$.

$\therefore$ Gain% $= \left(\dfrac{3x}{20} \times \dfrac{1}{x} \times 100\right)\% = 15\%.$

Ex. 23. *A man bought a horse and a carriage for Rs. 3000. He sold the horse at a gain of 20% and the carriage at a loss of 10%, thereby gaining 2% on the whole. Find the cost of the horse.* **(M.B.A. 2002)**

Sol. Let the C.P. of the horse be Rs. x. Then, C.P. of the carriage = Rs. $(3000 - x)$.

$\therefore$ 20% of $x - 10\%$ of $(3000 - x)$ = 2% of 3000

$\Rightarrow \dfrac{x}{5} - \dfrac{(3000 - x)}{10} = 60 \Rightarrow 2x - 5000 + x = 600 \Rightarrow 3x = 3600 \Rightarrow x = 1200.$

Hence, C.P. of the horse = Rs. 1200.

Ex. 24. *Find the single discount equivalent to a series discount of 20%, 10% and 5%.*

Sol. Let marked price be Rs. 100.

Then, Net S.P. = 95% of 90% of 80% of Rs. 100

= Rs. $\left(\dfrac{95}{100} \times \dfrac{90}{100} \times \dfrac{80}{100} \times 100\right)$ = Rs. 68.40.

$\therefore$ Required discount = $(100 - 68.40)\% = 31.6\%.$

Ex. 25. *After getting two successive discounts, a shirt with a list price of Rs. 150 is available at Rs. 105. If the second discount is 12.5%, find the first discount.*

Sol. Let the first discount be $x\%$.

Then, 87.5% of $(100 - x)\%$ of 150 = 105

$\Rightarrow \dfrac{87.5}{100} \times \dfrac{(100 - x)}{100} \times 150 = 105 \Rightarrow 100 - x = \left(\dfrac{105 \times 100 \times 100}{150 \times 87.5}\right) = 80$

$\Rightarrow x = (100 - 80) = 20.$

$\therefore$ First discount = 20%.

Ex. 26. *An uneducated retailer marks all his goods at 50% above the cost price and thinking that he will still make 25% profit, offers a discount of 25% on the marked price. What is his actual profit on the sales ?* (IGNOU, 2003)

Sol. Let C.P. = Rs. 100. Then, marked price = Rs. 150.
S.P. = 75% of Rs. 150 = Rs. 112.50.
∴ Gain% = 12.50%.

Ex. 27. *A retailer buys 40 pens at the marked price of 36 pens from a wholesaler. If he sells these pens giving a discount of 1%, what is the profit percent ?* (S.S.C. 2003)

Sol. Let the marked price of each pen be Re. 1.
Then, C.P. of 40 pens = Rs. 36. S.P. of 40 pens = 99% of Rs. 40 = Rs. 39.60.

∴ Profit% = $\left(\dfrac{3.60}{36} \times 100\right)$% = 10%.

Ex. 28. *At what percentage above the C.P. must an article be marked so as to gain 33% after allowing a customer a discount of 5% ?* (M.B.A. 2003)

Sol. Let C.P. = Rs. 100. Then, S.P. = Rs. 133.
Let marked price be Rs. x.

Then, 95% of x = 133 ⇒ $\dfrac{95}{100}x = 133$ ⇒ $x = \left(133 \times \dfrac{100}{95}\right) = 140.$

∴ Marked price = 40% above C.P.

Ex. 29. *When a producer allows 36% commission on the retail price of his product, he earns a profit of 8.8%. What would be his profit percent if the commission is reduced by 24% ?* (M.B.A. 2002)

Sol. Let retail price = Rs. 100. Then, commission = Rs. 36.
∴ S.P. = Rs. (100 − 36) = Rs. 64.
But, profit = 8.8%.

∴ C.P. = Rs. $\left(\dfrac{100}{108.8} \times 64\right)$ = Rs. $\dfrac{1000}{17}$.

Now commission = Rs. 12. New S.P. = Rs. (100 − 12) = Rs. 88.

Gain = Rs. $\left(88 - \dfrac{1000}{17}\right)$ = Rs. $\dfrac{496}{17}$.

∴ Gain% = $\left(\dfrac{496}{17} \times \dfrac{17}{1000} \times 100\right)$% = 49.6%.

EXERCISE 11A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer :*

1. I gain 70 paise on Rs. 70. My gain percent is :
   (a) 0.1%   (b) 1%   (c) 7%   (d) 10%

2. In terms of percentage profit, which is the best transaction ? (C.B.I. 2003)

	C.P. (in Rs.)	Profit (in Rs.)
(a)	36	17
(b)	50	24
(c)	40	19
(d)	60	29

3. If books bought at prices ranging from Rs. 200 to Rs. 350 are sold at prices ranging from Rs. 300 to Rs. 425, what is the greatest possible profit that might be made in selling eight books ?

   (a) Rs. 400   (b) Rs. 600

   (c) Cannot be determined   (d) None of these

4. A shopkeeper sold an article for Rs. 2090.42. Approximately, what will be the percentage profit if he sold that article for Rs. 2602.58 ?

   (a) 15%   (b) 20%   (c) 25%   (d) 30%

5. Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800, his gain percent is :   (R.R.B. 2003)

   (a) $4\frac{4}{7}$%   (b) $5\frac{5}{11}$%   (c) 10%   (d) 12%

6. A shopkeeper purchased 70 kg of potatoes for Rs. 420 and sold the whole lot at the rate of Rs. 6.50 per kg. What will be his gain percent ?   (S.S.C. 2003)

   (a) $4\frac{1}{6}$%   (b) $6\frac{1}{4}$%   (c) $8\frac{1}{3}$%   (d) 20%

7. Sam purchased 20 dozens of toys at the rate of Rs. 375 per dozen. He sold each one of them at the rate of Rs. 33. What was his percentage profit ? (Bank P.O. 2000)

   (a) 3.5   (b) 4.5   (c) 5.6   (d) 6.5   (e) None of these

8. 100 oranges are bought at the rate of Rs. 350 and sold at the rate of Rs. 48 per dozen. The percentage of profit or loss is :   (S.S.C. 2003)

   (a) $14\frac{2}{7}$% gain   (b) 15% gain   (c) $14\frac{2}{7}$% loss   (d) 15% loss

9. A man buys a cycle for Rs. 1400 and sells it at a loss of 15%. What is the selling price of the cycle ?   (S.S.C. 2002)

   (a) Rs. 1090   (b) Rs. 1160   (c) Rs. 1190   (d) Rs. 1202

10. A sells an article which costs him Rs. 400 to B at a profit of 20%. B then sells it to C, making a profit of 10% on the price he paid to A. How much does C pay B ?

   (a) Rs. 472   (b) Rs. 476   (c) Rs. 528   (d) Rs. 532

11. Peter purchased a machine for Rs. 80,000 and spent Rs. 5000 on repair and Rs. 1000 on transpo.' and sold it with 25% profit. At what price did he sell the machine ?

   (a) Rs. 1,05,100   (b) Rs. 1,06,250   (c) Rs. 1,07,500

   (d) Rs. 1,17,500   (e) None of these   (Bank P.O. 1998)

12. By selling an article for Rs. 100, a man gains Rs. 15. Then, his gain% is :

   (a) 15%   (b) $12\frac{2}{3}$%   (c) $17\frac{11}{17}$%   (d) $17\frac{1}{4}$%

13. When a commodity is sold for Rs. 34.80, there is a loss of 2%. What is the cost price of the commodity ?

   (a) Rs. 26.10   (b) Rs. 43   (c) Rs. 43.20   (d) Rs. 46.40

14. A shopkeeper expects a gain of $22\frac{1}{2}$% on his cost price. If in a week, his sale was of Rs. 392, what was his profit ?   (Bank P.O. 2003)

   (a) Rs. 18.20   (b) Rs. 70   (c) Rs. 72   (d) Rs. 88.25

15. The sale price of an article including the sales tax is Rs. 616. The rate of sales tax is 10%. If the shopkeeper has made a profit of 12%, then the cost price of the article is :

   (a) Rs. 500   (b) Rs. 515   (c) Rs. 550   (d) Rs. 600

16. Saransh purchased 120 reams of paper at Rs. 80 per ream. He spent Rs. 280 on transportation, paid octroi at the rate of 40 paise per ream and paid Rs. 72 to the coolie. If he wants to have a gain of 8%, what must be the selling price per ream ?
    (a) Rs. 86   (b) Rs. 87.48   (c) Rs. 89   (d) Rs. 90

17. A person bought 20 litres of milk at the rate of Rs. 8 per litre. He got it churned after spending Rs. 10 and 5 kg of cream and 20 litres of toned milk were obtained. If he sold the cream at Rs. 30 per kg and toned milk at Rs. 4 per litre, his profit in the transaction is :
    (a) 25%   (b) 35.3%   (c) 37.5%   (d) 42.5%

18. Jacob bought a scooter for a certain sum of money. He spent 10% of the cost on repairs and sold the scooter for a profit of Rs. 1100. How much did he spend on repairs if he made a profit of 20% ?   (Assistant Grade, 1997)
    (a) Rs. 400   (b) Rs. 440   (c) Rs. 500   (d) Rs. 550

19. A manufacturer undertakes to supply 2000 pieces of a particular component at Rs. 25 per piece. According to his estimates, even if 5% fail to pass the quality tests, then he will make a profit of 25%. However, as it turned out, 50% of the components were rejected. What is the loss to the manufacturer ?   (M.A.T. 2003)
    (a) Rs. 12,000   (b) Rs. 13,000   (c) Rs. 14,000   (d) Rs. 15,000

20. A trader buys a chair for Rs. 600 and sells it for Rs. 765 at a credit of 4 months. Reckoning money worth 6% p.a., his gain percent is :
    (a) 20%   (b) $22\frac{1}{2}$%   (c) 25%   (d) $27\frac{1}{2}$%

21. When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must the plot be sold in order to gain 15% ?   (A.A.O. Exam, 2003)
    (a) Rs. 21,000   (b) Rs. 22,500   (c) Rs. 25,300   (d) Rs. 25,800

22. A fruitseller sells mangoes at the rate of Rs. 9 per kg and thereby loses 20%. At what price per kg, he should have sold them to make a profit of 5% ?   (R.R.B. 2002)
    (a) Rs. 11.81   (b) Rs. 12   (c) Rs. 12.25   (d) Rs. 12.31

23. A property dealer sells a house for Rs. 6,30,000 and in the bargain makes a profit of 5%. Had he sold it for Rs. 5,00,000, then what percentage of loss or gain he would have made ?   (Hotel Management, 2001)
    (a) $2\frac{1}{4}$% gain   (b) 10% loss   (c) $12\frac{1}{2}$% loss   (d) $16\frac{2}{3}$% loss

24. A shopkeeper sells one transistor for Rs. 840 at a gain of 20% and another for Rs. 960 at a loss of 4%. His total gain or loss percent is :   (Hotel Management, 1999)
    (a) $5\frac{15}{17}$% loss   (b) $5\frac{15}{17}$% gain   (c) $6\frac{2}{3}$% gain   (d) None of these

25. If selling price of an article is $\frac{4}{3}$ of its cost price, the profit in the transaction is :
    (a) $16\frac{2}{3}$%   (b) $20\frac{1}{2}$%   (c) $25\frac{1}{2}$%   (d) $33\frac{1}{3}$%

26. The ratio of the cost price and the selling price is 4 : 5. The profit percent is :
    (a) 10%   (b) 20%   (c) 25%   (d) 30%
                                                              (Hotel Management, 2003)

27. The ratio between the sale price and the cost price of an article is 7 : 5. What is the ratio between the profit and the cost price of that article ?   (Bank P.O. 2000)
    (a) 2 : 7   (b) 5 : 2   (c) 7 : 2
    (d) Data inadequate   (e) None of these

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28. A man gains 20% by selling an article for a certain price. If he sells it at double the price, the percentage of profit will be :   (S.S.C. 2004)
  (a) 40   (b) 100   (c) 120   (d) 140

29. If selling price is doubled, the profit triples. Find the profit percent :(M.A.T. 2001)
  (a) $66\frac{2}{3}$ (b) 100   (c) $105\frac{1}{3}$ (d) 120

30. At what profit percent must an article be sold so that by selling at half that price, there may be a loss of 30% ?
  (a) 25%   (b) 36%   (c) 40%   (d) 42%

31. The C.P. of an article is 40% of the S.P. The percent that the S.P. is of C.P. is :
  (a) 250   (b) 240   (c) 60   (d) 40

32. By selling a pen for Rs. 15, a man loses one-sixteenth of what it costs him. The cost price of the pen is :
  (a) Rs. 16   (b) Rs. 18   (c) Rs. 20   (d) Rs. 21

33. By selling an article, Michael earned a profit equal to one-fourth of the price he bought it. If he sold it for Rs. 375, what was the cost price ?
  (a) Rs. 281.75   (b) Rs. 300   (c) Rs. 312.50   (d) Rs. 350

34. 10% loss on selling price is what percent loss on the cost price ?
  (a) $9\frac{1}{11}$%   (b) $9\frac{2}{11}$%   (c) 10%   (d) 11%

35. If loss is $\frac{1}{3}$ of S.P., the loss percentage is :
  (a) $16\frac{2}{3}$%   (b) 20%   (c) 25%   (d) $33\frac{1}{3}$%

36. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit ?   (M.A.T. 1998)
  (a) 30%   (b) 70%   (c) 100%   (d) 250%

37. The profit earned by selling an article for Rs. 832 is equal to the loss incurred when the same article is sold for Rs. 448. What should be the sale price for making 50% profit ?   (Bank P.O. 2000)
  (a) Rs. 920   (b) Rs. 960   (c) Rs. 1060   (d) Rs. 1200   (e) None of these

38. The profit earned by selling an article for Rs. 900 is double the loss incurred when the same article is sold for Rs. 450. At what price should the article be sold to make 25% profit ?
  (a) Rs. 600   (b) Rs. 750   (c) Rs. 800   (d) Data inadequate

39. The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit ?   (SIDBI, 2000)
  (a) Rs. 2000   (b) Rs. 2200   (c) Rs. 2400
  (d) Data inadequate   (e) None of these

40. Profit earned by selling an article for Rs. 1060 is 20% more than the loss incurred by selling the article for Rs. 950. At what price should the article be sold to earn 20% profit ?
  (a) Rs. 980   (b) Rs. 1080   (c) Rs. 1800   (d) None of these

41. If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percent is :
  (a) 25%   (b) $33\frac{1}{3}$%   (c) 50%   (d) $66\frac{2}{3}$%
                                                              (S.S.C. 2004)

42. The cost price of 19 articles is equal to the selling price of 16 articles. Gain percent is :

(a) $3\frac{9}{17}$%   (b) $15\frac{15}{19}$%   (c) $18\frac{3}{4}$%   (d) 20%

43. If the selling price of 50 articles is equal to the cost price of 40 articles, then the loss or gain percent is :   (Hotel Management, 2003)

(a) 20% loss   (b) 20% gain   (c) 25% loss   (d) 25% gain

44. If by selling 110 mangoes, the C.P. of 120 mangoes is realised, the gain percent is :

(a) $9\frac{1}{11}$%   (b) $9\frac{1}{9}$%   (c) $10\frac{10}{11}$%   (d) $11\frac{1}{9}$%

45. The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is :   (M.A.T. 2004)

(a) 15   (b) 16   (c) 18   (d) 25

46. On an order of 5 dozen boxes of a consumer product, a retailer receives an extra dozen free. This is equivalent to allowing him a discount of :   (C.B.I. 1997)

(a) 15%   (b) $16\frac{1}{6}$%   (c) $16\frac{2}{3}$%   (d) 20%

47. A man sold 18 cots for Rs. 16,800, gaining thereby the cost price of 3 cots. The cost price of a cot is :   (S.S.C. 2000)

(a) Rs. 650   (b) Rs. 700   (c) Rs. 750   (d) Rs. 800

48. If on selling 12 notebooks, a seller makes a profit equal to the selling price of 4 notebooks, what is his percent profit ?   (Bank P.O. 2000)

(a) $16\frac{2}{3}$ (b) 25   (c) 50

(d) Data inadequate   (e) None of these

49. On selling 17 balls at Rs. 720, there is a loss equal to the cost price of 5 balls. The cost price of a ball is :   (S.S.C. 2004)

(a) Rs. 45   (b) Rs. 50   (c) Rs. 55   (d) Rs. 60

50. A vendor loses the selling price of 4 oranges on selling 36 oranges. His loss percent is :

(a) 10%   (b) $11\frac{1}{9}$%   (c) $12\frac{1}{2}$%   (d) None of these

51. A man buys 2 dozen bananas at Rs. 16 per dozen. After selling 18 bananas at the rate of Rs. 12 per dozen, the shopkeeper reduced the rate to Rs. 4 per dozen. The percent loss is :   (Section Officers', 2003)

(a) 25.2%   (b) 32.4%   (c) 36.5%   (d) 37.5%

52. A man bought apples at the rate of 8 for Rs. 34 and sold them at the rate of 12 for Rs. 57. How many apples should be sold to earn a net profit of Rs. 45 ?   (S.S.C. 2003)

(a) 90   (b) 100   (c) 135   (d) 150

53. Oranges are bought at the rate of 10 for Rs. 25 and sold at the rate of 9 for Rs. 25. The profit is :

(a) $9\frac{1}{11}$%   (b) 10%   (c) $11\frac{1}{9}$%   (d) $12\frac{1}{2}$%

54. Some articles were bought at 6 for Rs. 5 and sold at 5 for Rs. 6. Gain percent is :

(a) 30%   (b) $33\frac{1}{3}$%   (c) 35%   (d) 44%

(S.S.C. 2004)

55. A man bought some fruits at the rate of 16 for Rs. 24 and sold them at the rate of 8 for Rs. 18. What is the profit percent ?   (Bank P.O. 2003)

(a) 25%   (b) 40%   (c) 50%   (d) 60%   (e) None of these

56. A man purchased a box full of pencils at the rate of 7 for Rs. 9 and sold all of them at the rate of 8 for Rs. 11. In this transaction, he gained Rs. 10. How many pencils did the box contain ?   (C.B.I. 1997)

    (a) 100   (b) 112   (c) 114   (d) 115

57. A man bought a number of clips at 3 for a rupee and an equal number at 2 for a rupee. At what price per dozen should he sell them to make a profit of 20% ?

    (a) Rs. 4   (b) Rs. 5   (c) Rs. 6   (d) Rs. 7

58. A man buys eggs at 2 for Re. 1 and an equal number at 3 for Rs. 2 and sells the whole at 5 for Rs. 3. His gain or loss percent is :

    (a) $2\frac{2}{7}$% loss   (b) $3\frac{6}{7}$% gain   (c) $3\frac{2}{7}$% loss   (d) $2\frac{6}{7}$% gain

59. A man bought some oranges at Rs. 10 per dozen and bought the same number of oranges at Rs. 8 per dozen. He sold these oranges at Rs. 11 per dozen and gained Rs. 120. The total number of oranges bought by him was :

    (a) 30 dozens   (b) 40 dozens   (c) 50 dozens   (d) 60 dozens

60. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20% ?   (C.B.I. 1998)

    (a) 3   (b) 4   (c) 5   (d) 6

61. By selling 12 toffees for a rupee, a man loses 20%. How many for a rupee should he sell to get a gain of 20% ?   (R.R.B. 2003)

    (a) 5   (b) 8   (c) 10   (d) 15

62. By selling 45 lemons for Rs. 40, a man loses 20%. How many should he sell for Rs. 24 to gain 20% in the transaction ?

    (a) 16   (b) 18   (c) 20   (d) 22

63. A trader mixes 26 kg of rice at Rs. 20 per kg with 30 kg of rice of other variety at Rs. 36 per kg and sells the mixture at Rs. 30 per kg. His profit percent is :

    (a) No profit, no loss   (b) 5%   (c) 8%
    (d) 10%   (e) None of these   (Bank P.O. 2003)

64. Arun purchased 30 kg of wheat at the rate of Rs. 11.50 per kg and 20 kg of wheat at the rate of Rs. 14.25 per kg. He mixed the two and sold the mixture. Approximately what price per kg should he sell the mixture to make 30% profit ? (Bank P.O. 1999)

    (a) Rs. 14.80   (b) Rs. 15.40   (c) Rs. 15.60
    (d) Rs. 16.30   (e) Rs. 18.20

65. Padam purchased 30 kg of rice at the rate of Rs. 17.50 per kg and another 30 kg rice at a certain rate. He mixed the two and sold the entire quantity at the rate of Rs. 18.60 per kg and made 20% overall profit. At what price per kg did he purchase the lot of another 30 kg rice ?   (Bank P.O. 2000)

    (a) Rs. 12.50   (b) Rs. 13.50   (c) Rs. 14.50
    (d) Rs. 15.50   (e) None of these

66. A trader mixes three varieties of groundnuts costing Rs. 50, Rs. 20 and Rs. 30 per kg in the ratio 2 : 4 : 3 in terms of weight, and sells the mixture at Rs. 33 per kg. What percentage of profit does he make ?   (Hotel Management, 1998)

    (a) 8%   (b) 9%   (c) 10%   (d) None of these

67. A dairyman pays Rs. 6.40 per litre of milk. He adds water and sells the mixture at Rs. 8 per litre, thereby making 37.5% profit. The proportion of water to milk received by the customers is :   (M.A.T. 2003)

    (a) 1 : 10   (b) 1 : 12   (c) 1 : 15   (d) 1 : 20

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68. By mixing two brands of tea and selling the mixture at the rate of Rs. 177 per kg, a shopkeeper makes a profit of 18%. If to every 2 kg of one brand costing Rs. 200 per kg, 3 kg of the other brand is added, then how much per kg does the other brand cost?

(a) Rs. 110   (b) Rs. 120   (c) Rs. 140   (d) None of these

(Hotel Management, 1999)

69. The manufacturer of a certain item can sell all he can produce at the selling price of Rs. 60 each. It costs him Rs. 40 in materials and labour to produce each item and he has overhead expenses of Rs. 3000 per week in order to operate the plant. The number of units he should produce and sell in order to make a profit of at least Rs. 1000 per week, is :

(a) 200   (b) 250   (c) 300   (d) 400

70. A dishonest dealer uses a scale of 90 cm instead of a metre scale and claims to sell at cost price. His profit is :   (N.I.F.T. 2000)

(a) 9%   (b) 10%   (c) 12%   (d) None of these

71. A shopkeeper professes to sell his goods at cost price but uses a weight of 800 gm instead of kilogram weight. Thus, he makes a profit of :   (C.B.I. 1997)

(a) 20%   (b) $16\frac{2}{3}$%   (c) 25%   (d) None of these

72. A dishonest dealer professes to sell his goods at cost price. But he uses a false weight and thus gains $6\frac{18}{47}$%. For a kg, he uses a weight of :   (A.A.O. Exam, 2003)

(a) 940 gms   (b) 947 gms   (c) 953 gms   (d) 960 gms

73. A shopkeeper cheats to the extent of 10% while buying as well as selling, by using false weights. His total gain is :   (Bank P.O. 2003)

(a) 10%   (b) 11%   (c) 20%   (d) 21%   (e) $22\frac{2}{9}$%

74. A grocer sells rice at a profit of 10% and uses weights which are 20% less than the market weight. The total gain earned by him will be :

(a) 30%   (b) 35%   (c) 37.5%   (d) None of these

75. A fair price shopkeeper takes 10% profit on his goods. He lost 20% goods during theft. His loss percent is :   (S.S.C. 2000)

(a) 8   (b) 10   (c) 11   (d) 12

76. A sells a bicycle to B at a profit of 20%. B sells it to C at a profit of 25%. If C pays Rs. 225 for it, the cost price of the bicycle for A is :   (B.S.F. 2001)

(a) Rs. 110   (b) Rs. 120   (c) Rs. 125   (d) Rs. 150

77. A bought a radio set and spent Rs. 110 on its repairs. He then sold it to B at 20% profit, B sold it to C at a loss of 10% and C sold it for Rs. 1188 at a profit of 10%. What is the amount for which A bought the radio set ?

(a) Rs. 850   (b) Rs. 890   (c) Rs. 930   (d) Rs. 950

78. A house worth Rs. 1,50,000 is sold by X to Y at 5% profit. Y sells the house back to X at 2% loss. Then, in the entire transaction :

(a) X loses Rs. 1350   (b) X gains Rs. 3150
(c) X loses Rs. 4350   (d) X gains Rs. 4350

79. A manufacturer sells a pair of glasses to a wholesale dealer at a profit of 18%. The wholesaler sells the same to a retailer at a profit of 20%. The retailer in turn sells them to a customer for Rs. 30.09, thereby earning a profit of 25%. The cost price for the manufacturer is :

(a) Rs. 15   (b) Rs. 16   (c) Rs. 17   (d) Rs. 18

80. An article was sold for Rs. 144. If the percentage of profit was numerically equal to the cost price, the cost of the article was :
   (a) Rs. 72   (b) Rs. 80   (c) Rs. 90   (d) Rs. 100

81. Rahul purchased a scooter at $\frac{13}{15}$th of its selling price and sold it at 12% more than its selling price. His gain is :
   (a) 20%   (b) $29\frac{3}{13}$%   (c) 30%   (d) $38\frac{1}{13}$%

82. A man buys an article for 10% less than its value and sells it for 10% more than its value. His gain or loss percent is :   (S.S.C. 1999)
   (a) no profit, no loss   (b) 20% profit
   (c) less than 20% profit   (d) more than 20% profit

83. Samant bought a microwave oven and paid 10% less than the original price. He sold it with 30% profit on the price he had paid. What percentage of profit did Samant earn on the original price ?   (Bank P.O. 2002)
   (a) 17%   (b) 20%   (c) 27%   (d) 32%   (e) None of these

84. If 5% more is gained by selling an article for Rs. 350 than by selling it for Rs. 340, the cost of the article is :   (C.B.I. 1997)
   (a) Rs. 50   (b) Rs. 160   (c) Rs. 200   (d) Rs. 225

85. If a man reduces the selling price of a fan from Rs. 400 to Rs. 380, his loss increases by 2%. The cost price of the fan is :   (R.R.B. 2001)
   (a) Rs. 480   (b) Rs. 500   (c) Rs. 600   (d) None of these

86. An article when sold at a gain of 5% yields Rs. 15 more than when sold at a loss of 5%. Its cost price would be :
   (a) Rs. 150   (b) Rs. 200   (c) Rs. 250   (d) Rs. 300

87. A shopkeeper sells an article at a loss of $12\frac{1}{2}$%. Had he sold it for Rs. 51.80 more, he would have earned a profit of 6%. The cost price of the article is :
   (a) Rs. 280   (b) Rs. 300   (c) Rs. 380   (d) Rs. 400
                                                                        (Section Officers', 2003)

88. The difference between the cost price and sale price of an article is Rs. 240. If the profit is 20%, the selling price is :
   (a) Rs. 1240   (b) Rs. 1400   (c) Rs. 1600   (d) None of these

89. A dealer sold an article at a loss of $2\frac{1}{2}$%. Had he sold it for Rs. 100 more, he would have gained $7\frac{1}{2}$%. To gain $12\frac{1}{2}$%, he should sell it for :
   (a) Rs. 850   (b) Rs. 925   (c) Rs. 1080   (d) Rs. 1125

90. The cash difference between the selling prices of an article at a profit of 4% and 6% is Rs. 3. The ratio of the two selling prices is :   (C.B.I. 2003)
   (a) 51 : 52   (b) 52 : 53   (c) 51 : 53   (d) 52 : 55

91. A shopkeeper sells two watches for Rs. 308 each. On one he gets 12% profit and on the other 12% loss. His profit or loss in the entire transaction was : (B.S.F. 2001)
   (a) Neither profit, nor loss   (b) $1\frac{11}{25}$% loss
   (c) $1\frac{11}{25}$% profit   (d) $3\frac{2}{25}$% loss

92. A man sells two flats at the rate of Rs. 1.995 lakhs each. On one he gains 5% and on the other, he loses 5%. His gain or loss percent in the whole transaction is :
   (a) 0.25% loss   (b) 0.25% gain   (c) 2.5% loss   (d) 25% loss

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93. A man sells two commodities for Rs. 4000 each, neither losing nor gaining in the deal. If he sold one commodity at a gain of 25%, the other commodity is sold at a loss of :

(a) $16\frac{2}{3}$%   (b) $18\frac{2}{9}$%   (c) 25%   (d) None of these.

94. A house and a shop were sold for Rs. 1 lakh each. In this transaction, the house sale resulted into 20% loss whereas the shop sale resulted into 20% profit. The entire transaction resulted in :

(a) no loss, no gain   (b) loss of Rs. $\frac{1}{12}$ lakh

(c) loss of Rs. $\frac{1}{18}$ lakh   (d) gain of Rs. $\frac{1}{24}$ lakh

95. Ranjan purchased 120 tables at a price of Rs. 110 per table. He sold 30 tables at a profit of Rs. 12 per table and 75 tables at a profit of Rs. 14 per table. The remaining tables were sold at a loss of Rs. 7 per table. What is the average profit per table ?

(a) Rs. 10.04   (b) Rs. 10.875   (c) Rs. 12.80   (d) Rs. 12.875

96. Hemant sold 10 sarees for a total profit of Rs. 460 and 12 sarees for a total profit of Rs. 144. At what profit per saree should he sell the remaining 20 sarees so that he gets an average profit of Rs. 18 per saree ?

(a) Rs. 7.40   (b) Rs. 7.60   (c) Rs. 7.80   (d) Rs. 8

97. Sanket purchased 20 dozen notebooks at Rs. 48 per dozen. He sold 8 dozen at 10% profit and the remaining 12 dozen with 20% profit. What is his profit percentage in the transaction ?

(a) 7.68   (b) 15   (c) 16   (d) 19.2

98. A man purchased sugar worth Rs. 400. He sold $\frac{3}{4}$th at a loss of 10% and the remainder at a gain of 10%. On the whole, he gets :

(a) a loss of 5%   (b) a gain of $5\frac{1}{2}$%

(c) a loss of $5\frac{1}{19}$%   (d) a loss of $5\frac{5}{19}$%

99. A businessman sold $\frac{2}{3}$ of his stock at a gain of 20% and the rest at a gain of 14%. The overall percentage of gain to the businessman is :

(a) 12%   (b) 17%   (c) 18%   (d) 20%

100. A cloth merchant sold half of his cloth at 20% profit, half of the remaining at 20% loss and the rest was sold at the cost price. In the total transaction, his gain or loss will be :   (S.S.C. 2003)

(a) Neither loss nor gain   (b) 5% loss

(c) 5% gain   (d) 10% gain

101. A person purchases 90 clocks and sells 40 clocks at a gain of 10% and 50 clocks at a gain of 20%. If he sold all of them at a uniform profit of 15%, then he would have got Rs. 40 less. The cost price of each clock is :   (Hotel Management, 2003)

(a) Rs. 50   (b) Rs. 60   (c) Rs. 80   (d) Rs. 90

102. A person earns 15% on an investment but loses 10% on another investment. If the ratio of the two investments be 3 : 5, what is the gain or loss on the two investments taken together ?

(a) $6\frac{1}{4}$% loss   (b) $13\frac{1}{8}$% gain   (c) $13\frac{1}{8}$% loss   (d) None of these

103. A man bought goods worth Rs. 6000 and sold half of them at a gain of 10%. At what gain percent must he sell the remainder so as to get a gain of 25% on the whole ?

(a) 25%   (b) 30%   (c) 35%   (d) 40%

80. An article was sold for Rs. 144. If the percentage of profit was numerically equal to the cost price, the cost of the article was :
   (a) Rs. 72   (b) Rs. 80   (c) Rs. 90   (d) Rs. 100

81. Rahul purchased a scooter at $\frac{13}{15}$ th of its selling price and sold it at 12% more than its selling price. His gain is :

   (a) 20%   (b) $29\frac{3}{13}$%   (c) 30%   (d) $38\frac{1}{13}$%

82. A man buys an article for 10% less than its value and sells it for 10% more than its value. His gain or loss percent is :   (S.S.C. 1999)
   (a) no profit, no loss   (b) 20% profit
   (c) less than 20% profit   (d) more than 20% profit

83. Samant bought a microwave oven and paid 10% less than the original price. He sold it with 30% profit on the price he had paid. What percentage of profit did Samant earn on the original price ?   (Bank P.O. 2002)
   (a) 17%   (b) 20%   (c) 27%   (d) 32%   (e) None of these

84. If 5% more is gained by selling an article for Rs. 350 than by selling it for Rs. 340, the cost of the article is :   (C.B.I. 1997)
   (a) Rs. 50   (b) Rs. 160   (c) Rs. 200   (d) Rs. 225

85. If a man reduces the selling price of a fan from Rs. 400 to Rs. 380, his loss increases by 2%. The cost price of the fan is :   (R.R.B. 2001)
   (a) Rs. 480   (b) Rs. 500   (c) Rs. 600   (d) None of these

86. An article when sold at a gain of 5% yields Rs. 15 more than when sold at a loss of 5%. Its cost price would be :
   (a) Rs. 150   (b) Rs. 200   (c) Rs. 250   (d) Rs. 300

87. A shopkeeper sells an article at a loss of $12\frac{1}{2}$%. Had he sold it for Rs. 51.80 more, he would have earned a profit of 6%. The cost price of the article is :
   (a) Rs. 280   (b) Rs. 300   (c) Rs. 380   (d) Rs. 400
                                                              (Section Officers', 2003)

88. The difference between the cost price and sale price of an article is Rs. 240. If the profit is 20%, the selling price is :
   (a) Rs. 1240   (b) Rs. 1400   (c) Rs. 1600   (d) None of these

89. A dealer sold an article at a loss of $2\frac{1}{2}$%. Had he sold it for Rs. 100 more, he would have gained $7\frac{1}{2}$%. To gain $12\frac{1}{2}$%, he should sell it for :

   (a) Rs. 850   (b) Rs. 925   (c) Rs. 1080   (d) Rs. 1125

90. The cash difference between the selling prices of an article at a profit of 4% and 6% is Rs. 3. The ratio of the two selling prices is :   (C.B.I. 2003)
   (a) 51 : 52   (b) 52 : 53   (c) 51 : 53   (d) 52 : 55

91. A shopkeeper sells two watches for Rs. 308 each. On one he gets 12% profit and on the other 12% loss. His profit or loss in the entire transaction was : (B.S.F. 2001)

   (a) Neither profit, nor loss   (b) $1\frac{11}{25}$% loss

   (c) $1\frac{11}{25}$% profit   (d) $3\frac{2}{25}$% loss

92. A man sells two flats at the rate of Rs. 1.995 lakhs each. On one he gains 5% and on the other, he loses 5%. His gain or loss percent in the whole transaction is :
   (a) 0.25% loss   (b) 0.25% gain   (c) 2.5% loss   (d) 25% loss

104. A fruitseller has 24 kg of apples. He sells a part of these at a gain of 20% and the balance at a loss of 5%. If on the whole he earns a profit of 10%, the amount of apples sold at a loss is :

(a) 4.6 kg   (b) 6 kg   (c) 9.6 kg   (d) 11.4 kg

105. Two-third of a consignment was sold at a profit of 5% and the remainder at a loss of 2%. If the total profit was Rs. 400, the value of the consignment (in Rs.) was :

(a) 10,000   (b) 12,000   (c) 15,000   (d) 20,000

106. A trader purchases a watch and a wall clock for Rs. 390. He sells them making a profit of 10% on the watch and 15% on the wall clock. He earns a profit of Rs. 51.50. The difference between the original prices of the wall clock and the watch is equal to :

(a) Rs. 80   (b) Rs. 100   (c) Rs. 110   (d) Rs. 120

107. Albert buys 4 horses and 9 cows for Rs. 13,400. If he sells the horses at 10% profit and the cows at 20% profit, then he earns a total profit of Rs. 1880. The cost of a horse is :   (C.D.S. 2003)

(a) Rs. 1000   (b) Rs. 2000   (c) Rs. 2500   (d) Rs. 3000

108. A man purchases two clocks A and B at a total cost of Rs. 650. He sells A with 20% profit and B at a loss of 25% and gets the same selling price for both the clocks. What are the purchasing prices of A and B respectively ?

(a) Rs. 225, Rs. 425   (b) Rs. 250, Rs. 400
(c) Rs. 275, Rs. 375   (d) Rs. 300, Rs. 350

109. The C.P. of two watches taken together is Rs. 840. If by selling one at a profit of 16% and the other at a loss of 12%, there is no loss or gain in the whole transaction, then the C.P. of the two watches are respectively :

(a) Rs. 360, Rs. 480   (b) Rs. 480, Rs. 360
(c) Rs. 380, Rs. 460   (d) Rs. 400, Rs. 440

110. On selling a chair at 7% loss and a table at 17% gain, a man gains Rs. 296. If he sells the chair at 7% gain and the table at 12% gain, then he gains Rs. 400. The actual price of the table is :

(a) Rs. 1600   (b) Rs. 1800   (c) Rs. 2200   (d) Rs. 2400

111. A shopkeeper offers 2.5% discount on cash purchases. What cash amount would Rohan pay for a cycle, the marked price of which is Rs. 650 ?   (IGNOU, 2003)

(a) Rs. 633.25   (b) Rs. 633.75   (c) Rs. 634   (d) Rs. 635

112. If a company sells a car with a marked price of Rs. 2,72,000 and gives a discount of 4% on Rs. 2,00,000 and 2.5% on the remaining amount of Rs. 72,000, then the actual price charged by the company for the car is :   (S.S.C. 2003)

(a) Rs. 2,50,000   (b) Rs. 2,55,000   (c) Rs. 2,60,100   (d) Rs. 2,62,200

113. Garima purchased a briefcase with an additional 10% discount on the reduced price after deducting 20% on the labelled price. If the labelled price was Rs. 1400, at what price did she purchase the briefcase ?   (Bank P.O. 2002)

(a) Rs. 980   (b) Rs. 1008   (c) Rs. 1056   (d) Rs. 1120   (e) None of these

114. A bag marked at Rs. 80 is sold for Rs. 68. The rate of discount is :

(a) 12%   (b) 15%   (c) $17\frac{11}{17}\%$ (d) 20%

115. A pair of articles was bought for Rs. 37.40 at a discount of 15%. What must be the marked price of each of the articles ?   (A.A.O. Exam, 2003)

(a) Rs. 11   (b) Rs. 22   (c) Rs. 33   (d) Rs. 44

116. A shopkeeper gives 12% additional discount on the discounted price, after giving an initial discount of 20% on the labelled price of a radio. If the final sale price of the radio is Rs. 704, then what is its labelled price ?   (R.R.B. 2002)

(a) Rs. 844.80   (b) Rs. 929.28   (c) Rs. 1000   (d) Rs. 1044.80

117. A fan is listed at Rs. 1500 and a discount of 20% is offered on the list price. What additional discount must be offered to the customer to bring the net price to Rs. 1104 ?

(a) 8%   (b) 10%   (c) 12%   (d) 15%

(S.S.C. 2002)

118. A discount of 15% on one article is the same as a discount of 20% on another article. The costs of the two articles can be :   (S.S.C. 1999)

(a) Rs. 40, Rs. 20   (b) Rs. 60, Rs. 40   (c) Rs. 80, Rs 60   (d) Rs. 60, Rs. 40

119. If the S.P. of Rs. 24 results in a 20% discount on list price, what S.P. would result in a 30% discount on list price ?

(a) Rs. 18   (b) Rs. 20   (c) Rs. 21   (d) Rs. 27

120. An article was sold for Rs. y after giving a discount of x%. Then, its list price is :

(a) $\dfrac{100y}{100-x}$ (b) $\dfrac{100y}{1-x}$ (c) $\dfrac{100y}{1-(x/100)}$ (d) None of these

121. Jatin bought a refrigerator with 20% discount on the labelled price. Had he bought it with 25% discount, he would have saved Rs. 500. At what price did he buy the refrigerator ?

(a) Rs. 5000   (b) Rs. 10,000   (c) Rs. 12,500   (d) Rs. 15,000

122. A manufacturer offers a 20% rebate on the marked price of a product. The retailer offers another 30% rebate on the reduced price. The two reductions are equivalent to a single reduction of :

(a) 40%   (b) 44%   (c) 46%   (d) 50%

123. Successive discounts of 10%, 12% and 15% amount to a single discount of :

(a) 32.68%   (b) 35.28%   (c) 36.68%   (d) None of these

(R.R.B. 2003)

124. List price of an article at a showroom is Rs. 2000 and it is being sold at successive discounts of 20% and 10%. Its net selling price will be :   (S.S.C. 2004)

(a) Rs. 1400   (b) Rs. 1440   (c) Rs. 1520   (d) Rs. 1700

125. Find the selling price of an article if a shopkeeper allows two successive discounts of 5% each on the marked price of Rs. 80.   (C.B.I. 2003)

(a) Rs. 70.10   (b) Rs. 70.20   (c) Rs. 72   (d) Rs. 72.20

126. The price of a VCR is marked at Rs. 12,000. If successive discounts of 15%, 10% and 5% be allowed, then at what price does a customer buy it ?

(a) Rs. 8400   (b) Rs. 8721   (c) Rs. 8856   (d) None of these

(Hotel Management, 2002)

127. After successive discounts of 12% and 5% an article was sold for Rs. 209. What was the original price of the article ?

(a) Rs. 226   (b) Rs. 250   (c) Rs. 252   (d) Rs. 269

128. Applied to a bill for Rs. 1,00,000, the difference between a discount of 40% and two successive discounts of 36% and 4% is :   (Section Officers', 2003)

(a) Nil   (b) Rs. 1440   (c) Rs. 2500   (d) Rs. 1960

129. The difference between a discount of 35% and two successive discounts of 20% on a certain bill was Rs. 22. Find the amount of the bill.   (Bank P.O. 1999)

(a) Rs. 200   (b) Rs. 1100   (c) Rs. 2200

(d) Data inadequate   (e) None of these

130. Two shopkeepers announce the same price of Rs. 700 for a sewing machine. The first offers successive discounts of 30% and 6% while the second offers successive discounts of 20% and 16%. The shopkeeper that offers better discount, charges .... less than the other shopkeeper.

(a) Rs. 9.80   (b) Rs. 16.80   (c) Rs. 22.40   (d) Rs. 36.40

131. The marked price of a watch was Rs. 720. A man bought the same for Rs. 550.80 after getting two successive discounts, the first being 10%. What was the second discount rate ?   (S.S.C. 2000)

    (a) 12%   (b) 14%   (c) 15%   (d) 18%

132. A shopkeeper purchased 150 identical pieces of calculators at the rate of Rs. 250 each. He spent an amount of Rs. 2500 on transport and packing. He fixed the labelled price of each calculator at Rs. 320. However, he decided to give a discount of 5% on the labelled price. What is the percentage profit earned by him ?   (Bank P.O. 1999)

    (a) 14%   (b) 15%   (c) 16%   (d) 20%   (e) None of these

133. A trader marked the price of his commodity so as to include a profit of 25%. He allowed discount of 16% on the marked price. His actual profit was :   (S.S.C. 2004)

    (a) 5%   (b) 9%   (c) 16%   (d) 25%

134. A tradesman marks his goods 30% above the C.P. If he allows a discount of $6\frac{1}{4}$%, then his gain percent is :

    (a) $21\frac{7}{8}$%   (b) 22%   (c) $23\frac{3}{4}$%   (d) None of these

135. The price of an article is raised by 30% and then two successive discounts of 10% each are allowed. Ultimately, the price of the article is :   (S.S.C. 2003)

    (a) decreased by 5.3%   (b) increased by 3%
    (c) increased by 5.3%   (d) increased by 10%

136. A retailer buys 30 articles from a wholesaler at the price of 27. If he sells them at their marked price, the gain percent in the transaction is :

    (a) $9\frac{1}{11}$%   (b) 10%   (c) $11\frac{1}{9}$%   (d) $16\frac{2}{3}$%

137. By selling an umbrella for Rs. 300, a shopkeeper gains 20%. During a clearance sale, the shopkeeper allows a discount of 10% on the marked price. His gain percent during the sale is :   (M.B.A. 2002)

    (a) 7   (b) 7.5   (c) 8   (d) 9

138. The cost price of an article is 64% of the marked price. Calculate the gain percent after allowing a discount of 12%.   (C.B.I. 1998)

    (a) 37.5%   (b) 48%   (c) 50.5%   (d) 52%

139. A shopkeeper allows a discount of 10% on the marked price of an item but charges a sales tax of 8% on the discounted price. If the customer pays Rs. 680.40 as the price including the sales tax, then what is the marked price of the item ?

    (a) Rs. 630   (b) Rs. 700   (c) Rs. 780   (d) None of these

140. At what percent above the cost price must a shopkeeper mark his goods so that he gains 20% even after giving a discount of 10% on the marked price ?   (S.S.C. 2004)

    (a) 25%   (b) 30%   (c) $33\frac{1}{3}$%   (d) $37\frac{1}{2}$%

141. At what price should a shopkeeper mark a radio that costs him Rs. 1200 in order that he may offer a discount of 20% on the marked price and still make a profit of 25% ?

    (a) Rs. 1675   (b) Rs. 1875   (c) Rs. 1900   (d) Rs. 2025   (e) None of these
                                                                                                (Bank P.O. 1998)

142. A shopkeeper earns a profit of 12% on selling a book at 10% discount on the printed price. The ratio of the cost price to the printed price of the book is :

    (a) 45 : 56   (b) 50 : 61   (c) 55 : 69   (d) 99 : 125

143. By selling an article at $\frac{2}{5}$ of the marked price, there is a loss of 25%. The ratio of the marked price and the cost price of the article is :   (S.S.C. 2003)

    (a) 2 : 5   (b) 5 : 2   (c) 8 : 15   (d) 15 : 8

144. A tradesman gives 4% discount on the marked price and gives 1 article free for buying every 15 articles and thus gains 35%. The marked price is above the cost price by :
 (a) 20%   (b) 39%   (c) 40%   (d) 50%

145. A trader marked the selling price of an article at 10% above the cost price. At the time of selling, he allows certain discount and suffers a loss of 1%. He allowed a discount of :   (S.S.C. 2003)
 (a) 9%   (b) 10%   (c) 10.5%   (d) 11%

146. A shopkeeper fixes the marked price of an item 35% above its cost price. The percentage of discount allowed to gain 8% is :   (Assistant Grade, 1997)
 (a) 20%   (b) 27%   (c) 31%   (d) 43%

147. A trader marked his goods at 20% above the cost price. He sold half the stock at the marked price, one quarter at a discount of 20% on the marked price and the rest at a discount of 40% on the marked price. His total gain is :   (S.S.C. 2004)
 (a) 2%   (b) 4.5%   (c) 13.5%   (d) 15%

148. A product when sold with 10% rebate on the listed price gave a profit of Rs. 70. What was its cost price ?   (Bank P.O. 2003)
 (a) Rs. 200   (b) Rs. 350   (c) Rs. 700
 (d) Cannot be determined   (e) None of these

149. The labelled price of a cupboard is Rs. 6500. The shopkeeper sold it by giving 5% discount on the labelled price and earned a profit of 15%. What approximately is the cost price of the cupboard ?   (Bank P.O. 1999)
 (a) Rs. 5000   (b) Rs. 5350   (c) Rs. 5600   (d) Rs. 5800   (e) Rs. 6000

150. Kunal bought a suitcase with 15% discount on the labelled price. He sold the suitcase for Rs. 2880 with 20% profit on the labelled price. At what price did he buy the suitcase?   (S.B.I.P.O. 1997)
 (a) Rs. 2040   (b) Rs. 2400   (c) Rs. 2604   (d) Rs. 2640   (e) None of these

151. A shopkeeper sells a badminton racket, whose marked price is Rs. 30, at a discount of 15% and gives a shuttle cock costing Rs. 1.50 free with each racket. Even then he makes a profit of 20%. His cost price per racket is :   (S.S.C. 2004)
 (a) Rs. 19.75   (b) Rs. 20   (c) Rs. 21   (d) Rs. 21.25

152. If a commission of 10% is given on the written price of an article, the gain is 20%. If the commission is increased to 20%, the gain is :
 (a) $6\frac{2}{3}$%   (b) $7\frac{1}{4}$%   (c) $12\frac{1}{2}$%   (d) $13\frac{1}{3}$%

153. A shopkeeper sold a T.V. set for Rs. 17,940 with a discount of 8% and earned a profit of 19.6%. What would have been the percentage of profit earned if no discount was offered ?   (Bank P.O. 2003)
 (a) 24.8%   (b) 25%   (c) 26.4%
 (d) Cannot be determined   (e) None of these

154. A shopkeeper sells 25 articles at Rs. 45 per article after giving 10% discount and earns 50% profit. If the discount is not given, the profit gained is :   (S.B.I.P.O. 2000)
 (a) 60%   (b) $60\frac{2}{3}$%   (c) 66%   (d) $66\frac{2}{3}$%   (e) None of these

155. A shopkeeper sold sarees at Rs. 266 each after giving 5% discount on labelled price. Had he not given the discount, he would have earned a profit of 12% on the cost price. What was the cost price of each saree ?   (S.B.I.P.O. 1999)
 (a) Rs. 240   (b) Rs. 260   (c) Rs. 280
 (d) Data inadequate   (e) None of these

156. Even after reducing the marked price of a transistor by Rs. 32, a shopkeeper makes a profit of 15%. If the cost price be Rs. 320, what percentage of profit would he have made if he had sold the transistor at the marked price ?
    (a) 10%   (b) 20%   (c) 25%   (d) None of these

157. A shopkeeper sold an article offering a discount of 5% and earned a profit of 23.5%. What would have been the percentage of profit earned if no discount was offered ?
    (a) 24.5   (b) 28.5   (c) 30
    (d) Data inadequate   (e) None of these   (Bank P.O. 2002)

158. Komal buys an article at a discount of 25%. At what percentage above the cost price should he sell it to make a profit of 25% over the original list price ?
    (a) 25   (b) 30   (c) 40   (d) 66.67

159. Peter bought an item at 20% discount on its original price. He sold it with 40% increase on the price he bought it. The new sale price is by what percent more than the original price ?   (Bank P.O. 2003)
    (a) 7.5   (b) 8   (c) 10   (d) 12   (e) None of these

160. Tarun got 30% concession on the labelled price of an article and sold it for Rs. 8750 with 25% profit on the price he bought. What was the labelled price ?
    (a) Rs. 10,000   (b) Rs. 12,000   (c) Rs. 16,000
    (d) Data inadequate   (e) None of these

ANSWERS

1. (b)	2. (d)	3. (d)	4. (c)	5. (b)	6. (c)	7. (c)	8. (a)	9. (c)
10. (c)	11. (c)	12. (c)	13. (d)	14. (c)	15. (a)	16. (d)	17. (b)	18. (c)
19. (b)	20. (e)	21. (c)	22. (a)	23. (d)	24. (b)	25. (d)	26. (c)	27. (e)
28. (d)	29. (b)	30. (c)	31. (a)	32. (a)	33. (b)	34. (a)	35. (c)	36. (b)
37. (b)	38. (b)	39. (a)	40. (d)	41. (c)	42. (c)	43. (a)	44. (a)	45. (b)
46. (c)	47. (d)	48. (c)	49. (d)	50. (a)	51. (d)	52. (a)	53. (c)	54. (d)
55. (c)	56. (b)	57. (c)	58. (d)	59. (d)	60. (c)	61. (b)	62. (b)	63. (b)
64. (d)	65. (b)	66. (c)	67. (a)	68. (d)	69. (a)	70. (d)	71. (c)	72. (a)
73. (d)	74. (c)	75. (d)	76. (d)	77. (b)	78. (b)	79. (c)	80. (b)	81. (b)
82. (d)	83. (a)	84. (c)	85. (d)	86. (a)	87. (a)	88. (d)	89. (d)	90. (b)
91. (b)	92. (a)	93. (a)	94. (b)	95. (b)	96. (b)	97. (c)	98. (a)	99. (c)
100. (c)	101. (c)	102. (d)	103. (d)	104. (c)	105. (c)	106. (c)	107. (b)	108. (b)
109. (a)	110. (d)	111. (b)	112. (d)	113. (b)	114. (b)	115. (b)	116. (c)	117. (a)
118. (c)	119. (c)	120. (a)	121. (b)	122. (b)	123. (a)	124. (b)	125. (d)	126. (b)
127. (b)	128. (b)	129. (c)	130. (a)	131. (b)	132. (a)	133. (a)	134. (a)	135. (c)
136. (c)	137. (c)	138. (a)	139. (b)	140. (c)	141. (b)	142. (a)	143. (d)	144. (d)
145. (b)	146. (a)	147. (a)	148. (d)	149. (b)	150. (a)	151. (b)	152. (a)	153. (e)
154. (d)	155. (e)	156. (c)	157. (c)	158. (c)	159. (d)	160. (a)		

SOLUTIONS

1. Gain% $= \left(\dfrac{0.70}{70} \times 100\right)\% = 1\%$.

2. (a) Profit% $= \left(\dfrac{17}{36} \times 100\right)\% = 47\dfrac{2}{9}\%$.   (b) Profit% $= \left(\dfrac{24}{50} \times 100\right)\% = 48\%$.

(c) Profit% $= \left(\frac{19}{40} \times 100\right)\% = 47\frac{1}{2}\%$.   (d) Profit% $= \left(\frac{29}{60} \times 100\right)\% = 48\frac{1}{3}\%$.

Clearly, (d) is the best transaction.

3. Least C.P. = Rs. (200 × 8) = Rs. 1600. Greatest S.P. = Rs. (425 × 8) = Rs. 3400.
   Required profit = Rs. (3400 − 1600) = Rs. 1800.

4. Profit = Rs. (2602.58 − 2090.42) = Rs. 512.16.

   Profit% $= \left(\frac{512.16}{2090.42} \times 100\right)\% = \left(\frac{512160}{209042} \times 10\right)\% = 24.5\% \approx 25\%$.

5. C.P. = Rs. (4700 + 800) = Rs. 5500; S.P. = Rs. 5800.

   Gain% $= \left(\frac{300}{5500} \times 100\right)\% = 5\frac{5}{11}\%$.

6. C.P. of 1 kg = Rs. $\left(\frac{420}{70}\right)$ = Rs. 6. S.P. of 1 kg = Rs. 6.50.

   ∴ Gain% $= \left(\frac{0.50}{6} \times 100\right)\% = \frac{25}{3}\% = 8\frac{1}{3}\%$.

7. C.P. of 1 toy = Rs. $\left(\frac{375}{12}\right)$ = Rs. 31.25. S.P. of 1 toy = Rs. 33.

   ∴ Profit% $= \left(\frac{1.75}{31.25} \times 100\right)\% = \frac{28}{5}\% = 5.6\%$.

8. C.P. of 1 orange = Rs. $\left(\frac{350}{100}\right)$ = Rs. 3.50. S.P. of 1 orange = Rs. $\left(\frac{48}{12}\right)$ = Rs. 4.

   ∴ Gain% $= \left(\frac{0.50}{3.50} \times 100\right)\% = \frac{100}{7}\% = 14\frac{2}{7}\%$.

9. S.P. = 85% of Rs. 1400 = Rs. $\left(\frac{85}{100} \times 1400\right)$ = Rs. 1190.

10. C.P. for B = 120% of Rs. 400 = Rs. $\left(\frac{120}{100} \times 400\right)$ = Rs. 480.

    C.P. for C = 110% of Rs. 480 = Rs. $\left(\frac{110}{100} \times 480\right)$ = Rs. 528.

11. C.P. = Rs. (80000 + 5000 + 1000) = Rs. 86000, Profit = 25%.

    ∴ S.P. = 125% of Rs. 86000 = Rs. $\left(\frac{125}{100} \times 86000\right)$ = Rs. 107500.

12. S.P. = Rs. 100, gain = Rs. 15.
    ∴ C.P. = Rs. (100 − 15) = Rs. 85.

    Gain% $= \left(\frac{15}{85} \times 100\right)\% = \frac{300}{17}\% = 17\frac{11}{17}\%$

13. C.P. = Rs. $\left(\frac{100}{75} \times 34.80\right)$ = Rs. 46.40.

14. C.P. = Rs. $\left(\frac{100}{122.50} \times 392\right)$ = Rs. $\left(\frac{1000}{1225} \times 392\right)$ = Rs. 320.
    ∴ Profit = Rs. (392 − 320) = Rs. 72.

SUB#

15. 110% of S.P. = 616 $\Rightarrow$ S.P. = Rs. $\left(\dfrac{616 \times 100}{110}\right)$ = Rs. 560.

$\therefore$ C.P. = Rs. $\left(\dfrac{100}{112} \times 560\right)$ = Rs. 500.

16. Total investment = Rs. $\left[120 \times 80 + 280 + \dfrac{40}{100} \times 120 + 72\right]$

$= $ Rs. (9600 + 280 + 48 + 72) = Rs. 10000.

S.P. of 120 reams = 108% of Rs. 10000 = Rs. 10800.

$\therefore$ S.P. per ream = Rs. $\left(\dfrac{10800}{120}\right)$ = Rs. 90.

17. Investment = Rs. (20 × 8 + 10) = Rs. 170. Receipt = Rs. (30 × 5 + 20 × 4) = Rs. 230.

$\therefore$ Gain% = $\left(\dfrac{60}{170} \times 100\right)$% = 35.29% = 35.3%.

18. Let the C.P. be Rs. x. Then, 20% of x = 1100 $\Rightarrow$ $\dfrac{20}{100} \times x$ = 1100 $\Rightarrow$ x = 5500.

C.P. = Rs. 5500, Expenditure on repairs = 10%.

Actual price = Rs. $\left(\dfrac{100}{110} \times 5500\right)$ = Rs. 5000.

$\therefore$ Expenditure on repairs = Rs. (5500 − 5000) = Rs. 500.

19. Total cost incurred = Rs. $\left[\dfrac{100}{125} \times 25 \times (95\% \text{ of } 2000)\right]$

$= $ Rs. $\left(\dfrac{100}{125} \times 25 \times 1900\right)$ = Rs. 38000.

Loss to the manufacturer = Rs. [38000 − (25 × 1000)] = Rs. 13000.

20. C.P. = Rs. $\left(600 + \dfrac{600 \times 6 \times 4}{100 \times 12}\right)$ = Rs. 612. Gain = Rs. (765 − 612) = Rs. 153.

$\therefore$ Gain% = $\left(\dfrac{153}{612} \times 100\right)$% = 25%.

21. 85 : 18700 = 115 : x or x = $\left(\dfrac{18700 \times 115}{85}\right)$ = 25300.

Hence, S.P. = Rs. 25,300.

22. 80 : 9 = 105 : x or x = $\left(\dfrac{9 \times 105}{80}\right)$ = 11.81.

Hence, S.P. per kg = Rs. 11.81.

23. C.P. = Rs. $\left(\dfrac{100}{105} \times 630000\right)$ = Rs. 600000.

$\therefore$ Required loss% = $\left(\dfrac{100000}{600000} \times 100\right)$% = $16\dfrac{2}{3}$%.

24. C.P. of 1st transistor = Rs. $\left(\dfrac{100}{120} \times 840\right)$ = Rs. 700.

C.P. of 2nd transistor = Rs. $\left(\dfrac{100}{96} \times 960\right)$ = Rs. 1000.

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So, total C.P. = Rs. (700 + 1000) = Rs. 1700.
Total S.P. = Rs. (840 + 960) = Rs. 1800.

$\therefore$ Gain% = $\left(\dfrac{100}{1700} \times 100\right)$% = $5\dfrac{15}{17}$%.

25. Let C.P. = Rs. x. Then, S.P. = Rs. $\dfrac{4x}{3}$. Gain = Rs. $\left(\dfrac{4x}{3} - x\right)$ = Rs. $\dfrac{x}{3}$.

$\therefore$ Gain% = $\left(\dfrac{x}{3} \times \dfrac{1}{x} \times 100\right)$% = $33\dfrac{1}{3}$%.

26. Let C.P. = Rs. $4x$. Then, S.P. = Rs. $5x$. Gain = Rs. $(5x - 4x)$ = Rs. x.

$\therefore$ Gain% = $\left(\dfrac{x}{4x} \times 100\right)$% = 25%.

27. Let C.P. = Rs. $5x$ and S.P. = Rs. $7x$. Then, Gain = Rs. $2x$.
$\therefore$ Required ratio = $2x : 5x = 2 : 5$.

28. Let C.P. = Rs. x. Then, S.P. = Rs. (120% of x) = Rs. $\dfrac{6x}{5}$.

New S.P. = Rs. $\left(2 \times \dfrac{6x}{5}\right)$ = Rs. $\dfrac{12x}{5}$. Profit = Rs. $\left(\dfrac{12x}{5} - x\right)$ = Rs. $\dfrac{7x}{5}$.

$\therefore$ Profit% = $\left(\dfrac{7x}{5} \times \dfrac{1}{x} \times 100\right)$% = 140%.

29. Let C.P. be Rs. x and S.P. be Rs. y. Then, $3(y - x) = (2y - x)$ $\Rightarrow$ $y = 2x$.
Profit = Rs. $(y - x)$ = Rs. $(2x - x)$ = Rs. x.

$\therefore$ Profit% = $\left(\dfrac{x}{x} \times 100\right)$% = 100%.

30. Let S.P. = Rs. x. New S.P. = Rs. $\dfrac{x}{2}$, Loss = 30%.

So, C.P. = Rs. $\left(\dfrac{100}{70} \times \dfrac{x}{2}\right)$ = Rs. $\dfrac{5x}{7}$. Profit = Rs. $\left(x - \dfrac{5x}{7}\right)$ = Rs. $\dfrac{2x}{7}$.

$\therefore$ Profit% = $\left(\dfrac{2x}{7} \times \dfrac{7}{5x} \times 100\right)$% = 40%.

31. C.P. = $\dfrac{40}{100} \times$ S.P. $\Rightarrow$ S.P. = $\dfrac{5}{2}$ C.P. = $\left(\dfrac{5}{2} \times 100\right)$% of C.P. = 250% of C.P.

32. Let the C.P. be Rs. x. Then, $x - 15 = \dfrac{x}{16}$ $\Rightarrow$ $x - \dfrac{x}{16} = 15$ $\Rightarrow$ $\dfrac{15x}{16} = 15$ $\Rightarrow$ $x = 16$.
$\therefore$ C.P. = Rs. 16.

33. S.P. = C.P. + $\dfrac{1}{4}$ C.P. = $\dfrac{5}{4}$ C.P.

$\therefore$ $\dfrac{5}{4}$ C.P. = 375 $\Rightarrow$ C.P. = Rs. $\left(375 \times \dfrac{4}{5}\right)$ = Rs. 300.

34. Let S.P. = Rs. 100. Then, Loss = Rs. 10, C.P. = Rs. (100 + 10) = Rs. 110.

$\therefore$ Loss% = $\left(\dfrac{10}{110} \times 100\right)$% = $9\dfrac{1}{11}$%.

35. Let S.P. = Rs. x. Then, Loss = Rs. $\dfrac{x}{3}$. C.P. = Rs. $\left(x + \dfrac{x}{3}\right)$ = Rs. $\dfrac{4x}{3}$.

$\therefore$ Loss% = $\left(\dfrac{x}{3} \times \dfrac{3}{4x} \times 100\right)$% = 25%.

36. Let C.P. = Rs. 100. Then, Profit = Rs. 320, S.P. = Rs. 420.
    New C.P. = 125% of Rs. 100 = Rs. 125; New S.P. = Rs. 420.
    Profit = Rs. (420 − 125) = Rs. 295.

    ∴ Required percentage = $\left(\frac{295}{420} \times 100\right)\% = \frac{1475}{21}\% \approx 70\%$.

37. Let C.P. = Rs. x. Then, $832 - x = x - 448 \Rightarrow 2x = 1280 \Rightarrow x = 640$.

    ∴ Required S.P. = 150% of Rs. 640 = Rs. $\left(\frac{150}{100} \times 640\right)$ = Rs. 960.

38. Let C.P. = Rs. x. Then, $900 - x = 2(x - 450) \Rightarrow 3x = 1800 \Rightarrow x = 600$.

    ∴ Required S.P. = 125% of Rs. 600 = Rs. $\left(\frac{125}{100} \times 600\right)$ = Rs. 750.

39. Let C.P. be Rs. x.

    Then, $\frac{1920 - x}{x} \times 100 = \frac{x - 1280}{x} \times 100 \Rightarrow 1920 - x = x - 1280$

    $\Rightarrow 2x = 3200 \Rightarrow x = 1600$.

    ∴ Required S.P. = 125% of Rs. 1600 = Rs. $\left(\frac{125}{100} \times 1600\right)$ = Rs. 2000.

40. Let C.P. be Rs. x.

    Then, $(1060 - x) = \frac{120}{100}(x - 950) \Rightarrow 106000 - 100x = 120x - 120 \times 950$

    $\Rightarrow 220x = 220000 \Rightarrow x = 1000$.

    ∴ Desired S.P. = Rs. $\left(\frac{120}{100} \times 1000\right)$ = Rs. 1200.

41. Let C.P. of each pen be Re. 1. Then, C.P. of 8 pens = Rs. 8; S.P. of 8 pens = Rs. 12.

    ∴ Gain% = $\left(\frac{4}{8} \times 100\right)\% = 50\%$.

42. Let C.P. of each article be Re. 1.
    Then, C.P. of 16 articles = Rs. 16; S.P. of 16 articles = Rs. 19.

    ∴ Gain% = $\left(\frac{3}{16} \times 100\right)\% = 18\frac{3}{4}\%$.

43. Let C.P. of each article be Re. 1.
    Then, C.P. of 50 articles = Rs. 50; S.P. of 50 articles = Rs. 40.

    ∴ Loss% = $\left(\frac{10}{50} \times 100\right)\% = 20\%$.

44. Let C.P. of each mango be Re. 1.
    C.P. of 110 mangoes = Rs. 110; S.P. of 110 mangoes = Rs. 120.

    ∴ Gain% = $\left(\frac{10}{110} \times 100\right)\% = 9\frac{1}{11}\%$.

45. Let C.P. of each article be Re. 1. C.P. of x articles = Rs. x; S.P. of x articles = Rs. 20.
    Profit = Rs. (20 − x).

    ∴ $\frac{20 - x}{x} \times 100 = 25 \Rightarrow 2000 - 100x = 25x \Rightarrow 125x = 2000 \Rightarrow x = 16$.

46. Clearly, the retailer gets 1 dozen out of 6 dozens free.

    ∴ Equivalent discount = $\left(\frac{1}{6} \times 100\right)\% = 16\frac{2}{3}\%$.

47. (S.P. of 18 cots) – (C.P. of 18 cots) = (C.P. of 3 cots)
   $\Rightarrow$ C.P. of 21 cots = S.P. of 18 cots = Rs. 16800

   $\Rightarrow$ C.P. of 1 cot = Rs. $\left(\dfrac{16800}{21}\right)$ = Rs. 800.

48. (S.P. of 12 notebooks) – (C.P. of 12 notebooks) = (S.P. of 4 notebooks)
   $\Rightarrow$ C.P. of 12 notebooks = S.P. of 8 notebooks.
   Let C.P. of each notebook be Re. 1.
   Then, C.P. of 8 notebooks = Rs. 8; S.P. of 8 notebooks = Rs. 12.

   $\therefore$ Gain% = $\left(\dfrac{4}{8}\times100\right)$% = 50%.

49. (C.P. of 17 balls) – (S.P. of 17 balls) = (C.P. of 5 balls)
   $\Rightarrow$ C.P. of 12 balls = S.P. of 17 balls = Rs. 720

   $\Rightarrow$ C.P. of 1 ball = Rs. $\left(\dfrac{720}{12}\right)$ = Rs. 60.

50. (C.P. of 36 mangoes) – (S.P. of 36 mangoes) = Loss = (S.P. of 4 mangoes)
   $\Rightarrow$ S.P. of 40 mangoes = C.P. of 36 mangoes.
   Let C.P. of each mango be Re. 1.
   C.P. of 40 mangoes = Rs. 40; S.P. of 40 mangoes = Rs. 36.

   $\therefore$ Loss% = $\left(\dfrac{4}{40}\times100\right)$% = 10%.

51. C.P. = Rs. (16 × 2) = 32. S.P. = Rs. (12 × 1.5 + 4 × 0.5) = Rs. (18 + 2) = Rs. 20.

   $\therefore$ Loss% = $\left(\dfrac{12}{32}\times100\right)$% = 37.5%.

52. C.P. of 1 apple = Rs. $\left(\dfrac{34}{8}\right)$ = Rs. 4.25. S.P. of 1 apple = Rs. $\left(\dfrac{57}{12}\right)$ = Rs. 4.75.
   Profit on each apple = Re. 0.50.

   $\therefore$ Number of apples required = $\left(\dfrac{45}{0.50}\right)$ = 90.

53. Suppose, number of oranges bought = L.C.M. of 9 and and 10 = 90.

   C.P. of 90 oranges = Rs. $\left(\dfrac{25}{10}\times90\right)$ = Rs. 225.

   S.P. of 90 oranges = Rs. $\left(\dfrac{25}{9}\times90\right)$ = Rs. 250.

   $\therefore$ Profit% = $\left(\dfrac{25}{225}\times100\right)$% = $\dfrac{100}{9}$% = $11\dfrac{1}{9}$%.

54. Suppose, number of articles bought = L.C.M. of 6 and 5 = 30.

   C.P. of 30 articles = Rs. $\left(\dfrac{5}{6}\times30\right)$ = Rs. 25. S.P. of 30 articles = Rs. $\left(\dfrac{6}{5}\times30\right)$ = Rs. 36.

   $\therefore$ Gain% = $\left(\dfrac{11}{25}\times100\right)$% = 44%.

55. Suppose, number of fruits bought = L.C.M. of 16 and 8 = 16.

   C.P. of 16 fruits = Rs. 24. S.P. of 16 fruits = Rs. $\left(\dfrac{18}{8}\times16\right)$ = Rs. 36.

   $\therefore$ Profit% = $\left(\dfrac{12}{24}\times100\right)$% = 50%.

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56. Suppose, number of pencils bought = L.C.M. of 7 and 8 = 56.

C.P. of 56 pencils = Rs. $\left(\frac{9}{7} \times 56\right)$ = Rs. 72. S.P. of 56 pencils = Rs. $\left(\frac{11}{8} \times 56\right)$ = Rs. 77.

Now, Rs. 5 are gained on 56 pencils.

So, Rs. 10 are gained on $\left(\frac{56}{5} \times 10\right)$ = 112 pencils.

57. Suppose he bought 1 dozen clips of each kind.

C.P. of 2 dozens = Rs. $\left(\frac{1}{3} \times 12 + \frac{1}{2} \times 12\right)$ = Rs. 10.

∴ S.P. of 2 dozens = 120% of Rs. 10 = Rs. $\left(\frac{120}{100} \times 10\right)$ = Rs. 12.

Hence, S.P. per dozen = Rs. 6.

58. Suppose he buys 6 eggs of each kind.

C.P. of 12 eggs = Rs. $\left(\frac{1}{2} \times 6 + \frac{2}{3} \times 6\right)$ = Rs. 7. S.P. of 12 eggs = Rs. $\left(\frac{3}{5} \times 12\right)$ = Rs. 7.20.

∴ Gain = $\left(\frac{0.20}{7} \times 100\right)$% = $2\frac{6}{7}$%.

59. C.P. of 2 dozen oranges = Rs. (10 + 8) = Rs. 18. S.P. of 2 dozen oranges = Rs. 22.
If profit is Rs. 4, oranges bought = 2 dozen.

If profit is Rs. 120, oranges bought = $\left(\frac{2}{4} \times 120\right)$ dozens = 60 dozens.

60. C.P. of 6 toffees = Re. 1. S.P. of 6 toffees = 120% of Re. 1 = Rs. $\frac{6}{5}$.

For Rs. $\frac{6}{5}$, toffees sold = 6. For Re. 1, toffees sold = $\left(6 \times \frac{5}{6}\right)$ = 5.

61. Let S.P. of 12 toffees be Rs. x. Then, 80 : 1 = 120 : x or x = $\left(\frac{120}{80}\right)$ = $\frac{3}{2}$.

For Rs. $\frac{3}{2}$, toffees sold = 12. For Re. 1, toffees sold = $\left(12 \times \frac{2}{3}\right)$ = 8.

62. Let S.P. of 45 lemons be Rs. x. Then, 80 : 40 = 120 : x or x = $\left(\frac{120 \times 40}{80}\right)$ = 60.

For Rs. 60, lemons sold = 45. For Rs. 24, lemons sold = $\left(\frac{45}{60} \times 24\right)$ = 18.

63. C.P. of 56 kg rice = Rs. (26 × 20 + 30 × 36) = Rs. (520 + 1080) = Rs. 1600.
S.P. of 56 kg rice = Rs. (56 × 30) = Rs. 1680.

∴ Gain = $\left(\frac{80}{1600} \times 100\right)$% = 5%.

64. C.P. of 50 kg wheat = Rs. (30 × 11.50 + 20 × 14.25) = Rs. (345 + 285) = Rs. 630.

S.P. of 50 kg wheat = 130% of Rs. 630 = Rs. $\left(\frac{130}{100} \times 630\right)$ = Rs. 819.

∴ S.P. per kg = Rs. $\left(\frac{819}{50}\right)$ = Rs. 16.38 = Rs. 16.30.

65. Let the required price per kg be Rs. x. Then,

C.P. of 60 kg rice = Rs. $(30 \times 17.50 + 30 \times x)$ = Rs. $(525 + 30x)$.

S.P. of 60 kg rice = Rs. (60×18.60) = Rs. 1116.

$$\therefore \quad \frac{1116 - (525 + 30x)}{525 + 30x} \times 100 = 20 \quad \leftrightarrow \quad \frac{591 - 30x}{525 + 30x} = \frac{1}{5}$$

$$\Leftrightarrow \quad 2955 - 150x = 525 + 30x \quad \Leftrightarrow \quad 180x = 2430 \quad \Leftrightarrow \quad x = \left(\frac{2430}{180}\right) = \left(\frac{27}{2}\right) = 13.50.$$

So, the C.P. of second lot is Rs. 13.50 per kg.

66. Suppose he bought 2 kg, 4 kg and 3 kg of the three varieties.

C.P. of 9 kg = Rs. $(2 \times 50 + 4 \times 20 + 3 \times 30)$ = Rs. 270.

S.P. of 9 kg = Rs. (9×33) = Rs. 297.

$$\therefore \quad \text{Profit}\% = \left(\frac{27}{270} \times 100\right)\% = 10\%.$$

67. Mean cost price = Rs. $\left(\frac{100}{137.5} \times 8\right)$ = Rs. $\frac{64}{11}$.

By the rule of alligation :

C.P. of 1 litre water   C.P. of 1 litre milk

0   6.40

Mean price
$\frac{64}{11}$

$\frac{64}{110}$ $\frac{64}{11}$

$$\therefore \quad \text{Required ratio} = \frac{64}{110} : \frac{64}{11} = 1 : 10.$$

68. Let the cost of the other brand be Rs. x per kg.

C.P. of 5 kg = Rs. $(2 \times 200 + 3 \times x)$ = Rs. $(400 + 3x)$.

S.P. of 5 kg = Rs. (5×177) = Rs. 885.

$$\therefore \quad \frac{885 - (400 + 3x)}{400 + 3x} \times 100 = 18 \quad \leftrightarrow \quad \frac{485 - 3x}{400 + 3x} = \frac{9}{50}$$

$$\leftrightarrow \quad 24250 - 150x = 3600 + 27x \quad \leftrightarrow \quad 177x = 20650 \quad \leftrightarrow \quad x = \left(\frac{350}{3}\right) = 116\frac{2}{3}.$$

So, cost of the other brand = Rs. 116.66.

69. Suppose, he must produce x items. Then, C.P. = Rs. $(40x + 300)$, S.P. = Rs. $60x$.

$$\therefore \quad 60x - (40x + 300) = 1000 \text{ or } 20x = 4000 \text{ or } x = 200.$$

70. Gain% = $\left(\frac{10}{90} \times 100\right)\%$ = $11\frac{1}{9}\%$.

71. Profit% = $\left(\frac{200}{800} \times 100\right)\%$ = 25%.

72. Let error = x gms. Then, $\frac{x}{1000 - x} \times 100 = 6\frac{18}{47}$ $\Leftrightarrow$ $\frac{100x}{1000 - x} = \frac{300}{47}$

$$\Leftrightarrow \quad 47x = 3(1000 - x) \quad \Leftrightarrow \quad 50x = 3000 \quad \Leftrightarrow \quad x = 60.$$

$\therefore$ Weight used = $(1000 - 60)$ = 940 gms.

73. **Rule :** $\text{Gain}\% = \dfrac{(100 + \text{common gain}\%)^2}{100} - 100.$

$\therefore \ \text{Gain}\% = \left[\dfrac{(100 + 10)^2}{100} - 100\right]\% = \left(\dfrac{12100 - 10000}{100}\right)\% = 21\%.$

74. Let us consider a packet of rice marked 1 kg.

Its actual weight is 80% of 1000 gm = 800 gm.

Let C.P. of each gm be Re. 1. Then, C.P. of this packet = Rs. 800.

S.P. of this packet = 110% of C.P. of 1 kg = Rs. $\left(\dfrac{110}{100} \times 1000\right)$ = Rs. 1100.

$\therefore \ \text{Gain}\% = \left(\dfrac{300}{800} \times 100\right)\% = 37.5\%.$

75. Suppose he has 100 items. Let C.P. of each item be Re. 1.

Total cost = Rs. 100. Number of items left after theft = 80.

S.P. of each item = Rs. 1.10.

$\therefore$ Total sale = Rs. (1.10×80) = Rs. 88.

Hence, $\text{Loss}\% = \left(\dfrac{12}{100} \times 100\right)\% = 12\%.$

76. 125% of 120% of A = 225 $\Rightarrow \dfrac{125}{100} \times \dfrac{120}{100} \times A = 225 \Rightarrow A = \left(225 \times \dfrac{2}{3}\right) = 150.$

77. 110% of 90% of 120% of A = 1188

$\Rightarrow \dfrac{110}{100} \times \dfrac{90}{100} \times \dfrac{120}{100} A = 1188 \Rightarrow \dfrac{1188}{1000} A = 1188 \Rightarrow A = 1000.$

$\therefore$ A purchased it for Rs. $(1000 - 110)$ = Rs. 890.

78. Money spent by X = Rs. 150000.

Money received by X = 105% of Rs. 150000 = Rs. 157500.

C.P. to X = 98% of Rs. 157500 = Rs. 154350.

$\therefore$ X gains Rs. $(157500 - 154350)$ = Rs. 3150.

79. Let the cost price for the manufacturer be Rs. x.

Then, 125% of 120% of 118% of x = 30.09.

$\Rightarrow \dfrac{125}{100} \times \dfrac{120}{100} \times \dfrac{118}{100} x = \dfrac{3009}{100} \Rightarrow \dfrac{177}{100} x = \dfrac{3009}{100} \Rightarrow x = \left(\dfrac{3009}{177}\right) = 17.$

80. Let C.P. = Rs. x, Profit% = x% and S.P. = Rs. 144.

$\therefore \ x = \left[\dfrac{100}{(100 + x)} \times 144\right] \Rightarrow x^2 + 100x = 14400 \Rightarrow x^2 + 100x - 14400 = 0$

$\Rightarrow x^2 + 180x - 80x - 14400 = 0 \Rightarrow (x + 180)(x - 80) = 0 \Rightarrow x = 80.$

81. Let S.P. be Rs. x. Then, C.P. = Rs. $\dfrac{13}{15}x$, Receipt = 112% of Rs. x = Rs. $\dfrac{28}{25}x$.

$\text{Gain} = \text{Rs.} \left(\dfrac{28x}{25} - \dfrac{13x}{15}\right) = \text{Rs.} \dfrac{19x}{75}.$

$\therefore \ \text{Gain}\% = \left(\dfrac{19x}{75} \times \dfrac{15}{13x} \times 100\right)\% = \dfrac{380}{13}\% = 29\dfrac{3}{13}\%.$

82. Let the article be worth Rs. x.

C.P. = 90% of Rs. x = Rs. $\dfrac{9x}{10}$; S.P. = 110% of Rs. x = Rs. $\dfrac{11x}{10}$.

Gain = Rs. $\left(\dfrac{11x}{10} - \dfrac{9x}{10}\right)$ = Rs. $\dfrac{x}{5}$.

$\therefore$ Gain% = $\left(\dfrac{x}{5} \times \dfrac{10}{9x} \times 100\right)\%$ = $22\dfrac{2}{9}\%$ > 20%.

83. Let original price = Rs. 100.

Then C.P. = Rs. 90, S.P. = 130% of Rs. 90 = Rs. $\left(\dfrac{130}{100} \times 90\right)$ = Rs. 117.

$\therefore$ Required percentage = (117 - 100)% = 17%.

84. Let C.P. be Rs. x. Then, 5% of x = (350 - 340) = 10 $\Rightarrow$ $\dfrac{x}{20}$ = 10 $\Rightarrow$ x = 200.

85. Let C.P. be Rs. x. Then, 2% of x = (400 - 380) = 20 $\Rightarrow$ $\dfrac{x}{50}$ = 20 $\Rightarrow$ x = 1000.

86. Let C.P. be Rs. x. Then, $\dfrac{105}{100}x - \dfrac{95}{100}x$ = 15 $\Rightarrow$ $\dfrac{10x}{100}$ = 15 $\Rightarrow$ x = 150.

87. Let C.P. be Rs. x. Then, (106% of x) - $\left(87\dfrac{1}{2}\% \text{ of } x\right)$ = 51.80

$\Rightarrow$ $18\dfrac{1}{2}\%$ of x = 51.80 $\Rightarrow$ x = $\left(\dfrac{51.80 \times 100 \times 2}{37}\right)$ = 280.

88. Let the C.P. be Rs. x.

Then, S.P. = 120% of Rs. x = Rs. $\left(x \times \dfrac{120}{100}\right)$ = Rs. $\dfrac{6x}{5}$.

$\therefore$ $\dfrac{6x}{5} - x$ = 240 $\Leftrightarrow$ x = 1200.

$\therefore$ S.P. = Rs. $\left(\dfrac{6}{5} \times 1200\right)$ = Rs. 1200.

89. Let C.P. be Rs. x. Then,

$\left(107\dfrac{1}{2}\% \text{ of } x\right) - \left(97\dfrac{1}{2}\% \text{ of } x\right)$ = 100 $\Rightarrow$ 10% of x = 100 $\Rightarrow$ x = 1000.

$\therefore$ Desired S.P. = $112\dfrac{1}{2}\%$ of Rs. 1000 = Rs. $\left(\dfrac{225}{2} \times \dfrac{1}{100} \times 1000\right)$ = Rs. 1125.

90. Let C.P. of the article be Rs. x. Then, Required ratio = $\dfrac{104\% \text{ of } x}{106\% \text{ of } x}$ = $\dfrac{104}{106}$ = $\dfrac{52}{53}$ = 52 : 53.

91. Loss% = $\left(\dfrac{\text{Common Loss and Gain\%}}{10}\right)^2\%$ = $\left(\dfrac{12}{10}\right)^2\%$ = $\dfrac{36}{25}\%$ = $1\dfrac{11}{25}\%$.

92. Loss% = $\left(\dfrac{5}{10}\right)^2\%$ = $(0.5)^2\%$ = 0.25%.

93. Total S.P. = Rs. 8000 and Total C.P. = Rs. 8000.
    S.P. of 1st commodity = Rs. 4000. Gain on it = 25%.

$\therefore$ C.P. of 1st commodity = Rs. $\left(\dfrac{100}{125} \times 4000\right)$ = Rs. 3200.

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C.P. of 2nd commodity = Rs. (8000 − 3200) = Rs. 4800.

S.P. of 2nd commodity = Rs. 4000.

∴ Loss on 2nd commodity = $\left(\dfrac{800}{4800} \times 100\right)\% = 16\dfrac{2}{3}\%.$

94. Total S.P. = Rs. 2 lakh.

C.P. of house = Rs. $\left(\dfrac{100}{80} \times 1\right)$ lakh = Rs. $\dfrac{5}{4}$ lakh.

C.P. of shop = Rs. $\left(\dfrac{100}{120} \times 1\right)$ lakh = Rs. $\dfrac{5}{6}$ lakh.

Total C.P. = Rs. $\left(\dfrac{5}{4} + \dfrac{5}{6}\right)$ lakh = Rs. $\dfrac{25}{12}$ lakh.

∴ Loss = Rs. $\left(\dfrac{25}{12} - 2\right)$ lakh = Rs. $\dfrac{1}{12}$ lakh.

95. Total C.P. = Rs. (120 × 110) = Rs. 13200.

Total S.P = Rs. [(30 × 110 + 30 × 12) + (75 × 110 + 75 × 14) + (15 × 110 − 15 × 7)]

= Rs. 14505.

Average profit = Rs. $\left(\dfrac{14505 - 13200}{120}\right)$ = Rs. $\dfrac{1305}{120}$ = Rs. 10.875.

96. Total profit required = Rs. (42 × 18) = Rs. 756.

Profit on 22 sarees = Rs. (460 + 144) = Rs. 604.

Profit on 20 sarees = Rs. (756 − 604) = Rs. 152.

Average profit on these sarees = Rs. $\left(\dfrac{152}{20}\right)$ = Rs. 7.60.

97. C.P. of 20 dozen = Rs. (48 × 20) = Rs. 960.

C.P. of 8 dozen = Rs. (48 × 8) = Rs. 384.

C.P. of 12 dozen = Rs. (960 − 384) = Rs. 576.

Total S.P. = Rs. $\left(\dfrac{110}{100} \times 384 + \dfrac{120}{100} \times 576\right)$ = Rs. 1113.60.

∴ Profit% = $\left(\dfrac{153.60}{960} \times 100\right)\% = 16\%.$

98. C.P. of $\dfrac{3}{4}$th = Rs. $\left(\dfrac{3}{4} \times 400\right)$ = Rs. 300, C.P. of $\dfrac{1}{4}$th = Rs. 100.

∴ Total S.P. = (90% of Rs. 300 + 110% of Rs. 100) = Rs. 380.

Loss = $\left(\dfrac{20}{400} \times 100\right)\% = 5\%.$

99. Let C.P. of whole be Rs. x. C.P. of $\dfrac{2}{3}$rd = Rs. $\dfrac{2x}{3}$, C.P. of $\dfrac{1}{3}$rd = Rs. $\dfrac{x}{3}$.

Total S.P. = Rs. $\left[\left(120\% \text{ of } \dfrac{2x}{3}\right) + \left(114\% \text{ of } \dfrac{x}{3}\right)\right]$ = Rs. $\left(\dfrac{4x}{5} + \dfrac{19x}{50}\right)$ = Rs. $\dfrac{59x}{50}$.

Gain = Rs. $\left(\dfrac{59x}{50} - x\right)$ = Rs. $\dfrac{9x}{50}$.

∴ Gain% = $\left(\dfrac{9x}{50} \times \dfrac{1}{x} \times 100\right)\% = 18\%.$

100. Let C.P. of whole be Rs. x. C.P. of $\frac{1}{2}$ stock = Rs. $\frac{x}{2}$, C.P. of $\frac{1}{4}$ stock = Rs. $\frac{x}{4}$.

Total S.P. = Rs. $\left[\left(120\% \text{ of } \frac{x}{2}\right) + \left(80\% \text{ of } \frac{x}{4}\right) + \frac{x}{4}\right]$ = Rs. $\left(\frac{3x}{5} + \frac{x}{5} + \frac{x}{4}\right)$ = Rs. $\frac{21x}{20}$.

Gain = Rs. $\left(\frac{21x}{20} - x\right)$ = Rs. $\frac{x}{20}$.

∴   Gain% = $\left(\frac{x}{20} \times \frac{1}{x} \times 100\right)\%$ = 5%.

101. Let C.P. of each clock be Rs. x. Then, C.P. of 90 clocks = Rs. $90x$.

∴ [(110% of $40x$) + (120% of $50x$)] − (115% of $90x$) = 40

⟹ $44x + 60x - 103.5x = 40$ ⟹ $0.5x = 40$ ⟹ $x = 80$.

102. Let the investments be $3x$ and $5x$. Then, total investment = $8x$.

Total receipt = (115% of $3x$ + 90% of $5x$) = $(3.45x + 4.5x) = 7.95x$.

∴   Loss = $\left(\frac{0.05x}{8x} \times 100\right)\%$ = 0.625%.

103. Let the required gain percent be $x\%$.

Then, (110% of 3000) + [(100 + x)% of 3000] = 125% of 6000

⟹ $\left(\frac{110}{100} \times 3000\right) + \left[\frac{(100 + x)}{100} \times 3000\right] = \frac{125}{100} \times 6000$

⟹ $30(100 + x) = 4200$ ⟹ $100 + x = 140$ ⟹ $x = 40\%$.

104. Let the quantity sold at a loss be x kg and let C.P. per kg be Re. 1.
Total C.P. = Rs. 24.

Total S.P. = Rs. [120% of $(24 - x)$ + 95% of x] = Rs. $\left[\frac{6}{5}(24 - x) + \frac{19x}{20}\right]$ = Rs. $\left(\frac{576 - 5x}{20}\right)$.

∴ $\frac{576 - 5x}{20} = 110\%$ of 24 ⟹ $\frac{576 - 5x}{20} = \frac{264}{10}$ ⟹ $576 - 5x = 528$

⟹ $5x = 48$ ⟹ $x = 9.6$ kg.

105. Let the total value be Rs. x. Value of $\frac{2}{3}$rd = Rs. $\frac{2x}{3}$, Value of $\frac{1}{3}$rd = Rs. $\frac{x}{3}$.

Total S.P. = Rs. $\left[\left(105\% \text{ of } \frac{2x}{3}\right) + \left(98\% \text{ of } \frac{x}{3}\right)\right]$ = Rs. $\left(\frac{210x}{300} + \frac{98x}{300}\right)$ = Rs. $\frac{308x}{300}$.

∴ $\frac{308x}{300} - x = 400$ ⟹ $\frac{8x}{300} = 400$ ⟹ $x = \left(\frac{400 \times 300}{8}\right)$ = 15000.

106. Let C.P. of watch be Rs. x. Then, C.P. of wall clock = Rs. $(390 - x)$.

∴   (10% of x) + [15% of $(390 - x)$] = 51.50 ⟹ $\frac{10}{100} \times x + \frac{15}{100} \times (390 - x) = \frac{515}{10}$

⟹ $10x + 5850 - 15x = 5150$ ⟹ $5x = 700$ ⟹ $x = 140$.

So, C.P. of watch = Rs. 140, C.P. of wall clock = Rs. 250.

∴   Difference = Rs. (250 − 140) = Rs. 110.

107. Let C.P. of each horse be Rs. x and C.P. of each cow be Rs. y. Then,

$4x + 9y = 13400$ ...(i)

And, 10% of $4x$ + 20% of $9y$ = 1880

⟹ $\frac{2}{5}x + \frac{9}{5}y = 1880$ ⟹ $2x + 9y = 9400$ ...(ii)

Solving (i) and (ii), we get : $x = 2000$ and $y = 600$.

∴   Cost price of each horse = Rs. 2000.

108. Let C.P. of clock A be Rs. x and that of clock B be Rs. $(650 - x)$. Then,

120% of $x = 75\%$ of $(650 - x)$ $\Rightarrow$ $650 - x = \dfrac{120}{75}x = \dfrac{8}{5}x$

$\Rightarrow$ $\dfrac{13}{5}x = 650 \Rightarrow x = \left(\dfrac{650 \times 5}{13}\right) = 250.$

$\therefore$ C.P. of A = Rs. 250, C.P. of B = Rs. 400.

109. Let the C.P. of the watches be Rs. x and Rs. $(840 - x)$.

$\therefore$ $(116\%$ of $x) + [88\%$ of $(840 - x)] = 840$

$\Rightarrow$ $116x + 73920 - 88x = 84000 \Rightarrow 28x = 10080 \Rightarrow x = 360.$

$\therefore$ Their cost prices are Rs. 360 and Rs. 480.

110. Let C.P. of the chair be Rs. x and that of the table be Rs. y.

Then, 17% of $y - 7\%$ of $x = 296$ $\Rightarrow$ $17y - 7x = 29600$ ...(i)

And, 12% of $y + 7\%$ of $x = 400$ $\Rightarrow$ $12y + 7x = 40000$ ...(ii)

Solving (i) and (ii), we get : $y = 2400$ and $x = 1600$.

$\therefore$ C.P. of table = Rs. 2400.

111. S.P. = $97\dfrac{1}{2}\%$ of Rs. 650 = Rs. $\left(\dfrac{195}{2} \times \dfrac{1}{100} \times 650\right)$ = Rs. 633.75.

112. M.P. = Rs. 272000.

Discount = Rs. $[(4\%$ of 200000) + (2.5\% of 72000)]$ = Rs. $(8000 + 1800)$ = Rs. 9800.

$\therefore$ Actual price = Rs. $(272000 - 9800)$ = Rs. 262200.

113. C.P. = 90% of 80% of Rs. 1400 = Rs. $\left(\dfrac{90}{100} \times \dfrac{80}{100} \times 1400\right)$ = Rs. 1008.

114. Rate of discount = $\left(\dfrac{12}{80} \times 100\right)\%$ = 15%.

115. S.P. of each article = Rs. $\left(\dfrac{37.40}{2}\right)$ = Rs. 18.70.

Let M.P. be Rs. x.

Then, 85% of $x = 18.70$ $\Rightarrow$ $x = \left(\dfrac{18.70 \times 100}{85}\right)$ = 22.

116. Let the labelled price be Rs. x.

88% of 80% of $x = 704$ $\Rightarrow$ $x = \left(\dfrac{704 \times 100 \times 100}{88 \times 80}\right)$ = 1000.

117. S.P. after 1st discount = Rs. $\left(\dfrac{80}{100} \times 1500\right)$ = Rs. 1200.

Net S.P. = Rs. 1104. Discount on Rs. 1200 = Rs. 96.

$\therefore$ Required discount = $\left(\dfrac{96}{1200} \times 100\right)\%$ = 8%.

118. Let the costs of the two articles be x and y. Then, 15% of $x = 20\%$ of $y \Rightarrow \dfrac{x}{y} = \dfrac{20}{15} = \dfrac{4}{3}$.

So, x and y must be in the ratio of 4 : 3.

119. Let the list price be Rs. x.

$\Rightarrow$ $\dfrac{80}{100}x = 24$ $\Rightarrow$ $x = \dfrac{24 \times 100}{80}$ = 30.

$\therefore$ Required S.P. = 70% of Rs. 30 = Rs. 21.

120. Let the list price be Rs. z.

$\therefore$ $(100 - x)\%$ of $z = y$ $\Rightarrow$ $\left(\dfrac{100 - x}{100}\right) \times z = y$ $\Rightarrow$ $z = \left(\dfrac{100y}{100 - x}\right)$.

121. Let the labelled price be Rs. x. Then,

$(80\% \text{ of } x) - (75\% \text{ of } x) = 500$ $\Rightarrow$ $5\% \text{ of } x = 500$ $\Rightarrow$ $x = \left(\dfrac{500 \times 100}{5}\right) = 10000$.

122. Let marked price be Rs. 100.

Then, Final S.P. $= 70\%$ of 80% of Rs. 100 $=$ Rs. $\left(\dfrac{70}{100} \times \dfrac{80}{100} \times 100\right) =$ Rs. 56.

$\therefore$ Single discount $= (100 - 56)\% = 44\%$.

123. Let marked price be Rs. 100.

Then, S.P. $= 85\%$ of 88% of 90% of Rs. 100 $=$ Rs. $\left(\dfrac{85}{100} \times \dfrac{88}{100} \times \dfrac{90}{100} \times 100\right) =$ Rs. 67.32.

$\therefore$ Single discount $= (100 - 67.32)\% = 32.68\%$.

124. S.P. $= 90\%$ of 80% of Rs. 2000 $=$ Rs. $\left(\dfrac{90}{100} \times \dfrac{80}{100} \times 2000\right) =$ Rs. 1440.

125. S.P. $= 95\%$ of 95% of Rs. 80 $=$ Rs. $\left(\dfrac{95}{100} \times \dfrac{95}{100} \times 80\right) =$ Rs. 72.20.

126. Actual price $= 95\%$ of 90% of 85% of Rs. 12000

$=$ Rs. $\left(\dfrac{95}{100} \times \dfrac{90}{100} \times \dfrac{85}{100} \times 12000\right) =$ Rs. 8721.

127. Let the original price be Rs. x. Then,

95% of 88% of $x = 209$ $\Rightarrow$ $x = \left(\dfrac{209 \times 100 \times 100}{95 \times 88}\right) = 250$.

128. S.P. in 1st case $= 60\%$ of Rs. 100000 $=$ Rs. 60000.

S.P. in 2nd case $= 96\%$ of 64% of Rs. 100000

$=$ Rs. $\left(\dfrac{96}{100} \times \dfrac{64}{100} \times 100000\right) =$ Rs. 61440.

$\therefore$ Difference $=$ Rs. $(61440 - 60000) =$ Rs. 1440.

129. Let the amount of the bill be Rs. x. Then,

$(65\% \text{ of } x) - (80\% \text{ of } 80\% \text{ of } x) = 22$ $\Rightarrow$ $\left(\dfrac{65}{100} \times x\right) - \left(\dfrac{80}{100} \times \dfrac{80}{100} \times x\right) = 22$

$\Rightarrow$ $\dfrac{65}{100}x - \dfrac{64}{100}x = 22$ $\Rightarrow$ $\dfrac{x}{100} = 22$ $\Rightarrow$ $x = 2200$.

130. S.P. in 1st case $= 94\%$ of 70% of Rs. 700 $=$ Rs. $\left(\dfrac{94}{100} \times \dfrac{70}{100} \times 700\right) =$ Rs. 460.60.

S.P. in 2nd case $= 84\%$ of 80% of Rs. 700 $=$ Rs. $\left(\dfrac{84}{100} \times \dfrac{80}{100} \times 700\right) =$ Rs. 470.40.

$\therefore$ Difference $=$ Rs. $(470.40 - 460.60) =$ Rs. 9.80.

131. Let the second discount rate be $x\%$. Then,

$(100 - x)\%$ of 90% of $720 = 550.80$

$\Rightarrow$ $\dfrac{(100 - x)}{100} \times \dfrac{90}{100} \times 720 = 550.80$ $\Rightarrow$ $(100 - x) = \left(\dfrac{55080}{9 \times 72}\right) = 85$ $\Rightarrow$ $x = 15$.

$\therefore$ Second discount rate $= 15\%$.

132. Cost of each calculator = Rs. $\left(250 + \frac{2500}{150}\right)$ = Rs. $266\frac{2}{3}$.

S.P. of each calculator = Rs. $\left(\frac{95}{100} \times 320\right)$ = Rs. 304.

∴   Profit% = $\left(\frac{112}{3} \times \frac{3}{800} \times 100\right)$% = 14%.

133. Let C.P. be Rs. 100. Then, marked price = Rs. 125.

S.P. = 84% of Rs. 125 = Rs. $\left(\frac{84}{100} \times 125\right)$ = Rs. 105.

∴   Profit% = (105 – 100)% = 5%.

134. Let C.P. be Rs. 100. Then, marked price = Rs. 130.

S.P. = $\left(100 - \frac{25}{4}\right)$% of Rs. 130 = Rs. $\left(\frac{375}{400} \times 130\right)$ = Rs. 121.875.

∴   Profit% = (121.875 – 100)% = 21.875% = $\frac{21875}{1000}$% = $21\frac{7}{8}$%.

135. Let the original price be Rs. 100. Then, marked price = Rs. 130.

Final price = 90% of 90% of Rs. 130 = Rs. $\left(\frac{90}{100} \times \frac{90}{100} \times 130\right)$ = Rs. 105.30.

∴   Increase in price = (105.30 – 100)% = 5.3%.

136. Let the marked price of each article be Re. 1.
Then, C.P. of 30 = Rs. 27, S.P. of 30 = Rs. 30.

∴   Gain% = $\left(\frac{3}{27} \times 100\right)$% = $11\frac{1}{9}$%.

137. Marked price = Rs. 300. C.P. = Rs. $\left(\frac{100}{120} \times 300\right)$ = Rs. 250.

Sale price = 90% of Rs. 300 = Rs. 270.

∴   Required gain% = $\left(\frac{20}{250} \times 100\right)$% = 8%.

138. Let marked price = Rs. 100. Then, C.P. = Rs. 64. S.P = Rs. 88.

∴   Gain% = $\left(\frac{24}{64} \times 100\right)$% = 37.5%.

139. Let the marked price be Rs. x. Then, 108% of 90% of x = 680.40

⇒ $\frac{108}{100} \times \frac{90}{100} x = 680.40$ ⇒ $x = \left(\frac{68040 \times 100}{108 \times 90}\right)$ = Rs. 700.

140. Let C.P. = Rs. 100. Then, S.P. = Rs. 120.

Let marked price be Rs. x. Then, 90% of x = 120   ⇒ $x = \left(\frac{120 \times 100}{90}\right)$ = $133\frac{1}{3}$.

∴   Marked price = $33\frac{1}{3}$% above C.P.

141. C.P. = Rs. 1200. S.P. = 125% of Rs. 1200 = Rs. $\left(\frac{125}{100} \times 1200\right)$ = Rs. 1500.

Let marked price be Rs. x. Then, 80% of x = 1500   ⇒ $x = \left(\frac{1500 \times 100}{80}\right)$ = 1875.

∴   Marked price = Rs. 1875.

SUB#

142. Let cost price be Rs. 100. The, S.P. = Rs. 112.
Let printed price be Rs. x.

$$90\% \text{ of } x = 112 \implies x = \left(\frac{112 \times 100}{90}\right) = \text{Rs. } \frac{1120}{9}.$$

∴ Required ratio $= 100 : \dfrac{1120}{9} = 900 : 1120 = 45 : 56$.

143. Let cost price = Rs. 100. Then,

$$\frac{2}{5} \text{ of (Marked Price)} = 75 \implies \text{Marked Price} = \text{Rs. } \left(\frac{75 \times 5}{2}\right) = \text{Rs. } \frac{375}{2}.$$

∴ Required ratio $= \dfrac{375}{2} : 100 = 375 : 200 = 15 : 8$.

144. Let the C.P. of each article be Rs. 100.
Then, C.P. of 16 articles = Rs. (100 × 16) = Rs. 1600.

$$\text{S.P. of 15 articles} = \text{Rs. } \left(1600 \times \frac{135}{100}\right) = \text{Rs. } 2160.$$

$$\text{S.P. of each article} = \text{Rs. } \frac{2160}{15} = \text{Rs. } 144.$$

If S.P. is Rs. 96, marked price = Rs. 100.

If S.P. is Rs. 144, marked price = Rs. $\left(\dfrac{100}{96} \times 144\right)$ = Rs. 150.

∴ Marked price = 50% above C.P.

145. Let C.P. = Rs. 100. Then, Marked Price = Rs. 110, S.P. = Rs. 99.

∴ Discount% $= \left(\dfrac{11}{110} \times 100\right)\% = 10\%$.

146. Let C.P. = Rs. 100. Then, Marked Price = Rs. 135, S.P. = Rs. 108.

∴ Discount% $= \left(\dfrac{27}{135} \times 100\right)\% = 20\%$.

147. Let C.P. of whole stock = Rs. 100. Then, Marked Price of whole stock = Rs. 120.

M.P. of $\dfrac{1}{2}$ stock = Rs. 60, M.P. of $\dfrac{1}{4}$ stock = Rs. 30.

∴ Total S.P. = Rs. [60 + (80% of 30) + (60% of 30)] = Rs. (60 + 24 + 18) = Rs. 102.
Hence, gain% = (102 − 100)% = 2%.

148. Since the marked price is not given, so the cost price cannot be determined.

149. S.P. = 95% of Rs. 6500 = Rs. $\left(\dfrac{95}{100} \times 6500\right)$ = Rs. 6175.

Profit = 15%.

∴ C.P. = Rs. $\left(\dfrac{110}{115} \times 6175\right)$ = Rs. 5369.56 ≈ Rs. 5350.

150. Let the labelled price be Rs. x. Then, 120% of x = 2880 ⟹ $x = \left(\dfrac{2880 \times 100}{120}\right) = 2400$.

∴ C.P. = 85% of Rs. 2400 = Rs. $\left(\dfrac{85}{100} \times 2400\right)$ = Rs. 2040.

151. Marked price = Rs. 30. S.P. = Rs. $\left[\left(\frac{85}{100} \times 30\right) - 1.50\right]$ = Rs. (25.50 − 1.50) = Rs. 24.

Let C.P. be Rs. x. Then, 120% of $x = 24 \Rightarrow x = \left(\frac{24 \times 100}{120}\right)$ = Rs. 20.

152. Let the marked price be Rs. 100.

Then, S.P. = Rs. $\left(\frac{90}{100} \times 100\right)$ = Rs. 90. Gain = 20%.

$\therefore$ C.P. = Rs. $\left(\frac{100}{120} \times 90\right)$ = Rs. 75.

New commission = Rs. 20; New S.P. = Rs. 80.

$\therefore$ New Profit = $\left(\frac{5}{75} \times 100\right)$% = $6\frac{2}{3}$%.

153. S.P. = Rs. 17940. Let marked price be Rs. x.

Then, $\frac{92}{100}x = 17940 \Rightarrow x$ = Rs. $\left(17940 \times \frac{100}{92}\right)$ = Rs. 19500.

C.P. = Rs. $\left(\frac{100}{119.6} \times 17940\right)$ = Rs. $\left(\frac{1000}{1196} \times 17940\right)$ = Rs. 15000.

Now C.P. = Rs. 15000, S.P. = Rs. 19500.

$\therefore$ Required profit% = $\left(\frac{4500}{15000} \times 100\right)$% = 30%.

154. S.P. of 1 article = Rs. 45. Let marked price of each article be Rs. x.

Then, $\frac{90}{100}x = 45 \Rightarrow x$ = Rs. $\left(\frac{45 \times 100}{90}\right)$ = Rs. 50.

C.P. = Rs. $\left(\frac{100}{150} \times 45\right)$ = Rs. 30.

Now, C.P. = Rs. 30, S.P. = Rs. 50.

$\therefore$ Required profit% = $\left(\frac{20}{30} \times 100\right)$% = $66\frac{2}{3}$%.

155. S.P. of 1 saree = Rs. 266. Let the labelled price of each saree be Rs. x.

Then, $\frac{95}{100}x = 266 \Rightarrow x$ = Rs. $\left(\frac{266 \times 100}{95}\right)$ = Rs. 280.

Now, S.P. = Rs. 280, Profit = 12%.

$\therefore$ C.P. of 1 saree = Rs. $\left(\frac{100}{112} \times 280\right)$ = Rs. 250.

156. C.P. = Rs. 320, Profit = 15%.

S.P. = Rs. $\left(\frac{115}{100} \times 320\right)$ = Rs. 368. Marked price = Rs. (368 + 32) = Rs. 400.

$\therefore$ Required profit% = $\left(\frac{80}{320} \times 100\right)$% = 25%.

157. Let C.P. be Rs. 100. Then, S.P. = Rs. 123.50.

Let marked price be Rs. x. Then, $\frac{95}{100}x = 123.50 \Rightarrow x$ = Rs. $\left(\frac{12350}{95}\right)$ = Rs. 130.

Now, S.P. = Rs. 130, C.P. = Rs. 100.

$\therefore$ Profit% = 30%.

158. Let original list price = Rs. 100. Then, C.P. = Rs. 75. Desired S.P. = Rs 125.

∴ Required percentage = $\left(\frac{50}{75} \times 100\right)\%$ = 66.67%.

159. Let the original price be Rs. 100. Then, C.P. = Rs. 80.

S.P. = 140% of Rs. 80 = Rs. $\left(\frac{140}{100} \times 80\right)$ = Rs. 112.

∴ Required percentage = (112 − 100)% = 12%.

160. C.P. = Rs. $\left(\frac{100}{125} \times 8750\right)$ = Rs. 7000. Let the labelled price be Rs. x.

Then, $\frac{70}{100} x = 7000 \Rightarrow x = $ Rs. $\left(\frac{7000 \times 100}{70}\right)$ = Rs. 10000.

EXERCISE 11B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. A shopkeeper sells some toys at Rs. 250 each. What percent profit does he make ? To find the answer, which of the following information given in Statements I and II is / are necessary ?

   I. Number of toys sold.
   II. Cost price of each toy.
(a) Only I is necessary.
(b) Only II is necessary.
(c) Both I and II are necessary.
(d) Either I or II is necessary.
(e) None of these

2. A shopkeeper sells some articles at the profit of 25% on the original price. What is the exact amount of profit ?

To find the answer, which of the following information given in Statements I and II is / are necessary ?

   I. Sale price of the article.
   II. Number of articles sold.
(a) Only I is necessary.
(b) Only II is necessary.
(c) Either I or II is necessary.
(d) Both I and II are necessary.
(e) None of these

Directions (*Questions 3 to 13*) : *Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is / are sufficient to answer the question. Read both the statements and*

Give answer (a) *if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;*

Give answer (b) *if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;*

Give answer (c) *if the data either in Statement I or in Statement II alone are sufficient to answer the question;*

Give answer (d) *if the data even in both Statements I and II together are not sufficient to answer the question;*

Give answer (e) *if the data in both Statements I and II together are necessary to answer the question.*

3. By selling a product with 20% profit, how much profit was earned ?

   I. The difference between cost and selling price is Rs. 40.

   II. The selling price is 120 percent of the cost price.   (S.B.I.P.O. 2003)

4. What is the cost price of the article ?

   I. The profit earned on the article is one-third of the cost price.

   II. The article is sold for Rs. 400.

5. What would have been the selling price per kg of rice?   (Bank P.O. 1999)

   I. 50 kg of rice was purchased for Rs. 3350 and Rs. 150 were spent on transport.

   II. Profit earned was 5%.

6. How much was the loss ?

   I. The cost is Rs. 300.

   II. The loss is 25% of the selling price.

7. A man mixes two types of rice (X and Y) and sells the mixture at the rate of Rs. 17 per kg. Find his profit percentage.   (M.B.A. 2002)

   I. The rate of X is Rs. 20 per kg.

   II. The rate of Y is Rs. 13 per kg.

8. What is the percent profit earned by selling the product ?   (Bank P.O. 2003)

   I. The profit earned was Rs. 50.

   II. Had it been sold for Rs. 310, the profit would have been Rs. 70.

9. What is the cost price of the cassette ?

   I. The percent profit made when the cassette is sold for Rs. 78 is twice as much as when it is sold for Rs. 69.

   II. If the price of the cassette is marked at 20% above the cost price and a discount of 10% is offered on the marked price, the seller gains 8%.

10. What was the cost price of the suitcase purchased by Richard ? (Bank P.O. 2002)

   I. Richard got 20% concession on the labelled price.

   II. Richard sold the suitcase for Rs. 2000 with 25% profit on the labelled price.

11. By selling a product for Rs. 100, how much profit was earned ? (Bank P.O. 2002)

   I. 20% profit would have been earned if it were sold for Rs. 90.

   II. The profit was one-third of the purchase price.

12. What is the price of a banana ?

   I. A man can buy 14 bananas and 35 oranges for Rs. 84.

   II. With 50% discount on the price of bananas, Rs. 12 would buy 4 bananas and 5 oranges.

13. How much profit did Anand make by selling a bed ?   (S.B.I.P.O. 1998)

   I. He bought the bed with 40% discount on labelled price.

   II. He sold it with 20% profit on the labelled price.

Directions (Questions 14 to 20) : Each of the following questions consists of a question followed by three statements I, II and III. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

14. How many articles were sold ?   (Bank P.O. 2002)

   I. Total profit earned was Rs. 1596.

   II. Cost price per article was Rs. 632.

   III. Selling price per article was Rs. 765.

   (a) Any two of the three   (b) I and II only

   (c) II and III only   (d) All I, II and III

   (e) Question cannot be answered even with the information in all the three statements.

15. What was the amount of profit earned ?   **(Bank P.O. 2003)**
      I. 10% discount was offered on the labelled price.
      II. Had there been no discount, profit would have been 30%.
      III. Selling price was more than the cost price by 20%.
      (a) All I, II and III   (b) Any two of the three
      (c) III, and either I or II   (d) I, and either II or III
      (e) Question cannot be answered even with the information in all the three statements.

16. What was the cost price of the watch ?
      I. The shopkeeper labelled the price of the watch 20% above the cost price.
      II. After allowing a discount of 15% on the labelled price, the shopkeeper charges
          Rs. 408 for the watch.
      III. Had there been no discount, the shopkeeper would have earned 20% profit.
      (a) I, and either II or III   (b) II, and either I or III
      (c) III, and either I or II   (d) I and II only
      (e) Any two of the three

17. How much profit did Manick earn on the cost price of an article by selling it ?
      I. He got 15% discount on the marked price at the time of purchase.
      II. He sold it for Rs. 3060.
      III. He earned 2% profit on the marked price.   **(S.B.I.P.O. 2000)**
      (a) I and II only   (b) II and III only
      (c) I only or II and III together   (d) All I, II and III
      (e) Even I, II and III together are not sufficient to answer the question.

18. By selling an article what is the profit percent gained ?   **(S.B.I.P.O. 2002)**
      I. 5% discount is given on list price.
      II. If discount is not given, 20% profit is gained.
      III. The cost price of the article is Rs. 5000.
      (a) Only I and II   (b) Only II and III   (c) Only I and III
      (d) All I, II and III   (e) None of these

19. An item costing Rs. 3000 is sold at a certain discount. Find the rate of discount offered.
      I. The profit earned after discount is 5%.
      II. Had the discount rate been doubled, the seller incurs a loss of 15%.
      III. The item is marked at a price 25% above the cost price.
      (a) Only I and II   (b) Only II and III   (c) Only I and III
      (d) All I, II and III   (e) Any two of the three

20. What was the percentage of discount given ?   **(R.B.I. 2003)**
      I. 23.5% profit was earned by selling an almirah for Rs. 12,350.
      II. If there were no discount, the earned profit would have been 30%.
      III. The cost price of the almirah was Rs. 10,000.
      (a) Only I and II   (b) Only II and III   (c) Only I and III
      (d) Any two of the three   (e) None of these

Directions (Questions 21 to 22) : *Each of these questions is followed by three
statements. You have to study the question and all the three statements given to decide
whether any information provided in the statement(s) is/are redundant and can be
dispensed with while answering the given question.*

21. What is the percent profit earned by the shopkeeper on selling the articles in his shop ?
      I. Labelled price of the articles sold was 130% of the cost price.
      II. Cost price of each article was Rs. 550.
      III. A discount of 10% on labelled price was offered.   **(S.B.I.P.O. 2001)**

(a) Only I

(b) Only II

(c) Only III

(d) All the three are required

(e) Question cannot be answered even with information in all the three statements.

22. What is the marked price of the suitcase ?

I. When a discount of 15% is offered, the profit earned is 10.5%.

II. The cost price of the suitcase is Rs. 1500.

III. The marked price is 30% above the cost price.

(a) I only

(b) Either I or III

(c) Any one of the three

(d) All I, II and III are required

(e) None of these

ANSWERS

1. (b)	2. (d)	3. (a)	4. (e)	5. (e)	6. (e)	7. (d)	8. (b)
9. (a)	10. (e)	11. (c)	12. (d)	13. (d)	14. (d)	15. (e)	16. (b)
17. (d)	18. (a)	19. (e)	20. (e)	21. (b)	22. (b)		

SOLUTIONS

1. S.P. = Rs. 250 each. To find gain percent, we must know the C.P. of each.

∴ Correct answer is (b).

2. Gain = 25% of C.P.

In order to find gain, we must know the sale price of each article and the number of articles sold.

∴ Correct answer is (d).

3. Gain = 20%

I. Profit = (S.P.) − (C.P.) = Rs. 40.

Thus, I gives the answer. But, II does not give the answer.

∴ Correct answer is (a).

4. I. Gain = $\frac{1}{3}$ (C.P.).

II. S.P. = Rs. 400.

Gain = (S.P.) − (C.P.) $\Rightarrow$ $\frac{1}{3}$ (C.P.) = (Rs. 400) − (C.P.) $\Rightarrow$ $\left(1 + \frac{1}{3}\right)$ (C.P.) = Rs. 400

$\Rightarrow$ C.P. = Rs. $\left(400 \times \frac{3}{4}\right)$ = Rs. 300.

Thus, I and II both are needed to get the answer.

∴ Correct answer is (e).

5. I. Total C.P. of 50 kg = Rs. (3350 + 150) = Rs. 3500.

∴ C.P. of 1 kg = Rs. $\left(\frac{3500}{50}\right)$ = Rs. 70.

II. Gain = 5%.

∴ S.P. of 1 kg = 105% of Rs. 70 = Rs. $\left(70 \times \frac{105}{100}\right)$ = Rs. 73.50.

Thus, both I and II are needed to get the answer.

∴ Correct answer is (c).

6. I. C.P. = Rs. 300.
    II. Loss = 25% of S.P.

Let S.P. be Rs. x. Then, loss = 25% of Rs. x = Rs. $\frac{x}{4}$.

Loss = (C.P.) – (S.P.) $\Rightarrow$ $\frac{x}{4} = 300 - x \Rightarrow \left(x + \frac{x}{4}\right) = 300$

$\Rightarrow$ $x = \left(300 \times \frac{4}{5}\right) = 240$.

$\therefore$ Loss = 25% of Rs. 240 = Rs. $\left(\frac{25}{100} \times 240\right)$ = Rs. 60.

Thus, I and II are required to get the answer.
$\therefore$ Correct answer is (e).

7. The ratio in which X and Y are mixed, is not given.
    So, both I and II together cannot give the answer.
    $\therefore$ Correct answer is (d).

8. II gives, S.P. = Rs. 310 and gain = Rs. 70.
    $\therefore$ C.P = Rs. (310 – 70) = Rs. 240.

    $\therefore$ Gain% = $\left(\frac{70}{240} \times 310\right)$%.

Thus, II alone gives the answer.
Clearly, I alone does not give the answer.
$\therefore$ Correct answer is (b).

9. Let the C.P. be Rs. x. Then,

I. $\frac{(78 - x)}{x} \times 100 = 2 \times \frac{(69 - x)}{x} \times 100 \Leftrightarrow 78 - x = 138 - 2x \Leftrightarrow x = 60$.

Thus, I only gives the answer.

II. Let the C.P. be Rs. x. Then, M.P. = Rs. $\left(\frac{120}{100} \times x\right)$ = Rs. $\frac{6x}{5}$.

    $\therefore$ S.P. = 90% of Rs. $\frac{6x}{5}$ = Rs. $\left(\frac{6x}{5} \times \frac{90}{100}\right)$ = Rs. $\frac{27x}{25}$.

Thus, 108% of $x = \frac{27x}{25}$. This does not give x.
$\therefore$ II does not give the answer.
$\therefore$ Correct answer is (a).

10. Let the labelled price be Rs. x.

I. C.P. = 80% of Rs. x = Rs. $\left(x \times \frac{80}{100}\right)$ = Rs. $\frac{4x}{5}$.

II. S.P. = Rs. 2000, S.P. = 125% of Rs. x = Rs. $\left(\frac{125}{100} \times x\right)$ = Rs. $\frac{5x}{4}$.

    $\therefore$ $\frac{5x}{4} = 2000 \Rightarrow x = \frac{2000 \times 4}{5} = 1600$.

    $\therefore$ C.P. = Rs. $\frac{4x}{5}$ = Rs. $\left(\frac{4}{5} \times 1600\right)$ = Rs. 1280.

Thus, I and II together give the answer.
$\therefore$ Correct answer is (e).

SUB#

11.   S.P. = Rs. 100.

I. When S.P. = Rs. 90, Gain = 20%.

$\therefore$ C.P. = Rs. $\left(\dfrac{100}{120} \times 90\right)$ = Rs. 75.

Now, (C.P. = Rs. 75 and S.P. = Rs. 100) $\Rightarrow$ Profit = Rs. 25.

Thus, I alone gives the answer.

II. Let the C.P. be Rs. x. Then, gain = Rs. $\dfrac{x}{3}$.

$\therefore$ S.P. = Rs. $\left(x + \dfrac{x}{3}\right)$ = Rs. $\dfrac{4x}{3}$.

Thus, $\dfrac{4x}{3} = 100 \Rightarrow x = \left(\dfrac{3 \times 100}{4}\right) = 75$ and so C.P. = Rs. 75.

Thus, II alone gives the answer.

$\therefore$ Correct answer is (c).

12.   Let the price of a banana be Rs. x and that of an orange Rs. y.

I. $14x + 35y = 84 \Rightarrow 2x + 5y = 12$ ...(i)

II. $4 \times \dfrac{x}{2} + 5y = 12 \Rightarrow 2x + 5y = 12$ ...(ii)

Thus, even I and II together do not give the answer.

$\therefore$ Correct answer is (d).

13.   I. Let the labelled price be Rs. x.

C.P. = 60% of Rs. x = Rs. $\left(x \times \dfrac{60}{100}\right)$ = Rs. $\dfrac{3x}{5}$.

II. S.P. = 120% of Rs. x = Rs. $\left(x \times \dfrac{120}{100}\right)$ = Rs. $\dfrac{6x}{5}$.

Profit = Rs. $\left(\dfrac{6x}{5} - \dfrac{3x}{5}\right)$ = Rs. $\dfrac{3x}{5}$.

Thus, even I and II together do not give the answer.

$\therefore$ Correct answer is (d).

14.   I. Total gain = Rs. 1596.

II. C.P. of each article = Rs. 632.

III. S.P. of each article = Rs. 765.

Let the number of articles be x.

Then, $765x - 632x = 1596 \Rightarrow x = \dfrac{1596}{133} = 12$.

Thus, all I, II and III are needed to get the answer.

$\therefore$ Correct answer is (d).

15.   Let the M.P. be Rs. x.

I. S.P. = 90% of Rs. x = Rs. $\left(x \times \dfrac{90}{100}\right)$ = Rs. $\dfrac{9x}{10}$.

II. If S.P. = Rs. x, then gain = 30%.

$\therefore$ C.P. = Rs. $\left(\dfrac{100}{130} \times x\right)$ = Rs. $\dfrac{10x}{13}$.

III. Gain = 20%.

Thus, I, II, III do not give the answer.

$\therefore$ Correct answer is (e).

16. I. Let the C.P. be Rs. x.

Then, M.P. = 120% of Rs. x = Rs. $\left(\dfrac{120}{100} \times x\right)$ = Rs. $\dfrac{6x}{5}$.

II. S.P. = 85% of M.P. = Rs. $\left(\dfrac{6x}{5} \times \dfrac{85}{100}\right)$ = Rs. $\dfrac{51x}{50}$

∴ $\dfrac{51x}{50}$ = 408 ⟹ $x = \left(408 \times \dfrac{50}{51}\right)$ ⟹ $x = 400$.

Thus, I and II give the answer.

III. When there is no discount, then S.P. = M.P. = Rs. $\dfrac{6x}{5}$ [From I]

Thus, II and III give the same answer.

∴ Correct answer is (b).

17. Let the M.P. be Rs. x.

I. C.P. = 85% of Rs. x = Rs. $\left(x \times \dfrac{85}{100}\right)$ = Rs. $\dfrac{17x}{20}$.

II. S.P. = Rs. 3060.

III. 102% of x = 3060 ⟹ $x = \left(3060 \times \dfrac{100}{102}\right)$ = 3000.

∴ C.P. = Rs. $\dfrac{17x}{20}$ = Rs. $\left(\dfrac{17}{20} \times 3000\right)$ = Rs. 2550.

So, gain = Rs. (3060 − 2550) = Rs. 510.

Thus all I, II and III give the answer.

∴ Correct answer is (d).

18. I. Let the list price be Rs. x.

Then, S.P. = 95% of Rs. x = Rs. $\left(x \times \dfrac{95}{100}\right)$ = Rs. $\dfrac{19x}{20}$.

II. When S.P. = Rs. x and gain = 20%.

Then, C.P. = Rs. $\left(\dfrac{100}{120} \times x\right)$ = Rs. $\dfrac{5x}{6}$.

∴ Gain = $\left(\dfrac{19x}{20} - \dfrac{5x}{6}\right) = \left(\dfrac{57x - 50x}{60}\right) = \dfrac{7x}{60}$.

∴ Gain% = $\left(\dfrac{7x}{60} \times \dfrac{6}{5x} \times 100\right)$% = 14%.

Thus, I and II only give the answer.

∴ Correct answer is (a).

19. C.P. = Rs. 3000. Let the rate of discount be x%.

I. S.P. = 105% of Rs. 3000 = Rs. 3150.

II. Let M.P. = Rs. x. Then, $\dfrac{(x - 3150)}{(x - 85\% \text{ of } 3000)} = \dfrac{1}{2}$ ⟹ $x = 3750$.

From I and II, discount = Rs. (3750 − 3150) = Rs. 600.

Discount% = $\left(\dfrac{600}{3750} \times 100\right)$% = 16%.

Thus, I and II give the answer.

III. M.P. = 125% of Rs. 3000 = Rs. 3750.

From I and III, discount = (M.P.) − (S.P.) = Rs. 600.

Thus, Discount% can be calculated.

Thus, I and III give the answer.

From II and III, we get : discount = Rs. $\left(\dfrac{3750 - 85\% \text{ of } 3000}{2}\right)$ = Rs. 600.

Thus, II and III give the answer.

∴ Correct answer is (e).

20. I. S.P. = Rs. 12350, Gain = 23.5%.

∴ C.P. = Rs. $\left(\dfrac{100}{123.5} \times 12350\right)$ = Rs. 10000.

II. M.P. = 130% of C.P. = 130% of Rs. 10000 = Rs. 13000.

From I and II, discount = Rs. (13000 − 12350) = Rs. 650.

Discount% = $\left(\dfrac{650}{13000} \times 100\right)\%$ = 5%.

Thus, I and II give the answer.

III gives C.P. = Rs. 10000.

So, II and III give the answer.

∴ Correct answer is (e).

21. I. Let C.P. be Rs. x. Then, M.P. = 130% of x = Rs. $\dfrac{13x}{10}$.

III. S.P. = 90% of M.P.

Thus, I and III give, S.P. = Rs. $\left(\dfrac{90}{100} \times \dfrac{13x}{10}\right)$ = Rs. $\dfrac{117x}{100}$.

Gain = Rs. $\left(\dfrac{117x}{100} - x\right)$ = Rs. $\dfrac{17x}{100}$.

Thus, from I and III, gain% can be obtained.

Clearly, II is redundant.

∴ Correct answer is (b).

22. II. C.P. = Rs. 1500.

I. Gain = 10.5%.

∴ From I and II, we get

S.P. = 110.5% of C.P. = Rs. $\left(\dfrac{110.5}{100} \times 1500\right)$ = Rs. 1657.50.

Discount = 15%.

∴ M.P. = Rs. $\left(\dfrac{100}{85} \times 1657.50\right)$ = Rs. 1950.

Thus, I and II give the answer and so III is redundant.

III. M.P. = 130% of C.P.

From II and III, we get : M.P. = Rs. $\left(\dfrac{130}{100} \times 1500\right)$ = Rs. 1950.

∴ II and III give the answer and so I is redundant.

So, either I or III is redundant.

∴ Correct answer is (b).

12. RATIO AND PROPORTION

IMPORTANT FACTS AND FORMULAE

I. **RATIO** : The ratio of two quantities a and b in the same units, is the fraction $\frac{a}{b}$ and we write it as $a : b$.

In the ratio $a : b$, we call a as the **first term** or **antecedent** and b, the **second term** or **consequent**.

Ex. The ratio $5 : 9$ represents $\frac{5}{9}$ with antecedent = 5, consequent = 9.

Rule : The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.

Ex. $4 : 5 = 8 : 10 = 12 : 15$ etc. Also, $4 : 6 = 2 : 3$.

2. **PROPORTION** : *The equality of two ratios is called proportion.*

If $a : b = c : d$, we write, $a : b :: c : d$ and we say that a, b, c, d are in proportion.

Here a and d are called **extremes**, while b and c are called **mean terms**.

Product of means = Product of extremes.

Thus, $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$.

3. (i) **Fourth Proportional** : If $a : b = c : d$, then d is called the fourth proportional to a, b, c.

(ii) **Third Proportional** : If $a : b = b : c$, then c is called the third proportional to a and b.

(iii) **Mean Proportional** : Mean proportional between a and b is $\sqrt{ab}$.

4. (i) **COMPARISON OF RATIOS** :

We say that $(a : b) > (c : d) \Leftrightarrow \frac{a}{b} > \frac{c}{d}$.

(ii) **COMPOUNDED RATIO** :

The compounded ratio of the ratios $(a : b)$, $(c : d)$, $(e : f)$ is $(ace : bdf)$.

5. (i) **Duplicate ratio** of $(a : b)$ is $(a^2 : b^2)$.

(ii) **Sub-duplicate ratio** of $(a : b)$ is $(\sqrt{a} : \sqrt{b})$.

(iii) **Triplicate ratio** of $(a : b)$ is $(a^3 : b^3)$.

(iv) **Sub-triplicate ratio** of $(a : b)$ is $\left(a^{\frac{1}{3}} : b^{\frac{1}{3}} \right)$.

(v) If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$. (componendo and dividendo)

6. **VARIATION** :

(i) We say that x is directly proportional to y, if $x = ky$ for some constant k and we write, $x \propto y$.

(ii) We say that x is inversely proportional to y, if $xy = k$ for some constant k and we write, $x \propto \frac{1}{y}$.

SUB#

SOLVED PROBLEMS

Ex. 1. *If a : b = 5 : 9 and b : c = 4 : 7, find a : b : c.*

Sol. $a : b = 5 : 9$ and $b : c = 4 : 7 = \left(4 \times \dfrac{9}{4}\right) : \left(7 \times \dfrac{9}{4}\right) = 9 : \dfrac{63}{4}$

$\Rightarrow \quad a : b : c = 5 : 9 : \dfrac{63}{4} = 20 : 36 : 63.$

Ex. 2. *Find :*
(i) the fourth proportional to 4, 9, 12;
(ii) the third proportional to 16 and 36;
(iii) the mean proportional between 0.08 and 0.18.

Sol.   (i) Let the fourth proportional to 4, 9, 12 be x.

Then, $4 : 9 :: 12 : x \iff 4 \times x = 9 \times 12 \iff x = \dfrac{9 \times 12}{4} = 27.$

∴   Fourth proportional to 4, 9, 12 is 27.

(ii) Let the third proportional to 16 and 36 be x.

Then, $16 : 36 :: 36 : x \iff 16 \times x = 36 \times 36 \iff x = \dfrac{36 \times 36}{16} = 81.$

∴   Third proportional to 16 and 36 is 81.

(iii) Mean proportional between 0.08 and 0.18

$= \sqrt{0.08 \times 0.18} = \sqrt{\dfrac{8}{100} \times \dfrac{18}{100}} = \sqrt{\dfrac{144}{100 \times 100}} = \dfrac{12}{100} = 0.12.$

Ex. 3. *If x : y = 3 : 4, find (4x + 5y) : (5x − 2y).*

Sol. $\dfrac{x}{y} = \dfrac{3}{4} \Rightarrow \dfrac{4x + 5y}{5x - 2y} = \dfrac{4\left(\dfrac{x}{y}\right) + 5}{5\left(\dfrac{x}{y}\right) - 2} = \dfrac{\left(4 \times \dfrac{3}{4} + 5\right)}{\left(5 \times \dfrac{3}{4} - 2\right)} = \dfrac{(3 + 5)}{\left(\dfrac{7}{4}\right)} = \dfrac{32}{7}.$

Ex. 4. *Divide Rs. 672 in the ratio 5 : 3.*

Sol. Sum of ratio terms = (5 + 3) = 8.

∴   First part = Rs. $\left(672 \times \dfrac{5}{8}\right)$ = Rs. 420; Second part = Rs. $\left(672 \times \dfrac{3}{8}\right)$ = Rs. 252.

Ex. 5. *Divide Rs. 1162 among A, B, C in the ratio 35 : 28 : 20.*

Sol. Sum of ratio terms = (35 + 28 + 20) = 83.

A's share = Rs. $\left(1162 \times \dfrac{35}{83}\right)$ = Rs. 490; B's share = Rs. $\left(1162 \times \dfrac{28}{83}\right)$ = Rs. 392;

C's share = Rs. $\left(1162 \times \dfrac{20}{83}\right)$ = Rs. 280.

Ex. 6. *A bag contains 50 p, 25 p and 10 p coins in the ratio 5 : 9 : 4, amounting to Rs. 206. Find the number of coins of each type.*

Sol. Let the number of 50 p, 25 p and 10 p coins be 5x, 9x and 4x respectively.

Then, $\dfrac{5x}{2} + \dfrac{9x}{4} + \dfrac{4x}{10} = 206$

$\iff 50x + 45x + 8x = 4120 \iff 103x = 4120 \iff x = 40.$

∴   Number of 50 p coins = (5 × 40) = 200; Number of 25 p coins = (9 × 40) = 360;

Number of 10 p coins = (4 × 40) = 160.

SUB#

296   Quantitative Aptitude

Ex. 7. *A mixture contains alcohol and water in the ratio 4 : 3. If 5 litres of water is added to the mixture, the ratio becomes 4 : 5. Find the quantity of alcohol in the given mixture.*

Sol. Let the quantity of alcohol and water be $4x$ litres and $3x$ litres respectively. Then,

$$\frac{4x}{3x+5} = \frac{4}{5} \Leftrightarrow 20x = 4(3x+5) \Leftrightarrow 8x = 20 \Leftrightarrow x = 2.5.$$

∴   Quantity of alcohol = (4×2.5) litres = 10 litres.

EXERCISE 12

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark* (✓) *against the correct answer :*

1. If $A : B = 5 : 7$ and $B : C = 6 : 11$, then $A : B : C$ is :
   (a) 55 : 77 : 66   (b) 30 : 42 : 77   (c) 35 : 49 : 42   (d) None of these

2. If $A : B = 3 : 4$ and $B : C = 8 : 9$, then $A : C$ is :
   (a) 1 : 3   (b) 3 : 2   (c) 2 : 3   (d) 1 : 2

3. If $A : B = 8 : 15$, $B : C = 5 : 8$ and $C : D = 4 : 5$, then $A : D$ is equal to :
   (a) 2 : 7   (b) 4 : 15   (c) 8 : 15   (d) 15 : 4

4. If $A : B : C = 2 : 3 : 4$, then $\dfrac{A}{B} : \dfrac{B}{C} : \dfrac{C}{A}$ is equal to :   (S.S.C. 2002)
   (a) 4 : 9 : 16   (b) 8 : 9 : 12   (c) 8 : 9 : 16   (d) 8 : 9 : 24

5. If $A : B = \dfrac{1}{2} : \dfrac{3}{8}$, $B : C = \dfrac{1}{3} : \dfrac{5}{9}$ and $C : D = \dfrac{5}{6} : \dfrac{3}{4}$, then the ratio $A : B : C : D$ is :
   (a) 4 : 6 : 8 : 10   (b) 6 : 4 : 8 : 10   (c) 6 : 8 : 9 : 10   (d) 8 : 6 : 10 : 9

6. If $A : B = 2 : 3$, $B : C = 4 : 5$ and $C : D = 6 : 7$, then $A : B : C : D$ is :
   (a) 16 : 22 : 30 : 35   (b) 16 : 24 : 15 : 35
   (c) 16 : 24 : 30 : 35   (d) 18 : 24 : 30 : 35   (S.S.C. 2002)

7. If $2A = 3B = 4C$, then $A : B : C$ is :
   (a) 2 : 3 : 4   (b) 4 : 3 : 2   (c) 6 : 4 : 3   (d) 20 : 15 : 2

8. If $\dfrac{A}{3} = \dfrac{B}{4} = \dfrac{C}{5}$, then $A : B : C$ is :
   (a) 4 : 3 : 5   (b) 5 : 4 : 3   (c) 3 : 4 : 5   (d) 20 : 15 : 2

9. If $2A = 3B$ and $4B = 5C$, then $A : C$ is :
   (a) 4 : 3   (b) 8 : 15   (c) 15 : 8   (d) 3 : 4

10. The ratio of $4^{3.5} : 2^5$ is same as :
    (a) 2 : 1   (b) 4 : 1   (c) 7 : 5   (d) 7 : 10

11. If $\dfrac{1}{5} : \dfrac{1}{x} = \dfrac{1}{x} : \dfrac{1}{1.25}$, then the value of x is :
    (a) 1.5   (b) 2   (c) 2.5   (d) 3.5

12. If $0.75 : x :: 5 : 8$, then x is equal to :   (L.I.C. 2003)
    (a) 1.12   (b) 1.20   (c) 1.25   (d) 1.30

13. If $x : y = 5 : 2$, then $(8x + 9y) : (8x + 2y)$ is :   (S.S.C. 2001)
    (a) 22 : 29   (b) 26 : 61   (c) 29 : 22   (d) 61 : 26

14. If 15% of x = 20% of y, then $x : y$ is :
    (a) 3 : 4   (b) 4 : 3   (c) 17 : 16   (d) 16 : 17

15. If $(x : y) = 2 : 1$, then $(x^2 - y^2) : (x^2 + y^2)$ is :
   (a) $3 : 5$ (b) $5 : 3$ (c) $1 : 3$ (d) $3 : 1$

16. If $(4x^2 - 3y^2) : (2x^2 + 5y^2) = 12 : 19$, then $(x : y)$ is :
   (a) $2 : 3$ (b) $1 : 2$ (c) $3 : 2$ (d) $2 : 1$

17. If $x^2 + 4y^2 = 4xy$, then $x : y$ is :
   (a) $2 : 1$ (b) $1 : 2$ (c) $1 : 1$ (d) $1 : 4$

18. If $5x^2 - 13xy + 6y^2 = 0$, then $x : y$ is :
   (a) $(2 : 1)$ only   (b) $(3 : 5)$ only
   (c) $(5 : 3)$ or $(1 : 2)$ (d) $(3 : 5)$ or $(2 : 1)$

19. If $\frac{x}{5} = \frac{y}{8}$, then $(x + 5) : (y + 8)$ is equal to :
   (a) $3 : 5$ (b) $13 : 8$ (c) $8 : 5$ (d) $5 : 8$

20. If $\frac{a}{3} = \frac{b}{4} = \frac{c}{7}$, then $\frac{a + b + c}{c}$ is equal to :
   (a) 7 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{1}{7}$

21. If $(a + b) : (b + c) : (c + a) = 6 : 7 : 8$ and $(a + b + c) = 14$, then the value of c is :
   (a) 6 (b) 7 (c) 8 (d) 14

22. The salaries of A, B, C are in the ratio $2 : 3 : 5$. If the increments of 15%, 10% and 20% are allowed respectively in their salaries, then what will be the new ratio of their salaries ?   **(Bank P.O. 2002)**
   (a) $3 : 3 : 10$ (b) $10 : 11 : 20$
   (c) $23 : 33 : 60$ (d) Cannot be determined

23. If Rs. 782 be divided into three parts, proportional to $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$, then the first part is :   **(C.B.I. 2003)**
   (a) Rs. 182   (b) Rs. 190   (c) Rs. 196   (d) Rs. 204

24. If 76 is divided into four parts proportional to 7, 5, 3, 4, then the smallest part is :
   (a) 12   (b) 15   (c) 16   (d) 19

25. Two numbers are in the ratio $3 : 5$. If 9 is subtracted from each, the new numbers are in the ratio $12 : 23$. The smaller number is :   **(S.S.C. 2003)**
   (a) 27   (b) 33   (c) 49   (d) 55

26. Two numbers are in the ratio $1 : 2$. If 7 is added to both, their ratio changes to $3 : 5$. The greatest number is :   **(Hotel Management, 2003)**
   (a) 24   (b) 26   (c) 28   (d) 32

27. Rs. 1210 were divided among A, B, C so that $A : B = 5 : 4$ and $B : C = 9 : 10$. Then, C gets :
   (a) Rs. 340   (b) Rs. 400   (c) Rs. 450   (d) Rs. 475

28. In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of $1 : 2 : 3$. If there are Rs. 30 in all, how many 5 p coins are there ?   **(Hotel Management, 2003)**
   (a) 50   (b) 100   (c) 150   (d) 200

29. The ratio of three numbers is $3 : 4 : 5$ and the sum of their squares is 1250. The sum of the numbers is :
   (a) 30   (b) 50   (c) 60   (d) 90

30. The ratio of three numbers is $3 : 4 : 7$ and their product is 18144. The numbers are :
   (a) 9, 12, 21   (b) 15, 20, 25   (c) 18, 24, 42   (d) None of these

31. Salaries of Ravi and Sumit are in the ratio $2 : 3$. If the salary of each is increased by Rs. 4000, the new ratio becomes $40 : 57$. What is Sumit's present salary ?
   (a) Rs. 17,000   (b) Rs. 20,000   (c) Rs. 25,500   (d) None of these
                                                                              (Bank P.O. 2003)

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32. If Rs. 510 be divided among A, B, C in such a way that A gets $\frac{2}{3}$ of what B gets and
    B gets $\frac{1}{4}$ of what C gets, then their shares are respectively :   (I.M.T. 2002)
    (a) Rs. 120, Rs. 240, Rs. 150   (b) Rs. 60, Rs. 90, Rs. 360
    (c) Rs. 150, Rs. 300, Rs. 60   (d) None of these

33. The sum of three numbers is 98. If the ratio of the first to the second is 2 : 3 and that
    of the second to the third is 5 : 8, then the second number is :   (S.S.C. 2001)
    (a) 20   (b) 30   (c) 48   (d) 58

34. A fraction which bears the same ratio to $\frac{1}{27}$ that $\frac{3}{11}$ does to $\frac{5}{9}$, is equal to :
    (a) $\frac{1}{55}$ (b) $\frac{1}{11}$ (c) $\frac{3}{11}$ (d) 55
                                                                        (S.S.C. 2001)

35. Rs. 366 are divided amongst A, B and C so that A may get $\frac{1}{2}$ as much as B and C
    together, B may get $\frac{2}{3}$ as much as A and C together, then the share of A is :
    (a) Rs. 122   (b) Rs. 129.60   (c) Rs. 146.60   (d) Rs. 183

36. A sum of Rs. 1300 is divided amongst P, Q, R and S such that
    $\frac{P's\ share}{Q's\ share} = \frac{Q's\ share}{R's\ share} = \frac{R's\ share}{S's\ share} = \frac{2}{3}$. Then, P's share is :   (L.I.C. 2003)
    (a) Rs. 140   (b) Rs. 160   (c) Rs. 240   (d) Rs. 320

37. A and B together have Rs. 1210. If $\frac{4}{15}$ of A's amount is equal to $\frac{2}{5}$ of B's amount,
    how much amount does B have ?   (A.A.O. 2003)
    (a) Rs. 460   (b) Rs. 484   (c) Rs. 550   (d) Rs. 664

38. Two numbers are respectively 20% and 50% more than a third number. The ratio of
    the two numbers is :   (S.S.C. 2003)
    (a) 2 : 5   (b) 3 : 5   (c) 4 : 5   (d) 6 : 7

39. Two whole numbers whose sum is 72 cannot be in the ratio :
    (a) 5 : 7   (b) 3 : 5   (c) 3 : 4   (d) 4 : 5

40. If a carton containing a dozen mirrors is dropped, which of the following cannot be the
    ratio of broken mirrors to unbroken mirrors ?
    (a) 2 : 1   (b) 3 : 1   (c) 3 : 2   (d) 7 : 5

41. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There
    is a proposal to increase these seats by 40%, 50% and 75% respectively. What will
    be the ratio of increased seats ?   (Bank P.O. 2003)
    (a) 2 : 3 : 4   (b) 6 : 7 : 8   (c) 6 : 8 : 9   (d) None of these

42. The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase
    in the number of boys and girls be 20% and 10% respectively, what will be the new
    ratio ?   (R.B.I. 2003)
    (a) 8 : 9   (b) 17 : 18
    (c) 21 : 22   (d) Cannot be determined

43. A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3.
    If C gets Rs. 1000 more than D, what is B's share ?   (R.B.I. 2003)
    (a) Rs. 500   (b) Rs. 1500   (c) Rs. 2000   (d) None of these

44. If 40% of a number is equal to two-third of another number, what is the ratio of first
    number to the second number ?   (Bank P.O. 2002)
    (a) 2 : 5   (b) 3 : 7   (c) 5 : 3   (d) 7 : 3

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45. Ratio of the earnings of A and B is 4 : 7. If the earnings of A increase by 50% and those of B decrease by 25%, the new ratio of their earnings becomes 8 : 7. What are A's earnings ?
(Bank P.O. 2002)
(a) Rs. 21,000   (b) Rs. 26,000   (c) Rs. 28,000   (d) Data inadequate

46. What least number must be subtracted from each of the numbers 14, 17, 34 and 42 so that the remainders may be proportional ?
(a) 0   (b) 1   (c) 2   (d) 7

47. In a mixture of 60 litres, the ratio of milk and water is 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is :
(a) 20 litres   (b) 30 litres   (c) 40 litres   (d) 60 litres

48. The fourth proportional to 5, 8, 15 is :   (R.R.B. 2002)
(a) 18   (b) 24   (c) 19   (d) 20   (e) 21

49. The mean proportional between 234 and 104 is :
(a) 12   (b) 39   (c) 54   (d) None of these

50. The third proportional to 0.36 and 0.48 is :
(a) 0.64   (b) 0.1728   (c) 0.42   (d) 0.94

51. The third proportional to $(x^2 - y^2)$ and $(x - y)$ is :
(a) $(x + y)$ (b) $(x - y)$ (c) $\dfrac{x + y}{x - y}$ (d) $\dfrac{x - y}{x + y}$

52. The ratio of third proportional to 12 and 30 and the mean proportional between 9 and 25 is :
(a) 2 : 1   (b) 5 : 1   (c) 7 : 15   (d) 9 : 14

53. In a ratio, which is equal to 3 : 4, if the antecedent is 12, then the consequent is :
(a) 9   (b) 16   (c) 20   (d) 24

54. The prices of a scooter and a T.V. are in the ratio 7 : 5. If the scooter costs Rs. 8000 more than a T.V. set, then the price of a T.V. set is :
(a) Rs. 20,000   (b) Rs. 24,000   (c) Rs. 28,000   (d) Rs. 32,000

55. An amount of Rs. 735 was divided between A, B and C. If each of them had received Rs. 25 less, their shares would have been in the ratio of 1 : 3 : 2. The money received by C was :
(a) Rs. 195   (b) Rs. 200   (c) Rs. 225   (d) Rs. 245

56. An amount of Rs. 2430 is divided among A, B and C such that if their shares be reduced by Rs. 5, Rs. 10 and Rs. 15 respectively, the remainders shall be in the ratio of 3 : 4 : 5. Then, B's share was :
(a) Rs. 605   (b) Rs. 790   (c) Rs. 800   (d) Rs. 810

57. The ratio between two numbers is 3 : 4 and their L.C.M. is 180. The first number is :
(a) 60   (b) 45   (c) 20   (d) 15

58. An alloy is to contain copper and zinc in the ratio 9 : 4. The zinc required to be melted with 24 kg of copper is :
(a) $10\frac{2}{3}$ kg   (b) $10\frac{1}{3}$ kg   (c) $9\frac{2}{3}$ kg   (d) 9 kg

59. 60 kg of an alloy A is mixed with 100 kg of alloy B. If alloy A has lead and tin in the ratio 3 : 2 and alloy B has tin and copper in the ratio 1 : 4, then the amount of tin in the new alloy is :
(a) 36 kg   (b) 44 kg   (c) 53 kg   (d) 80 kg

60. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these be mixed to get an alloy 15 times as heavy as water ?
(a) 1 : 1   (b) 2 : 3   (c) 1 : 2   (d) 3 : 2

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61. 15 litres of mixture contains 20% alcohol and the rest water. If 3 litres of water be mixed with it, the percentage of alcohol in the new mixture would be :

(a) 15%   (b) $16\frac{2}{3}$%   (c) 17%   (d) $18\frac{1}{2}$%

62. 20 litres of a mixture contains milk and water in the ratio 5 : 3. If 4 litres of this mixture be replaced by 4 litres of milk, the ratio of milk to water in the new mixture would be :

(a) 2 : 1   (b) 7 : 3   (c) 8 : 3   (d) 4 : 3

63. 85 kg of a mixture contains milk and water in ratio 27 : 7. How much more water is to be added to get a new mixture containing milk and water in the ratio 3 : 1 ?

(a) 5 kg   (b) 6.5 kg   (c) 7.25 kg   (d) 8 kg

64. The ages of A and B are in the ratio 3 : 1. Fifteen years hence, the ratio will be 2 : 1. Their present ages are :

(a) 30 years, 10 years   (b) 45 years, 15 years

(c) 21 years, 7 years   (d) 60 years, 20 years

65. The average age of three boys is 25 years and their ages are in the proportion 3 : 5 : 7. The age of the youngest boy is :

(a) 21 years   (b) 18 years   (c) 15 years   (d) 9 years

66. The speeds of three cars are in the ratio 5 : 4 : 6. The ratio between the time taken by them to travel the same distance is :

(a) 5 : 4 : 6   (b) 6 : 4 : 5   (c) 10 : 12 : 15   (d) 12 : 15 : 10

67. In a college, the ratio of the number of boys to girls is 8 : 5. If there are 160 girls, the total number of students in the college is :

(a) 100   (b) 250   (c) 260   (d) 416

68. The sides of a triangle are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ and its perimeter is 104 cm. The length of the longest side is :

(a) 52 cm   (b) 48 cm   (c) 32 cm   (d) 26 cm

69. The ratio of the number of boys and girls in a school is 3 : 2. If 20% of the boys and 25% of the girls are scholarship holders, what percentage of the students does not get the scholarship ?

(a) 56   (b) 70   (c) 78   (d) 80

70. In a school, 10% of the boys are same in number as $\frac{1}{4}$th of the girls. What is the ratio of boys to girls in that school ?

(a) 3 : 2   (b) 5 : 2   (c) 2 : 1   (d) 4 : 3

71. Three containers have their volumes in the ratio 3 : 4 : 5. They are full of mixtures of milk and water. The mixtures contain milk and water in the ratio of (4 : 1), (3 : 1) and (5 : 2) respectively. The contents of all these three containers are poured into a fourth container. The ratio of milk and water in the fourth container is :

(a) 4 : 1   (b) 151 : 48   (c) 157 : 53   (d) 5 : 2

72. x varies inversely as square of y. Given that $y = 2$ for $x = 1$. The value of x for $y = 6$ will be equal to :   (C.D.S. 2003)

(a) 3   (b) 9   (c) $\frac{1}{3}$ (d) $\frac{1}{9}$

73. If 10% of x = 20% of y, then $x : y$ is equal to :   (C.D.S. 2003)

(a) 1 : 2   (b) 2 : 1   (c) 5 : 1   (d) 10 : 1

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74. The electricity bill of a certain establishment is partly fixed and partly varies as the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is Rs. 1800. In another month 620 units are consumed and the bill is Rs. 2040. In yet another month 500 units are consumed. The bill for that month would be :

    (a) Rs. 1560   (b) Rs. 1680   (c) Rs. 1840   (d) Rs. 1950

75. The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditures is 3 : 2. If at the end of the year, each saves Rs. 1600, then the income of A is :

    (a) Rs. 3400   (b) Rs. 3600   (c) Rs. 4000   (d) Rs. 4400

76. Zinc and copper are melted together in the ratio 9 : 11. What is the weight of melted mixture, if 28.8 kg of zinc has been consumed in it ?

    (a) 58 kg   (b) 60 kg   (c) 64 kg   (d) 70 kg

77. The compounded ratio of (2 : 3), (6 : 11) and (11 : 2) is :

    (a) 1 : 2   (b) 2 : 1   (c) 11 : 24   (d) 36 : 121

78. If 0.4 of a number is equal to 0.06 of another number, the ratio of the numbers is :

    (a) 2 : 3   (b) 3 : 4   (c) 3 : 20   (d) 20 : 3

79. The least whole number which when subtracted from both the terms of the ratio 6 : 7 gives a ratio less than 16 : 21 is :

    (a) 2   (b) 3   (c) 4   (d) 6

80. A and B are two alloys of gold and copper prepared by mixing metals in the ratio 7 : 2 and 7 : 11 respectively. If equal quantities of the alloys are melted to form a third alloy C, the ratio of gold and copper in C will be :

    (a) 5 : 7   (b) 5 : 9   (c) 7 : 5   (d) 9 : 5

81. Which of the following ratios is greatest ?

    (a) 7 : 15   (b) 15 : 23   (c) 17 : 25   (d) 21 : 29

82. A certain amount was divided between A and B in the ratio 4 : 3. If B's share was Rs. 4800, the total amount was :

    (a) Rs. 11,200   (b) Rs. 6400   (c) Rs. 19,200   (d) Rs. 39,200

83. A sum of Rs. 53 is divided among A, B, C in such a way that A gets Rs. 7 more than what B gets and B gets Rs. 8 more than what C gets. The ratio of their shares is :

    (a) 16 : 9 : 18   (b) 25 : 18 : 10   (c) 18 : 25 : 10   (d) 15 : 8 : 30

84. What is the ratio whose terms differ by 40 and the measure of which is $\frac{2}{7}$?

    (a) 16 : 56   (b) 14 : 56   (c) 15 : 56   (d) 16 : 72

ANSWERS

1. (b)	2. (c)	3. (b)	4. (d)	5. (d)	6. (c)	7. (c)	8. (c)
9. (c)	10. (b)	11. (c)	12. (b)	13. (c)	14. (b)	15. (a)	16. (c)
17. (a)	18. (d)	19. (d)	20. (b)	21. (a)	22. (c)	23. (d)	24. (a)
25. (b)	26. (c)	27. (b)	28. (c)	29. (c)	30. (c)	31. (d)	32. (b)
33. (b)	34. (a)	35. (a)	36. (b)	37. (b)	38. (c)	39. (c)	40. (c)
41. (a)	42. (c)	43. (c)	44. (c)	45. (d)	46. (c)	47. (d)	48. (b)
49. (d)	50. (a)	51. (d)	52. (b)	53. (b)	54. (c)	55. (c)	56. (d)
57. (b)	58. (a)	59. (b)	60. (d)	61. (b)	62. (b)	63. (a)	64. (b)
65. (c)	66. (d)	67. (d)	68. (b)	69. (c)	70. (b)	71. (c)	72. (d)
73. (b)	74. (b)	75. (c)	76. (c)	77. (b)	78. (c)	79. (b)	80. (c)
81. (d)	82. (a)	83. (b)	84. (a)				

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$$\boxed{\textbf{SOLUTIONS}}$$

1. $A : B = 5 : 7, B : C = 6 : 11 = \left(6 \times \dfrac{7}{6}\right) : \left(11 \times \dfrac{7}{6}\right) = 7 : \dfrac{77}{6}.$

$\therefore A : B : C = 5 : 7 : \dfrac{77}{6} = 30 : 42 : 77.$

2. $\left(\dfrac{A}{B} = \dfrac{3}{4}, \dfrac{B}{C} = \dfrac{8}{9}\right) \Rightarrow \dfrac{A}{C} = \left(\dfrac{A}{B} \times \dfrac{B}{C}\right) = \left(\dfrac{3}{4} \times \dfrac{8}{9}\right) = \dfrac{2}{3} \Rightarrow A : C = 2 : 3.$

3. $\dfrac{A}{B} = \dfrac{8}{15}, \dfrac{B}{C} = \dfrac{5}{8}$ and $\dfrac{C}{D} = \dfrac{4}{5} \Rightarrow \dfrac{A}{D} = \left(\dfrac{A}{B} \times \dfrac{B}{C} \times \dfrac{C}{D}\right) = \left(\dfrac{8}{15} \times \dfrac{5}{8} \times \dfrac{4}{5}\right) = \dfrac{4}{15}$

$\Rightarrow A : D = 4 : 15.$

4. Let $A = 2x, B = 3x$ and $C = 4x.$ Then, $\dfrac{A}{B} = \dfrac{2x}{3x} = \dfrac{2}{3}, \dfrac{B}{C} = \dfrac{3x}{4x} = \dfrac{3}{4}$ and $\dfrac{C}{A} = \dfrac{4x}{2x} = \dfrac{2}{1}$

$\Rightarrow \dfrac{A}{B} : \dfrac{B}{C} : \dfrac{C}{A} = \dfrac{2}{3} : \dfrac{3}{4} : \dfrac{2}{1} = 8 : 9 : 24.$

5. $A : B = \dfrac{1}{2} : \dfrac{3}{8} = 4 : 3, B : C = \dfrac{1}{3} : \dfrac{5}{9} = 3 : 5, C : D = \dfrac{5}{6} : \dfrac{3}{4} = 10 : 9$

$\Rightarrow A : B = 4 : 3, B : C = 3 : 5$ and $C : D = 5 : \dfrac{9}{2}$

$\Rightarrow A : B : C : D = 4 : 3 : 5 : \dfrac{9}{2} = 8 : 6 : 10 : 9.$

6. $A : B = 2 : 3, B : C = 4 : 5 = \left(4 \times \dfrac{3}{4}\right) : \left(5 \times \dfrac{3}{4}\right) = 3 : \dfrac{15}{4}$

and $C : D = 6 : 7 = \left(6 \times \dfrac{15}{24}\right) : \left(7 \times \dfrac{15}{24}\right) = \dfrac{15}{4} : \dfrac{25}{8}$

$\Rightarrow A : B : C : D = 2 : 3 : \dfrac{15}{4} : \dfrac{35}{8} = 16 : 24 : 30 : 35.$

7. Let $2A = 3B = 4C = k.$ Then, $A = \dfrac{k}{2}, B = \dfrac{k}{3}$ and $C = \dfrac{k}{4}$

$\Rightarrow A : B : C = \dfrac{k}{2} : \dfrac{k}{3} : \dfrac{k}{4} = 6 : 4 : 3.$

8. Let $\dfrac{A}{3} = \dfrac{B}{4} = \dfrac{C}{5} = k.$ Then, $A = 3k, B = 4k$ and $C = 5k$

$\Rightarrow A : B : C = 3k : 4k : 5k = 3 : 4 : 5.$

9. $2A = 3B$ and $4B = 5C \Rightarrow \dfrac{A}{B} = \dfrac{3}{2}$ and $\dfrac{B}{C} = \dfrac{5}{4}$

$\Rightarrow \dfrac{A}{C} = \left(\dfrac{A}{B} \times \dfrac{B}{C}\right) = \left(\dfrac{3}{2} \times \dfrac{5}{4}\right) = \dfrac{15}{8} \Rightarrow A : C = 15 : 8.$

10. $\dfrac{4^{3.5}}{2^5} = \dfrac{(2^2)^{3.5}}{2^5} = \dfrac{2^{(2 \times 3.5)}}{2^5} = \dfrac{2^7}{2^5} = 2^2 = 4.$

$\therefore$ Required ratio is $4 : 1.$

11. $\dfrac{1}{5} : \dfrac{1}{x} = \dfrac{1}{x} : \dfrac{100}{125} \Rightarrow \left(\dfrac{1}{x} \times \dfrac{1}{x}\right) = \left(\dfrac{1}{5} \times \dfrac{100}{125}\right) = \dfrac{4}{25}$

$\Rightarrow \dfrac{1}{x^2} = \dfrac{4}{25} \Rightarrow x^2 = \dfrac{25}{4} \Rightarrow x = \dfrac{5}{2} = 2.5.$

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12. $(x \times 5) = (0.75 \times 8) \Rightarrow x = \dfrac{6}{5} = 1.20.$

13. Let $x = 5k$ and $y = 2k$. Then, $\dfrac{8x + 9y}{8x + 2y} = \dfrac{(8 \times 5k) + (9 \times 2k)}{(8 \times 5k) + (2 \times 2k)} = \dfrac{58k}{44k} = \dfrac{29}{22}.$

    $\Rightarrow (8x + 9y) : (8x + 2y) = 29 : 22.$

14. 15% of x = 20% of $y \Rightarrow \dfrac{15x}{100} = \dfrac{20y}{100} \Rightarrow \dfrac{x}{y} = \left(\dfrac{20}{100} \times \dfrac{100}{15}\right) = \dfrac{4}{3}$

    $\Rightarrow x : y = 4 : 3.$

15. $\dfrac{x}{y} = \dfrac{2}{1} \Leftrightarrow \dfrac{x^2}{y^2} = \dfrac{4}{1} \Leftrightarrow \dfrac{x^2 + y^2}{x^2 - y^2} = \dfrac{4 + 1}{4 - 1}$ [By componendo and dividendo]

    $\Leftrightarrow \dfrac{x^2 - y^2}{x^2 + y^2} = \dfrac{3}{5} \Leftrightarrow (x^2 - y^2) : (x^2 + y^2) = 3 : 5.$

16. $\dfrac{4x^2 - 3y^2}{2x^2 + 5y^2} = \dfrac{12}{19} \Leftrightarrow 19(4x^2 - 3y^2) = 12(2x^2 + 5y^2)$

    $\Leftrightarrow 52x^2 = 117y^2 \Leftrightarrow 4x^2 = 9y^2 \Leftrightarrow \dfrac{x^2}{y^2} = \dfrac{9}{4} \Leftrightarrow \dfrac{x}{y} = \dfrac{3}{2}.$

    $\therefore$ Required ratio is $3 : 2$.

17. $x^2 + 4y^2 = 4xy \Leftrightarrow x^2 - 4xy + 4y^2 = 0 \Leftrightarrow (x - 2y)^2 = 0$

    $\Leftrightarrow (x - 2y) = 0 \Leftrightarrow x = 2y \Leftrightarrow \dfrac{x}{y} = \dfrac{2}{1}.$

    $\therefore x : y = 2 : 1.$

18. $5x^2 - 13xy + 6y^2 = 0 \Leftrightarrow 5x^2 - 10xy - 3xy + 6y^2 = 0$

    $\Leftrightarrow 5x(x - 2y) - 3y(x - 2y) = 0 \Leftrightarrow (x - 2y)(5x - 3y) = 0$

    $\Leftrightarrow x = 2y$ or $5x = 3y \Leftrightarrow \dfrac{x}{y} = \dfrac{2}{1}$ or $\dfrac{x}{y} = \dfrac{3}{5}$

    $\therefore (x : y) = (2 : 1)$ or $(3 : 5)$.

19. Let $\dfrac{x}{5} = \dfrac{y}{8} = k$. Then, $x = 5k$ and $y = 8k$.

    $\therefore \dfrac{x + 5}{y + 8} = \dfrac{5k + 5}{8k + 8} = \dfrac{5(k + 1)}{8(k + 1)} = \dfrac{5}{8} \Rightarrow (x + 5) : (y + 8) = 5 : 8.$

20. Let $\dfrac{a}{3} = \dfrac{b}{4} = \dfrac{c}{7} = k$. Then, $a = 3k, b = 4k, c = 7k$.

    $\therefore \dfrac{a + b + c}{c} = \dfrac{3k + 4k + 7k}{7k} = \dfrac{14k}{7k} = 2.$

21. Let $(a + b) = 6k, (b + c) = 7k$ and $(c + a) = 8k$.

    Then, $2(a + b + c) = 21k \Leftrightarrow 2 \times 14 = 21k \Leftrightarrow k = \dfrac{28}{21} = \dfrac{4}{3}.$

    $\therefore (a + b) = \left(6 \times \dfrac{4}{3}\right) = 8 \Rightarrow c = (a + b + c) - (a + b) = (14 - 8) = 6.$

22. Let $A = 2k, B = 3k$ and $C = 5k$.

    A's new salary $= \dfrac{115}{100}$ of $2k = \left(\dfrac{115}{100} \times 2k\right) = \dfrac{23}{10}k$

    B's new salary $= \dfrac{110}{100}$ of $3k = \left(\dfrac{110}{100} \times 3k\right) = \dfrac{33}{10}k$

$$\text{C's new salary} = \frac{120}{100} \text{ of } 5k = \left(\frac{120}{100} \times 5k\right) = 6k.$$

$$\therefore \quad \text{New ratio} = \frac{23k}{10} : \frac{33k}{10} : 6k = 23 : 33 : 60.$$

23. Given ratio $= \frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9.$

$$\therefore \quad \text{1st part} = \text{Rs.} \left(782 \times \frac{6}{23}\right) = \text{Rs. } 204.$$

24. Given ratio $= 7 : 5 : 3 : 4$, Sum of ratio terms $= 19.$

$$\therefore \quad \text{Smallest part} = \left(76 \times \frac{3}{19}\right) = 12.$$

25. Let the numbers be $3x$ and $5x$. Then, $\frac{3x-9}{5x-9} = \frac{12}{23} \iff 23(3x-9) = 12(5x-9)$

$$\iff 9x = 99 \iff x = 11.$$

$$\therefore \quad \text{The smaller number} = (3 \times 11) = 33.$$

26. Let the numbers be x and $2x$. Then, $\frac{x+7}{2x+7} = \frac{3}{5} \iff 5(x+7) = 3(2x+7) \iff x = 14.$

$$\therefore \quad \text{Greatest number} = 28.$$

27. $A : B = 5 : 4$, $B : C = 9 : 10 = \left(9 \times \frac{4}{9}\right) : \left(10 \times \frac{4}{9}\right) = 4 : \frac{40}{9}.$

$$\therefore \quad A : B : C = 5 : 4 : \frac{40}{9} = 45 : 36 : 40.$$

Sum of ratio terms $= (45 + 36 + 40) = 121.$

$$\therefore \quad \text{C's share} = \text{Rs.} \left(1210 \times \frac{40}{121}\right) = \text{Rs. } 400.$$

28. Let the number of 25 p, 10 p and 5 p coins be x, $2x$ and $3x$ respectively.

Then, sum of their values $= \text{Rs.} \left(\frac{25x}{100} + \frac{10 \times 2x}{100} + \frac{5 \times 3x}{100}\right) = \text{Rs.} \frac{60x}{100}.$

$$\therefore \quad \frac{60x}{100} = 30 \iff x = \frac{30 \times 100}{60} = 50.$$

Hence, the number of 5 p coins $= (3 \times 50) = 150.$

29. Let the numbers be $3x$, $4x$ and $5x$. Then,
$9x^2 + 16x^2 + 25x^2 = 1250 \iff 50x^2 = 1250 \iff x^2 = 25 \iff x = 5.$

$$\therefore \quad \text{Sum of numbers} = (3x + 4x + 5x) = 12x = (12 \times 5) = 60.$$

30. Let the numbers be $3x$, $4x$ and $7x$. Then,
$3x \times 4x \times 7x = 18144 \iff x^3 = 216 \iff x^3 = 6^3 \iff x = 6.$

$$\therefore \quad \text{The numbers are 18, 24 and 42.}$$

31. Let the original salaries of Ravi and Sumit be Rs. $2x$ and Rs. $3x$ respectively. Then,

$\frac{2x+4000}{3x+4000} = \frac{40}{57} \iff 57(2x+4000) = 40(3x+4000) \iff 6x = 68000 \iff 3x = 34000.$

Sumit's present salary $= (3x + 4000) = \text{Rs. }(34000 + 4000) = \text{Rs. } 38,000.$

32. $\left(A = \frac{2}{3}B \text{ and } B = \frac{1}{4}C\right) \iff \frac{A}{B} = \frac{2}{3} \text{ and } \frac{B}{C} = \frac{1}{4}$

$\Rightarrow A : B = 2 : 3$ and $B : C = 1 : 4 = 3 : 12 \Rightarrow A : B : C = 2 : 3 : 12.$

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∴ A's share = Rs. $\left(510 \times \frac{2}{17}\right)$ = Rs. 60; B's share = Rs. $\left(510 \times \frac{3}{17}\right)$ = Rs. 90;

C's share = Rs. $\left(510 \times \frac{12}{17}\right)$ = Rs. 360.

33. Let the three parts be A, B, C. Then,

$A : B = 2 : 3$ and $B : C = 5 : 8 = \left(5 \times \frac{3}{5}\right) : \left(8 \times \frac{3}{5}\right) = 3 : \frac{24}{5}$

⇒ $A : B : C = 2 : 3 : \frac{24}{5} = 10 : 15 : 24$ ⇒ $B = \left(98 \times \frac{15}{49}\right) = 30$.

34. Let $x : \frac{1}{27} :: \frac{3}{11} : \frac{5}{9}$. Then, $x \times \frac{5}{9} = \frac{1}{27} \times \frac{3}{11}$ ⇔ $x = \left(\frac{1}{27} \times \frac{3}{11} \times \frac{9}{5}\right) = \frac{1}{55}$.

35. $A : (B + C) = 1 : 2$ ⇒ A's share = Rs. $\left(366 \times \frac{1}{3}\right)$ = Rs. 122.

36. Let P = 2x and Q = 3x. Then, $\frac{Q}{R} = \frac{2}{3}$ ⇒ $R = \frac{3}{2} Q = \left(\frac{3}{2} \times 3x\right) = \frac{9x}{2}$.

Also, $\frac{R}{S} = \frac{2}{3}$ ⇒ $S = \frac{3}{2} R = \left(\frac{3}{2} \times \frac{9x}{2}\right) = \frac{27x}{4}$.

Thus, P = 2x, Q = 3x, R = $\frac{9x}{2}$ and S = $\frac{27x}{4}$.

Now, P + Q + R + S = 1300 ⇔ $\left(2x + 3x + \frac{9x}{2} + \frac{27x}{4}\right) = 1300$

⇔ $(8x + 12x + 18x + 27x) = 5200$

⇔ $65x = 5200$ ⇔ $x = \frac{5200}{65} = 80$.

∴ P's share = Rs. (2 × 80) = Rs. 160.

37. $\frac{4}{15} A = \frac{2}{5} B$ ⇔ $A = \left(\frac{2}{5} \times \frac{15}{4}\right) B$ ⇔ $A = \frac{3}{2} B$ ⇔ $\frac{A}{B} = \frac{3}{2}$ ⇔ A : B = 3 : 2

∴ B's share = Rs. $\left(1210 \times \frac{2}{5}\right)$ = Rs. 484.

38. Let the third number be x.

Then, first number = 120% of $x = \frac{120x}{100} = \frac{6x}{5}$;

second number = 150% of $x = \frac{150x}{100} = \frac{3x}{2}$.

∴ Ratio of first two numbers = $\frac{6x}{5} : \frac{3x}{2} = 12x : 15x = 4 : 5$.

39. The sum of the ratio terms must divide 72. So, the ratio cannot be 3 : 4.

40. For dividing 12 into two whole numbers, the sum of the ratio terms must be a factor of 12. So, they cannot be in the ratio 3 : 2.

41. Originally, let the number of seats for Mathematics, Physics and Biology be 5x, 7x and 8x respectively.

Number of increased seats are (140% of 5x), (150% of 7x) and (175% of 8x)

i.e. $\left(\frac{140}{100} \times 5x\right)$, $\left(\frac{150}{100} \times 7x\right)$ and $\left(\frac{175}{100} \times 8x\right)$ i.e. 7x, $\frac{21x}{2}$ and 14x.

∴ Required ratio = $7x : \frac{21x}{2} : 14x = 14x : 21x : 28x = 2 : 3 : 4$.

42. Originally, let the number of boys and girls in the college be $7x$ and $8x$ respectively.
Their increased number is (120% of $7x$) and (110% of $8x$)

$i.e. \left(\dfrac{120}{100} \times 7x\right)$ and $\left(\dfrac{110}{100} \times 8x\right)$ $i.e. \dfrac{42x}{5}$ and $\dfrac{44x}{5}$.

∴ Required ratio $= \dfrac{42x}{5} : \dfrac{44x}{5} = 21 : 22$.

43. Let the shares of A, B, C and D be Rs. $5x$, Rs. $2x$, Rs. $4x$ and Rs. $3x$ respectively.
Then, $4x - 3x = 1000 \Leftrightarrow x = 1000$.

∴ B's share = Rs. $2x$ = Rs. (2×1000) = Rs. 2000.

44. Let 40% of A $= \dfrac{2}{3}$ B. Then, $\dfrac{40A}{100} = \dfrac{2B}{3} \Leftrightarrow \dfrac{2A}{5} = \dfrac{2B}{3} \Leftrightarrow \dfrac{A}{B} = \left(\dfrac{2}{3} \times \dfrac{5}{2}\right) = \dfrac{5}{3}$.

∴ A : B = 5 : 3.

45. Let the original earnings of A and B be Rs. $4x$ and Rs. $7x$.

New earnings of A = 150% of Rs. $4x$ = Rs. $\left(\dfrac{150}{100} \times 4x\right)$ = Rs. $6x$.

New earnings of B = 75% of Rs. $7x$ = Rs. $\left(\dfrac{75}{100} \times 7x\right)$ = Rs. $\dfrac{21x}{4}$.

∴ $6x : \dfrac{21x}{4} = 8 : 7 \Leftrightarrow \dfrac{6x \times 4}{21x} = \dfrac{8}{7}$.

This does not give x. So, the given data is inadequate.

46. Let the required number be x. Then, $(14 - x) : (17 - x) :: (34 - x) : (42 - x)$.

∴ $\dfrac{14 - x}{17 - x} = \dfrac{34 - x}{42 - x} \Leftrightarrow (14 - x)(42 - x) = (17 - x)(34 - x)$

$\Leftrightarrow x^2 - 56x + 588 = x^2 - 51x + 578 \Leftrightarrow 5x = 10 \Leftrightarrow x = 2$.

∴ Required number = 2.

47. Quantity of milk $= \left(60 \times \dfrac{2}{3}\right)$ litres = 40 litres.

Quantity of water in it = (60 − 40) litres = 20 litres.
New Ratio required = 1 : 2.

Let quantity of water to be added further be x litres. Then, milk : water $= \dfrac{40}{(20 + x)}$.

Now, $\dfrac{40}{(20 + x)} = \dfrac{1}{2} \Leftrightarrow 20 + x = 80 \Leftrightarrow x = 60$.

Quantity of water to be further added = 60 litres.

48. Let the fourth proportional to 5, 8, 15 be x.

Then, $5 : 8 :: 15 : x \Leftrightarrow 5x = (8 \times 15) \Leftrightarrow x = \dfrac{(8 \times 15)}{5} = 24$.

49. Required mean proportional $= \sqrt{234 \times 104} = \sqrt{13 \times 9 \times 2 \times 13 \times 8} = (13 \times 3 \times 4) = 156$.

50. Let the third proportional to 0.36 and 0.48 be x.

Then, $0.36 : 0.48 :: 0.48 : x \Leftrightarrow x = \left(\dfrac{0.48 \times 0.48}{0.36}\right) = 0.64$.

51. Let the third proportional to $(x^2 - y^2)$ and $(x - y)$ be z. Then,

$(x^2 - y^2) : (x - y) :: (x - y) : z \Leftrightarrow (x^2 - y^2) \times z = (x - y)^2 \Leftrightarrow z = \dfrac{(x - y)^2}{(x^2 - y^2)} = \dfrac{(x - y)}{(x + y)}$.

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52. Let the third proportional to 12 and 30 be x.

Then, $12 : 30 :: 30 : x \Leftrightarrow 12x = 30 \times 30 \Leftrightarrow x = \dfrac{(30 \times 30)}{12} = 75$.

∴ Third proportional to 12 and 30 = 75.

Mean proportional between 9 and 25 = $\sqrt{9 \times 25}$ = 15.

∴ Required ratio = 75 : 15 = 5 : 1.

53. We have $\dfrac{3}{4} = \dfrac{12}{x} \Leftrightarrow 3x = 48 \Leftrightarrow x = 16$.

∴ Consequent = 16.

54. Let the prices of a scooter and a T.V. set be Rs. 7x and Rs. 5x respectively. Then,

$7x - 5x = 8000 \Leftrightarrow 2x = 8000 \Leftrightarrow x = 4000$.

∴ Price of a T.V. set = Rs. (7×4000) = Rs. 28000.

55. Remainder = Rs. $[735 - (25 \times 3)]$ = Rs. 660.

∴ Money received by C = Rs. $\left[\left(660 \times \dfrac{2}{6}\right) + 25\right]$ = Rs. 225.

56. Remainder = Rs. $[2430 - (5 + 10 + 15)]$ = Rs. 2400.

∴ B's share = Rs. $\left[\left(2400 \times \dfrac{4}{12}\right) + 10\right]$ = Rs. 810.

57. Let the required numbers be $3x$ and $4x$. Then, their L.C.M. is $12x$.

∴ $12x = 180 \Leftrightarrow x = 15$. Hence, the first number is 45.

58. Let the required quantity of copper be x kg.

Then, $9 : 4 :: 24 : x \Leftrightarrow 9x = 4 \times 24 \Leftrightarrow x = \dfrac{4 \times 24}{9} = 10\dfrac{2}{3}$.

Hence, the required quantity of copper is $10\dfrac{2}{3}$ kg.

59. Quantity of tin in 60 kg of A = $\left(60 \times \dfrac{2}{5}\right)$ kg = 24 kg.

Quantity of tin in 100 kg of B = $\left(100 \times \dfrac{1}{5}\right)$ kg = 20 kg.

Quantity of tin in the new alloy = $(24 + 20)$ kg = 44 kg.

60. $G = 19W$ and $C = 9W$.

Let 1 gm of gold be mixed with x gm of copper to get $(1 + x)$ gm of the alloy.

(1 gm gold) + (x gm copper) = ($x + 1$) gm of alloy

$\Leftrightarrow 19W + 9Wx = (x + 1) \times 15W \Leftrightarrow 19 + 9x = 15(x + 1) \Leftrightarrow 6x = 4 \Leftrightarrow x = \dfrac{2}{3}$.

∴ Ratio of gold with copper = $1 : \dfrac{2}{3} = 3 : 2$.

61. Alcohol in 15 litres of mix. = 20% of 15 litres = $\left(\dfrac{20}{100} \times 15\right)$ litres = 3 litres.

Water in it = $(15 - 3)$ litres = 12 litres.

New quantity of mix. = $(15 + 3)$ litres = 18 litres.

Quantity of alcohol in it = 3 litres.

Percentage of alcohol in new mix. = $\left(\dfrac{3}{18} \times 100\right)\% = 16\dfrac{2}{3}\%$.

62. Quantity of milk in 16 litres of mix. $= \left(16 \times \frac{5}{8}\right)$ litres = 10 litres.

Quantity of milk in 20 litres of new mix. = (10 + 4) litres.

Quantity of water in it = (20 – 14) litres = 6 litres.

∴ Ratio of milk and water in the new mix. = 14 : 6 = 7 : 3.

63. Milk in 85 kg of mix. $= \left(85 \times \frac{27}{34}\right)$ kg $= \frac{135}{2}$ kg.

Water in it $= \left(85 - \frac{135}{2}\right)$ kg $= \frac{35}{2}$ kg.

Let x kg of water be added to it.

Then, $\dfrac{\left(\frac{135}{2}\right)}{\left(\frac{35}{2}+x\right)} = \dfrac{3}{1} \Leftrightarrow \dfrac{135}{35+2x} = \dfrac{3}{1} \Leftrightarrow 105 + 6x = 135 \Leftrightarrow 6x = 30 \Leftrightarrow x = 5.$

∴ Quantity of water to be added = 5 kg.

64. Let the ages of A and B be $3x$ years and x years respectively.

Then, $\dfrac{3x + 15}{x + 15} = \dfrac{2}{1} \Leftrightarrow 2x + 30 = 3x + 15 \Leftrightarrow x = 15.$

So, A's age = (3×15) years = 45 years and B's age = 15 years.

65. Total age of 3 boys = (25×3) years = 75 years. Ratio of their ages = 3 : 5 : 7.

Age of the youngest $= \left(75 \times \frac{3}{15}\right)$ years = 15 years.

66. Ratio of time taken $= \frac{1}{5} : \frac{1}{4} : \frac{1}{6} = 12 : 15 : 10.$

67. Let the number of boys and girls be $8x$ and $5x$ respectively. Then, $5x = 160 \Leftrightarrow x = 32$

∴ Total number of students = $13x = (13 \times 32) = 416.$

68. Ratio of sides $= \frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3.$

Largest side $= \left(104 \times \frac{6}{13}\right)$ cm = 48 cm.

69. Let boys = $3x$ and girls = $2x$.

Number of these who do not get scholarship

$= (80\% \text{ of } 3x) + (75\% \text{ of } 2x) = \left(\frac{80}{100} \times 3x\right) + \left(\frac{75}{100} \times 2x\right) = \frac{39x}{10}.$

Required percentage $= \left(\frac{39x}{10} \times \frac{1}{5x} \times 100\right)\% = 78\%.$

70. 10% of B $= \frac{1}{4}$ G $\Leftrightarrow \frac{10B}{100} = \frac{1}{4}$ G $\Leftrightarrow$ B $= \frac{5}{2}$ G

∴ $\dfrac{B}{G} = \dfrac{5}{2} \Leftrightarrow$ B : G = 5 : 2.

71. Let the three containers contain $3x$, $4x$ and $5x$ litres of mixtures respectively.

Milk in 1st mix. $= \left(3x \times \frac{4}{5}\right)$ litres $= \frac{12x}{5}$ litres.

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Water in 1st mix. $= \left(3x - \dfrac{12x}{5}\right)$ litres $= \dfrac{3x}{5}$ litres.

Milk in 2nd mix. $= \left(4x \times \dfrac{3}{4}\right)$ litres $= 3x$ litres.

Water in 2nd mix. $= (4x - 3x)$ litres $= x$ litres.

Milk in 3rd mix. $= \left(5x \times \dfrac{5}{7}\right)$ litres $= \dfrac{25x}{7}$ litres.

Water in 3rd mix. $= \left(5x - \dfrac{25x}{7}\right)$ litres $= \dfrac{10x}{7}$ litres.

Total milk in final mix. $= \left(\dfrac{12x}{5} + 3x + \dfrac{25x}{7}\right)$ litres $= \dfrac{314x}{35}$ litres.

Total water in final mix. $= \left(\dfrac{3x}{5} + x + \dfrac{10x}{7}\right)$ litres $= \dfrac{106x}{35}$ litres.

Required ratio of milk and water $= \dfrac{314x}{35} : \dfrac{106x}{35} = 157 : 53$.

72. Given $x = \dfrac{k}{y^2}$, where k is a constant.

Now, $y = 2$ and $x = 1$ gives $k = 4$.

$\therefore \quad x = \dfrac{4}{y^2} \Rightarrow x = \dfrac{4}{6^2}$, when $y = 6 \Rightarrow x = \dfrac{4}{36} = \dfrac{1}{9}$.

73. 10% of x = 20% of $y \Leftrightarrow \dfrac{10x}{100} = \dfrac{20y}{100} \Leftrightarrow \dfrac{x}{10} = \dfrac{y}{5} \Leftrightarrow \dfrac{x}{y} = \dfrac{10}{5} = \dfrac{2}{1}$.

$\therefore \quad x : y = 2 : 1$.

74. Let the fixed amount be Rs. x and the cost of each unit be Rs. y. Then,

$540y + x = 1800$ ...(i) and $620y + x = 2040$ ...(ii)

On subtracting (i) from (ii), we get $80y = 240 \Leftrightarrow y = 3$.

Putting $y = 3$ in (i), we get :

$540 \times 3 + x = 1800 \Leftrightarrow x = (1800 - 1620) = 180$.

$\therefore$ Fixed charges = Rs. 180, Charge per unit = Rs. 3.

Total charges for consuming 500 units = Rs. $(180 + 500 \times 3)$ = Rs. 1680.

75. Let the incomes of A and B be Rs. $5x$ and Rs. $4x$ respectively and let their expenditures be Rs. $3y$ and Rs. $2y$ respectively.

Then, $5x - 3y = 1600$ ...(i) and $4x - 2y = 1600$ ...(ii)

On multiplying (i) by 2, (ii) by 3 and subtracting, we get : $2x = 1600 \Leftrightarrow x = 800$.

$\therefore$ A's income = Rs. $5x$ = Rs. (5×800) = Rs. 4000.

76. For 9 kg zinc, mixture melted = $(9 + 11)$ kg.

For 28.8 kg zinc, mixture melted $= \left(\dfrac{20}{9} \times 28.8\right)$ kg = 64 kg.

77. Required ratio $= \left(\dfrac{2}{3} \times \dfrac{6}{11} \times \dfrac{11}{2}\right) = \dfrac{2}{1} = 2 : 1$.

78. $0.4A = 0.06B \Leftrightarrow \dfrac{A}{B} = \dfrac{0.06}{0.40} = \dfrac{6}{40} = \dfrac{3}{20}$.

$\therefore \quad A : B = 3 : 20$.

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79. Let x be subtracted. Then,

$$\frac{6-x}{7-x} < \frac{16}{21} \Leftrightarrow 21(6-x) < 16(7-x) \Leftrightarrow 5x > 14 \Leftrightarrow x > 2.8.$$

∴ Least such whole number is 3.

80. Gold in C = $\left(\frac{7}{9} + \frac{7}{18}\right)$ units = $\frac{7}{6}$ units. Copper in C = $\left(\frac{2}{9} + \frac{11}{18}\right)$ units = $\frac{5}{6}$ units.

∴ Gold : Copper = $\frac{7}{6} : \frac{5}{6}$ = 7 : 5.

81. $\frac{7}{15}$ = 0.466, $\frac{15}{23}$ = 0.652, $\frac{17}{25}$ = 0.68 and $\frac{21}{29}$ = 0.724.

Clearly, 0.724 is greatest and therefore, 21 : 29 is greatest.

82. If B's share is Rs. 3, total amount = Rs. 7.

If B's share is Rs. 4800, total amount = Rs. $\left(\frac{7}{3} \times 4800\right)$ = Rs. 11200.

83. Suppose C gets Rs. x. Then, B gets Rs. $(x + 8)$ and A gets Rs. $(x + 15)$.

Then, $x + (x + 8) + (x + 15) = 53 \Leftrightarrow x = 10.$

∴ A : B : C = (10 + 15) : (10 + 8) : 10 = 25 : 18 : 10.

84. Let the ratio be $x : (x + 40)$. Then,

$$\frac{x}{(x + 40)} = \frac{2}{7} \Leftrightarrow 7x = 2x + 80 \Leftrightarrow 5x = 80 \Leftrightarrow x = 16.$$

∴ Required ratio = 16 : 56.

13. PARTNERSHIP

IMPORTANT FACTS AND FORMULAE

1. **Partnership :** When two or more than two persons run a business jointly, they are called *partners* and the deal is known as *partnership*.

2. **Ratio of Division of Gains :**

   (i) *When investments of all the partners are for the same time*, the gain or loss is distributed among the partners in the ratio of their investments.

   Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year :

   (A's share of profit) : (B's share of profit) = $x : y$.

   (ii) *When investments are for different time periods*, then equivalent capitals are calculated for a unit of time by taking (capital × number of units of time). Now, gain or loss is divided in the ratio of these capitals.

   Suppose A invests Rs. x for p months and B invests Rs. y for q months, then

   (A's share of profit) : (B's share of profit) = $xp : yq$.

3. **Working and Sleeping Partners :** A partner who manages the business is known as a *working partner* and the one who simply invests the money is a *sleeping partner*.

SOLVED EXAMPLES

Ex. 1. *A, B and C started a business by investing Rs. 1,20,000, Rs. 1,35,000 and Rs. 1,50,000 respectively. Find the share of each, out of an annual profit of Rs. 56,700.*

Sol. Ratio of shares of A, B and C = Ratio of their investments

$$= 120000 : 135000 : 150000 = 8 : 9 : 10.$$

A's share = Rs. $\left(56700 \times \dfrac{8}{27}\right)$ = Rs. 16800.

B's share = Rs. $\left(56700 \times \dfrac{9}{27}\right)$ = Rs. 18900.

C's share = Rs. $\left(56700 \times \dfrac{10}{27}\right)$ = Rs. 21000.

Ex. 2. *Alfred started a business investing Rs. 45,000. After 3 months, Peter joined him with a capital of Rs. 60,000. After another 6 months, Ronald joined them with a capital of Rs. 90,000. At the end of the year, they made a profit of Rs. 16,500. Find the share of each.*

Sol. Clearly, Alfred invested his capital for 12 months, Peter for 9 months and Ronald for 3 months.

So, ratio of their capitals = $(45000 \times 12) : (60000 \times 9) : (90000 \times 3)$

$$= 540000 : 540000 : 270000 = 2 : 2 : 1.$$

∴ Alfred's share = Rs. $\left(16500 \times \dfrac{2}{5}\right)$ = Rs. 6600;

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Peter's share = Rs. $\left(16500 \times \dfrac{2}{5}\right)$ = Rs. 6600;

Ronald's share = Rs. $\left(16500 \times \dfrac{1}{5}\right)$ = Rs. 3300.

Ex. 3. *A, B and C start a business each investing Rs. 20,000. After 5 months A withdrew Rs. 5000, B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69,900 was recorded. Find the share of each.*

Sol.   Ratio of the capitals of A, B and C

$= 20000 \times 5 + 15000 \times 7 : 20000 \times 5 + 16000 \times 7 : 20000 \times 5 + 26000 \times 7$

$= 205000 : 212000 : 282000 = 205 : 212 : 282.$

∴   A's share = Rs. $\left(69900 \times \dfrac{205}{699}\right)$ = Rs. 20500;

B's share = Rs. $\left(69900 \times \dfrac{212}{699}\right)$ = Rs. 21200;

C's share = Rs. $\left(69900 \times \dfrac{282}{699}\right)$ = Rs. 28200.

Ex. 4. *A, B and C enter into partnership. A invests 3 times as much as B invests and B invests two-third of what C invests. At the end of the year, the profit earned is Rs. 6600. What is the share of B ?*

Sol.   Let C's capital = Rs. x. Then, B's capital = Rs. $\dfrac{2}{3}x$.

A's capital = Rs. $\left(3 \times \dfrac{2}{3}x\right)$ = Rs. 2x.

∴   Ratio of their capitals = $2x : \dfrac{2}{3}x : x = 6 : 2 : 3.$

Hence, B's share = Rs. $\left(6600 \times \dfrac{2}{11}\right)$ = Rs. 1200.

Ex. 5. *Four milkmen rented a pasture. A grazed 24 cows for 3 months, B 10 cows for 5 months, C 35 cows for 4 months and D 21 cows for 3 months. If A's share of rent is Rs. 720, find the total rent of the field.*

Sol.   Ratio of shares of A, B, C, D = $(24 \times 3) : (10 \times 5) : (35 \times 4) : (21 \times 3)$

$= 72 : 50 : 140 : 63.$

Let total rent be Rs. x. Then, A's share = Rs. $\dfrac{72x}{325}$.

∴ $\dfrac{72x}{325} = 720 \Leftrightarrow x = \dfrac{720 \times 325}{72} = 3250.$

Hence, total rent of the field is Rs. 3250.

Ex. 6. *A invested Rs. 76,000 in a business. After few months, B joined him with Rs. 57,000. At the end of the year, the total profit was divided between them in the ratio 2 : 1. After how many months did B join ?*

Sol.   Suppose B joined after x months. Then, B's money was invested for $(12 - x)$ months.

∴ $\dfrac{76000 \times 12}{57000 \times (12 - x)} = \dfrac{2}{1} \quad \Leftrightarrow \quad 912000 = 114000\,(12 - x)$

$\Leftrightarrow \quad 114\,(12 - x) = 912 \quad \Leftrightarrow \quad (12 - x) = 8 \quad \Leftrightarrow \quad x = 4.$

Hence, B joined after 4 months.

Ex. 7. *A, B and C enter into a partnership by investing in the ratio of 3 : 2 : 4. After one year, B invests another Rs. 2,70,000 and C, at the end of 2 years, also invests Rs. 2,70,000. At the end of three years, profits are shared in the ratio of 3 : 4 : 5. Find the initial investment of each.*

Sol. Let the initial investments of A, B and C be Rs. $3x$, Rs. $2x$ and Rs. $4x$ respectively. Then,

$(3x \times 36) : [(2x \times 12) + (2x + 270000) \times 24] : [(4x \times 24) + (4x + 270000) \times 12]$

$= 3 : 4 : 5.$

$\Leftrightarrow 108x : (72x + 6480000) : (144x + 3240000) = 3 : 4 : 5$

$\therefore \dfrac{108x}{72x + 6480000} = \dfrac{3}{4} \quad \Leftrightarrow \quad 432x = 216x + 19440000$

$\Leftrightarrow \quad 216x = 19440000 \quad \Leftrightarrow \quad x = 90000.$

Hence, A's initial investment $= 3x =$ Rs. 2,70,000;

B's initial investment $= 2x =$ Rs. 1,80,000;

C's initial investment $= 4x =$ Rs. 3,60,000.

EXERCISE 13A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark* (✓) *against the correct answer :*

1. P and Q started a business investing Rs. 85,000 and Rs. 15,000 respectively. In what ratio the profit earned after 2 years be divided between P and Q respectively ?

    (a) 3 : 4   (b) 3 : 5   (c) 15 : 23   (d) 17 : 23   (e) None of these

    (B.S.R.B. 2003)

2. Anand and Deepak started a business investing Rs. 22,500 and Rs. 35,000 respectively. Out of a total profit of Rs. 13,800, Deepak's share is :

    (a) Rs. 5400   (b) Rs. 7200   (c) Rs. 8400   (d) Rs. 9600

3. A, B, C enter into a partnership investing Rs. 35,000, Rs. 45,000 and Rs. 55,000 respectively. The respective shares of A, B, C in an annual profit of Rs. 40,500 are :

    (a) Rs. 10,500, Rs. 13,500, Rs. 16,500   (b) Rs. 11,500, Rs. 13,000, Rs. 16,000

    (c) Rs. 11,000, Rs. 14,000, Rs. 15,500   (d) Rs. 11,500, Rs. 12,500, Rs. 16,500

    (C.B.I. 1997)

4. Reena and Shaloo are partners in a business. Reena invests Rs. 35,000 for 8 months and Shaloo invests Rs. 42,000 for 10 months. Out of a profit of Rs. 31,570, Reena's share is :

    (a) Rs. 9471   (b) Rs. 12,628   (c) Rs. 18,040   (d) Rs. 18,942

5. Kamal started a business investing Rs. 9000. After five months, Sameer joined with a capital of Rs. 8000. If at the end of the year, they earn a profit of Rs. 6970, then what will be the share of Sameer in the profit ?   **(R.R.B. 2003)**

    (a) Rs. 1883.78   (b) Rs. 2380   (c) Rs. 3690   (d) Rs. 3864

6. Simran started a software business by investing Rs. 50,000. After six months, Nanda joined her with a capital of Rs. 80,000. After 3 years, they earned a profit of Rs. 24,500. What was Simran's share in the profit ?   **(Bank P.O. 2004)**

    (a) Rs. 9423   (b) Rs. 10,250   (c) Rs. 12,500   (d) Rs. 14,000   (e) None of these

7. A and B started a business in partnership investing Rs. 20,000 and Rs. 15,000 respectively. After six months, C joined them with Rs. 20,000. What will be B's share in the total profit of Rs. 25,000 earned at the end of 2 years from the starting of the business ?   (S.B.I.P.O. 2000)

(a) Rs. 7500   (b) Rs. 9000   (c) Rs. 9500   (d) Rs. 10,000   (e) None of these

8. Aman started a business investing Rs. 70,000. Rakhi joined him after six months with an amount of Rs. 1,05,000 and Sagar joined them with Rs. 1.4 lakhs after another six months. The amount of profit earned should be distributed in what ratio among Aman, Rakhi and Sagar respectively, 3 years after Aman started the business ?

(a) 7 : 6 : 10   (b) 12 : 15 : 16   (c) 42 : 45 : 56
(d) Cannot be determined   (e) None of these   (Bank P.O. 2003)

9. Arun, Kamal and Vinay invested Rs. 8000, Rs. 4000 and Rs. 8000 respectively in a business. Arun left after six months. If after eight months, there was a gain of Rs. 4005, then what will be the share of Kamal ?   (R.R.B. 1998)

(a) Rs. 890   (b) Rs. 1335   (c) Rs. 1602   (d) Rs. 1780

10. A, B and C enter into a partnership. They invest Rs. 40,000, Rs. 80,000 and Rs. 1,20,000 respectively. At the end of the first year, B withdraws Rs. 40,000, while at the end of the second year, C withdraws Rs. 80,000. In what ratio will the profit be shared at the end of 3 years ?   (Hotel Management, 1997)

(a) 2 : 3 : 5   (b) 3 : 4 : 7   (c) 4 : 5 : 9   (d) None of these

11. A, B and C enter into a partnership. A initially invests Rs. 25 lakhs and adds another Rs. 10 lakhs after one year. B initially invests Rs. 35 lakhs and withdraws Rs. 10 lakhs after 2 years and C invests Rs. 30 lakhs. In what ratio should the profits be divided at the end of 3 years ?

(a) 10 : 10 : 9   (b) 20 : 20 : 19   (c) 20 : 19 : 18   (d) None of these

12. Shekhar started a business investing Rs. 25,000 in 1999. In 2000, he invested an additional amount of Rs. 10,000 and Rajeev joined him with an amount of Rs. 35,000. In 2001, Shekhar invested another additional amount of Rs. 10,000 and Jatin joined them with an amount of Rs. 35,000. What will be Rajeev's share in the profit of Rs. 1,50,000 earned at the end of 3 years from the start of the business in 1999 ?

(a) Rs. 45,000   (b) Rs. 50,000   (c) Rs. 70,000   (d) Rs. 75,000   (e) None of these
                                                                               (S.B.I.P.O. 2001)

13. A and B entered into a partnership investing Rs. 16,000 and Rs. 12,000 respectively. After 3 months, A withdrew Rs. 5000 while B invested Rs. 5000 more. After 3 more months, C joins the business with a capital of Rs. 21,000. The share of B exceeds that of C, out of a total profit of Rs. 26,400 after one year by :

(a) Rs. 2400   (b) Rs. 3000   (c) Rs. 3600   (d) Rs. 4800

14. A and B start a business with investments of Rs. 5000 and Rs. 4500 respectively. After 4 months, A takes out half of his capital. After two more months, B takes out one-third of his capital while C joins them with a capital of Rs. 7000. At the end of a year, they earn a profit of Rs. 5080. Find the share of each member in the profit.

(a) A – Rs. 1400, B – Rs. 1900, C – Rs. 1780
(b) A – Rs. 1600, B – Rs. 1800, C – Rs. 1680
(c) A – Rs. 1800, B – Rs. 1500, C – Rs. 1780
(d) A – Rs. 1680, B – Rs. 1600, C – Rs. 1800
(e) None of these   (Bank P.O. 2003)

15. A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35,000, A receives :

(a) Rs. 8400   (b) Rs. 11,900   (c) Rs. 13,600   (d) Rs. 14,700

16. Three partners A, B, C start a business. Twice A's capital is equal to thrice B's capital and B's capital is four times C's capital. Out of a total profit of Rs. 16,500 at the end of the year, B's share is :

(a) Rs. 4000   (b) Rs. 6000   (c) Rs. 7500   (d) Rs. 6600

17. If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of Rs. 4650, C will receive :

(a) Rs. 465   (b) Rs. 900   (c) Rs. 1550   (d) Rs. 2250

18. A, B and C enter into partnership. A invests some money at the beginning. B invests double the amount after 6 months and C invests thrice the amount after 8 months. If the annual profit be Rs. 27,000, C's share is :

(a) Rs. 8625   (b) Rs. 9000   (c) Rs. 10,800   (d) Rs. 11,250

19. A, B, C hired a car for Rs. 520 and used it for 7, 8 and 11 hours respectively. Hire charges paid by B were :

(a) Rs. 140   (b) Rs. 160   (c) Rs. 180   (d) Rs. 220

20. A, B and C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent ?   (S.S.C. 2000)

(a) Rs. 45   (b) Rs. 50   (c) Rs. 55   (d) Rs. 60

21. In a business, A and C invested amounts in the ratio 2 : 1, whereas the ratio between amounts invested by A and B was 3 : 2. If Rs. 1,57,300 was their profit, how much amount did B receive ?   (Bank P.O. 1999)

(a) Rs. 24,200   (b) Rs. 36,300   (c) Rs. 48,400   (d) Rs. 72,600

22. A and B started a partnership business investing some amount in the ratio of 3 : 5. C joined them after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C ?

(a) 3 : 5 : 2   (b) 3 : 5 : 5   (c) 6 : 10 : 5

(d) Data inadequate   (e) None of these   (Bank P.O. 2000)

23. A, B and C enter into a partnership and their shares are in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. After 2 months, A withdraws half of his capital and after 10 months, a profit of Rs. 378 is divided among them. What is B's share ?   (S.S.C. 2000)

(a) Rs. 129   (b) Rs. 144   (c) Rs. 156   (d) Rs. 168

24. A, B and C enter into a partnership in the ratio $\frac{7}{2} : \frac{4}{3} : \frac{6}{5}$. After 4 months, A increases his share by 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is :   (L.I.C.A.A.O. 2003)

(a) Rs. 2100   (b) Rs. 2400   (c) Rs. 3600   (d) Rs. 4000

25. A, B, C started a business with their investments in the ratio 1 : 3 : 5. After 4 months, A invested the same amount as before and B as well as C withdrew half of their investments. The ratio of their profits at the end of the year is :

(a) 4 : 3 : 5   (b) 5 : 6 : 10   (c) 6 : 5 : 10   (d) 10 : 5 : 6

26. A and B entered into partnership with capitals in the ratio 4 : 5. After 3 months, A withdrew $\frac{1}{4}$ of his capital and B withdrew $\frac{1}{5}$ of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is :   (A.A.O. Exam, 2003)

(a) Rs. 330   (b) Rs. 360   (c) Rs. 380   (d) Rs. 430

27. In a partnership, A invests $\frac{1}{6}$ of the capital for $\frac{1}{6}$ of the time, B invests $\frac{1}{3}$ of the capital for $\frac{1}{3}$ of the time and C, the rest of the capital for the whole time. Out of a profit of Rs. 4600, B's share is :

(a) Rs. 650   (b) Rs. 800   (c) Rs. 960   (d) Rs. 1000

28. A, B and C jointly thought of engaging themselves in a business venture. It was agreed that A would invest Rs. 6500 for 6 months, B, Rs. 8400 for 5 months and C, Rs. 10,000 for 3 months. A wants to be the working member for which he was to receive 5% of the profits. The profit earned was Rs. 7400. Calculate the share of B in the profit.

    (a) Rs. 1900   (b) Rs. 2660   (c) Rs. 2800   (d) Rs. 2840

                                                                      (M.B.A. 2002)

29. X and Y invested in a business. They earned some profit which they divided in the ratio of 2 : 3. If X invested Rs. 40,000, the amount invested by Y is :

    (a) Rs. 45,000   (b) Rs. 50,000   (c) Rs. 60,000   (d) Rs. 80,000

30. Manick received Rs. 6000 as his share out of the total profit of Rs. 9000 which he and Raunaq earned at the end of one year. If Manick invested Rs. 20,000 for 6 months, whereas Raunaq invested his amount for the whole year, what was the amount invested by Raunaq ?

    (a) Rs. 4000   (b) Rs. 5000   (c) Rs. 6000   (d) Rs. 10,000

31. A, B and C enter into a partnership with a capital in which A's contribution is Rs. 10,000. If out of a total profit of Rs. 1000, A gets Rs. 500 and B gets Rs. 300, then C's capital is :

    (a) Rs. 4000   (b) Rs. 5000   (c) Rs. 6000   (d) Rs. 9000

32. A, B and C started a shop by investing Rs. 27,000, Rs. 72,000 and Rs. 81,000 respectively. At the end of the year, the profits were distributed among them. If C's share of profit be Rs. 36,000, then the total profit was :

    (a) Rs. 80,000   (b) Rs. 95,600   (c) Rs. 1,08,000   (d) Rs. 1,16,000

33. A and B started a business jointly. A's investment was thrice the investment of B and the period of his investment was two times the period of investment of B. If B received Rs. 4000 as profit, then their total profit is :

    (a) Rs. 16,000   (b) Rs. 20,000   (c) Rs. 24,000   (d) Rs. 28,000

34. A started a business with Rs. 21,000 and is joined afterwards by B with Rs. 36,000. After how many months did B join if the profits at the end of the year are divided equally ?

    (a) 3   (b) 4   (c) 5   (d) 6

35. A began a business with Rs. 85,000. He was joined afterwards by B with Rs. 42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1 ?   **(N.I.F.T. 2003)**

    (a) 4 months   (b) 5 months   (c) 6 months   (d) 8 months.

36. A starts business with Rs. 3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital ?   **(S.S.C. 2000)**

    (a) Rs. 7500   (b) Rs. 8000   (c) Rs. 8500   (d) Rs. 9000

37. A and B start a business jointly. A invests Rs. 16,000 for 8 months and B remains in the business for 4 months. Out of total profit, B claims $\frac{2}{7}$ of the profit. How much money was contributed by B ?

    (a) Rs. 10,500   (b) Rs. 11,900   (c) Rs. 12,800   (d) Rs. 13,600

38. Two friends P and Q started a business investing in the ratio of 5 : 6. R joined them after six months investing an amount equal to that of Q's. At the end of the year, 20% profit was earned which was equal to Rs. 98,000. What was the amount invested by R ?   **(S.B.I.P.O. 1999)**

    (a) Rs. 1,05,000   (b) Rs. 1,75,000   (c) Rs. 2,10,000

    (d) Data inadequate   (e) None of these

39. Three partners shared the profit in a business in the ratio 5 : 7 : 8. They had partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments ?   **(Hotel Management, 1998)**

    (a) 5 : 7 : 8   (b) 28 : 49 : 64   (c) 38 : 28 : 21   (d) None of these

40. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is :
   (a) Rs. 1425   (b) Rs. 1500   (c) Rs. 1537.50   (d) Rs. 1576

41. A and B started a business with initial investments in the ratio 14 : 15 and their annual profits were in the ratio 7 : 6. If A invested the money for 10 months, for how many months did B invest his money ?
   (a) 6   (b) 7   (c) 8   (d) 9

42. A and B are partners in a business. A contributes $\frac{1}{4}$ of the capital for 15 months and B received $\frac{2}{3}$ of the profit. For how long B's money was used ?   (S.S.C. 2000)
   (a) 6 months   (b) 9 months   (c) 10 months   (d) 1 year

ANSWERS

1. (e)	2. (c)	3. (a)	4. (b)	5. (b)	6. (e)	7. (a)	8. (b)	9. (a)
10. (b)	11. (d)	12. (b)	13. (c)	14. (b)	15. (d)	16. (b)	17. (b)	18. (b)
19. (b)	20. (a)	21. (c)	22. (c)	23. (b)	24. (d)	25. (b)	26. (a)	27. (b)
28. (b)	29. (c)	30. (b)	31. (b)	32. (a)	33. (d)	34. (c)	35. (d)	36. (d)
37. (c)	38. (c)	39. (d)	40. (b)	41. (c)	42. (c)			

SOLUTIONS

1. P : Q = 85000 : 15000 = 85 : 15 = 17 : 3.
2. Ratio of their shares = 22500 : 35000 = 9 : 14.

   Deepak's share = Rs. $\left(13800 \times \frac{14}{23}\right)$ = Rs. 8400.

3. A : B : C = 35000 : 45000 : 55000 = 7 : 9 : 11.

   A's share = Rs. $\left(40500 \times \frac{7}{27}\right)$ = Rs. 10500.

   B's share = Rs. $\left(40500 \times \frac{9}{27}\right)$ = Rs. 13500.

   C's share = Rs. $\left(40500 \times \frac{11}{27}\right)$ = Rs. 16500.

4. Ratio of their shares = (35000 × 8) : (42000 × 10) = 2 : 3.

   Reena's share = Rs. $\left(31570 \times \frac{2}{5}\right)$ = Rs. 12628.

5. Kamal : Sameer = (9000 × 12) : (8000 × 7) = 108 : 56 = 27 : 14.

   ∴ Sameer's share = Rs. $\left(6970 \times \frac{14}{41}\right)$ = Rs. 2380.

6. Simran : Nanda = (50000 × 36) : (80000 × 30) = 3 : 4.

   ∴ Simran's share = Rs. $\left(24500 \times \frac{3}{7}\right)$ = Rs. 10500.

7. A : B : C = (20000 × 24) : (15000 × 24) : (20000 × 18) = 4 : 3 : 3.

   ∴ B's share = Rs. $\left(25000 \times \frac{3}{10}\right)$ = Rs. 7500.

SUB#

8. Aman : Rakhi : Sagar = $(70000 \times 36) : (105000 \times 30) : (140000 \times 24) = 12 : 15 : 16$.

9. Arun : Kamal : Vinay = $(8000 \times 6) : (4000 \times 8) : (8000 \times 8) = 48 : 32 : 64 = 3 : 2 : 4$.

   $\therefore$ Kamal's share = Rs. $\left(4005 \times \frac{2}{9}\right)$ = Rs. 890.

10. A : B : C = $(40000 \times 36) : (80000 \times 12 + 40000 \times 24) : (120000 \times 24 + 40000 \times 12)$
    = $144 : 192 : 336 = 3 : 4 : 7$.

11. A : B : C = $(25 \text{ lakhs} \times 1) + (35 \text{ lakhs} \times 2) : (35 \text{ lakhs} \times 2 + 25 \text{ lakhs} \times 1) : (30 \text{ lakhs} \times 3)$
    = 95 lakhs : 95 lakhs : 90 lakhs = 19 : 19 : 18.

12. Shekhar : Rajeev : Jatin
    = $(25000 \times 12 + 35000 \times 12 + 45000 \times 12) : (35000 \times 24) : (35000 \times 12)$
    = 1260000 : 840000 : 420000 = 3 : 2 : 1.

    $\therefore$ Rajeev's share = Rs. $\left(150000 \times \frac{2}{6}\right)$ = Rs. 50000.

13. A : B : C = $(16000 \times 3 + 11000 \times 9) : (12000 \times 3 + 17000 \times 9) : (21000 \times 6)$
    = $147 : 189 : 126 = 7 : 9 : 6$.

    $\therefore$ Difference of B and C's shares = Rs. $\left(26400 \times \frac{9}{22} - 26400 \times \frac{6}{22}\right)$ = Rs. 3600.

14. A : B : C = $(5000 \times 4 + 2500 \times 8) : (4500 \times 6 + 3000 \times 6) : (7000 \times 6)$
    = $40000 : 45000 : 42000 = 40 : 45 : 42$.

    $\therefore$ A's share = Rs. $\left(5080 \times \frac{40}{127}\right)$ = Rs. 1600;

    B's share = Rs. $\left(5080 \times \frac{45}{127}\right)$ = Rs. 1800;

    C's share = Rs. $\left(5080 \times \frac{42}{127}\right)$ = Rs. 1680.

15. Let C = x. Then, B = $x + 5000$ and A = $x + 5000 + 4000 = x + 9000$.
    So, $x + x + 5000 + x + 9000 = 50000 \Leftrightarrow 3x = 36000 \Leftrightarrow x = 12000$.
    A : B : C = 21000 : 17000 : 12000 = 21 : 17 : 12.

    $\therefore$ A's share = Rs. $\left(35000 \times \frac{21}{50}\right)$ = Rs. 14,700.

16. Let C = x. Then, B = $4x$ and 2A = $3 \times 4x = 12x$ or A = $6x$.
    $\therefore$ A : B : C = $6x : 4x : x = 6 : 4 : 1$.

    So, B's capital = Rs. $\left(16500 \times \frac{4}{11}\right)$ = Rs. 6000.

17. Let 4A = 6B = 10C = k. Then, A = $\frac{k}{4}$, B = $\frac{k}{6}$ and C = $\frac{k}{10}$.

    $\therefore$ A : B : C = $\frac{k}{4} : \frac{k}{6} : \frac{k}{10} = 15 : 10 : 6$.

    Hence, C's share = Rs. $\left(4650 \times \frac{6}{31}\right)$ = Rs. 900.

18. Let A's investment be Rs. x.
    Then, Ratio of capitals = $(x \times 12) : (2x \times 6) : (3x \times 4) = 12x : 12x : 12x = 1 : 1 : 1$.

    $\therefore$ C's share = Rs. $\left(27000 \times \frac{1}{3}\right)$ = Rs. 9000.

SUB#

19. $A : B : C = 7 : 8 : 11$.

Hire charges paid by B = Rs. $\left(520 \times \frac{8}{26}\right)$ = Rs. 160.

20. $A : B : C = 10 \times 7 : 12 \times 5 : 15 \times 3 = 70 : 60 : 45 = 14 : 12 : 9$.

∴ C's rent = Rs. $\left(175 \times \frac{9}{35}\right)$ = Rs. 45.

21. $A : B = 3 : 2$ ⟹ $B : A = 2 : 3 = 4 : 6$ and $A : C = 2 : 1 = 6 : 3$.

So, $B : A : C = 4 : 6 : 3$ or $A : B : C = 6 : 4 : 3$.

∴ B's share = Rs. $\left(157300 \times \frac{4}{13}\right)$ = Rs. 48400.

22. Let the initial investments of A and B be $3x$ and $5x$.

$A : B : C = (3x \times 12) : (5x \times 12) : (5x \times 6) = 36 : 60 : 30 = 6 : 10 : 5$.

23. Ratio of initial investments $= \frac{1}{2} : \frac{1}{3} : \frac{1}{4} = 6 : 4 : 3$.

Let their initial investments be $6x$, $2x$ and $3x$ respectively.

$A : B : C = (6x \times 2 + 3x \times 10) : (4x \times 12) : (3x \times 12) = 42 : 48 : 36 = 7 : 8 : 6$.

∴ B's share = Rs. $\left(378 \times \frac{8}{21}\right)$ = Rs. 144.

24. Ratio of initial investments $= \frac{7}{2} : \frac{4}{3} : \frac{6}{5} = 105 : 40 : 36$.

Let the initial investments be $105x$, $40x$ and $36x$.

∴ $A : B : C = \left(105x \times 4 + \frac{150}{100} \times 105x \times 8\right) : (40x \times 12) : (36x \times 12)$

$= 1680x : 480x : 432x = 35 : 10 : 9$.

Hence, B's share = Rs. $\left(21600 \times \frac{10}{54}\right)$ = Rs. 4000.

25. Let their initial investments be x, $3x$ and $5x$ respectively. Then,

$A : B : C = (x \times 4 + 2x \times 8) : \left(3x \times 4 + \frac{3x}{2} \times 8\right) : \left(5x \times 4 + \frac{5x}{2} \times 8\right)$

$= 20x : 24x : 40x = 5 : 6 : 10$.

26. $A : B = \left[4x \times 3 + \left(4x - \frac{1}{4} \times 4x\right) \times 7\right] : \left[5x \times 3 + \left(5x - \frac{1}{5} \times 5x\right) \times 7\right]$

$= (12x + 21x) : (15x + 28x) = 33x : 43x = 33 : 43$.

∴ A's share = Rs. $\left(760 \times \frac{33}{76}\right)$ = Rs. 330.

27. Suppose A invests Rs. $\frac{x}{6}$ for $\frac{y}{6}$ months. Then, B invests Rs. $\frac{x}{3}$ for $\frac{y}{3}$ months.

C invests $\left[x - \left(\frac{x}{6} + \frac{x}{3}\right)\right]$ i.e., Rs. $\frac{x}{2}$ for y months.

∴ $A : B : C = \left(\frac{x}{6} \times \frac{y}{6}\right) : \left(\frac{x}{3} \times \frac{y}{3}\right) : \left(\frac{x}{2} \times y\right) = \frac{1}{36} : \frac{1}{9} : \frac{1}{2} = 1 : 4 : 18$.

Hence, B's share = Rs. $\left(4600 \times \frac{4}{23}\right)$ = Rs. 800.

28. For managing, A receives = 5% of Rs. 7400 = Rs. 370.
Balance = Rs. (7400 − 370) = Rs. 7030.
Ratio of their investments = $(6500 \times 6) : (8400 \times 5) : (10000 \times 3)$
$= 39000 : 42000 : 30000 = 13 : 14 : 10$.
∴ B's share = Rs. $\left(7030 \times \dfrac{14}{37}\right)$ = Rs. 2660.

29. Suppose Y invested Rs. y. Then, $\dfrac{40000}{y} = \dfrac{2}{3}$ or $y = \left(\dfrac{40000 \times 3}{2}\right) = 60000$.

30. Suppose Raunaq invested Rs. x. Then, Manick : Raunaq $= (20000 \times 6) : (x \times 12)$
∴ $\dfrac{120000}{12x} = \dfrac{6000}{3000}$ or $x = \dfrac{120000}{24} = 5000$.

31. $A : B : C = 500 : 300 : 200 = 5 : 3 : 2$.
Let their capitals be $5x$, $3x$ and $2x$ respectively. Then, $5x = 10000 \Leftrightarrow x = 2000$.
∴ C's capital $= 2x = $ Rs. 4000.

32. $A : B : C = 27000 : 72000 : 81000 = 3 : 8 : 9$. So, C's share : Total Profit $= 9 : 20$.
Let the total profit be Rs. x. Then, $\dfrac{9}{20} = \dfrac{36000}{x}$ or $x = \dfrac{36000 \times 20}{9} = 80000$.

33. Suppose B invested Rs. x for y months. Then, A invested Rs. $3x$ for $2y$ months.
So, $A : B = (3x \times 2y) : (x \times y) = 6xy : xy = 6 : 1$.
∴ B's profit : Total profit $= 1 : 7$.
Let the total profit be Rs. x. Then, $\dfrac{1}{7} = \dfrac{4000}{x}$ or $x = 28000$.

34. Suppose B joined after x months.
Then, $21000 \times 12 = 36000 \times (12 - x) \Leftrightarrow 36x = 180 \Leftrightarrow x = 5$.
Hence, B joined after 5 months.

35. Suppose B joined for x months. Then, $\dfrac{85000 \times 12}{42500 \times x} = \dfrac{3}{1}$ or $x = \dfrac{85000 \times 12}{42500 \times 3} = 8$.
So, B joined for 8 months.

36. Let B's capital be Rs. x. Then, $\dfrac{3500 \times 12}{7x} = \dfrac{2}{3} \Leftrightarrow 14x = 126000 \Leftrightarrow x = 9000$.

37. Let the total profit be Rs. x. Then, $B = \dfrac{2x}{7}$ and $A = \left(x - \dfrac{2x}{7}\right) = \dfrac{5x}{7}$.
So, $A : B = \dfrac{5x}{7} : \dfrac{2x}{7} = 5 : 2$.
Let B's capital be Rs. y. Then, $\dfrac{16000 \times 8}{y \times 4} = \dfrac{5}{2} \Leftrightarrow y = \left(\dfrac{16000 \times 8 \times 2}{5 \times 4}\right) = 12800$.

38. Let the total profit be Rs. z.
Then, 20% of $x = 98000 \Leftrightarrow x = \left(\dfrac{98000 \times 100}{20}\right) = 490000$.
Let the capitals of P, Q and R be Rs. $5x$, Rs. $6x$ and Rs. $6x$ respectively. Then,
$(5x \times 12) + (6x \times 12) + (6x \times 6) = 490000 \times 12$
$\Leftrightarrow 168x = 490000 \times 12 \Leftrightarrow x = \left(\dfrac{490000 \times 12}{168}\right) = 35000$.
∴ R's investment $= 6x = $ Rs. $(6 \times 35000) = $ Rs. 210000.

39. Let their investments be Rs. x for 14 months; Rs. y for 8 months and Rs. z for 7 months respectively.

Then, $14x : 8y : 7z = 5 : 7 : 8$.

Now, $\dfrac{14x}{8y} = \dfrac{5}{7} \quad \Leftrightarrow \quad 70x = 40y \quad \Leftrightarrow \quad y = \dfrac{7}{4}x$.

And, $\dfrac{14x}{7z} = \dfrac{5}{8} \quad \Leftrightarrow \quad 112x = 35z \quad \Leftrightarrow \quad z = \dfrac{112}{35}x = \dfrac{16}{5}x$.

$\therefore \quad x : y : z = x : \dfrac{7}{4}x : \dfrac{16}{5}x = 20 : 35 : 64.$

40. Let the total profit be Rs. 100.

After paying to charity, A's share $= Rs. \left(95 \times \dfrac{3}{5}\right) = Rs.\ 57$.

If A's share is Rs. 57, total profit $= Rs.\ 100$.

If A's share is Rs. 855, total profit $= \left(\dfrac{100}{57} \times 855\right) = 1500$.

41. Suppose A invested Rs. $14x$ for 10 months and B invested Rs. $15x$ for y months. Then,

$\dfrac{14x \times 10}{15x \times y} = \dfrac{7}{6} \quad \Leftrightarrow \quad y = \dfrac{840}{105} = 8$.

Hence, B invested the money for 8 months.

42. Let the total profit be Rs. z. Then,

B's share $= Rs.\ \dfrac{2z}{3}$, A's share $= Rs. \left(z - \dfrac{2z}{3}\right) = Rs.\ \dfrac{z}{3}$.

$\therefore \quad A : B = \dfrac{z}{3} : \dfrac{2z}{3} = 1 : 2.$

Let the total capital be Rs. x and suppose B's money was used for x months. Then,

$\dfrac{\frac{1}{4}x \times 15}{\frac{3}{4}x \times y} = \dfrac{1}{2} \quad \Leftrightarrow \quad y = \left(\dfrac{15 \times 2}{3}\right) = 10$.

Thus, B's money was used for 10 months.

EXERCISE 13B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (*Questions 1 to 4*) : *Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and*

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

SUB#

1. Ravi, Gagan and Nitin are running a business firm in partnership. What is Gagan's share in the profit earned by them ?   (M.B.A. 2002)
   I. Ravi, Gagan and Nitin invested the amounts in the ratio of 2 : 4 : 7.
   II. Nitin's share in the profit is Rs. 8750.

2. A and B start a business jointly. What is A's share out of an annual profit of Rs. 23,800 ?
   I. B's investment is $12\frac{1}{2}\%$ more than A's investment.
   II. A's investment is Rs. 1,20,000.

3. A and B are in a partnership business of one year. At the end of the year, a profit of Rs. 20,000 was earned. What is A's share ?
   I. A invested Rs. 50,000.
   II. B withdrew his capital after 8 months.

4. Rahul, Anurag and Vivek started a business together. In what proportion would the annual profit be distributed among them ?   (Bank P.O. 1999)
   I. Rahul got one-fourth of the profit.
   II. Rahul and Vivek contributed 75% of the total investment.

Directions (*Questions 5 to 8*) : *Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the given question.*

5. What is R's share of profit in a joint venture ?   (S.B.I.P.O. 2000)
   I. Q started business investing Rs. 80,000.
   II. R joined him after 3 months.
   III. P joined after 4 months with a capital of Rs. 1,20,000 and got Rs. 6000 as his share of profit.
   (a) All I, II and III   (b) I and III only   (c) II and III only
   (d) Even with all I, II, and III, the answer cannot be arrived at
   (e) None of these

6. What is the difference in the shares of profit between P and Q in a joint business at the end of one year ?
   I. P invested Rs. 80,000 and withdrew Rs. 20,000 after 6 months.
   II. Q joined four months after the start of business.
   III. Q's amount was 80% of P's amount during the last six months.
   (a) I and II only   (b) II and III only   (c) All I, II and III
   (d) Even with all I, II and III together, the answer cannot be arrived at.
   (e) None of these.

7. A, B and C together start a business with a total investment of Rs. 15,000. At the end of the year, the total profit is Rs. 3000. What is A's share in the profit ?
   I. A's contribution is $\frac{3}{2}$ times B's.
   II. B's contribution is twice that of C.
   III. A's contribution is thrice that of C.
   (a) I and II only   (b) II and III only   (c) All I, II and III
   (d) Any two of the three   (e) None of these

8. How much did Rohit get as profit at the year-end in the business done by Nitin, Rohit and Kunal ?   (S.B.I.P.O. 1999)
   I. Kunal invested Rs. 8000 for nine months, his profit was $\frac{3}{2}$ times that of Rohit's and his investment was four times that of Nitin.

II. Nitin and Rohit invested for one year in the proportion 1 : 2 respectively.

III. The three together got Rs. 1000 as profit at the year end.

(a) Only I and II (b) Only I and III

(c) Question cannot be answered even with the information in all the three statements.

(d) All I, II and III (e) None of these

Directions (Questions 9-10) : *Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is redundant and can be dispensed with while answering the given question.*

9. Three friends, P, Q and R started a partnership business investing money in the ratio of 5 : 4 : 2 respectively for a period of 3 years. What is the amount received by P as his share in the total profit ? (S.B.I.P.O. 2000)

I. Total amount invested in the business in Rs. 22,000.

II. Profit earned at the end of 3 years is $\frac{3}{8}$ of the total investment.

III. The average amount of profit earned per year is Rs. 2750.

(a) I or II or III (b) Either III only, or I and II together

(c) Any two of the three (d) All I, II and III are required

(e) None of these

10. What will be the percentage share of Y in the profit earned by X, Y and Z together ?

I. X, Y and Z invested a total amount of Rs. 25,000 for a period of two years.

II. The profit earned at the end of 2 years is 30%.

III. The amount invested by Y is equal to the amount invested by X and Z together.

(a) I and II only (b) II and III only

(c) Any two of the three (d) All I, II and III are required

(e) Question cannot be answered even with information in all the three statements.

ANSWERS

1. (e) 2. (a) 3. (d) 4. (e) 5. (d) 6. (d) 7. (d)

8. (d) 9. (b) 10. (a)

SOLUTIONS

1. Let us name Ravi, Gagan and Nitin by R, G and N respectively.

I. R : G : N = 2 : 4 : 7.

II. N = 8750.

From I and II, we get :

When N = 7, then G = 4. When N = 8750, then G = $\left(\frac{4}{7} \times 8750\right)$ = 5000.

Thus, both I and II are needed to get the answer.

∴ Correct answer is (e).

2. Annual profit = Rs. 23800.

I. Let A's investment = Rs. x. Then, B's investment = $112\frac{1}{2}$% of Rs. x = Rs. $\left(\frac{9x}{8}\right)$.

SUB#

$$\therefore \quad A : B = x : \frac{9x}{8} = 8 : 9.$$

A's share $= $ Rs. $\left(23800 \times \frac{8}{17}\right) = $ Rs. 11200.

Thus, I only gives the answer.

II. A's investment $= $ Rs. 120000.

This is not sufficient to get the answer.

Thus, I gives the answer but II is not sufficient to get the answer.

$\therefore$ Correct answer is (a).

3. Since B's investment is not given, both the statements even do not give the answer.

$\therefore$ Correct answer is (d).

4. Let the total investment be Rs. x. Then, $R = \frac{x}{4}$.

$$R + V = \left(\frac{75}{100} \times x\right) = \frac{3x}{4} \Rightarrow V = \left(\frac{3x}{4} - \frac{x}{4}\right) = \frac{x}{2}.$$

$$\therefore \quad A = x - \left(\frac{x}{4} + \frac{x}{2}\right) = \frac{x}{4}.$$

$$R : A : V = \frac{x}{4} : \frac{x}{4} : \frac{x}{2} = 1 : 1 : 2.$$

Thus, both I and II are needed to get the answer.

$\therefore$ Correct answer is (e).

5. From I, II and III, we get P : Q : R = $(120000 \times 8) : (80000 \times 12) : (x \times 9)$.

Since R's investment is not given, the above ratio cannot be given.

$\therefore$ Given data is inadequate.

$\therefore$ Correct answer is (d).

6. I. P's investment $= (80000 \times 6 + 60000 \times 6) = 840000$ for 1 month.

II & III. Q's investment = 80% of Rs. 60000 for 8 months

$= $ Rs. (48000×8) for 1 month $= 384000$ for 1 month

P : Q $= 840000 : 384000 = 35 : 16$.

But, the total profit is not given, so data is inadequate.

$\therefore$ Correct answer is (d).

7. Let C's contribution be Rs. x

From I and II, we get : C = Rs. x, B = Rs. 2x and A = Rs. $\left(\frac{3}{2} \times 2x\right) = $ Rs. 3x.

From II and III, we get C = Rs. x, B = Rs. 2x and A = Rs. 3x.

From I and III, we get C = Rs. x, A = Rs. 3x and B = Rs. $\left(\frac{2}{3} \times 3x\right) = $ Rs. 2x.

Thus, A : B : C = $3x : 2x : x = 3 : 2 : 1$.

A's share $= $ Rs. $\left(3000 \times \frac{3}{6}\right) = $ Rs. 1500.

Thus, any two of three give the answer.

$\therefore$ Correct answer is (d).

SUB#

8. I and II give, K = Rs. (8000 × 9) for 1 month = Rs. 72000 for 1 month.

$$N = Rs. \left(\frac{1}{4} \times 8000 \times 12\right) \text{ for 1 month} = Rs. 24000 \text{ for 1 month.}$$

R = Rs. 48000 for 1 month.

∴ K : N : R = 72000 : 24000 : 48000 = 3 : 1 : 2.

III gives, total profit = Rs. 1000.

∴ Rohit's share = Rs. $\left(1000 \times \frac{2}{6}\right)$ = Rs. $333\frac{1}{3}$.

∴ Correct answer is (d).

9. I and II give, profit after 3 years = Rs. $\left(\frac{3}{8} \times 22000\right)$ = Rs. 8250.

From III also, profit after 3 years = Rs. (2750 × 3) = Rs. 8250.

∴ P's share = Rs. $\left(8250 \times \frac{5}{11}\right)$ = Rs. 3750.

Thus, (either III is redundant) or (I and II are redundant).

∴ Correct answer is (b).

10. From III, Y = X + Z ⇒ Y's investment is 50%.

∴ Share of Y is 50%.

Thus, I and II are redundant.

∴ Correct answer is (a).

14. CHAIN RULE

IMPORTANT FACTS AND FORMULAE

1. **Direct Proportion** : *Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.*

   Ex. 1. *Cost is directly proportional to the number of articles.*
   (More Articles, More Cost)

   Ex. 2. *Work done is directly proportional to the number of men working on it.*
   (More Men, More Work)

2. **Indirect Proportion** : *Two quantities are said to be indirectly proportional, if on the increase of the one, the other decreases to the same extent and vice-versa.*

   Ex. 1. *The time taken by a car in covering a certain distance is inversely proportional to the speed of the car.*
   (More speed, Less is the time taken to cover a distance)

   Ex. 2. *Time taken to finish a work is inversely proportional to the number of persons working at it.*
   (More persons, Less is the time taken to finish a job)

   Remark : In solving questions by chain rule, we compare every item with the term to be found out.

SOLVED EXAMPLES

Ex. 1. *If 15 toys cost Rs. 234, what do 35 toys cost ?*

Sol. Let the required cost be Rs. x. Then,

More toys, More cost (Direct Proportion)

$\therefore$ $15 : 35 :: 234 : x$ $\Leftrightarrow$ $(15 \times x) = (35 \times 234)$ $\Leftrightarrow$ $x = \left(\dfrac{35 \times 234}{15}\right) = 546.$

Hence, the cost of 35 toys is Rs. 546.

Ex. 2. *If 36 men can do a piece of work in 25 hours, in how many hours will 15 men do it ?*

Sol. Let the required number of hours be x. Then,

Less men, More hours (Indirect Proportion)

$\therefore$ $15 : 36 :: 25 : x$ $\Leftrightarrow$ $(15 \times x) = (36 \times 25)$ $\Leftrightarrow$ $x = \dfrac{36 \times 25}{15} = 60.$

Hence, 15 men can do it in 60 hours.

Ex. 3. *If the wages of 6 men for 15 days be Rs. 2100, then find the wages of 9 men for 12 days.*

Sol. Let the required wages be Rs. x.

More men, More wages (Direct Proportion)
Less days, Less wages (Direct Proportion)

Men 6 : 9 ⎫
           ⎬ :: 2100 : x
Days 15 : 12 ⎭

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$$\therefore \quad (6 \times 15 \times x) = (9 \times 12 \times 2100) \quad \Leftrightarrow \quad x = \left(\frac{9 \times 12 \times 2100}{6 \times 15} \right) = 2520.$$

Hence, the required wages are Rs. 2520.

Ex. 4. *If 20 men can build a wall 56 metres long in 6 days, what length of a similar wall can be built by 35 men in 3 days ?*

Sol. Let the required length be x metres.

  More men, More length built   *(Direct Proportion)*

  Less days, Less length built   *(Direct Proportion)*

  Men $20 : 35$ $\Big\}$ $:: 56 : x$
  Days $6 : 3$

$$\therefore \quad (20 \times 6 \times x) = (35 \times 3 \times 56) \quad \Leftrightarrow \quad x = \frac{(35 \times 3 \times 56)}{120} = 49.$$

Hence, the required length is 49 m.

Ex. 5. *If 15 men, working 9 hours a day, can reap a field in 16 days, in how many days will 18 men reap the field, working 8 hours a day ?*

Sol. Let the required number of days be x.

  More men, Less days   *(Indirect Proportion)*

  Less hours per day, More days   *(Indirect Proportion)*

  Men $18 : 15$ $\Big\}$ $:: 16 : x$
  Hours per day $8 : 9$

$$\therefore \quad (18 \times 8 \times x) = (15 \times 9 \times 16) \quad \Leftrightarrow \quad x = \left(\frac{15 \times 144}{144} \right) = 15.$$

Hence, required number of days = 15.

Ex. 6. *If 9 engines consume 24 metric tonnes of coal, when each is working 8 hours a day, how much coal will be required for 8 engines, each running 13 hours a day, it being given that 3 engines of former type consume as much as 4 engines of latter type ?*

Sol. Let 3 engines of former type consume 1 unit in 1 hour.

  Then, 4 engines of latter type consume 1 unit in 1 hour.

$\therefore$ 1 engine of former type consumes $\frac{1}{3}$ unit in 1 hour.

  1 engine of latter type consumes $\frac{1}{4}$ unit in 1 hour.

  Let the required consumption of coal be x units.

  Less engines, Less coal consumed   *(Direct Proportion)*

  More working hours, More coal consumed   *(Direct Proportion)*

  Less rate of consumption, Less coal consumed   *(Direct Proportion)*

  Number of engines $9 : 8$
  Working hours $8 : 13$ $\Big\}$ $:: 24 : x$
  Rate of consumption $\frac{1}{3} : \frac{1}{4}$

$$\therefore \quad \left(9 \times 8 \times \frac{1}{3} \times x \right) = \left(8 \times 13 \times \frac{1}{4} \times 24 \right) \quad \Leftrightarrow \quad 24x = 624 \quad \Leftrightarrow \quad x = 26.$$

Hence, the required consumption of coal = 26 metric tonnes.

Ex. 7. *A contract is to be completed in 46 days and 117 men were set to work, each working 8 hours a day. After 33 days, $\frac{4}{7}$ of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day ?*

Sol. Remaining work $= \left(1 - \frac{4}{7}\right) = \frac{3}{7}$. Remaining period $= (46 - 33)$ days $= 13$ days.

Let the total men working at it be x.

Less work, Less men   (*Direct Proportion*)
Less days, More men   (*Indirect Proportion*)
More Hrs/Day, Less men   (*Indirect Proportion*)

$$\left.\begin{array}{ll} \text{Work} & \dfrac{4}{7} : \dfrac{3}{7} \\ \text{Days} & 13 : 33 \\ \text{Hrs/Day} & 9 : 8 \end{array}\right\} :: 117 : x$$

$\therefore \quad \dfrac{4}{7} \times 13 \times 9 \times x = \dfrac{3}{7} \times 33 \times 8 \times 117$ or $x = \left(\dfrac{3 \times 33 \times 8 \times 117}{4 \times 13 \times 9}\right) = 198.$

$\therefore$ Additional men to be employed $= (198 - 117) = 81.$

Ex. 8. *A garrison of 3300 men had provisions for 32 days, when given at the rate of 850 gms per head. At the end of 7 days, a reinforcement arrives and it was found that the provisions will last 17 days more, when given at the rate of 825 gms per head. What is the strength of the reinforcement ?*

Sol. The problem becomes :

3300 men taking 850 gms per head have provisions for $(32 - 7)$ or 25 days. How many men taking 825 gms each have provisions for 17 days ?

Less ration per head, more men   (*Indirect Proportion*)
Less days, More men   (*Indirect Proportion*)

$$\left.\begin{array}{ll} \text{Ration} & 825 : 850 \\ \text{Days} & 17 : 25 \end{array}\right\} :: 3300 : x$$

$\therefore \quad 825 \times 17 \times x = 850 \times 25 \times 3300$ or $x = \dfrac{850 \times 25 \times 3300}{825 \times 17} = 5000.$

$\therefore$ Strength of reinforcement $= (5500 - 3300) = 1700.$

EXERCISE 14

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

1. If the cost of x metres of wire is d rupees, then what is the cost of y metres of wire at the same rate ?   (M.B.A. 2002)

   (a) Rs. $\left(\dfrac{xy}{d}\right)$ (b) Rs. (xd) (c) Rs. (yd) (d) Rs. $\left(\dfrac{yd}{x}\right)$

2. If the price of 6 toys is Rs. 264.37, what will be the approximate price of 5 toys ?

   (a) Rs. 140   (b) Rs. 100   (c) Rs. 200   (d) Rs. 220   (e) Rs. 240

                                                                                              (Bank P.O. 2000)

3. The price of 357 mangoes is Rs. 1517.25. What will be the approximate price of 9 dozens of such mangoes ?
   (a) Rs. 3000   (b) Rs. 3500   (c) Rs. 4000   (d) Rs. 2500

4. If a quarter kg of potato costs 60 paise, how many paise will 200 gm cost ?
   (a) 48 paise   (b) 54 paise   (c) 56 paise   (d) 72 paise

   (C.B.I. 2001)

5. If 11.25 m of a uniform iron rod weighs 42.75 kg, what will be the weight of 6 m of the same rod ?
   (a) 22.8 kg   (b) 25.6 kg   (c) 28 kg   (d) 26.5 kg

6. On a scale of map, 0.6 cm represents 6.6 km. If the distance between the points on the map is 80.5 cm, the actual distance between these points is :
   (a) 9 km   (b) 72.5 km   (c) 190.75 km   (d) 885.5 km

7. An industrial loom weaves 0.128 metres of cloth every second. Approximately, how many seconds will it take for the loom to weave 25 metres of cloth ?
   (a) 178   (b) 195   (c) 204   (d) 488

   (M.B.A. 2003)

8. A flagstaff 17.5 m high casts a shadow of length 40.25 m. The height of the building, which casts a shadow of length 28.75 m under similar conditions will be : (M.B.A. 2002)
   (a) 10 m   (b) 12.5 m   (c) 17.5 m   (d) 21.25 m

9. A man completes $\frac{5}{8}$ of a job in 10 days. At this rate, how many more days will it take him to finish the job ? (M.B.A. 2003)
   (a) 5   (b) 6   (c) 7   (d) $7\frac{1}{2}$

10. 36 men can complete a piece of work in 18 days. In how many days will 27 men complete the same work ? (Bank P.O. 1998)
    (a) 12   (b) 18   (c) 22   (d) 24   (e) None of these

11. A fort had provision of food for 150 men for 45 days. After 10 days, 25 men left the fort. The number of days for which the remaining food will last, is : (S.S.C. 2001)
    (a) $29\frac{1}{5}$ (b) $37\frac{1}{4}$ (c) 42   (d) 54

12. A wheel that has 6 cogs is meshed with a larger wheel of 14 cogs. When the smaller wheel has made 21 revolutions, then the number of revolutions made by the larger wheel is : (M.A.T. 2000)
    (a) 4   (b) 9   (c) 12   (d) 49

13. In a camp, there is a meal for 120 men or 200 children. If 150 children have taken the meal, how many men will be catered to with the remaining meal ?
    (a) 20   (b) 30   (c) 40   (d) 50

    (Railways, 2003)

14. The cost of 16 packets of salt, each weighing 900 grams is Rs. 28. What will be the cost of 27 packets, if each packet weighs 1 kg ?
    (a) Rs. 52.50   (b) Rs. 56   (c) Rs. 58.50   (d) Rs. 64.75

15. 4 mat-weavers can weave 4 mats in 4 days. At the same rate, how many mats would be woven by 8 mat-weavers in 8 days ? (S.S.C. 2004)
    (a) 4   (b) 8   (c) 12   (d) 16

16. Running at the same constant rate, 6 identical machines can produce a total of 270 bottles per minute. At this rate, how many bottles could 10 such machines produce in 4 minutes ? (M.A.T. 2004)
    (a) 648   (b) 1800   (c) 2700   (d) 10800

17. In a dairy farm, 40 cows eat 40 bags of husk in 40 days. In how many days one cow will eat one bag of husk ?   (Railways, 2003)

(a) 1   (b) $\frac{1}{40}$ (c) 40   (d) 80

18. 12 men working 8 hours per day complete a piece of work in 10 days. To complete the same work in 8 days, working 15 hours a day, the number of men required, is :

(a) 4   (b) 5   (c) 6   (d) 8

19. 10 men, working 6 hours a day can complete a work in 18 days. How many hours a day must 15 men work to complete the same work in 12 days ?   (S.S.C. 2004)

(a) 6   (b) 10   (c) 12   (d) 15

20. 39 persons can repair a road in 12 days, working 5 hours a day. In how many days will 30 persons, working 6 hours a day, complete the work ?   (C.B.I. 2003)

(a) 10   (b) 13   (c) 14   (d) 15

21. 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day ?   (M.B.A. 2002)

(a) 9   (b) 10   (c) 11   (d) 12

22. If 8 men can reap 80 hectares in 24 days, then how many hectares can 36 men reap in 30 days ?   (C.B.I. 2001)

(a) 350   (b) 400   (c) 425   (d) 450

23. A certain number of persons can dig a trench 100 m long, 50 m broad and 10 m deep in 10 days. The same number of persons can dig another trench 20 m broad and 15 m deep in 30 days. The length of the second trench is :

(a) 400 m   (b) 500 m   (c) 800 m   (d) 900 m

24. If 5 men or 9 women can do a piece of work in 19 days, then in how many days will 3 men and 6 women do the same work ?

(a) 12   (b) 15   (c) 18   (d) 21

25. 49 pumps can empty a reservoir in $6\frac{1}{2}$ days, working 8 hours a day. If 196 pumps are used for 5 hours each day, then the same work will be completed in :

(a) 2 days   (b) $2\frac{1}{2}$ days   (c) $2\frac{3}{5}$ days   (d) 3 days

26. 30 labourers, working 7 hours a day can finish a piece of work in 18 days. If the labourers work 6 hours a day, then the number of labourers to finish the same piece of work in 30 days, will be :

(a) 15   (b) 21   (c) 22   (d) 25

27. If 7 spiders make 7 webs in 7 days, then 1 spider will make 1 web in how many days ?

(a) 1   (b) $\frac{7}{2}$ (c) 7   (d) 49

(Railways, 2003)

28. If 18 pumps can raise 2170 tonnes of water in 10 days, working 7 hours a day; in how many days will 16 pumps raise 1736 tonnes of water, working 9 hours a day ?

(a) 6   (b) 7   (c) 8   (d) 9

29. If 80 lamps can be lighted, 5 hours per day for 10 days for Rs. 21.25, then the number of lamps, which can be lighted 4 hours daily for 30 days, for Rs. 76.50, is :

(a) 100   (b) 120   (c) 150   (d) 160

30. If 12 carpenters, working 6 hours a day, can make 460 chairs in 24 days, how many chairs will 18 carpenters make in 36 days, each working 8 hours a day ?

(a) 1260   (b) 1320   (c) 920   (d) 1380

31. 400 persons, working 9 hours per day complete $\frac{1}{4}$th of the work in 10 days. The number of additional persons, working 8 hours per day, required to complete the remaining work in 20 days, is :

   (a) 675   (b) 275   (c) 250   (d) 225

32. If 9 examiners can examine a certain number of answer books in 12 days, working 5 hours a day; for how many hours a day would 4 examiners have to work in order to examine twice the number of answer books in 30 days ?

   (a) 6   (b) 8   (c) 9   (d) 10

33. If 17 labourers can dig a ditch 20 m long in 18 days, working 8 hours a day; how many more labourers should be engaged to dig a similar ditch 39 m long in 6 days, each labourer working 9 hours a day ?

   (a) 34   (b) 51   (c) 68   (d) 85

34. 20 men complete one-third of a piece of work in 20 days. How many more men should be employed to finish the rest of the work in 25 more days ?

   (a) 10   (b) 12   (c) 15   (d) 20

35. If 18 binders bind 900 books in 10 days, how many binders will be required to bind 660 books in 12 days ?

   (a) 22   (b) 14   (c) 13   (d) 11

36. If $\frac{3}{5}$ of a cistern is filled in 1 minute, how much more time will be required to fill the rest of it ?

   (a) 30 sec   (b) 40 sec   (c) 36 sec   (d) 24 sec

37. If x men, working x hours per day, can do x units of work in x days, then y men, working y hours per day would be able to complete how many units of work in y days ?

   (a) $\frac{x^2}{y^3}$ (b) $\frac{x^3}{y^2}$ (c) $\frac{y^2}{x^3}$ (d) $\frac{y^3}{x^2}$

38. A rope makes 70 rounds of the circumference of a cylinder whose radius of the base is 14 cm. How many times can it go round a cylinder with radius 20 cm ?

   (a) 40   (b) 49   (c) 100   (d) None of these

39. If 5 engines consume 6 metric tonnes of coal when each is running 9 hours a day, how many metric tonnes of coal will be needed for 8 engines, each running 10 hours a day, it being given that 3 engines of the former type consume as much as 4 engines of the latter type ?

   (a) $3\frac{1}{8}$ (b) 8   (c) $8\frac{8}{9}$ (d) $6\frac{12}{25}$

40. If a certain number of workmen can do a piece of work in 25 hours, in how many hours will another set of an equal number of men, do a piece of work, twice as great, supposing that 2 men of the first set can do as much work in an hour, as 3 men of the second set do in an hour ?

   (a) 60   (b) 75   (c) 90   (d) 105

41. Some persons can do a piece of work in 12 days. Two times the number of such persons will do half of that work in :

   (a) 6 days   (b) 4 days   (c) 3 days   (d) 12 days

42. A certain number of men can finish a piece of work in 100 days. If, there were 10 men less, it would take 10 days more for the work to be finished. How many men were there originally ?

   (a) 75   (b) 82   (c) 100   (d) 110

SUB#

43. In a camp, 95 men had provisions for 200 days. After 5 days, 30 men left the camp. For how many days will the remaining food last now ?

(a) 180   (b) 285   (c) $139\frac{16}{19}$ (d) None of these

44. A garrison of 500 men had provisions for 27 days. After 3 days a reinforcement of 300 men arrived. For how many more days will the remaining food last now ?

(a) 15   (b) 16   (c) $17\frac{1}{2}$ (d) 18

45. A garrison had provisions for a certain number of days. After 10 days, $\frac{1}{5}$ of the men desert and it is found that the provisions will now last just as long as before. How long was that ?

(a) 15 days   (b) 25 days   (c) 35 days   (d) 50 days

46. 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take, if 3 women do as much work as 2 men ?

(a) 18   (b) 20   (c) 25   (d) 30

47. A contractor undertook to do a certain piece of work in 9 days. He employed certain number of men, but 6 of them being absent from the very first day, the rest could finish the work in 15 days. The number of men originally employed were :

(a) 12   (b) 15   (c) 18   (d) 24

48. A contractor undertakes to do a piece of work in 40 days. He engages 100 men at the beginning and 100 more after 35 days and completes the work in stipulated time. If he had not engaged the additional men, how many days behind schedule would it be finished ?

(a) 3   (b) 5   (c) 6   (d) 9

49. A contractor employed 30 men to do a piece of work in 38 days. After 25 days, he employed 5 men more and the work was finished one day earlier. How many days he would have been behind, if he had not employed additional men ?

(a) 1   (b) $1\frac{1}{4}$ (c) $1\frac{3}{4}$ (d) $1\frac{1}{2}$

50. 12 men and 18 boys, working $7\frac{1}{2}$ hours a day, can do a piece of work in 60 days. If a man works equal to 2 boys, then how many boys will be required to help 21 men to do twice the work in 50 days, working 9 hours a day ?

(a) 30   (b) 42   (c) 48   (d) 90

51. If 3 men or 6 boys can do a piece of work in 10 days, working 7 hours a day; how many days will it take to compete a piece of work twice as large with 6 men and 2 boys working together for 8 hours a day ?

(a) 6   (b) $7\frac{1}{2}$ (c) $8\frac{1}{2}$ (d) 9

52. 2 men and 7 boys can do a piece of work in 14 days; 3 men and 8 boys can do the same in 11 days. Then, 8 men and 6 boys can do three times the amount of this work in :

(a) 18 days   (b) 21 days   (c) 24 days   (d) 30 days

ANSWERS

1. (d)   2. (d)   3. (d)   4. (a)   5. (a)   6. (d)   7. (b)   8. (b)   9. (b)
10. (d)   11. (c)   12. (b)   13. (b)   14. (a)   15. (d)   16. (b)   17. (c)   18. (d)
19. (a)   20. (b)   21. (d)   22. (d)   23. (b)   24. (b)   25. (c)   26. (b)   27. (c)

28. (b)	29. (b)	30. (d)	31. (b)	32. (c)	33. (b)	34. (b)	35. (d)	36. (b)
37. (d)	38. (b)	39. (b)	40. (b)	41. (c)	42. (d)	43. (b)	44. (a)	45. (d)
46. (d)	47. (b)	48. (b)	49. (a)	50. (b)	51. (b)	52. (b)		

SOLUTIONS

1. Cost of x metres = Rs. d. Cost of 1 metre = Rs. $\left(\dfrac{d}{x}\right)$.

   Cost of y metres = Rs. $\left(\dfrac{d}{x} \times y\right)$ = Rs. $\left(\dfrac{yd}{x}\right)$.

2. Let the required price be Rs. x. Then, *Less toys, Less cost (Direct Proportion)*

   $\therefore$ $6 : 5 :: 264.37 : x$ $\Leftrightarrow$ $6x = (5 \times 264.37)$ $\Leftrightarrow$ $x = \dfrac{(5 \times 264.37)}{6}$ $\Leftrightarrow$ $x = 220.308$.

   $\therefore$ Approximate price of 5 toys = Rs. 220.

3. Let the required price be Rs. x. Then, *More mangoes, More price (Direct Proportion)*

   $\therefore$ $357 : (49 \times 12) :: 1517.25 : x$

   $\Leftrightarrow$ $357x = (49 \times 12 \times 1517.25)$ $\Leftrightarrow$ $x = \dfrac{(49 \times 12 \times 1517.25)}{357}$ $\Leftrightarrow$ $x = 2499$.

   Hence, the approximate price is Rs. 2500.

4. Let the required cost be x paise. *Less weight, Less cost (Direct Proportion)*

   $\therefore$ $250 : 200 :: 60 : x$ $\Leftrightarrow$ $250 \times x = (200 \times 60)$ $\Leftrightarrow$ $x = \dfrac{(200 \times 60)}{250}$ $\Leftrightarrow$ $x = 48$.

5. Let the required weight be x kg. Then, *Less length, Less weight (Direct Proportion)*

   $\therefore$ $11.25 : 6 :: 42.75 : x$ $\Leftrightarrow$ $11.25 \times x = 6 \times 42.75$ $\Leftrightarrow$ $x = \dfrac{(6 \times 42.75)}{11.25}$ $\Leftrightarrow$ $x = 22.8$.

6. Let the actual distance be x km. Then,

   More distance on the map, More is the actual distance (Direct Proportion)

   $\therefore$ $0.6 : 80.5 :: 6.6 : x$ $\Leftrightarrow$ $0.6x = 80.5 \times 6.6$ $\Leftrightarrow$ $x = \dfrac{80.5 \times 6.6}{0.6}$ $\Leftrightarrow$ $x = 885.5$.

7. Let the required time be x seconds. Then, *More metres, more time (Direct Proportion)*

   $\therefore$ $0.128 : 25 :: 1 : x$

   $\Leftrightarrow$ $0.128 \times x = 25 \times 1$ $\Leftrightarrow$ $x = \dfrac{25}{0.128} = \dfrac{25 \times 1000}{128}$ $\Leftrightarrow$ $x = 195.31$.

   $\therefore$ Required time = 195 sec (approximately).

8. Let the height of the building be x metres.

   Less lengthy shadow, Less is the height (Direct Proportion)

   $\therefore$ $40.25 : 28.75 :: 17.5 : x$ $\Leftrightarrow$ $40.25 \times x = 28.75 \times 17.5$

   $\Leftrightarrow$ $x = \dfrac{(28.75 \times 17.5)}{40.25}$ $\Leftrightarrow$ $x = 12.5$.

9. Work done = $\dfrac{5}{8}$. Balance work = $\left(1 - \dfrac{5}{8}\right) = \dfrac{3}{8}$.

   Less work, Less days (Direct Proportion)

   Let the required number of days be x.

   Then, $\dfrac{5}{8} : \dfrac{3}{8} :: 10 : x$ $\Leftrightarrow$ $\dfrac{5}{8} \times x = \dfrac{3}{8} \times 10$ $\Leftrightarrow$ $x = \left(\dfrac{3}{8} \times 10 \times \dfrac{8}{5}\right) = 6$.

10. Let the required number of days be x.
   Then, *Less men, More days* (*Indirect Proportion*)
   $$\therefore \quad 27 : 36 :: 18 : x \iff 27 \times x = 36 \times 18 \iff x = \frac{36 \times 18}{27} \iff x = 24.$$

11. **After 10 days : 150 men had food for 35 days.**
   Suppose 125 men had food for x days. Now, *Less men, More days* (*Indirect Proportion*)
   $$\therefore \quad 125 : 150 :: 35 : x \iff 125 \times x = 150 \times 35 \iff x = \frac{150 \times 35}{125} \iff x = 42.$$
   Hence, the remaining food will last for 42 days.

12. Let the required number of revolutions made by larger wheel be x.
   Then, *More cogs, Less revolutions* (*Indirect Proportion*)
   $$\therefore \quad 14 : 6 :: 21 : x \iff 14 \times x = 6 \times 21 \iff x = \left(\frac{6 \times 21}{14}\right) = 9.$$

13. There is a meal for 200 children. 150 children have taken the meal.
   Remaining meal is to be catered to 50 children.
   Now, 200 children = 120 men
   $$50 \text{ children} = \left(\frac{120}{200} \times 50\right) \text{ men} = 30 \text{ men}.$$

14. Let the required cost be Rs. x. Then,
   More packets, More cost   (*Direct Proportion*)
   More weight, More cost   (*Direct Proportion*)
   Packets 16 : 27 ⎫
                              ⎬ :: 28 : x
   Weight 900 : 1000 ⎭
   $$\therefore \quad (16 \times 900 \times x) = (27 \times 1000 \times 28) \iff x = \frac{(27 \times 1000 \times 28)}{16 \times 900} = \frac{105}{2} = 52.50.$$

15. Let the required number of mats be x.
   More weavers, More mats   (*Direct Proportion*)
   More days, More mats   (*Direct Proportion*)
   Weavers 4 : 8 ⎫
                          ⎬ :: 4 : x
   Days   4 : 8 ⎭
   $$\therefore \quad 4 \times 4 \times x = 8 \times 8 \times 4 \iff x = \frac{(8 \times 8 \times 4)}{(4 \times 4)} = 16.$$

16. Let the required number of bottles be x.
   More machines, More bottles   (*Direct Proportion*)
   More minutes, More bottles   (*Direct Proportion*)
   Machines   6 : 10 ⎫
                                      ⎬ :: 270 : x
   Time (in Minutes) 1 : 4 ⎭
   $$\therefore \quad 6 \times 1 \times x = 10 \times 4 \times 270 \iff x = \frac{10 \times 4 \times 270}{6} \iff x = 1800.$$

17. Let the required number of days be x.
   Less cows, More days   (*Indirect Proportion*)
   Less bags, Less days   (*Direct Proportion*)
   Cows 1 : 40 ⎫
                      ⎬ :: 40 : x
   Bags 40 : 1 ⎭
   $$\therefore \quad 1 \times 40 \times x = 40 \times 1 \times 40 \iff x = 40.$$

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18. Let the required number of men be x.

   Less days, More men   *(Indirect Proportion)*

   More working hrs per day, Less men   *(Indirect Proportion)*

Days $8:10$
Working Hrs $15:8$ $\Big\}$ $::12:x$

$\therefore\ 8\times15\times x = 10\times8\times12 \ \Leftrightarrow\ x = \dfrac{10\times8\times12}{8\times15} \ \Leftrightarrow\ x = 8.$

19. Let the required number of hours per day be x.

   More men, Less hours per day   *(Indirect Proportion)*

   Less days, More hours per day   *(Indirect Proportion)*

Men $15:10$
Days $12:18$ $\Big\}$ $::6:x$

$\therefore\ 15\times12\times x = 10\times18\times6 \ \Leftrightarrow\ x = \dfrac{10\times18\times6}{15\times12} \ \Leftrightarrow\ x = 6.$

20. Let the required number of days be x.

   Less persons, More days   *(Indirect Proportion)*

   More working hrs per day, Less days   *(Indirect Proportion)*

Persons $30:39$
Working hrs/day $6:5$ $\Big\}$ $::12:x$

$\therefore\ 30\times6\times x = 39\times5\times12 \ \Leftrightarrow\ x = \dfrac{39\times5\times12}{30\times6} \ \Leftrightarrow\ x = 13.$

21. Let the required number of working hours per day be x.

   More pumps, Less working hours per day   *(Indirect Proportion)*

   Less days, More working hours per day   *(Indirect Proportion)*

Pumps $4:3$
Days $1:2$ $\Big\}$ $::8:x$

$\therefore\ 4\times1\times x = 3\times2\times8 \ \Leftrightarrow\ x = \dfrac{3\times2\times8}{4} \ \Leftrightarrow\ x = 12.$

22. Let the required number of hectares be x. Then,

   More men, More hectares   *(Direct Proportion)*

   More days, More hectares   *(Direct Proportion)*

Men $8:36$
Days $24:30$ $\Big\}$ $::80:x$

$\therefore\ 8\times24\times x = 36\times30\times80 \ \Leftrightarrow\ x = \dfrac{(36\times30\times80)}{(8\times24)} \ \Leftrightarrow\ x = 450.$

23. Let the required length be x metres.

   More breadth, Less length   *(Indirect Proportion)*

   More depth, Less length   *(Indirect Proportion)*

   More days, More length   *(Direct Proportion)*

Breadth $20:50$
Depth $15:10$ $\Big\}$ $::100:x$
Days $10:30$

$\therefore\ 20\times15\times10\times x = 50\times10\times30\times100 \ \Leftrightarrow\ x = \dfrac{(50\times10\times30\times100)}{(20\times15\times10)} \ \Leftrightarrow\ x = 500.$

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24. Let the required number of days be x.

5 men $\equiv 9$ women $\Leftrightarrow$ 3 men $\equiv \left(\dfrac{9}{5} \times 3\right)$ women $= \dfrac{27}{5}$ women.

$\therefore$ (3 men and 6 women) $= \left(\dfrac{27}{5} + 6\right)$ women $= \dfrac{57}{5}$ women.

Now, *More women, Less days (Indirect Proportion)*

$\therefore$ $\dfrac{57}{5} : 9 :: 19 : x$ $\Leftrightarrow$ $\dfrac{57}{5} \times x = 9 \times 19$ $\Leftrightarrow$ $x = \left(9 \times 19 \times \dfrac{5}{57}\right) = 15$.

25. Let the required number of days be x. Then,
More pumps, Less days   (*Indirect Proportion*)
Less working hrs/day, More days   (*Indirect Proportion*)
Pumps $196 : 49$ $\Big\}$ $:: \dfrac{13}{2} : x$
Working Hrs/Day $5 : 8$

$\therefore$ $196 \times 5 \times x = 49 \times 8 \times \dfrac{13}{2}$ $\Leftrightarrow$ $x = \left(49 \times 8 \times \dfrac{13}{2} \times \dfrac{1}{196 \times 5}\right)$ $\Leftrightarrow$ $x = \dfrac{13}{5} = 2\dfrac{3}{5}$.

26. Let the required number of labourers be x. Then,
Less working hrs/day, More labourers   (*Indirect Proportion*)
More days, Less labourers   (*Indirect Proportion*)
Working Hrs/Day $6 : 7$ $\Big\}$ $:: 30 : x$
Days $30 : 18$
$\therefore$ $6 \times 30 \times x = 7 \times 18 \times 30$ $\Leftrightarrow$ $6x = 126$ $\Leftrightarrow$ $x = 21$.

27. Let the required number of days be x. Then,
Less spiders, More days   (*Indirect Proportion*)
Less webs, Less days   (*Direct Proportion*)
$\therefore$ Spiders $1 : 7$ $\Big\}$ $:: 7 : x$
Webs $7 : 1$
$\therefore$ $1 \times 7 \times x = 7 \times 1 \times 7$ $\Leftrightarrow$ $x = 7$.

28. Let the required number of days be x. Then,
Less pumps, More days   (*Indirect Proportion*)
Less weight, Less days   (*Direct Proportion*)
More hours/day, Less days   (*Indirect Proportion*)
Pumps $16 : 18$
Weight $2170 : 1736$ $\Big\}$ $:: 10 : x$
Hours/Day $9 : 7$
$\therefore$ $(16 \times 2170 \times 9 \times x) = (18 \times 1736 \times 7 \times 10)$ $\Leftrightarrow$ $x = \dfrac{18 \times 1736 \times 7 \times 10}{16 \times 2170 \times 9} = 7$.

29. Let the required number of lamps be x.
Less hours per day, More lamps   (*Indirect Proportion*)
More money, More lamps   (*Direct Proportion*)
More days, Less lamps   (*Indirect Proportion*)
Hours per day $4 : 5$
Money $21.25 : 76.50$ $\Big\}$ $:: 80 : x$
Number of days $30 : 10$
$\therefore$ $4 \times 21.25 \times 30 \times x = 5 \times 76.50 \times 10 \times 80$ $\Leftrightarrow$

$$x = \frac{5 \times 76.50 \times 10 \times 80}{4 \times 21.25 \times 30} \quad \Leftrightarrow \quad x = 120.$$

30. Let the required number of chairs be x. Then,

More carpenters, More chairs   (*Direct Proportion*)
More hours per day, More chairs   (*Direct Proportion*)
More days, More chairs   (*Direct Proportion*)

Carpenters   12 : 18 ⎫
Hours per day 6 : 8 ⎬ :: 460 : x
Days   24 : 36 ⎭

∴ $(12 \times 6 \times 24 \times x) = (18 \times 8 \times 36 \times 460) \quad \Leftrightarrow \quad x = \frac{(18 \times 8 \times 36 \times 460)}{(12 \times 6 \times 24)} = 1380.$

∴ Required number of chairs = 1380.

31. Let the number of persons completing the work in 20 days be x.

Work done = $\frac{1}{4}$, Remaining work = $\left(1 - \frac{1}{4}\right) = \frac{3}{4}$.

Less hours per day, More men required   (*Indirect Proportion*)
More work, More men required   (*Direct Proportion*)
More days, Less men required   (*Indirect Proportion*)

Hours per day 8 : 9   ⎫
Work $\frac{1}{4} : \frac{3}{4}$ ⎬ :: 400 : x
Days   20 : 10   ⎭

∴ $8 \times \frac{1}{4} \times 20 \times x = 9 \times \frac{3}{4} \times 10 \times 400 \quad \Leftrightarrow \quad 40x = 27000 \quad \Leftrightarrow \quad x = 675.$

∴ Additional men = (675 − 400) = 275.

32. Let the required number of working hours per day be x.

Less examiners, More working hours per day   (*Indirect Proportion*)
More days, Less working hours per day   (*Indirect Proportion*)
More answer books, More working hours per day (*Direct Proportion*)

Examiners   4 : 9   ⎫
Days   30 : 12 ⎬ :: 5 : x
Answer books 1 : 2   ⎭

∴ $(4 \times 30 \times 1 \times x) = (9 \times 12 \times 2 \times 5) \quad \Leftrightarrow \quad 120x = 1080 \quad \Leftrightarrow \quad x = 9.$

33. Let the total number of men to be engaged be x.

More length, More labourers   (*Direct Proportion*)
Less days, More labourers   (*Indirect Proportion*)
More hours per day, Less labourers (*Indirect Proportion*)

Length   26 : 39 ⎫
Days   6 : 18 ⎬ :: 17 : x
Hours per day 9 : 8 ⎭

∴ $(26 \times 6 \times 9 \times x) = (39 \times 18 \times 8 \times 17) \quad \Leftrightarrow \quad x = \frac{(39 \times 18 \times 8 \times 17)}{(26 \times 6 \times 9)} = 68.$

∴ Number of more labourers = (68 − 17) = 51.

34. Let the total number of men be x. Work done = $\frac{1}{3}$, Remaining work = $\left(1 - \frac{1}{3}\right) = \frac{2}{3}$.

More work, More men   (*Direct Proportion*)
More days, Less men   (*Indirect Proportion*)

$$\text{Work } \frac{1}{3} : \frac{2}{3} \atop \text{Days } 25 : 20 \Big\} :: 20 : x$$

$$\therefore \left(\frac{1}{3} \times 25 \times x\right) = \left(\frac{2}{3} \times 20 \times 20\right) \Leftrightarrow x = \frac{800}{25} = 32$$

$\therefore$ More men to be employed = $(32 - 20) = 12$.

35. Let the required number of binders be x.

Less books, Less binders   (*Direct Proportion*)
More days, Less binders   (*Indirect Proportion*)

$$\text{Books } 900 : 600 \atop \text{Days } 12 : 10 \Big\} :: 18 : x$$

$$\therefore (900 \times 12 \times x) = (600 \times 10 \times 18) \Leftrightarrow x = \frac{600 \times 10 \times 18}{900 \times 12} = 11$$

36. Let the required time be x seconds.

Part filled $= \frac{3}{5}$, Remaining part $= \left(1 - \frac{3}{5}\right) = \frac{2}{5}$.

Less part, Less time   (*Direct Proportion*)

$$\therefore \frac{3}{5} : \frac{2}{5} :: 60 : x \Leftrightarrow \left(\frac{3}{5} \times x\right) = \left(\frac{2}{5} \times 60\right) \Leftrightarrow x = 40.$$

37. Let the required number of units of work be z.

More men, More work   (*Direct Proportion*)
More working hours, More work   (*Direct Proportion*)
More days, More work   (*Direct Proportion*)

$$\text{Men } \quad\quad x : y \atop \text{Hours per day } x : y \atop \text{Days } \quad\quad x : y \Big\} :: x : z$$

$$\therefore (x \times x \times x \times z) = (y \times y \times y \times x) \Leftrightarrow z = \frac{y^3}{x^2}.$$

38. Let the required number of rounds be x.

More radius, Less rounds   (*Indirect Proportion*)

$$\therefore 20 : 14 :: 70 : x \Leftrightarrow (20 \times x) = (14 \times 70) \Leftrightarrow x = \frac{14 \times 70}{20} \Leftrightarrow x = 49.$$

Hence, the required number of rounds = 49.

39. Let the required quantity of coal be x metric tonnes.

More engines, More coal   (*Direct Proportion*)
More hours per day, More coal   (*Direct Proportion*)
More rate, More coal   (*Direct Proportion*)

$$\text{Engines } \quad 5 : 8 \atop \text{Hours per day } 9 : 10 \atop \text{Rate } \quad\quad \frac{1}{3} : \frac{1}{4} \Big\} :: 6 : x$$

$$\therefore \left(5 \times 9 \times \frac{1}{3} \times x\right) = \left(8 \times 10 \times \frac{1}{4} \times 6\right) \Leftrightarrow 15x = 120 \Leftrightarrow x = 8.$$

40. Let the required number of hours be x.

Speeds of working of first and second type of men are $\frac{1}{2}$ and $\frac{1}{3}$.

More work, More time (*Direct Proportion*)
Less speed, More time (*Indirect Proportion*)

$$\left.\begin{array}{ll} \text{Work} & 1:2 \\ \text{Speed} & \frac{1}{3}:\frac{1}{2} \end{array}\right\} :: 25 : x$$

$$\therefore \left(1 \times \frac{1}{3} \times x\right) = \left(2 \times \frac{1}{2} \times 25\right) \Leftrightarrow x = 75.$$

41. Let x men can do the work in 12 days and the required number of days be z.
More men, Less days (*Indirect Proportion*)
Less work, Less days (*Direct Proportion*)

$$\left.\begin{array}{ll} \text{Men} & 2x:x \\ \text{Work} & 1:\frac{1}{2} \end{array}\right\} :: 12 : z$$

$$\therefore \left(2x \times 1 \times z\right) = \left(x \times \frac{1}{2} \times 12\right) \Leftrightarrow 2xz = 6x \Leftrightarrow z = 3.$$

42. Originally, let there be x men.
Less men, More days (*Indirect Proportion*)

$$\therefore (x-10):x::100:110 \Leftrightarrow (x-10) \times 110 = x \times 100 \Leftrightarrow 10x = 1100 \Leftrightarrow x = 110.$$

43. Let the remaining food will last for x days.
95 men had provisions for 195 days. 65 men had provisions for x days.
Less men, More days (*Indirect Proportion*)

$$\therefore 65:95::195:x \Leftrightarrow (65 \times x) = (95 \times 195) \Leftrightarrow x = \frac{95 \times 195}{65} = 285.$$

44. Let the remaining food will last for x days.
500 men had provisions for $(27-3) = 24$ days.
$(500 + 300)$ men had provisions for x days.
More men, Less days (*Indirect Proportion*)

$$\therefore 800:500::24:x \Leftrightarrow (800 \times x) = (500 \times 24) \Leftrightarrow x = \left(\frac{500 \times 24}{800}\right) = 15.$$

45. Initially, let there be x men having food for y days.

After 10 days, x men had food for $(y-10)$ days. Also, $\left(x - \dfrac{x}{5}\right)$ men had food for y days.

$$\therefore x(y-10) = \frac{4x}{5} \times y \Leftrightarrow 5xy - 50x = 4xy \Leftrightarrow xy - 50x = 0$$

$$\Leftrightarrow x(y-50) = 0 \Leftrightarrow y - 50 = 0 \Leftrightarrow y = 50.$$

46. 3 women = 2 men. So, 21 women = 14 men.
Less men, More days (*Indirect Proportion*)
Less hours per day, More days (*Indirect Proportion*)

$$\left.\begin{array}{ll} \text{Men} & 14:15 \\ \text{Hours per day} & 6:8 \end{array}\right\} :: 21 : x$$

$\therefore$ $(14 \times 6 \times x) = (15 \times 8 \times 21)$ $\Leftrightarrow$ $x = \dfrac{(15 \times 8 \times 21)}{(14 \times 6)} = 30.$

$\therefore$ Required number of days = 30.

47. Let there be x men at the beginning.

Less men, More days   (*Indirect Proportion*)

$\therefore$ $15 : 9 :: x : (x - 6)$ $\Leftrightarrow$ $15(x - 6) = 9x$ $\Leftrightarrow$ $6x = 90$ $\Leftrightarrow$ $x = 15.$

48. $[(100 \times 35) + (200 \times 5)]$ men can finish the work in 1 day.

$\therefore$ 4500 men can finish the work in 1 day. 100 men can finish it in $\dfrac{4500}{100} = 45$ days.

This is 5 days behind schedule.

49. After 25 days, 35 men complete the work in 12 days.

Thus, 35 men can finish the remaining work in 12 days.

$\therefore$ 30 men can do it in $\dfrac{(12 \times 35)}{30} = 14$ days, which is **1 day behind.**

50. 1 man = 2 boys $\Leftrightarrow$ (12 men + 18 boys) = $(12 \times 2 + 18)$ boys = 42 boys.

Let required number of boys $= x$. 21 men + x boys = $(21 \times 2 + x)$ boys = $(42 + x)$ boys.

Less days, More boys   (*Indirect Proportion*)

More hrs per day, Less boys   (*Indirect Proportion*)

Days	$50 : 60$		
Hours per day	$9 : \dfrac{15}{2}$	$::$	$42 : (42 + x)$
Work	$1 : 2$		

$\therefore$ $[50 \times 9 \times 1 \times (42 + x)] = \left(60 \times \dfrac{15}{2} \times 2 \times 42\right)$

$\Leftrightarrow$ $(42 + x) = \dfrac{37800}{450}$ $\Leftrightarrow$ $42 + x = 84$ $\Leftrightarrow$ $x = 42.$

51. 3 men = 6 boys $\Leftrightarrow$ (6 men + 2 boys) = 14 boys.

More work, More days   (*Direct Proportion*)

More boys, Less days   (*Indirect Proportion*)

More hours per day, Less days (*Indirect Proportion*)

Work	$1 : 2$		
Boys	$14 : 6$	$::$	$10 : x$
Hours per day	$8 : 7$		

$\therefore$ $(1 \times 14 \times 8 \times x) = (2 \times 6 \times 7 \times 10)$ $\Leftrightarrow$ $x = \dfrac{840}{112} = 7\dfrac{1}{2}.$

52. (2×14) men + (7×14) boys = (3×11) men + (8×11) boys.

$\Leftrightarrow$ 5 men = 10 boys $\Leftrightarrow$ 1 man = 2 boys.

$\therefore$ (2 men + 7 boys) = $(2 \times 2 + 7)$ boys = 11 boys.

(8 men + 6 boys) = $(8 \times 2 + 6)$ boys = 22 boys.

Let the required number of days be x.

Now, **More boys, Less days**   (*Indirect Proportion*)

   More work, More days   (*Direct Proportion*)

Boys	$22 : 11$		
Work	$1 : 3$	$::$	$14 : x$

$\therefore$ $(22 \times 1 \times x) = (11 \times 3 \times 14)$ $\therefore$ $x = \dfrac{462}{22} = 21.$

Hence, the required number of days = 21.

15. TIME AND WORK

IMPORTANT FACTS AND FORMULAE

1. If A can do a piece of work in n days, then A's 1 day's work $= \frac{1}{n}$.

2. If A's 1 day's work $= \frac{1}{n}$, then A can finish the work in n days.

3. If A is thrice as good a workman as B, then :
   Ratio of work done by A and B = 3 : 1.
   Ratio of times taken by A and B to finish a work = 1 : 3.

SOLVED EXAMPLES

Ex. 1. *Worker A takes 8 hours to do a job. Worker B takes 10 hours to do the same job. How long should it take both A and B, working together but independently, to do the same job ?* (IGNOU, 2003)

Sol. A's 1 hour's work $= \frac{1}{8}$, B's 1 hour's work $= \frac{1}{10}$.

$(A + B)$'s 1 hour's work $= \left(\frac{1}{8} + \frac{1}{10}\right) = \frac{9}{40}$.

∴ Both A and B will finish the work in $\frac{40}{9} = 4\frac{4}{9}$ days.

Ex. 2. *A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work?* (Bank P.O. 2003)

Sol. $(A + B)$'s 1 day's work $= \frac{1}{4}$, A's 1 day's work $= \frac{1}{12}$.

∴ B's 1 day's work $= \left(\frac{1}{4} - \frac{1}{12}\right) = \frac{1}{6}$.

Hence, B alone can complete the work in 6 days.

Ex. 3. *A can do a piece of work in 7 days of 9 hours each and B can do it in 6 days of 7 hours each. How long will they take to do it, working together $8\frac{2}{5}$ hours a day?*

Sol. A can complete the work in $(7 \times 9) = 63$ hours.
B can complete the work in $(6 \times 7) = 42$ hours.

∴ A's 1 hour's work $= \frac{1}{63}$ and B's 1 hour's work $= \frac{1}{42}$.

$(A + B)$'s 1 hour's work $= \left(\frac{1}{63} + \frac{1}{42}\right) = \frac{5}{126}$.

Both will finish the work in $\left(\frac{126}{5}\right)$ hrs.

Number of days of $8\frac{2}{5}$ hrs each $= \left(\frac{126}{5} \times \frac{5}{42}\right) = 3$ days.

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Ex. 4. *A and B can do a piece of work in 18 days; B and C can do it in 24 days; A and C can do it in 36 days. In how many days will A, B and C finish it, working together and separately ?*

Sol.   (A + B)'s 1 day's work = $\frac{1}{18}$, (B + C)'s 1 day's work = $\frac{1}{24}$,

and (A + C)'s 1 day's work = $\frac{1}{36}$.

Adding, we get : 2 (A + B + C)'s 1 day's work = $\left(\frac{1}{18} + \frac{1}{24} + \frac{1}{36}\right) = \frac{9}{72} = \frac{1}{8}$.

∴   (A + B + C)'s 1 day's work = $\frac{1}{16}$.

Thus, A, B and C together can finish the work in 16 days.

Now, A's 1 day's work = {(A + B + C)'s 1 day's work} – {(B + C)'s 1 day's work}

$= \left(\frac{1}{16} - \frac{1}{24}\right) = \frac{1}{48}$.

∴   A alone can finish the work in 48 days.

Similarly, B's 1 day's work = $\left(\frac{1}{16} - \frac{1}{36}\right) = \frac{5}{144}$.

∴   B alone can finish the work in $\frac{144}{5} = 28\frac{4}{5}$ days.

And, C's 1 day's work = $\left(\frac{1}{16} - \frac{1}{18}\right) = \frac{1}{144}$.

∴   C alone can finish the work in 144 days.

Ex. 5. *A is twice as good a workman as B and together they finish a piece of work in 18 days. In how many days will A alone finish the work ?*

Sol.   (A's 1 day's work) : (B's 1 day's work) = 2 : 1.

(A + B)'s 1 day's work = $\frac{1}{18}$.

Divide $\frac{1}{18}$ in the ratio 2 : 1.

A's 1 day's work = $\left(\frac{1}{18} \times \frac{2}{3}\right) = \frac{1}{27}$

Hence, A alone can finish the work in 27 days.

Ex. 6. *A can do a certain job in 12 days. B is 60% more efficient than A. How many days does B alone take to do the same job ?*

Sol.   Ratio of times taken by A and B = 160 : 100 = 8 : 5.

Suppose B alone takes x days to do the job.

Then, 8 : 5 :: 12 : x   ⇒   8x = 5 × 12   ⇒ $x = 7\frac{1}{2}$ days.

Ex. 7. *A can do a piece of work in 80 days. He works at it for 10 days and then B alone finishes the remaining work in 42 days. In how much time will A and B, working together, finish the work ?*

Sol.   Work done by A in 10 days = $\left(\frac{1}{80} \times 10\right) = \frac{1}{8}$.

Remaining work $= \left(1 - \frac{1}{8}\right) = \frac{7}{8}$

Now, $\frac{7}{8}$ work is done by B in 42 days.

Whole work will be done by B in $\left(42 \times \frac{8}{7}\right) = 48$ days.

∴ A's 1 day's work $= \frac{1}{80}$ and B's 1 day's work $= \frac{1}{48}$

∴ (A + B)'s 1 day's work $= \left(\frac{1}{80} + \frac{1}{48}\right) = \frac{8}{240} = \frac{1}{30}$.

Hence, both will finish the work in 30 days.

Ex. 8. *A and B undertake to do a piece of work for Rs. 600. A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. Find the share of each.*

Sol.   C's 1 day's work $= \frac{1}{3} - \left(\frac{1}{6} + \frac{1}{8}\right) = \frac{1}{24}$.

∴   A : B : C = Ratio of their 1 day's work $= \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$.

∴   A's share = Rs. $\left(600 \times \frac{4}{8}\right)$ = Rs. 300, B's share = Rs. $\left(600 \times \frac{3}{8}\right)$ = Rs. 225.

C's share = Rs. $[600 - (300 + 225)]$ = Rs. 75.

Ex. 9. *A and B working separately can do a piece of work in 9 and 12 days respectively. If they work for a day alternately, A beginning, in how many days, the work will be completed ?*

Sol.   (A + B)'s 2 days' work $= \left(\frac{1}{9} + \frac{1}{12}\right) = \frac{7}{36}$.

Work done in 5 pairs of days $= \left(5 \times \frac{7}{36}\right) = \frac{35}{36}$.

Remaining work $= \left(1 - \frac{35}{36}\right) = \frac{1}{36}$.

On 11th day, it is A's turn. $\frac{1}{9}$ work is done by him in 1 day.

$\frac{1}{36}$ work is done by him in $\left(9 \times \frac{1}{36}\right) = \frac{1}{4}$ day.

∴   Total time taken $= \left(10 + \frac{1}{4}\right)$ days $= 10\frac{1}{4}$ days.

Ex. 10. *45 men can complete a work in 16 days. Six days after they started working, 30 more men joined them. How many days will they now take to complete the remaining work ?*

Sol.   (45 × 16) men can complete the work in 1 day.

∴   1 man's 1 day's work $= \frac{1}{720}$.

45 men's 6 days' work $= \left(\frac{1}{16} \times 6\right) = \frac{3}{8}$. Remaining work $= \left(1 - \frac{3}{8}\right) = \frac{5}{8}$.

75 men's 1 day's work $= \frac{75}{720} = \frac{5}{48}$.

Now, $\frac{5}{48}$ work is done by them in 1 day.

∴ $\frac{5}{8}$ work is done by them in $\left(\frac{48}{5} \times \frac{5}{8}\right)$ = 6 days.

Ex. 11. *2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days. In how many days can 2 men and 1 boy do the work?*

Sol. Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y.

Then, $2x + 3y = \frac{1}{10}$ and $3x + 2y = \frac{1}{8}$.

Solving, we get : $x = \frac{7}{200}$ and $y = \frac{1}{100}$.

∴ (2 men + 1 boy)'s 1 day's work = $\left(2 \times \frac{7}{200} + 1 \times \frac{1}{100}\right) = \frac{16}{200} = \frac{2}{25}$

So, 2 men and 1 boy together can finish the work in $\frac{25}{2} = 12\frac{1}{2}$ days.

EXERCISE 15A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer :*

1. A does a work in 10 days and B does the same work in 15 days. In how many days they together will do the same work ? **(R.R.B. 2003)**

   (a) 5 days   (b) 6 days   (c) 8 days   (d) 9 days

2. A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, what part of the same work they can finish in a day ?

   (a) $\frac{1}{6}$ (b) $\frac{1}{9}$ (c) $\frac{2}{5}$ (d) $\frac{2}{7}$

   (S.S.C. 2002)

3. A tyre has two punctures. The first puncture alone would have made the tyre flat in 9 minutes and the second alone would have done it in 6 minutes. If air leaks out at a constant rate, how long does it take both the punctures together to make it flat ?

   (a) $1\frac{1}{2}$ minutes   (b) $3\frac{1}{2}$ minutes   (c) $3\frac{3}{5}$ minutes   (d) $4\frac{1}{4}$ minutes

   (D.M.R.C. 2003)

4. A, B and C can complete a piece of work in 24, 6 and 12 days respectively. Working together, they will complete the same work in : **(C.B.I. 2003)**

   (a) $\frac{1}{24}$ day   (b) $\frac{7}{24}$ day   (c) $3\frac{3}{7}$ days   (d) 4 days

5. A man can do a job in 15 days. His father takes 20 days and his son finishes it in 25 days. How long will they take to complete the job if they all work together ?

   (a) Less than 6 days   (b) Exactly 6 days

   (c) Approximately 6.4 days   (d) More than 10 days

   (Hotel Management, 2003)

6. A man can do a piece of work in 5 days, but with the help of his son, he can do it in 3 days. In what time can the son do it alone ? **(S.S.C. 2004)**

   (a) $6\frac{1}{2}$ days   (b) 7 days   (c) $7\frac{1}{2}$ days   (d) 8 days

SUB#

7. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With the help of C, they did the job in 4 days only. Then, C alone can do the job in :   (S.S.C. 2003)

   (a) $9\frac{1}{5}$ days   (b) $9\frac{2}{5}$ days   (c) $9\frac{3}{5}$ days   (d) 10 days

8. A takes twice as much time as B or thrice as much time to finish a piece of work. Working together, they can finish the work in 2 days. B can do the work alone in :
   (S.S.C. 2002)

   (a) 4 days   (b) 6 days   (c) 8 days   (d) 12 days

9. X can do $\frac{1}{4}$ of a work in 10 days, Y can do 40% of the work in 40 days and Z can do $\frac{1}{3}$ of the work in 13 days. Who will complete the work first ?

   (a) X   (b) Y   (c) Z   (d) X and Z both

10. P, Q and R are three typists who working simultaneously can type 216 pages in 4 hours. In one hour, R can type as many pages more than Q as Q can type more than P. During a period of five hours, R can type as many pages as P can during seven hours. How many pages does each of them type per hour ?

    (a) 14, 17, 20   (b) 15, 17, 22   (c) 15, 18, 21   (d) 16, 18, 22

11. Ronald and Elan are working on an assignment. Ronald takes 6 hours to type 32 pages on a computer, while Elan takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages ?

    (a) 7 hours 30 minutes   (b) 8 hours
    (c) 8 hours 15 minutes   (d) 8 hours 25 minutes

    (SCMHRD, 2002)

12. Two workers A and B are engaged to do a work. A working alone takes 8 hours more to complete the job than if both worked together. If B worked alone, he would need $4\frac{1}{2}$ hours more to complete the job than they both working together. What time would they take to do the work together ?

    (a) 4 hours   (b) 5 hours   (c) 6 hours   (d) 7 hours

13. P can complete a work in 12 days working 8 hours a day. Q can complete the same work in 8 days working 10 hours a day. If both P and Q work together, working 8 hours a day, in how many days can they complete the work ?   (Bank P.O. 1999)

    (a) $5\frac{5}{11}$ (b) $5\frac{6}{11}$ (c) $6\frac{5}{11}$ (d) $6\frac{6}{11}$

14. A and B can do a work in 12 days, B and C in 15 days, C and A in 20 days. If A, B and C work together, they will complete the work in :   (S.S.C. 1999)

    (a) 5 days   (b) $7\frac{5}{6}$ days   (c) 10 days   (d) $15\frac{2}{3}$ days

15. A and B can do a work in 8 days, B and C can do the same work in 12 days. A, B and C together can finish it in 6 days. A and C together will do it in :

    (a) 4 days   (b) 6 days   (c) 8 days   (d) 12 days

    (R.R.B. 2001)

16. A and B can do a piece of work in 72 days; B and C can do it in 120 days; A and C can do it in 90 days. In what time can A alone do it ?

    (a) 80 days   (b) 100 days   (c) 120 days   (d) 150 days

17. A and B can do a piece of work in 5 days; B and C can do it in 7 days; A and C can do it in 4 days. Who among these will take the least time if put to do it alone ?

    (a) A   (b) B   (c) C   (d) Data inadequate

18. A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it ?

    (a) 8 hours   (b) 10 hours   (c) 12 hours   (d) 24 hours

                                                   (S.S.C. 2002)

19. A can do a certain work in the same time in which B and C together can do it. If A and B together could do it in 10 days and C alone in 50 days, then B alone could do it in :   (S.S.C. 2003)

    (a) 15 days   (b) 20 days   (c) 25 days   (d) 30 days

20. A works twice as fast as B. If B can complete a work in 12 days independently, the number of days in which A and B can together finish the work is :

    (a) 4 days   (b) 6 days   (c) 8 days   (d) 18 days

                                            (Asstt. Grade, 1997)

21. A is twice as good a workman as B and together they finish a piece of work in 14 days. The number of days taken by A alone to finish the work is :

    (a) 11   (b) 21   (c) 28   (d) 42

22. A is thrice as good a workman as B and therefore is able to finish a job in 60 days less than B. Working together, they can do it in :   (S.S.C. 1999)

    (a) 20 days   (b) $22\frac{1}{2}$ days   (c) 25 days   (d) 30 days

23. A and B can do a job together in 7 days. A is $1\frac{3}{4}$ times as efficient as B. The same job can be done by A alone in :   (S.S.C. 2003)

    (a) $9\frac{1}{3}$ days   (b) 11 days   (c) $12\frac{1}{4}$ days   (d) $16\frac{1}{3}$ days

24. Sakshi can do a piece of work in 20 days. Tanya is 25% more efficient than Sakshi. The number of days taken by Tanya to do the same piece of work is :

    (a) 15   (b) 16   (c) 18   (d) 25

                                          (Hotel Management, 2003)

25. A is 30% more efficient than B. How much time will they, working together, take to complete a job which A alone could have done in 23 days ?

    (a) 11 days   (b) 13 days   (c) $20\frac{3}{17}$ days   (d) None of these

                                          (Hotel Management, 1998)

26. A does half as much work as B in three-fourth of the time. If together they take 18 days to complete the work, how much time shall B take to do it ?

    (a) 30 days   (b) 35 days   (c) 40 days   (d) None of these

27. A is 50% as efficient as B. C does half of the work done by A and B together. If C alone does the work in 40 days, then A, B and C together can do the work in :

    (a) $13\frac{1}{3}$ days   (b) 15 days   (c) 20 days   (d) 30 days

28. Two workers A and B working together completed a job in 5 days. If A worked twice as efficiently as he actually did and B worked $\frac{1}{3}$ as efficiently as he actually did, the work would have been completed in 3 days. A alone could complete the work in :

    (a) $5\frac{1}{4}$ days   (b) $6\frac{1}{4}$ days   (c) $7\frac{1}{2}$ days   (d) None of these

29. A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is :   (S.S.C. 2000)

    (a) $\frac{1}{4}$ (b) $\frac{1}{10}$ (c) $\frac{7}{15}$ (d) $\frac{8}{15}$

30. A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish the remaining work ?

(a) 5　　　　　(b) $5\frac{1}{2}$　　　　　(c) 6　　　　　(d) 8

(Bank P.O. 2002)

31. A and B can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days B had to leave and A alone completed the remaining work. The whole work was completed in :　　　　　(S.S.C. 2004)

(a) 8 days　　　　　(b) 10 days　　　　　(c) 12 days　　　　　(d) 15 days

32. A can finish a work in 24 days, B in 9 days and C in 12 days. B and C start the work but are forced to leave after 3 days. The remaining work was done by A in :

(a) 5 days　　　　　(b) 6 days　　　　　(c) 10 days　　　　　(d) $10\frac{1}{2}$ days

(S.S.C. 2003)

33. A machine P can print one lakh books in 8 hours, machine Q can print the same number of books in 10 hours while machine R can print them in 12 hours. All the machines are started at 9 a.m. while machine P is closed at 11 a.m. and the remaining two machines complete the work. Approximately at what time will the work be finished ?　　　　　(Bank P.O. 2003)

(a) 11:30 a.m.　　　　　(b) 12 noon　　　　　(c) 12:30 p.m.　　　　　(d) 1 p.m.

34. A and B can do a piece of work in 30 days, while B and C can do the same work in 24 days and C and A in 20 days. They all work together for 10 days when B and C leave. How many days more will A take to finish the work ?　　　　　(C.B.I. 2003)

(a) 18 days　　　　　(b) 24 days　　　　　(c) 30 days　　　　　(d) 36 days

35. X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last ?　　　　　(Bank P.O. 2004)

(a) 6 days　　　　　(b) 10 days　　　　　(c) 15 days　　　　　(d) 20 days

36. A and B can together finish a work in 30 days. They worked together for 20 days and then B left. After another 20 days, A finished the remaining work. In how many days A alone can finish the job ?　　　　　(S.S.C. 2003)

(a) 40　　　　　(b) 50　　　　　(c) 54　　　　　(d) 60

37. X can do a piece of work in 40 days. He works at it for 8 days and then Y finished it in 16 days. How long will they together take to complete the work ?

(a) $13\frac{1}{3}$ days　　　　　(b) 15 days　　　　　(c) 20 days　　　　　(d) 56 days

(Hotel Management, 1999)

38. A, B and C together can complete a piece of work in 10 days. All the three started working at it together and after 4 days A left. Then B and C together completed the work in 10 more days. A alone could complete the work in :

(a) 15 days　　　　　(b) 16 days　　　　　(c) 25 days　　　　　(d) 50 days

39. A does $\frac{4}{5}$ of a work in 20 days. He then calls in B and they together finish the remaining work in 3 days. How long B alone would take to do the whole work ?

(a) 23 days　　　　　(b) 37 days　　　　　(c) $37\frac{1}{2}$ days　　　　　(d) 40 days

(S.S.C. 2002)

40. A and B together can do a piece of work in 30 days. A having worked for 16 days, B finishes the remaining work alone in 44 days. In how many days shall B finish the whole work alone ?　　　　　(C.B.I. 1997)

(a) 30 days　　　　　(b) 40 days　　　　　(c) 60 days　　　　　(d) 70 days

41. A and B together can do a piece of work in 12 days, which B and C together can do in 16 days. After A has been working at it for 5 days and B for 7 days, C finishes it in 13 days. In how many days C alone will do the work ?

    (a) 16   (b) 24   (c) 36   (d) 48

42. A and B can do a piece of work in 45 days and 40 days respectively. They began to do the work together but A leaves after some days and then B completed the remaining work in 23 days. The number of days after which A left the work was :

    (a) 6   (b) 8   (c) 9   (d) 12

                                                                        (Bank P.O. 1998)

43. A can do a piece of work in 14 days which B can do in 21 days. They begin together but 3 days before the completion of the work, A leaves off. The total number of days to complete the work is :   (R.R.B. 2002)

    (a) $6\frac{3}{5}$ (b) $8\frac{1}{2}$ (e) $10\frac{1}{5}$ (d) $13\frac{1}{2}$

44. A, B and C can complete a work separately in 24, 36 and 48 days respectively. They started together but C left after 4 days of start and A left 3 days before the completion of the work. In how many days will the work be completed ?

    (a) 15 days   (b) 22 days   (c) 25 days   (d) 35 days

45. A, B and C together earn Rs. 300 per day, while A and C together earn Rs. 188 and B and C together earn Rs. 152. The daily earning of C is :

    (a) Rs. 40   (b) Rs. 68   (c) Rs. 112   (d) Rs. 150

46. A, B and C are employed to do a piece of work for Rs. 529. A and B together are supposed to do $\frac{19}{23}$ of the work and B and C together $\frac{8}{23}$ of the work. What amount should A be paid ?   (C.B.I. 1997)

    (a) Rs. 315   (b) Rs. 345   (c) Rs. 355   (d) Rs. 375

47. Kim can do a work in 3 days while David can do the same work in 2 days. Both of them finish the work together and get Rs. 150. What is the share of Kim ?

    (a) Rs. 30   (b) Rs. 60   (c) Rs. 70   (d) Rs. 75

                                                                        (S.S.C. 1999)

48. If A can do $\frac{1}{4}$ of a work in 3 days and B can do $\frac{1}{6}$ of the same work in 4 days, how much will A get if both work together and are paid Rs. 180 in all ?

    (a) Rs. 36   (b) Rs. 60   (c) Rs. 108   (d) Rs. 120

49. A alone can do a piece of work in 6 days and B alone in 8 days. A and B undertook to do it for Rs. 3200. With the help of C, they completed the work in 3 days. How much is to be paid to C ?   (S.S.C. 2004)

    (a) Rs. 375   (b) Rs. 400   (c) Rs. 600   (d) Rs. 800

50. A sum of money is sufficient to pay A's wages for 21 days and B's wages for 28 days. The same money is sufficient to pay the wages of both for :

    (a) 12 days   (b) $12\frac{1}{4}$ days   (c) 14 days   (d) $24\frac{1}{2}$ days

51. A can do a piece of work in 10 days; B in 15 days. They work for 5 days. The rest of the work was finished by C in 2 days. If they get Rs. 1500 for the whole work, the daily wages of B and C are :

    (a) Rs. 150   (b) Rs. 225   (c) Rs. 250   (d) Rs. 300

52. A and B together can complete a work in 12 days. A alone can complete it in 20 days. If B does the work only for half a day daily, then in how many days A and B together will complete the work ?   (R.R.B. 2003)

    (a) 10 days   (b) 11 days   (c) 15 days   (d) 20 days

53. A alone can complete a work in 16 days and B alone in 12 days. Starting with A, they work on alternate days. The total work will be completed in : (S.S.C. 2004)

(a) 12 days (b) 13 days (c) $13\frac{5}{7}$ days (d) $13\frac{3}{4}$ days

54. A, B and C can do a piece of work in 11 days, 20 days and 55 days respectively, working alone. How soon can the work be done if A is assisted by B and C on alternate days ?

(a) 7 days (b) 8 days (c) 9 days (d) 10 days

55. A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day ?

(a) 12 days (b) 15 days (c) 16 days (d) 18 days

(R.R.B. 2002)

56. A and B can separately do a piece of work in 20 and 15 days respectively. They worked together for 6 days, after which B was replaced by C. If the work was finished in next 4 days, then the number of days in which C alone could do the work will be :

(a) 30 (b) 35 (c) 40 (d) 60

57. A, B and C can do a piece of work in 36, 54 and 72 days respectively. They started the work but A left 8 days before the completion of the work while B left 12 days before the completion. The number of days for which C worked is :

(a) 4 (b) 8 (c) 12 (d) 24

58. Twenty women can do a work in sixteen days. Sixteen men can complete the same work in fifteen days. What is the ratio between the capacity of a man and a woman ?

(a) 3 : 4 (b) 4 : 3 (c) 5 : 3 (d) Data inadequate

(B.S.R.B. 1998)

59. 10 men can complete a piece of work in 15 days and 15 women can complete the same work in 12 days. If all the 10 men and 15 women work together, in how many days will the work get completed ? (S.B.I.P.O. 1999)

(a) 6 (b) $6\frac{1}{3}$ (c) $6\frac{2}{3}$ (d) $7\frac{2}{3}$

60. Seven men can complete a work in 12 days. They started the work and after 5 days, two men left. In how many days will the work be completed by the remaining men ?

(a) 5 (b) 6 (c) 7 (d) 8 (e) None of these

61. 12 men complete a work in 9 days. After they have worked for 6 days, 6 more men join them. How many days will they take to complete the remaining work ?

(a) 2 days (b) 3 days (c) 4 days (d) 5 days (e) None of these

(R.R.B. 2002)

62. Three men, four women and six children can complete a work in seven days. A woman does double the work a man does and a child does half the work a man does. How many women alone can complete this work in 7 days ? (S.B.I.P.O. 2003)

(a) 7 (b) 8 (c) 12

(d) Cannot be determined (e) None of these

63. A man, a woman and a boy can complete a job in 3, 4 and 12 days respectively. How many boys must assist 1 man and 1 woman to complete the job in $\frac{1}{4}$ of a day ?

(a) 1 (b) 4 (c) 19 (d) 41

(S.S.C. 2000)

64. 10 men and 15 women together can complete a work in 6 days. It takes 100 days for one man alone to complete the same work. How many days will be required for one woman alone to complete the same work ? (Bank P.O. 1999)

(a) 90 (b) 125 (c) 145 (d) 150 (e) None of these

65. 12 men can complete a piece of work in 4 days, while 15 women can complete the same work in 4 days. 6 men start working on the job and after working for 2 days, all of them stopped working. How many women should be put on the job to complete the remaining work, if it is to be completed in 3 days ?   (S.B.I.P.O. 2000)

(a) 15   (b) 18   (c) 22

(d) Data inadequate   (e) None of these

66. Twelve children take sixteen days to complete a work which can be completed by eight adults in twelve days. Sixteen adults started working and after three days ten adults left and four children joined them. How many days will they take to complete the remaining work ?

(a) 3   (b) 4   (c) 6   (d) 8   (e) None of these

67. 10 women can complete a work in 7 days and 10 children take 14 days to complete the work. How many days will 5 women and 10 children take to complete the work ?

(a) 3   (b) 5   (c) 7

(d) Cannot be determined   (e) None of these   (Bank P.O. 2003)

68. Sixteen men can complete a work in twelve days. Twenty-four children can complete the same work in eighteen days. Twelve men and eight children started working and after eight days three more children joined them. How many days will they now take to complete the remaining work ?

(a) 2 days   (b) 4 days   (c) 6 days   (d) 8 days   (e) None of these

69. Twenty-four men can complete a work in sixteen days. Thirty-two women can complete the same work in twenty-four days. Sixteen men and sixteen women started working and worked for twelve days. How many more men are to be added to complete the remaining work in 2 days ?   (Bank P.O. 1999)

(a) 16   (b) 24   (c) 36   (d) 48   (e) None of these

70. 5 men and 2 boys working together can do four times as much work as a man and a boy. Working capacities of a woman and a boy are in the ratio :

(a) 1 : 2   (b) 2 : 1   (c) 1 : 3   (d) 3 : 1

71. If 12 men and 16 boys can do a piece of work in 5 days; 13 men and 24 boys can do it in 4 days, then the ratio of the daily work done by a man to that of a boy is :

(a) 2 : 1   (b) 3 : 1   (c) 3 : 2   (d) 5 : 4

(S.S.C. 1999)

72. 4 men and 6 women can complete a work in 8 days, while 3 men and 7 women can complete it in 10 days. In how many days will 10 women complete it ?

(a) 35   (b) 40   (c) 45   (d) 50

(S.S.C. 2004)

73. One man, 3 women and 4 boys can do a piece of work in 96 hours, 2 men and 8 boys can do it in 80 hours, 2 men and 3 women can do it in 120 hours. 5 men and 12 boys can do it in :

(a) $39\frac{1}{11}$ hours   (b) $42\frac{7}{11}$ hours   (c) $43\frac{7}{11}$ hours   (d) 44 hours

74. If 6 men and 8 boys can do a piece of work in 10 days while 26 men and 48 boys can do the same in 2 days, the time taken by 15 men and 20 boys in doing the same type of work will be :   (S.S.C. 1999)

(a) 4 days   (b) 5 days   (c) 6 days   (d) 7 days

SUB#

ANSWERS

1. (b)	2. (a)	3. (c)	4. (c)	5. (c)	6. (c)	7. (c)	8. (b)	9. (c)
10. (c)	11. (c)	12. (c)	13. (a)	14. (c)	15. (c)	16. (c)	17. (a)	18. (c)
19. (c)	20. (a)	21. (b)	22. (b)	23. (b)	24. (b)	25. (b)	26. (a)	27. (a)
28. (b)	29. (d)	30. (c)	31. (c)	32. (c)	33. (d)	34. (a)	35. (b)	36. (d)
37. (a)	38. (c)	39. (c)	40. (c)	41. (b)	42. (a)	43. (c)	44. (a)	45. (a)
46. (b)	47. (b)	48. (d)	49. (b)	50. (a)	51. (b)	52. (c)	53. (d)	54. (b)
55. (b)	56. (c)	57. (d)	58. (b)	59. (c)	60. (c)	61. (a)	62. (a)	63. (d)
64. (c)	65. (a)	66. (c)	67. (c)	68. (b)	69. (b)	70. (b)	71. (a)	72. (b)
73. (c)	74. (a)							

SOLUTIONS

1. A's 1 day's work $= \dfrac{1}{10}$ and B's 1 day's work $= \dfrac{1}{15}$.

   $\therefore$ (A + B)'s 1 day's work $= \left(\dfrac{1}{10} + \dfrac{1}{15}\right) = \dfrac{1}{6}$.

   So, both together will finish the work in 6 days.

2. A's 1 day's work $= \dfrac{1}{18}$ and B's 1 day's work $= \dfrac{1}{9}$.

   $\therefore$ (A + B)'s 1 day's work $= \left(\dfrac{1}{18} + \dfrac{1}{9}\right) = \dfrac{1}{6}$.

3. 1 minute's work of both the punctures $= \left(\dfrac{1}{9} + \dfrac{1}{6}\right) = \dfrac{5}{18}$.

   So, both the punctures will make the tyre flat in $\dfrac{18}{5} = 3\dfrac{3}{5}$ min.

4. (A + B + C)'s 1 day's work $= \left(\dfrac{1}{24} + \dfrac{1}{6} + \dfrac{1}{12}\right) = \dfrac{7}{24}$.

   So, A, B and C together will complete the job in $\dfrac{24}{7} = 3\dfrac{3}{7}$ days.

5. 1 day's work of the three persons $= \left(\dfrac{1}{15} + \dfrac{1}{20} + \dfrac{1}{25}\right) = \dfrac{47}{300}$.

   So, all the three together will complete the work in $\dfrac{300}{47} = 6.4$ days.

6. Son's 1 day's work $= \left(\dfrac{1}{3} - \dfrac{1}{5}\right) = \dfrac{2}{15}$.

   $\therefore$ The son alone can do the work in $\dfrac{15}{2} = 7\dfrac{1}{2}$ days.

7. (A + B + C)'s 1 day's work $= \dfrac{1}{4}$, A's 1 day's work $= \dfrac{1}{16}$, B's 1 day's work $= \dfrac{1}{12}$.

   $\therefore$ C's 1 day's work $= \dfrac{1}{4} - \left(\dfrac{1}{16} + \dfrac{1}{12}\right) = \left(\dfrac{1}{4} - \dfrac{7}{48}\right) = \dfrac{5}{48}$.

   So, C alone can do the work in $\dfrac{48}{5} = 9\dfrac{3}{5}$ days.

8. Suppose A, B and C take x, $\dfrac{x}{2}$ and $\dfrac{x}{3}$ hours respectively to finish the work.

Then, $\left(\dfrac{1}{x} + \dfrac{2}{x} + \dfrac{3}{x}\right) = \dfrac{1}{2}$ $\Rightarrow$ $\dfrac{6}{x} = \dfrac{1}{2}$ $\Rightarrow$ $\therefore = 12$.

So, B takes 6 hours to finish the work.

9. Whole work will be done by X in $(10 \times 4) = 40$ days.

Whole work will be done by Y in $\left(40 \times \dfrac{100}{40}\right) = 100$ days.

Whole work will be done by Z in $(13 \times 3) = 39$ days.

$\therefore$ Z will complete the work first.

10. Let the number of pages typed in one hour by P, Q and R be x, y and z respectively.
Then,

$x + y + z = \dfrac{216}{4}$ $\Rightarrow$ $x + y + z = 54$ ...(i)

$z - y = y - x$ $\Rightarrow$ $2y = x + z$ ...(ii)

$5z = 7x$ $\Rightarrow$ $x = \dfrac{5}{7}z$ ...(iii)

Solving (i), (ii) and (iii), we get $x = 15$, $y = 18$, $z = 21$.

11. Number of pages typed by Ronald in 1 hour $= \dfrac{32}{6} = \dfrac{16}{3}$.

Number of pages typed by Elan in 1 hour $= \dfrac{40}{5} = 8$.

Number of pages typed by both in 1 hour $= \left(\dfrac{16}{3} + 8\right) = \dfrac{40}{3}$.

$\therefore$ Time taken by both to type 110 pages $= \left(110 \times \dfrac{3}{40}\right)$ hrs $= 8\dfrac{1}{4}$ hrs $= 8$ hrs 15 min.

12. Let A and B together take x hours to complete the work. Then,

A alone takes $(x + 8)$ hrs and B alone takes $\left(x + \dfrac{9}{2}\right)$ hrs to complete the work. Then,

$\dfrac{1}{(x + 8)} + \dfrac{1}{\left(x + \dfrac{9}{2}\right)} = \dfrac{1}{x}$ $\Rightarrow$ $\dfrac{1}{(x + 8)} + \dfrac{2}{(2x + 9)} = \dfrac{1}{x}$ $\Rightarrow$ $x(4x + 25) = (x + 8)(2x + 9)$

$\Rightarrow$ $2x^2 = 72$ $\Rightarrow$ $x^2 = 36$ $\Rightarrow$ $x = 6$.

13. P can complete the work in (12×8) hrs. $= 96$ hrs.

Q can complete the work in (8×10) hrs. $= 80$ hrs.

$\therefore$ P's 1 hour's work $= \dfrac{1}{96}$ and Q's 1 hour's work $= \dfrac{1}{80}$.

$(P + Q)$'s 1 hour's work $= \left(\dfrac{1}{96} + \dfrac{1}{80}\right) = \dfrac{11}{480}$.

So, both P and Q will finish the work in $\left(\dfrac{480}{11}\right)$ hrs.

$\therefore$ Number of days of 8 hours each $= \left(\dfrac{480}{11} \times \dfrac{1}{8}\right) = \dfrac{60}{11}$ days $= 5\dfrac{5}{11}$ days.

14. (A + B)'s 1 day's work $= \frac{1}{12}$; (B + C)'s 1 day's work $= \frac{1}{15}$; (A + C)'s 1 day's work $= \frac{1}{20}$.

Adding, we get : 2 (A + B + C)'s 1 day's work $= \left(\frac{1}{12} + \frac{1}{15} + \frac{1}{20}\right) = \frac{12}{60} = \frac{1}{5}$.

∴ (A + B + C)'s 1 day's work $= \frac{1}{10}$.

So, A, B and C together can complete the work in 10 days.

15. (A + B + C)'s 1 day's work $= \frac{1}{6}$; (A + B)'s 1 day's work $= \frac{1}{8}$;

(B + C)'s 1 day's work $= \frac{1}{12}$.

∴ (A + C)'s 1 day's work $= \left(2 \times \frac{1}{6}\right) - \left(\frac{1}{8} + \frac{1}{12}\right) = \left(\frac{1}{3} - \frac{5}{24}\right) = \frac{3}{24} = \frac{1}{8}$.

So, A and C together will do the work in 8 days.

16. (A + B)'s 1 day's work $= \frac{1}{72}$; (B + C)'s 1 day's work $= \frac{1}{120}$; (A + C)'s 1 day's work $= \frac{1}{90}$.

Adding, we get : 2 (A + B + C)'s 1 day's work $= \left(\frac{1}{72} + \frac{1}{120} + \frac{1}{90}\right) = \frac{12}{360} = \frac{1}{30}$.

⇒ (A + B + C)'s 1 day's work $= \frac{1}{60}$.

So, A's 1 day's work $= \left(\frac{1}{60} - \frac{1}{120}\right) = \frac{1}{120}$.

∴ A alone can do the work in 120 days.

17. (A + B)'s 1 day's work $= \frac{1}{5}$; (B + C)'s 1 day's work $= \frac{1}{7}$; (A + C)'s 1 day's work $= \frac{1}{4}$.

Adding, we get : 2 (A + B + C)'s 1 day's work $= \left(\frac{1}{5} + \frac{1}{7} + \frac{1}{4}\right) = \frac{83}{140}$.

(A + B + C)'s 1 day's work $= \frac{83}{280}$.

A's 1 day's work $= \left(\frac{83}{280} - \frac{1}{7}\right) = \frac{43}{280}$; B's 1 day's work $= \left(\frac{83}{280} - \frac{1}{4}\right) = \frac{13}{280}$;

C's 1 day's work $= \left(\frac{83}{280} - \frac{1}{5}\right) = \frac{27}{280}$.

Thus time taken by A, B, C is $\frac{280}{43}$ days, $\frac{280}{13}$ days, $\frac{280}{27}$ days respectively.

Clearly, the time taken by A is least.

18. A's 1 hour's work $= \frac{1}{4}$; (B + C)'s 1 hour's work $= \frac{1}{3}$; (A + C)'s 1 hour's work $= \frac{1}{2}$.

(A + B + C)'s 1 hour's work $= \left(\frac{1}{4} + \frac{1}{3}\right) = \frac{7}{12}$.

B's 1 hour's work $= \left(\frac{7}{12} - \frac{1}{2}\right) = \frac{1}{12}$.

∴ B alone will take 12 hours to do the work.

19. $(A + B)$'s 1 day's work $= \dfrac{1}{10}$; C's 1 day's work $= \dfrac{1}{50}$.

$(A + B + C)$'s 1 day's work $= \left(\dfrac{1}{10} + \dfrac{1}{50}\right) = \dfrac{6}{50} = \dfrac{3}{25}$ ...(i)

Also, A's 1 day's work $= (B + C)$'s 1 day's work   ...(ii)

From (i) and (ii), we get : $2 \times (A$'s 1 day's work$) = \dfrac{3}{25}$.

$\Rightarrow$ A's 1 day's work $= \dfrac{3}{50}$.

$\therefore$ B's 1 day's work $= \left(\dfrac{1}{10} - \dfrac{3}{50}\right) = \dfrac{2}{50} = \dfrac{1}{25}$.

So, B alone could do the work in 25 days.

20. Ratio of rates of working of A and B $= 2 : 1$. So, ratio of times taken $= 1 : 2$.

$\therefore$ A's 1 day's work $= \dfrac{1}{6}$; B's 1 day's work $= \dfrac{1}{12}$.

$(A + B)$'s 1 day's work $= \left(\dfrac{1}{6} + \dfrac{1}{12}\right) = \dfrac{3}{12} = \dfrac{1}{4}$.

So, A and B together can finish the work in 4 days.

21. (A's 1 day's work) : (B's 1 day's work) $= 2 : 1$.

$(A + B)$'s 1 day's work $= \dfrac{1}{14}$.

Divide $\dfrac{1}{14}$ in the ratio $2 : 1$.

$\therefore$ A's 1 day's work $= \left(\dfrac{1}{14} \times \dfrac{2}{3}\right) = \dfrac{1}{21}$.

Hence, A alone can finish the work in 21 days.

22. Ratio of times taken by A and B $= 1 : 3$.

If difference of time is 2 days, B takes 3 days.

If difference of time is 60 days, B takes $\left(\dfrac{3}{2} \times 60\right) = 90$ days.

So, A takes 30 days to do the work.

A's 1 day's work $= \dfrac{1}{30}$; B's 1 day's work $= \dfrac{1}{90}$.

$(A + B)$'s 1 day's work $= \left(\dfrac{1}{30} + \dfrac{1}{90}\right) = \dfrac{4}{90} = \dfrac{2}{45}$.

$\therefore$ A and B together can do the work in $\dfrac{45}{2} = 22\dfrac{1}{2}$ days.

23. (A's 1 day's work) : (B's 1 day's work) $= \dfrac{7}{4} : 1 = 7 : 4$.

Let A's and B's 1 day's work be $7x$ and $4x$ respectively.

Then, $7x + 4x = \dfrac{1}{7} \Rightarrow 11x = \dfrac{1}{7} \Rightarrow x = \dfrac{1}{77}$.

$\therefore$ A's 1 day's work $= \left(\dfrac{1}{77} \times 7\right) = \dfrac{1}{11}$.

SUB#

24. Ratio of times taken by Sakshi and Tanya = 125 : 100 = 5 : 4.

Suppose Tanya takes x days to do the work.

$$5 : 4 :: 20 : x \implies x = \left(\frac{4 \times 20}{5}\right) \implies x = 16 \text{ days.}$$

Hence, Tanya takes 16 days to complete the work.

25. Ratio of times taken by A and B = 100 : 130 = 10 : 13.

Suppose B takes x days to do the work.

$$\text{Then, } 10 : 13 :: 23 : x \implies x = \left(\frac{23 \times 13}{10}\right) \implies x = \frac{299}{10}.$$

A's 1 day's work $= \frac{1}{23}$; B's 1 days work $= \frac{10}{299}$.

$(A + B)$'s 1 day's work $= \left(\frac{1}{23} + \frac{10}{299}\right) = \frac{23}{299} = \frac{1}{13}$.

∴   A and B together can complete the job in 13 days.

26. Suppose B takes x days to do the work.

∴   A takes $\left(2 \times \frac{3}{4} x\right) = \frac{3x}{2}$ days to do it.

$(A + B)$'s 1 day's work $= \frac{1}{18}$.

∴ $\frac{1}{x} + \frac{2}{3x} = \frac{1}{18}$ or $x = 30$.

27. (A's 1 day's work) : (B's 1 day's work) = 150 : 100 = 3 : 2.

Let A's and B's 1 day's work be $3x$ and $2x$ respectively.

Then, C's 1 day's work $= \left(\frac{3x + 2x}{2}\right) = \frac{5x}{2}$.

∴ $\frac{5x}{2} = \frac{1}{40}$ or $x = \left(\frac{1}{40} \times \frac{2}{5}\right) = \frac{1}{100}$.

A's 1 day's work $= \frac{3}{100}$; B's 1 day's work $= \frac{1}{50}$; C's 1 day's work $= \frac{1}{40}$.

$(A + B + C)$'s 1 day's work $= \left(\frac{3}{100} + \frac{1}{50} + \frac{1}{40}\right) = \frac{15}{200} = \frac{3}{40}$.

So, A, B and C together can do the work in $\frac{40}{3} = 13\frac{1}{3}$ days.

28. Let A's 1 day's work $= x$ and B's 1 day's work $= y$.

Then, $x + y = \frac{1}{5}$ and $2x + \frac{1}{3} y = \frac{1}{3}$.

Solving, we get : $x = \frac{4}{25}$ and $y = \frac{1}{25}$.

∴   A's 1 day's work $= \frac{4}{25}$.

So, A alone could complete the work in $\frac{25}{4} = 6\frac{1}{4}$ days.

29. A's 1 day's work $= \frac{1}{15}$; B's 1 day's work $= \frac{1}{20}$.

$(A + B)$'s 1 day's work $= \left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{60}$.

$(A + B)$'s 4 days' work $= \left(\dfrac{7}{60} \times 4\right) = \dfrac{7}{15}$

$\therefore$ Remaining work $= \left(1 - \dfrac{7}{15}\right) = \dfrac{8}{15}$.

30. B's 10 days' work $= \left(\dfrac{1}{15} \times 10\right) = \dfrac{2}{3}$. Remaining work $= \left(1 - \dfrac{2}{3}\right) = \dfrac{1}{3}$.

Now, $\dfrac{1}{18}$ work is done by A in 1 day.

$\therefore$ $\dfrac{1}{3}$ work is done by A in $\left(18 \times \dfrac{1}{3}\right) = 6$ days.

31. $(A + B)$'s 1 day's work $= \left(\dfrac{1}{15} + \dfrac{1}{10}\right) = \dfrac{1}{6}$.

Work done by A and B in 2 days $= \left(\dfrac{1}{6} \times 2\right) = \dfrac{1}{3}$. Remaining work $= \left(1 - \dfrac{1}{3}\right) = \dfrac{2}{3}$.

Now, $\dfrac{1}{15}$ work is done by A in 1 day.

$\therefore$ $\dfrac{2}{3}$ work will be done by A in $\left(15 \times \dfrac{2}{3}\right) = 10$ days.

Hence, total time taken $= (10 + 2) = 12$ days.

32. $(B + C)$'s 1 day's work $= \left(\dfrac{1}{9} + \dfrac{1}{12}\right) = \dfrac{7}{36}$.

Work done by B and C in 3 days $= \left(\dfrac{7}{36} \times 3\right) = \dfrac{7}{12}$.

Remaining work $= \left(1 - \dfrac{7}{12}\right) = \dfrac{5}{12}$.

Now, $\dfrac{1}{24}$ work is done by A in 1 day.

So, $\dfrac{5}{12}$ work is done by A in $\left(24 \times \dfrac{5}{12}\right) = 10$ days.

33. $(P + Q + R)$'s 1 hour's work $= \left(\dfrac{1}{8} + \dfrac{1}{10} + \dfrac{1}{12}\right) = \dfrac{37}{120}$.

Work done by P, Q and R in 2 hours $= \left(\dfrac{37}{120} \times 2\right) = \dfrac{37}{60}$.

Remaining work $= \left(1 - \dfrac{37}{60}\right) = \dfrac{23}{60}$.

$(Q + R)$'s 1 hour's work $= \left(\dfrac{1}{10} + \dfrac{1}{12}\right) = \dfrac{11}{60}$.

Now, $\dfrac{11}{60}$ work is done by Q and R in 1 hour.

So, $\dfrac{23}{60}$ work will be done by Q and R in $\left(\dfrac{60}{11} \times \dfrac{23}{60}\right) = \dfrac{23}{11}$ hours ≈ 2 hours.

So, the work will be finished approximately 2 hours after 11 a.m., i.e., around 1 p.m.

34. $2 (A + B + C)$'s 1 day's work $= \left(\frac{1}{30} + \frac{1}{24} + \frac{1}{20}\right) = \frac{15}{120} = \frac{1}{8}$.

$\Rightarrow$ $(A + B + C)$'s 1 day's work $= \frac{1}{16}$.

Work done by A, B and C in 10 days $= \frac{10}{16} = \frac{5}{8}$. Remaining work $= \left(1 - \frac{5}{8}\right) = \frac{3}{8}$.

A's 1 day's work $= \left(\frac{1}{16} - \frac{1}{24}\right) = \frac{1}{48}$.

Now, $\frac{1}{48}$ work is done by A in 1 day.

So, $\frac{3}{8}$ work will be done by A in $\left(48 \times \frac{3}{8}\right) = 18$ days.

35. Work done by X in 4 days $= \left(\frac{1}{20} \times 4\right) = \frac{1}{5}$. Remaining work $= \left(1 - \frac{1}{5}\right) = \frac{4}{5}$.

$(X + Y)$'s 1 day's work $= \left(\frac{1}{20} + \frac{1}{12}\right) = \frac{8}{60} = \frac{2}{15}$.

Now, $\frac{2}{15}$ work is done by X and Y in 1 day.

So, $\frac{4}{5}$ work will be done by X and Y in $\left(\frac{15}{2} \times \frac{4}{5}\right) = 6$ days.

Hence, total time taken $= (6 + 4)$ days $= 10$ days.

36. $(A + B)$'s 20 days' work $= \left(\frac{1}{30} \times 20\right) = \frac{2}{3}$. Remaining work $= \left(1 - \frac{2}{3}\right) = \frac{1}{3}$.

Now, $\frac{1}{3}$ work is done by A in 20 days.

Whole work will be done by A in $(20 \times 3) = 60$ days.

37. Work done by X in 8 days $= \left(\frac{1}{40} \times 8\right) = \frac{1}{5}$. Remaining work $= \left(1 - \frac{1}{5}\right) = \frac{4}{5}$.

Now, $\frac{4}{5}$ work is done by Y in 16 days.

Whole work will be done by Y in $\left(16 \times \frac{5}{4}\right) = 20$ days.

$\therefore$ X's 1 day's work $= \frac{1}{40}$, Y's 1 day's work $= \frac{1}{20}$.

$(X + Y)$'s 1 day's work $= \left(\frac{1}{40} + \frac{1}{20}\right) = \frac{3}{40}$.

Hence, X and Y will together complete the work in $\frac{40}{3} = 13\frac{1}{3}$ days.

38. Work done by A, B and C in 4 days $= \left(\frac{1}{10} \times 4\right) = \frac{2}{5}$. Remaining work $= \left(1 - \frac{2}{5}\right) = \frac{3}{5}$.

Now, $\frac{3}{5}$ work is done by B and C in 10 days.

Whole work will be done by B and C in $\left(10 \times \frac{5}{3}\right) = \frac{50}{3}$ days.

SUB#

$(A + B + C)$'s 1 day's work $= \frac{1}{10}$, $(B + C)$'s 1 day's work $= \frac{3}{50}$.

A's 1 day's work $= \left(\frac{1}{10} - \frac{3}{50}\right) = \frac{2}{50} = \frac{1}{25}$.

∴ A alone could complete the work in 25 days.

39. Whole work is done by A in $\left(20 \times \frac{5}{4}\right)$ = 25 days.

Now, $\left(1 - \frac{4}{5}\right)$ i.e., $\frac{1}{5}$ work is done by A and B in 3 days.

Whole work will be done by A and B in (3×5) = 15 days.

A's 1 day's work $= \frac{1}{25}$, $(A + B)$'s 1 day's work $= \frac{1}{15}$.

∴ B's 1 day's work $= \left(\frac{1}{15} - \frac{1}{25}\right) = \frac{4}{150} = \frac{2}{75}$.

So, B alone would do the work in $\frac{75}{2} = 37\frac{1}{2}$ days.

40. Let A's 1 day's work $= x$ and B's 1 day's work $= y$.

Then, $x + y = \frac{1}{30}$ and $16x + 44y = 1$.

Solving these two equations, we get : $x = \frac{1}{60}$ and $y = \frac{1}{60}$.

∴ B's 1 day's work $= \frac{1}{60}$.

Hence, B alone shall finish the whole work in 60 days.

41. A's 5 days' work + B's 7 days' work + C's 13 days' work = 1

⇒ $(A + B)$'s 5 days' work + $(B + C)$'s 2 days' work + C's 11 days' work = 1

⇒ $\frac{5}{12} + \frac{2}{16}$ + C's 11 days' work = 1

⇒ C's 11 days' work $= 1 - \left(\frac{5}{12} + \frac{2}{16}\right) = \frac{11}{24}$.

⇒ C's 1 day's work $= \left(\frac{11}{24} \times \frac{1}{11}\right) = \frac{1}{24}$.

∴ C alone can finish the work in 24 days.

42. $(A + B)$'s 1 day's work $= \left(\frac{1}{45} + \frac{1}{40}\right) = \frac{17}{360}$.

Work done by B in 23 days $= \left(\frac{1}{40} \times 23\right) = \frac{23}{40}$. Remaining work $= \left(1 - \frac{23}{40}\right) = \frac{17}{40}$.

Now, $\frac{17}{360}$ work was done by $(A + B)$ in 1 day.

$\frac{17}{40}$ work was done by $(A + B)$ in $\left(1 \times \frac{360}{17} \times \frac{17}{40}\right)$ = 9 days.

∴ A left after 9 days.

43. B's 3 days' work $= \left(\frac{1}{21} \times 3\right) = \frac{1}{7}$. Remaining work $= \left(1 - \frac{1}{7}\right) = \frac{6}{7}$.

$(A + B)$'s 1 day's work $= \left(\frac{1}{14} + \frac{1}{21}\right) = \frac{5}{42}$.

Now, $\frac{5}{42}$ work is done by A and B in 1 day.

$\therefore$ $\frac{6}{7}$ work is done by A and B in $\left(\frac{42}{5} \times \frac{6}{7}\right) = \frac{36}{5}$ days.

Hence, total time taken $= \left(3 + \frac{36}{5}\right)$ days $= 10\frac{1}{5}$ days.

44. $(A + B + C)$'s 1 day's work $= \left(\frac{1}{24} + \frac{1}{36} + \frac{1}{48}\right) = \frac{13}{144}$.

Work done by $(A + B + C)$ in 4 days $= \left(\frac{13}{144} \times 4\right) = \frac{13}{36}$.

Work done by B in 3 days $= \left(\frac{1}{36} \times 3\right) = \frac{1}{12}$. Remaining work $= \left[1 - \left(\frac{13}{36} + \frac{1}{12}\right)\right] = \frac{5}{9}$.

$(A + B)$'s 1 day's work $= \left(\frac{1}{24} + \frac{1}{36}\right) = \frac{5}{72}$.

Now, $\frac{5}{72}$ work is done by A and B in $\left(\frac{72}{5} \times \frac{5}{9}\right) = 8$ days.

Hence, total time taken $= (4 + 3 + 8)$ days $= 15$ days.

45. B's daily earning $=$ Rs. $(300 - 188) =$ Rs. 112.
A's daily earning $=$ Rs. $(300 - 152) =$ Rs. 148.
C's daily earning $=$ Rs. $[300 - (112 + 148)] =$ Rs. 40.

46. Work done by A $= \left(1 - \frac{8}{23}\right) = \frac{15}{23}$.

$\therefore$ $A : (B + C) = \frac{15}{23} : \frac{8}{23} = 15 : 8$.

So, A's share $=$ Rs. $\left(\frac{15}{23} \times 529\right) =$ Rs. 345.

47. Kim's wages : David's wages $=$ Kim's 1 day's work : David's 1 day's work

$$= \frac{1}{3} : \frac{1}{2} = 2 : 3.$$

$\therefore$ Kim's share $=$ Rs. $\left(\frac{2}{5} \times 150\right) =$ Rs. 60.

48. Whole work is done by A in $(3 \times 4) = 12$ days.
Whole work is done by B in $(4 \times 6) = 24$ days.

A's wages : B's wages $=$ A's 1 day's work : B's 1 day's work $= \frac{1}{12} : \frac{1}{24} = 2 : 1$.

$\therefore$ A's share $=$ Rs. $\left(\frac{2}{3} \times 180\right) =$ Rs. 120.

SUB#

49. C's 1 day's work $= \frac{1}{3} - \left(\frac{1}{6} + \frac{1}{8}\right) = \frac{1}{3} - \frac{7}{24} = \frac{1}{24}$.

A's wages : B's wages : C's wages $= \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$.

$\therefore$ C's share $= Rs. \left(\frac{1}{8} \times 3200\right) = Rs. 400$.

50. Let total money be Rs. x.

A's 1 day's wages $= Rs. \frac{x}{21}$, B's 1 day's wages $= Rs. \frac{x}{28}$.

$\therefore$ (A + B)'s 1 day's wages $= Rs. \left(\frac{x}{21} + \frac{x}{28}\right) = Rs. \frac{x}{12}$.

$\therefore$ Money is sufficient to pay the wages of both for 12 days.

51. Part of the work done by A $= \left(\frac{1}{10} \times 5\right) = \frac{1}{2}$.

Part of the work done by B $= \left(\frac{1}{15} \times 5\right) = \frac{1}{3}$.

Part of the work done by C $= 1 - \left(\frac{1}{2} + \frac{1}{3}\right) = \frac{1}{6}$.

So, (A's share) : (B's share) : (C's share) $= \frac{1}{2} : \frac{1}{3} : \frac{1}{6} = 3 : 2 : 1$.

$\therefore$ A's share $= Rs. \left(\frac{3}{6} \times 1500\right) = Rs. 750$, B's share $= Rs. \left(\frac{2}{6} \times 1500\right) = Rs. 500$,

C's share $= Rs. \left(\frac{1}{6} \times 1500\right) = Rs. 250$.

A's daily wages $= Rs. \left(\frac{750}{5}\right) = Rs. 150$; B's daily wages $= Rs. \left(\frac{500}{5}\right) = Rs. 100$;

C's daily wages $= Rs. \left(\frac{250}{2}\right) = Rs. 125$.

$\therefore$ Daily wages of B and C = Rs. (100 + 125) = Rs. 225.

52. B's 1 day's work $= \left(\frac{1}{12} - \frac{1}{20}\right) = \frac{2}{60} = \frac{1}{30}$.

Now, (A + B)'s 1 day's work $= \left(\frac{1}{20} + \frac{1}{60}\right) = \frac{4}{60} = \frac{1}{15}$. [$\because$ B works for half day only]

So, A and B together will complete the work in 15 days.

53. (A + B)'s 2 days' work $= \left(\frac{1}{16} + \frac{1}{12}\right) = \frac{7}{48}$.

Work done in 6 pairs of days $= \left(\frac{7}{48} \times 6\right) = \frac{7}{8}$. Remaining work $= \left(1 - \frac{7}{8}\right) = \frac{1}{8}$.

Work done by A on 13th day $= \frac{1}{16}$. Remaining work $= \left(\frac{1}{8} - \frac{1}{16}\right) = \frac{1}{16}$.

On 14th day, it is B's turn.

SUB#

$\frac{1}{12}$ work is done by B in 1 day. $\frac{1}{16}$ work is done by B in $\left(12 \times \frac{1}{16}\right) = \frac{3}{4}$ day.

$\therefore$ Total time taken $= 13\frac{3}{4}$ days.

54. (A + B)'s 1 day's work $= \left(\frac{1}{11} + \frac{1}{20}\right) = \frac{31}{220}$. (A + C)'s 1 day's work $= \left(\frac{1}{11} + \frac{1}{55}\right) = \frac{6}{55}$.

Work done in 2 days $= \left(\frac{31}{220} + \frac{6}{55}\right) = \frac{55}{220} = \frac{1}{4}$.

Now, $\frac{1}{4}$ work is done by A in 2 days.

$\therefore$ Whole work will be done in $(2 \times 4) = 8$ days.

55. A's 2 days' work $= \left(\frac{1}{20} \times 2\right) = \frac{1}{10}$.

(A + B + C)'s 1 day's work $= \left(\frac{1}{20} + \frac{1}{30} + \frac{1}{60}\right) = \frac{6}{60} = \frac{1}{10}$.

Work done in 3 days $= \left(\frac{1}{10} + \frac{1}{10}\right) = \frac{1}{5}$.

Now, $\frac{1}{5}$ work is done in 3 days.

$\therefore$ Whole work will be done in $(3 \times 5) = 15$ days.

56. (A + B)'s 6 days' work $= 6\left(\frac{1}{20} + \frac{1}{15}\right) = \frac{7}{10}$; (A + C)'s 4 days' work $= \frac{3}{10}$;

(A + C)'s 1 day's work $= \frac{3}{40}$. A's 1 day's work $= \frac{1}{20}$.

$\therefore$ C's 1 day's work $= \left(\frac{3}{40} - \frac{1}{20}\right) = \frac{1}{40}$.

Hence, C alone can finish the work in 40 days.

57. Suppose the work was finished in x days.

Then, A's $(x - 8)$ days' work + B's $(x - 12)$ days' work + C's x days' work = 1

$\Rightarrow \quad \frac{(x - 8)}{36} + \frac{(x - 12)}{54} + \frac{x}{72} = 1 \Leftrightarrow 6(x - 8) + 4(x - 12) + 3x = 216$

$\therefore 13x = 312$ or $x = 24$.

58. (20×16) women can complete the work in 1 day.

$\therefore$ 1 woman's 1 day's work $= \frac{1}{320}$.

(16×15) men can complete the work in 1 day.

$\therefore$ 1 man's 1 day's work $= \frac{1}{240}$.

So, required ratio $= \frac{1}{240} : \frac{1}{320} = 4 : 3$.

59. 10 men's 1 day's work $= \frac{1}{15}$; 15 women's 1 day's work $= \frac{1}{12}$.

(10 men + 15 women)'s 1 day's work $= \left(\frac{1}{15} + \frac{1}{12}\right) = \frac{9}{60} = \frac{3}{20}$.

$\therefore$ 10 men and 15 women will complete the work in $\frac{3}{20} = 6\frac{2}{3}$ days.

60. (7×12) men can complete the work in 1 day.

$\therefore$ 1 man's 1 day's work $= \frac{1}{84}$.

7 men's 5 days' work $= \left(\frac{1}{12} \times 5\right) = \frac{5}{12}$. Remaining work $= \left(1 - \frac{5}{12}\right) = \frac{7}{12}$.

5 men's 1 day's work $= \left(\frac{1}{84} \times 5\right) = \frac{5}{84}$.

$\frac{5}{84}$ work is done by them in 1 day.

$\frac{7}{12}$ work is done by them in $\left(\frac{84}{5} \times \frac{7}{12}\right) = \frac{49}{5}$ days $= 9\frac{4}{5}$ days.

61. 1 man's 1 day's work $= \frac{1}{108}$.

12 men's 6 days' work $= \left(\frac{1}{9} \times 6\right) = \frac{2}{3}$. Remaining work $= \left(1 - \frac{2}{3}\right) = \frac{1}{3}$.

18 men's 1 day's work $= \left(\frac{1}{108} \times 18\right) = \frac{1}{6}$.

$\frac{1}{6}$ work is done by them in 1 day.

$\therefore \frac{1}{3}$ work is done by them in $\left(6 \times \frac{1}{3}\right) = 2$ days.

62. Let 1 woman's 1 day's work $= x$.

Then, 1 man's 1 day's work $= \frac{x}{2}$ and 1 child's 1 day's work $= \frac{x}{4}$.

So, $\left(\frac{3x}{2} + 4x + \frac{6x}{4}\right) = \frac{1}{7} \Rightarrow \frac{28x}{4} = \frac{1}{7} \Rightarrow x = \left(\frac{1}{7} \times \frac{4}{28}\right) = \frac{1}{49}$.

$\therefore$ 1 woman alone can complete the work in 49 days.

So, to complete the work in 7 days, number of women required $= \left(\frac{49}{7}\right) = 7$.

63. (1 man + 1 woman)'s 1 day's work $= \left(\frac{1}{3} + \frac{1}{4}\right) = \frac{7}{12}$.

Work done by 1 man and 1 woman in $\frac{1}{4}$ day $= \left(\frac{7}{12} \times \frac{1}{4}\right) = \frac{7}{48}$.

Remaining work $= \left(1 - \frac{7}{48}\right) = \frac{41}{48}$.

Work done by 1 boy in $\frac{1}{4}$ day $= \left(\frac{1}{12} \times \frac{1}{4}\right) = \frac{1}{48}$.

$\therefore$ Number of boys required $= \left(\frac{41}{48} \times 48\right) = 41$.

64. 1 man's 1 day's work $= \frac{1}{100}$. (10 men + 15 women)'s 1 day's work $= \frac{1}{6}$.

15 women's 1 day's work $= \left(\frac{1}{6} - \frac{10}{100}\right) = \left(\frac{1}{6} - \frac{1}{10}\right) = \frac{1}{15}$.

1 woman's 1 day's work $= \dfrac{1}{225}$.

∴ 1 woman alone can complete the work in 225 days.

65. 1 man's 1 day's work $= \dfrac{1}{48}$; 1 woman's 1 day's work $= \dfrac{1}{60}$.

6 men's 2 days' work $= \left(\dfrac{6}{48} \times 2\right) = \dfrac{1}{4}$. Remaining work $= \left(1 - \dfrac{1}{4}\right) = \dfrac{3}{4}$.

Now, $\dfrac{1}{60}$ work is done in 1 day by 1 woman.

So, $\dfrac{3}{4}$ work will be done in 3 days by $\left(60 \times \dfrac{3}{4} \times \dfrac{1}{3}\right) = 15$ women.

66. 1 child's 1 day's work $= \dfrac{1}{192}$; 1 adult's 1 day's work $= \dfrac{1}{96}$.

Work done in 3 days $= \left(\dfrac{1}{96} \times 16 \times 3\right) = \dfrac{1}{2}$. Remaining work $= \left(1 - \dfrac{1}{2}\right) = \dfrac{1}{2}$.

(6 adults + 4 children)'s 1 day's work $= \left(\dfrac{6}{96} + \dfrac{4}{192}\right) = \dfrac{1}{12}$.

$\dfrac{1}{12}$ work is done by them in 1 day.

$\dfrac{1}{2}$ work is done by them $\left(12 \times \dfrac{1}{2}\right) = 6$ days.

67. 1 woman's 1 day's work $= \dfrac{1}{70}$; 1 child's 1 day's work $= \dfrac{1}{140}$.

(5 women + 10 children)'s 1 day's work $= \left(\dfrac{5}{70} + \dfrac{10}{140}\right) = \left(\dfrac{1}{14} + \dfrac{1}{14}\right) = \dfrac{1}{7}$.

∴ 5 women and 10 children will complete the work in 7 days.

68. 1 man's 1 day's work $= \dfrac{1}{192}$; 1 child's 1 day's work $= \dfrac{1}{432}$.

Work done in 8 days $= 8\left(\dfrac{12}{192} + \dfrac{8}{432}\right) = 8\left(\dfrac{1}{16} + \dfrac{1}{54}\right) = \dfrac{35}{54}$.

Remaining work $= \left(1 - \dfrac{35}{54}\right) = \dfrac{19}{54}$.

(12 men + 11 children)'s 1 day's work $= \left(\dfrac{12}{192} + \dfrac{11}{432}\right) = \dfrac{19}{216}$.

Now, $\dfrac{19}{216}$ work is done by them in 1 day.

∴ $\dfrac{19}{54}$ work will be done by them in $\left(\dfrac{216}{19} \times \dfrac{19}{54}\right) = 4$ days.

69. 1 man's 1 day's work $= \dfrac{1}{384}$; 1 woman's 1 day's work $= \dfrac{1}{768}$.

Work done in 12 days $= 12\left(\dfrac{16}{384} + \dfrac{16}{768}\right) = \left(12 \times \dfrac{3}{48}\right) = \dfrac{3}{4}$.

Remaining work $= \left(1 - \dfrac{3}{4}\right) = \dfrac{1}{4}$.

(16 men + 16 women)'s 2 days' work $= 2\left(\dfrac{16}{384} + \dfrac{16}{768}\right) - \left(2 \times \dfrac{1}{16}\right) = \dfrac{1}{8}$.

Remaining work $= \left(\dfrac{1}{4} - \dfrac{1}{8}\right) = \dfrac{1}{8}$.

$\dfrac{1}{384}$ work is done in 1 day by 1 man.

$\therefore \dfrac{1}{8}$ work will be done in 2 days by $\left(384 \times \dfrac{1}{8} \times \dfrac{1}{2}\right) = 24$ men.

70. Let 1 man's 1 day's work $= x$ and 1 boy's 1 day's work $= y$.

Then, $5x + 2y = 4(x + y) \Rightarrow x = 2y \Rightarrow \dfrac{x}{y} = \dfrac{2}{1}$.

71. Let 1 man's 1 day's work $= x$ and 1 boy's 1 day's work $= y$.

Then, $12x + 16y = \dfrac{1}{5}$ and $13x + 24y = \dfrac{1}{4}$.

Solving these two equations, we get : $x = \dfrac{1}{100}$ and $y = \dfrac{1}{200}$.

$\therefore$ Required ratio $= x : y = \dfrac{1}{100} : \dfrac{1}{200} = 2 : 1$.

72. Let 1 man's 1 day's work $= x$ and 1 woman's 1 day's work $= y$.

Then, $4x + 6y = \dfrac{1}{8}$ and $3x + 7y = \dfrac{1}{10}$.

Solving these two equations, we get : $x = \dfrac{11}{400}$, $y = \dfrac{1}{400}$.

$\therefore$ 1 woman's 1 day's work $= \dfrac{1}{400}$.

$\Rightarrow$ 10 women's 1 day's work $= \left(\dfrac{1}{400} \times 10\right) = \dfrac{1}{40}$.

Hence, 10 women will complete the work in 40 days.

73. Let 1 man's 1 hour's work $= x$, 1 woman's 1 hour's work $= y$
and 1 boy's 1 hour's work $= z$. Then,

$x + 3y + 4z = \dfrac{1}{96}$ ...(i) $2x + 8z = \dfrac{1}{80}$ ...(ii) $2x + 3y = \dfrac{1}{120}$ ...(iii)

Adding (ii) and (iii) and subtracting (i) from it, we get : $3x + 4z = \dfrac{1}{96}$ ...(iv)

From (ii) and (iv), we get $x = \dfrac{1}{480}$. Substituting, we get : $y = \dfrac{1}{720}$, $z = \dfrac{1}{960}$.

(5 men + 12 boys)'s 1 hour's work $= \left(\dfrac{5}{480} + \dfrac{12}{960}\right) = \left(\dfrac{1}{96} + \dfrac{1}{80}\right) = \dfrac{11}{480}$.

$\therefore$ 5 men and 12 boys can do the work in $\dfrac{480}{11}$ i.e., $43\dfrac{7}{11}$ hours.

74. Let 1 man's 1 day's work $= x$ and 1 boy's 1 day's work $= y$.

Then, $6x + 8y = \dfrac{1}{10}$ and $26x + 48y = \dfrac{1}{2}$.

Solving these two equations, we get : $x = \dfrac{1}{100}$ and $y = \dfrac{1}{200}$.

(15 men + 20 boys)'s 1 day's work $= \left(\dfrac{15}{100} + \dfrac{20}{200}\right) = \dfrac{1}{4}$.

∴ 15 men and 20 boys can do the work in 4 days.

EXERCISE 15B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4) : Each of the questions given below consists of a statement and/or a question followed by two statements labelled I and II. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. How long will Machine Y, working alone, take to produce x candles ? (M.B.A. 2002)

   I. Machine X produces x candles in 5 minutes.

   II. Machine X and Machine Y working at the same time produce x candles in 2 minutes.

2. B alone can complete a work in 12 days. How many days will A, B and C together take to complete the work ?

   I. A and B together can complete the work in 3 days.

   II. B and C together can complete the work in 6 days.

3. Is it cheaper to employ X to do a certain job than to employ Y ?

   I. X is paid 20% more per hour than Y, but Y takes 2 hours longer to complete the job.

   II. X is paid Rs. 80 per hour.

4. A and B together can complete a task in 7 days. B alone can do it in 20 days. What part of the work was carried out by A ?   (M.B.A. 1998)

   I. A completed the job alone after A and B worked together for 5 days.

   II. Part of the work done by A could have been done by B and C together in 6 days.

Directions (Questions 5 to 9) : Each of the following questions consists of a question followed by three statements I, II and III. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

5. In how many days can A and B working together complete a job ?

   I. A alone can complete the job in 30 days.

   II. B alone can complete the job in 40 days.

   III. B takes 10 days more than A to complete the job.

(a) I and II only   (b) II and III only   (c) I and III only

(d) Any two of the three   (e) All I, II and III

6. In how many days can the work be completed by A and B together ?

I. A alone can complete the work in 8 days.

II. If A alone works for 5 days and B alone works for 6 days, the work gets completed.

III. B alone can complete the work in 16 days. (Bank P.O. 2003)

(a) I and II only   (b) II and III only   (c) Any two of the three

(d) II and either I or III   (e) None of these

7. How many workers are required for completing the construction work in 10 days ?

I. 20% of the work can be completed by 8 workers in 8 days.

II. 20 workers can complete the work in 16 days.

III. One-eighth of the work can be completed by 8 workers in 5 days. (Bank P.O. 2003)

(a) I only   (b) II and III only   (c) III only

(d) I and III only   (e) Any one of the three

8. In how many days can the work be done by 9 men and 15 women ?

I. 6 men and 5 women can complete the work in 6 days.

II. 3 men and 4 women can complete the work in 10 days.

III. 18 men and 15 women can complete the work in 2 days.

(a) III only   (b) All I, II and III   (c) Any two of the three

(d) Any one of the three   (e) None of these

9. In how many days can 10 women finish a work ? (R.B.I. 2002)

I. 10 men can complete the work in 6 days.

II. 10 men and 10 women together can complete the work in $3\frac{3}{7}$ days.

III. If 10 men work for 3 days and thereafter 10 women replace them, the remaining work is completed in 4 days.

(a) Any two of the three   (b) I and II only   (c) II and III only

(d) I and III only   (e) None of these

Directions (Questions 10-11) : *Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is/are redundant and can be dispensed with while answering the given question.*

10. In how many days can the work be completed by A, B and C together ?

I. A and B together can complete the work in 6 days.

II. B and C together can complete the work in $3\frac{3}{4}$ days.

III. A and C together can complete the work in $3\frac{1}{3}$ days. (S.B.I.P.O. 2001)

(a) Any one of the three   (b) I only

(c) II only   (d) III only

(e) Information in all the three statements is necessary to answer the question.

11. 8 men and 14 women are working together in a field. After working for 3 days, 5 men and 8 women leave the work. How many more days will be required to complete the work ? (S.B.I.P.O. 1999)

I. 19 men and 12 women together can complete the work in 18 days.

II. 16 men can complete two-third of the work in 16 days.

III. In a day, the work done by three men is equal to the work done by four women.

(a) I only   (b) II only   (c) III only

(d) I or II or III   (e) II or III only

ANSWERS

1. (e)   2. (e)   3. (d)   4. (a)   5. (d)   6. (c)   7. (e)   8. (c)

9. (a)   10. (c)   11. (d)

SOLUTIONS

1.   I gives, Machine X produces $\frac{x}{5}$ candles in 1 min.

   II gives, Machines X and Y produce $\frac{x}{2}$ candles in 1 min.

   From I and II, Y produces $\left(\frac{x}{2} - \frac{x}{5}\right) = \frac{3x}{10}$ candles in 1 min.

   $\frac{3x}{10}$ candles are produced by Y in 1 min.

   x candles will be produced by Y in $\left(\frac{10}{3x} \times x\right)$ min $= \frac{10}{3}$ min.

   Thus, I and II both are necessary to get the answer.

   ∴ Correct answer is (e).

2. Given : B's 1 day's work $= \frac{1}{12}$.

   I gives, (A + B)'s 1 day's work $= \frac{1}{3}$.

   $\Rightarrow$ A's 1 day's work $= \left(\frac{1}{3} - \frac{1}{12}\right) = \frac{3}{12} = \frac{1}{4}$.

   II gives, (B + C)'s 1 day's work $= \frac{1}{6}$ $\Rightarrow$ C's 1 day's work $= \left(\frac{1}{6} - \frac{1}{12}\right) = \frac{1}{12}$.

   ∴ (A + B + C)'s 1 day's work $= \left(\frac{1}{4} + \frac{1}{12} + \frac{1}{12}\right) = \frac{5}{12}$.

   Hence, they all finish the work in $\frac{12}{5} = 2\frac{2}{5}$ days.

   Thus, I and II both are necessary to get the answer.

   ∴ Correct answer is (c).

3. Suppose X takes x hours and Y takes $(x + 2)$ hours to complete the job.

   II. X is paid Rs. 80 per hour.

   Total payment to X = Rs. (80x).

   I. X = 120% of Y $= \frac{120}{100}Y = \frac{6}{5}Y$ $\Rightarrow$ Y $= \frac{5}{6}$ X.

   ∴ Y is paid Rs. $\left(\frac{5}{6} \times 80\right)$ per hour $\Rightarrow$ Y is paid Rs. $\left[\frac{200}{3}(x + 2)\right]$.

   We cannot compare (80x) and $\frac{200}{3}(x + 2)$.

   ∴ Correct answer is (d).

4.   B's 1 day's work $= \frac{1}{20}$. (A + B)'s 1 day's work $= \frac{1}{7}$.

   I. (A + B)'s 5 day's work $= \frac{5}{7}$. Remaining work $= \left(1 - \frac{5}{7}\right) = \frac{2}{7}$.

   $\therefore \frac{2}{7}$ work was carried by A.

   II. is irrelevant.

   $\therefore$ Correct answer is (a).

5.   I. A can complete the job in 30 days.

   $\therefore$ A's 1 day's work $= \frac{1}{30}$. Remaining work $= \left(1 - \frac{5}{7}\right) = \frac{2}{7}$.

   II. B can complete the job in 40 days.

   $\therefore$ B's 1 day's work $= \frac{1}{40}$.

   III. B takes 10 days more than A to complete the job.

   I and II gives, (A + B)'s 1 day's work $= \left(\frac{1}{30} + \frac{1}{40}\right) = \frac{7}{120}$.

   $\therefore$ I and III also give the same answer.
      II and III also give the same answer.

   $\therefore$ Correct answer is (d).

6.   I. A can complete the job in 8 days. So, A's 1 day's work $= \frac{1}{8}$.

   II. A works for 5 days, B works for 6 days and the work is completed.

   III. B can complete the job in 16 days. So, B's 1 day's work $= \frac{1}{16}$.

   I and III : (A + B)'s 1 day's work $= \left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

   $\therefore$ Both can finish the work in $\frac{16}{3}$ days.

II and III : Suppose A takes x days to finish the work.

   Then, $\frac{5}{x} + \frac{6}{16} = 1 \Rightarrow \frac{5}{x} = \left(1 - \frac{3}{8}\right) = \frac{5}{8} \Rightarrow x = 8$.

   $\therefore$ (A + B)'s 1 day's work $= \left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

   $\therefore$ Both can finish it in $\frac{16}{3}$ days.

I and II : A's 1 day's work $= \frac{1}{8}$. Suppose B takes x days to finish the work.

   Then from II, $\left(5 \times \frac{1}{8} + 6 \times \frac{1}{x} = 1\right) \Rightarrow \frac{6}{x} = \left(1 - \frac{5}{8}\right) = \frac{3}{8} \Rightarrow x = \left(\frac{8 \times 6}{3}\right) = 16$.

   $\therefore$ (A + B)'s 1 day's work $= \left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$.

   $\therefore$ Both can finish it in $\frac{16}{3}$ days.

   Hence, the correct answer is (c).

7. I. $\dfrac{20}{100}$ work can be completed by (8×8) workers in 1 day.

    $\Rightarrow$ Whole work can be completed by $(8 \times 8 \times 5)$ workers in 1 day

    $= \dfrac{8 \times 8 \times 5}{10}$ workers in 10 days = 32 workers in 10 days.

  II. (20×16) workers can finish it in 1 day.

    $\Rightarrow \dfrac{(20 \times 16)}{10}$ workers can finish it in 10 days.

    $\Rightarrow$ 32 workers can finish it in 10 days.

  III. $\dfrac{1}{8}$ work can be completed by (8×5) workers in 1 day.

    $\Rightarrow$ Whole work can be completed by $(8 \times 5 \times 8)$ workers in 1 day

    $= \dfrac{8 \times 5 \times 8}{10}$ workers in 10 days = 32 workers in 10 days.

    $\therefore$ Any one of the three gives the answer.

    $\therefore$ Correct answer is (e).

8. Clearly, any two of the three will give two equations in x and y, which can be solved simultaneously.

    $\therefore$ Correct answer is (c).

$$\left[\text{For example I and II together give} \left(6x + 5y = \frac{1}{6}, \; 3x + 4y = \frac{1}{10} \right) \right]$$

9. I. (10×6) men can complete the work in 1 day.

    $\Rightarrow$ 1 man's 1 day's work $= \dfrac{1}{60}$.

  II. $\left(10 \times \dfrac{24}{7} \right)$ men $+ \left(10 \times \dfrac{24}{7} \right)$ women can complete the work in 1 day.

    $\Rightarrow \left(\dfrac{240}{7} \right)$ men's 1 day work $+ \left(\dfrac{240}{7} \right)$ women's 1 day work = 1

    $\Rightarrow \left(\dfrac{240}{7} \times \dfrac{1}{60} \right) + \left(\dfrac{240}{7} \right)$ women's 1 day's work = 1.

    $\Rightarrow \left(\dfrac{240}{7} \right)$ women's 1 day's work $= \left(1 - \dfrac{4}{7} \right) = \dfrac{3}{7}$

    $\Rightarrow$ 10 women's 1 day's work $= \left(\dfrac{3}{7} \times \dfrac{7}{240} \times 10 \right) = \dfrac{1}{8}$.

    So, 10 women can finish the work in 8 days.

  III. (10 men's work for 3 days) + (10 women's work for 4 days) = 1

    $\Rightarrow$ (10×3) men's 1 day work + (10×4) women's 1 day's work = 1

    $\Rightarrow$ 30 men's 1 day's work + 40 women's 1 day's work = 1.

    Thus, I and III will give us the answer.

    And, II and III will give us the answer.

    $\therefore$ Correct answer is (a).

SUB#

10.   I. $(A + B)$'s 1 day's work $= \frac{1}{6}$.

   II. $(B + C)$'s 1 day's work $= \frac{4}{15}$.

  III. $(A + C)$'s 1 day's work $= \frac{3}{10}$.

Adding, we get $2 (A + B + C)$'s 1 day's work $= \left(\frac{1}{6} + \frac{4}{15} + \frac{3}{10} \right) = \frac{22}{30}$

$\Rightarrow$ $(A + B + C)$'s 1 day's work $= \left(\frac{1}{2} \times \frac{22}{30} \right) = \frac{11}{30}$.

Thus, A, B and C together can finish the work in $\frac{30}{11}$ days.

Hence I, II and III are necessary to answer the question.

$\therefore$ Correct answer is (e).

11.   Clearly, I only gives the answer.

Similarly, II only gives the answer.

And, III only gives the answer.

$\therefore$ Correct answer is (d).

SUB#

16. PIPES AND CISTERNS

IMPORTANT FACTS AND FORMULAE

1. **Inlet** : A pipe connected with a tank or a cistern or a reservoir, that fills it, is known as an inlet.

   Outlet : A pipe connected with a tank or a cistern or a reservoir, emptying it, is known as an outlet.

2. (i) If a pipe can fill a tank in x hours, then :

   part filled in 1 hour $= \dfrac{1}{x}$.

   (ii) If a pipe can empty a full tank in y hours, then :

   part emptied in 1 hour $= \dfrac{1}{y}$.

   (iii) If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $y > x$), then on opening both the pipes, the net part filled

   in 1 hour $= \left(\dfrac{1}{x} - \dfrac{1}{y}\right)$.

   (iv) If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (where $x > y$), then on opening both the pipes, the net part emptied

   in 1 hour $= \left(\dfrac{1}{y} - \dfrac{1}{x}\right)$.

SOLVED EXAMPLES

Ex. 1. *Two pipes A and B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank?*

Sol. Part filled by A in 1 hour $= \dfrac{1}{36}$; Part filled by B in 1 hour $= \dfrac{1}{45}$.

Part filled by (A + B) in 1 hour $= \left(\dfrac{1}{36} + \dfrac{1}{45}\right) = \dfrac{9}{180} = \dfrac{1}{20}$.

Hence, both the pipes together will fill the tank in 20 hours.

Ex. 2. *Two pipes can fill a tank in 10 hours and 12 hours respectively while a third pipe empties the full tank in 20 hours. If all the three pipes operate simultaneously, in how much time will the tank be filled?*

Sol. Net part filled in 1 hour $= \left(\dfrac{1}{10} + \dfrac{1}{12} - \dfrac{1}{20}\right) = \dfrac{8}{60} = \dfrac{2}{15}$.

∴ The tank will be full in $\dfrac{15}{2}$ hrs $= 7$ hrs 30 min.

Ex. 3. *If two pipes function simultaneously, the reservoir will be filled in 12 hours. One pipe fills the reservoir 10 hours faster than the other. How many hours does it take the second pipe to fill the reservoir?*

Sol. Let the reservoir be filled by first pipe in x hours.

Then, second pipe will fill it in $(x + 10)$ hours.

∴ $\dfrac{1}{x} + \dfrac{1}{(x + 10)} = \dfrac{1}{12}$ ⟺ $\dfrac{x + 10 + x}{x(x + 10)} = \dfrac{1}{12}$

⟺ $x^2 - 14x - 120 = 0$ ⟺ $(x - 20)(x + 6) = 0$

⟺ $x = 20.$ [*neglecting the – ve value of* x]

So, the second pipe will take $(20 + 10)$ hrs *i.e.*, 30 hrs to fill the reservoir.

Ex. 4. *A cistern has two taps which fill it in 12 minutes and 15 minutes respectively. There is also a waste pipe in the cistern. When all the three are opened, the empty cistern is full in 20 minutes. How long will the waste pipe take to empty the full cistern?*

Sol. Work done by the waste pipe in 1 minute

$$= \frac{1}{20} - \left(\frac{1}{12} + \frac{1}{15}\right) = -\frac{1}{10} \qquad [-\text{ ve sign means emptying}]$$

∴   Waste pipe will empty the full cistern in 10 minutes.

Ex. 5. *An electric pump can fill a tank in 3 hours. Because of a leak in the tank, it took $3\frac{1}{2}$ hours to fill the tank. If the tank is full, how much time will the leak take to empty it?*

Sol. Work done by the leak in 1 hour $= \left[\dfrac{1}{3} - \dfrac{1}{\left(\dfrac{7}{2}\right)}\right] = \left(\dfrac{1}{3} - \dfrac{2}{7}\right) = \dfrac{1}{21}.$

∴   The leak will empty the tank in 21 hours.

Ex. 6. *Two pipes can fill a cistern in 14 hours and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom it took 32 minutes more to fill the cistern. When the cistern is full, in what time will the leak empty it?*

Sol. Work done by the two pipes in 1 hour $= \left(\dfrac{1}{14} + \dfrac{1}{16}\right) = \dfrac{15}{112}.$

∴   Time taken by these pipes to fill the tank $= \dfrac{112}{15}$ hrs $= 7$ hrs 28 min.

Due to leakage, time taken $= 7$ hrs 28 min + 32 min = 8 hrs

∴   Work done by (two pipes + leak) in 1 hour $= \dfrac{1}{8}.$

∴   Work done by the leak in 1 hour $= \left(\dfrac{15}{112} - \dfrac{1}{8}\right) = \dfrac{1}{112}.$

∴   Leak will empty the full cistern in 112 hours.

Ex. 7. *Two pipes A and B can fill a tank in 36 min. and 45 min. respectively. A water pipe C can empty the tank in 30 min. First A and B are opened. After 7 minutes, C is also opened. In how much time, the tank is full?*

Sol. Part filled in 7 min. $= 7\left(\dfrac{1}{36} + \dfrac{1}{45}\right) = \dfrac{7}{20}.$

Remaining part $= \left(1 - \dfrac{7}{20}\right) = \dfrac{13}{20}.$

Net part filled in 1 min. when A, B and C are opened $= \left(\dfrac{1}{36} + \dfrac{1}{45} - \dfrac{1}{30} \right) = \dfrac{1}{60}$.

Now, $\dfrac{1}{60}$ part is filled in 1 min.

$\dfrac{13}{20}$ part is filled in $\left(60 \times \dfrac{13}{20} \right) = 39$ min.

Total time taken to fill the tank = $(39 + 7)$ min. = 46 min.

Ex. 8. *Two pipes A and B can fill a tank in 24 min. and 32 min. respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 18 minutes ?*

Sol. Let B be closed after x minutes. Then,

part filled by (A + B) in x min. + part filled by A in $(18 - x)$ min. = 1

$\therefore \quad x \left(\dfrac{1}{24} + \dfrac{1}{32} \right) + (18 - x) \times \dfrac{1}{24} = 1 \quad \Leftrightarrow \quad \dfrac{7x}{96} + \dfrac{18 - x}{24} = 1$

$\Leftrightarrow \quad 7x + 4(18 - x) = 96 \quad \Leftrightarrow \quad x = 8.$

Hence, B must be closed after 8 minutes.

EXERCISE 16A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer :*

1. Two pipes A and B can fill a tank in 20 and 30 minutes respectively. If both the pipes are used together, then how long will it take to fill the tank ? **(M.A.T. 2003)**

   (a) 12 min   (b) 15 min   (c) 25 min   (d) 50 min

2. A cistern can be filled by a tap in 4 hours while it can be emptied by another tap in 9 hours. If both the taps are opened simultaneously, then after how much time will the cistern get filled ? **(Hotel Management, 1997)**

   (a) 4.5 hrs   (b) 5 hrs   (c) 6.5 hrs   (d) 7.2 hrs

3. A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely ?

   (a) 3 hrs 15 min   (b) 3 hrs 45 min   (c) 4 hrs   (d) 4 hrs 15 min

   (S.S.C. 2003)

4. A water tank is two-fifth full. Pipe A can fill a tank in 10 minutes and pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely ? **(Bank P.O. 1999)**

   (a) 6 min. to empty   (b) 6 min. to fill   (c) 9 min. to empty

   (d) 9 min. to fill   (e) None of these

5. Pipe A can fill a tank in 5 hours, pipe B in 10 hours and pipe C in 30 hours. If all the pipes are open, in how many hours will the tank be filled ? **(C.B.I. 1997)**

   (a) 2   (b) 2.5   (c) 3   (d) 3.5

6. Pipes A and B can fill a tank in 5 and 6 hours respectively. Pipe C can empty it in 12 hours. If all the three pipes are opened together, then the tank will be filled in :

   (a) $1\dfrac{13}{17}$ hours   (b) $2\dfrac{8}{11}$ hours   (c) $3\dfrac{9}{17}$ hours   (d) $4\dfrac{1}{2}$ hours

   (Bank P.O. 2002)

7. Three pipes A, B and C can fill a tank from empty to full in 30 minutes, 20 minutes and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions P, Q and R respectively. What is the proportion of solution R in the liquid in the tank after 3 minutes ?   (D.M.R.C. 2003)

(a) $\frac{5}{11}$ (b) $\frac{6}{11}$ (c) $\frac{7}{11}$ (d) $\frac{8}{11}$

8. Two pipes A and B can separately fill a cistern in 60 minutes and 75 minutes respectively. There is a third pipe in the bottom of the cistern to empty it. If all the three pipes are simultaneously opened, then the cistern is full in 50 minutes. In how much time, the third pipe alone can empty the cistern ?   (S.S.C. 2003)

(a) 90 min   (b) 100 min   (c) 110 min   (d) 120 min

9. A pump can fill a tank with water in 2 hours. Because of a leak, it took $2\frac{1}{3}$ hours to fill the tank. The leak can drain all the water of the tank in :   (S.S.C. 2002)

(a) $4\frac{1}{3}$ hrs   (b) 7 hrs   (c) 8 hrs   (d) 14 hrs

10. Two taps A and B can fill a tank in 5 hours and 20 hours respectively. If both the taps are open then due to a leakage, it took 30 minutes more to fill the tank. If the tank is full, how long will it take for the leakage alone to empty the tank ?

(a) $4\frac{1}{2}$ hrs   (b) 9 hrs   (c) 18 hrs   (d) 36 hrs

11. Two pipes A and B together can fill a cistern in 4 hours. Had they been opened separately, then B would have taken 6 hours more than A to fill the cistern. How much time will be taken by A to fill the cistern separately ?   (NABARD, 2001)

(a) 1 hr   (b) 2 hrs   (c) 6 hrs   (d) 8 hrs.

12. One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 36 minutes, then the slower pipe alone will be able to fill the tank in :   (C.B.I. 2003)

(a) 81 min   (b) 108 min   (c) 144 min   (d) 192 min

13. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank ?

(a) 20 hrs   (b) 25 hrs   (c) 35 hrs

(d) Cannot be determined   (e) None of these   (Bank P.O. 2003)

14. A tank is filled by three pipes with uniform flow. The first two pipes operating simultaneously fill the tank in the same time during which the tank is filled by the third pipe alone. The second pipe fills the tank 5 hours faster than the first pipe and 4 hours slower than the third pipe. The time required by the first pipe is :

(a) 6 hrs   (b) 10 hrs   (c) 15 hrs   (d) 30 hrs

(M.B.A. 2002)

15. 12 buckets of water fill a tank when the capacity of each tank is 13.5 litres. How many buckets will be needed to fill the same tank, if the capacity of each bucket is 9 litres ?

(a) 8   (b) 15   (c) 16   (d) 18

16. Bucket P has thrice the capacity as bucket Q. It takes 60 turns for bucket P to fill the empty drum. How many turns it will take for both the buckets P and Q, having each turn together to fill the empty drum ?

(a) 30   (b) 40   (c) 45   (d) 90

17. Two pipes A and B can fill a tank in 12 minutes and 15 minutes respectively. If both the taps are opened simultaneously, and the tap A is closed after 3 minutes, then how much more time will it take to fill the tank by tap B ?

(a) 7 min 15 sec   (b) 7 min 45 sec   (c) 8 min 5 sec   (d) 8 min 15 sec

18. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank ? (U.P.S.C. 2002)
    (a) 10 min 20 sec   (b) 11 min 45 sec   (c) 12 min 30 sec   (d) 14 min 40 sec

19. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours, C is closed. In how much time, will the tank be full ?
    (a) 12 hrs   (b) 13 hrs   (c) 16 hrs   (d) 18 hrs

20. A large tanker can be filled by two pipes A and B in 60 minutes and 40 minutes respectively. How many minutes will it take to fill the tanker from empty state if B is used for half the time and A and B fill it together for the other half ?
    (a) 15 min   (b) 20 min   (c) 27.5 min   (d) 30 min
                                                                    (D.M.R.C. 2003)

21. Two pipes A and B can fill a cistern in 12 minutes and 15 minutes respectively while a third pipe C can empty the full tank in 6 minutes. A and B are kept open for 5 minutes in the beginning and then C is also opened. In what time is the cistern emptied ?

    (a) 30 min   (b) 33 min   (c) $37\frac{1}{2}$ min   (d) 45 min

22. Two pipes A and B can fill a tank in 6 hours and 4 hours respectively. If they are opened on alternate hours and if pipe A is opened first, in how many hours, the tank shall be full ?

    (a) 4   (b) $4\frac{1}{2}$ (c) 5   (d) $5\frac{1}{2}$

23. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in :   (S.S.C. 1999)

    (a) 6 hrs   (b) $6\frac{2}{3}$ hrs   (c) 5   (d) $7\frac{1}{2}$ hrs

24. A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3. The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump ?
    (a) 50 m^3/min   (b) 60 m^3/min   (c) 72 m^3/min   (d) None of these

25. A leak in the bottom of a tank can empty the full tank in 8 hours. An inlet pipe fills water at the rate of 6 litres a minute. When the tank is full, the inlet is opened and due to the leak, the tank is empty in 12 hours. How many litres does the cistern hold ?
    (a) 7580   (b) 7960   (c) 8290   (d) 8640

26. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank is :   (Bank P.O. 2001)
    (a) 60 gallons   (b) 100 gallons   (c) 120 gallons   (d) 180 gallons

27. Two pipes A and B can fill a cistern in $37\frac{1}{2}$ minutes and 45 minutes respectively. Both pipes are opened. The cistern will be filled in just half an hour, if the pipe B is turned off after :   (S.S.C. 2004)
    (a) 5 min   (b) 9 min   (c) 10 min   (d) 15 min

28. Three pipes A, B and C can fill a tank in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is :   (L.I.C.A.A.O. 2003)
    (a) 10   (b) 12   (c) 14   (d) 16

ANSWERS

1. (a)	2. (d)	3. (b)	4. (a)	5. (c)	6. (c)	7. (b)	8. (b)
9. (d)	10. (d)	11. (c)	12. (c)	13. (c)	14. (c)	15. (d)	16. (c)
17. (d)	18. (d)	19. (a)	20. (d)	21. (d)	22. (c)	23. (c)	24. (a)
25. (d)	26. (c)	27. (b)	28. (c)				

SOLUTIONS

1. Part filled by A in 1 min. $= \dfrac{1}{20}$; Part filled by B in 1 min. $= \dfrac{1}{30}$.

   Part filled by (A + B) in 1 min. $= \left(\dfrac{1}{20} + \dfrac{1}{30} \right) = \dfrac{1}{12}$.

   ∴ Both the pipes can fill the tank in 12 minutes.

2. Net part filled in 1 hour $= \left(\dfrac{1}{4} - \dfrac{1}{9} \right) = \dfrac{5}{36}$.

   ∴ The cistern will be filled in $\dfrac{36}{5}$ hrs i.e., 7.2 hrs.

3. Time taken by one tap to fill half the tank = 3 hrs.

   Part filled by the four taps in 1 hour $= \left(4 \times \dfrac{1}{6} \right) = \dfrac{2}{3}$.

   Remaining part $= \left(1 - \dfrac{1}{2} \right) = \dfrac{1}{2}$.

   ∴ $\dfrac{2}{3} : \dfrac{1}{2} :: 1 : x$ or $x = \left(\dfrac{1}{2} \times 1 \times \dfrac{3}{2} \right) = \dfrac{3}{4}$ hrs i.e., 45 mins.

   So, total time taken = 3 hrs 45 min.

4. Clearly, pipe B is faster than pipe A and so, the tank will be emptied.

   Part to be emptied $= \dfrac{2}{5}$.

   Part emptied by (A + B) in 1 minute $= \left(\dfrac{1}{6} - \dfrac{1}{10} \right) = \dfrac{1}{15}$.

   ∴ $\dfrac{1}{15} : \dfrac{2}{5} :: 1 : x$ or $x = \left(\dfrac{2}{5} \times 1 \times 15 \right) = 6$ min.

   So, the tank will be emptied in 6 min.

5. Part filled by (A + B + C) in 1 hour $= \left(\dfrac{1}{5} + \dfrac{1}{10} + \dfrac{1}{30} \right) = \dfrac{1}{3}$.

   ∴ All the three pipes together will fill the tank in 3 hours.

6. Net part filled in 1 hour $= \left(\dfrac{1}{5} + \dfrac{1}{6} - \dfrac{1}{12} \right) = \dfrac{17}{60}$.

   ∴ The tank will be full in $\dfrac{60}{17}$ hrs i.e., $3\dfrac{9}{17}$ hrs.

7. Part filled by (A + B + C) in 3 minutes $= 3 \left(\dfrac{1}{30} + \dfrac{1}{20} + \dfrac{1}{10} \right) = \left(3 \times \dfrac{11}{60} \right) = \dfrac{11}{20}$.

Part filled by C in 3 minutes $= \dfrac{3}{10}$.

∴ Required ratio $= \left(\dfrac{3}{10} \times \dfrac{20}{11} \right) = \dfrac{6}{11}$.

8. Work done by the third pipe in 1 min.

$$-\dfrac{1}{50} - \left(\dfrac{1}{60} + \dfrac{1}{75} \right) = \left(\dfrac{1}{50} - \dfrac{3}{100} \right) = -\dfrac{1}{100}. \quad \text{[− ve } sign \ means \ emptying]$$

∴ The third pipe alone can empty the cistern in 100 min.

9. Work done by the leak in 1 hour $= \left(\dfrac{1}{2} - \dfrac{3}{7} \right) = \dfrac{1}{14}$.

∴ Leak will empty the tank in 14 hrs.

10. Part filled by (A + B) in 1 hour $= \left(\dfrac{1}{5} + \dfrac{1}{20} \right) = \dfrac{1}{4}$.

So, A and B together can fill the tank in 4 hours.

Work done by the leak in 1 hour $= \left(\dfrac{1}{4} - \dfrac{2}{9} \right) = \dfrac{1}{36}$.

∴ Leak will empty the tank in 36 hrs.

11. Let the cistern be filled by pipe A alone in x hours.

Then, pipe B will fill it in $(x + 6)$ hours.

∴ $\dfrac{1}{x} + \dfrac{1}{(x+6)} = \dfrac{1}{4}$ ⇔ $\dfrac{x + 6 + x}{x(x+6)} = \dfrac{1}{4}$

⇔ $x^2 - 2x - 24 = 0$ ⇔ $(x - 6)(x + 4) = 0$

⇔ $x = 6$. [neglecting the − ve value of x]

12. Let the slower pipe alone fill the tank in x minutes.

Then, faster pipe will fill it in $\dfrac{x}{3}$ minutes.

∴ $\dfrac{1}{x} + \dfrac{3}{x} = \dfrac{1}{36}$ ⇔ $\dfrac{4}{x} = \dfrac{1}{36}$ ⇔ $x = 144$ min.

13. Suppose pipe A alone takes x hours to fill the tank.

Then, pipes B and C will take $\dfrac{x}{2}$ and $\dfrac{x}{4}$ hours respectively to fill the tank.

∴ $\dfrac{1}{x} + \dfrac{2}{x} + \dfrac{4}{x} = \dfrac{1}{5}$ ⇔ $\dfrac{7}{x} = \dfrac{1}{5}$ ⇔ $x = 35$ hrs.

14. Suppose, first pipe alone takes x hours to fill the tank. Then, second and third pipes will take $(x - 5)$ and $(x - 9)$ hours respectively to fill the tank.

∴ $\dfrac{1}{x} + \dfrac{1}{(x-5)} = \dfrac{1}{(x-9)}$ ⇔ $\dfrac{x - 5 + x}{x(x-5)} = \dfrac{1}{(x-9)}$

⇔ $(2x - 5)(x - 9) = x(x - 5)$ ⇔ $x^2 - 18x + 45 = 0$

⇔ $(x - 15)(x - 3) = 0$ ⇔ $x = 15$. [neglecting x = 3]

15. Capacity of the tank $= (12 \times 13.5)$ litres $= 162$ litres.

Capacity of each bucket $= 9$ litres.

Number of buckets needed $= \left(\dfrac{162}{9} \right) = 18$.

SUB#

16. Let capacity of P be x litres. Then, capacity of $Q = \frac{x}{3}$ litres.

Capacity of the drum $= 60x$ litres.

Required number of turns $= \frac{60x}{\left(x + \frac{x}{3}\right)} = \left(60x \times \frac{3}{4x}\right) = 45$.

17. Part filled in 3 min. $= 3\left(\frac{1}{12} + \frac{1}{15}\right) = \left(3 \times \frac{9}{60}\right) = \frac{9}{20}$.

Remaining part $= \left(1 - \frac{9}{20}\right) = \frac{11}{20}$.

Part filled by B in 1 min. $= \frac{1}{15}$.

$\frac{1}{15} : \frac{11}{20} :: 1 : x$ or $x = \left(\frac{11}{20} \times 1 \times 15\right) = 8\frac{1}{4}$ min. $= 8$ min. 15 sec.

∴ Remaining part is filled by B in 8 min. 15 sec.

18. Part filled in 4 minutes $= 4\left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{15}$.

Remaining part $= \left(1 - \frac{7}{15}\right) = \frac{8}{15}$.

Part filled by B in 1 minute $= \frac{1}{20}$.

$\frac{1}{20} : \frac{8}{15} :: 1 : x$ or $x = \left(\frac{8}{15} \times 1 \times 20\right) = 10\frac{2}{3}$ min. $= 10$ min. 40 sec.

∴ The tank will be full in (4 min. + 10 min. 40 sec) = 14 min. 40 sec.

19. Part filled in 10 hours $= 10\left(\frac{1}{15} + \frac{1}{20} - \frac{1}{25}\right) = \frac{23}{30}$.

Remaining part $= \left(1 - \frac{23}{30}\right) = \frac{7}{30}$.

(A + B)'s 1 hour's work $= \left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{60}$.

$\frac{7}{60} : \frac{7}{30} :: 1 : x$ or $x = \left(\frac{7}{30} \times 1 \times \frac{60}{7}\right) = 2$ hours.

∴ The tank will be full in (10 + 2) hrs = 12 hrs.

20. Part filled by (A + B) in 1 minute $= \left(\frac{1}{60} + \frac{1}{40}\right) = \frac{1}{24}$.

Suppose the tank is filled in x minutes.

Then, $\frac{x}{2}\left(\frac{1}{24} + \frac{1}{40}\right) = 1$ ⟺ $\frac{x}{2} \times \frac{1}{15} = 1$ ⟺ $x = 30$ min.

21. Part filled in 5 min. $= 5\left(\frac{1}{12} + \frac{1}{15}\right) = \left(5 \times \frac{9}{60}\right) = \frac{3}{4}$.

Part emptied in 1 min. when all the pipes are opened

$= \frac{1}{6} - \left(\frac{1}{12} + \frac{1}{15}\right) = \left(\frac{1}{6} - \frac{3}{20}\right) = \frac{1}{60}$.

Now, $\frac{1}{60}$ part is emptied in 1 min.

$\therefore \quad \frac{3}{4}$ part will be emptied in $\left(60 \times \frac{3}{4}\right) = 45$ min.

22. A's work in 1 hour $= \frac{1}{6}$, B's work in 1 hour $= \frac{1}{4}$.

(A + B)'s 2 hour's work when opened alternately $= \left(\frac{1}{6} + \frac{1}{4}\right) = \frac{5}{12}$.

(A + B)'s 4 hour's work when opened alternately $= \frac{10}{12} = \frac{5}{6}$.

Remaining part $= \left(1 - \frac{5}{6}\right) = \frac{1}{6}$.

Now, it is A's turn and $\frac{1}{6}$ part is filled by A in 1 hour.

$\therefore$ Total time taken to fill the tank $= (4 + 1)$ hrs $= 5$ hrs.

23. (A + B)'s 1 hour's work $= \left(\frac{1}{12} + \frac{1}{15}\right) = \frac{9}{60} = \frac{3}{20}$.

(A + C)'s 1 hour's work $= \left(\frac{1}{12} + \frac{1}{20}\right) = \frac{8}{60} = \frac{2}{15}$.

Part filled in 2 hrs $= \left(\frac{3}{20} + \frac{2}{15}\right) = \frac{17}{60}$; Part filled in 6 hrs $= \left(3 \times \frac{17}{60}\right) = \frac{17}{20}$.

Remaining part $= \left(1 - \frac{17}{20}\right) = \frac{3}{20}$.

Now, it is the turn of A and B and $\frac{3}{20}$ part is filled by A and B in 1 hour.

$\therefore$ Total time taken to fill the tank $= (6 + 1)$ hrs $= 7$ hrs.

24. Let the filling capacity of the pump be x m^3/min.

Then, emptying capacity of the pump $= (x + 10)$ m^3/min.

So, $\frac{2400}{x} - \frac{2400}{(x + 10)} = 8 \quad \Leftrightarrow \quad x^2 + 10x - 3000 = 0$

$\Leftrightarrow \quad (x - 50)(x + 60) = 0 \quad \Leftrightarrow \quad x = 50.$ 　　　[neglecting the – ve value of x]

25. Work done by the inlet in 1 hour $= \left(\frac{1}{8} - \frac{1}{12}\right) = \frac{1}{24}$.

Work done by the inlet in 1 min. $= \left(\frac{1}{24} \times \frac{1}{60}\right) = \frac{1}{1440}$.

$\therefore$ Volume of $\frac{1}{1440}$ part $= 6$ litres.

$\therefore$ Volume of whole $= (1440 \times 6)$ litres $= 8640$ litres.

26. Work done by the waste pipe in 1 minute

$= \frac{1}{15} - \left(\frac{1}{20} + \frac{1}{24}\right) = \left(\frac{1}{15} - \frac{11}{120}\right) = -\frac{1}{40}$. 　　　[– ve sign means emptying]

$\therefore$ Volume of $\frac{1}{40}$ part $= 3$ gallons.

Volume of whole $= (3 \times 40)$ gallons $= 120$ gallons.

27. Let B be turned off after x minutes. Then,

Part filled by $(A + B)$ in x min. + Part filled by A in $(30 - x)$ min. $= 1$.

$\therefore \quad x\left(\dfrac{2}{75} + \dfrac{1}{45}\right) + (30 - x)\cdot\dfrac{2}{75} = 1$

$\Leftrightarrow \dfrac{11x}{225} + \dfrac{(60 - 2x)}{75} = 1 \quad \Leftrightarrow \quad 11x + 180 - 6x = 225 \quad \Leftrightarrow \quad x = 9$.

28. Part filled in 2 hours $= \dfrac{2}{6} = \dfrac{1}{3}$, Remaining part $= \left(1 - \dfrac{1}{3}\right) = \dfrac{2}{3}$.

$\therefore \quad (A + B)$'s 7 hour's work $= \dfrac{2}{3}$; $(A + B)$'s 1 hour's work $= \dfrac{2}{21}$.

$\therefore \quad$ C's 1 hour's work $= [(A + B + C)$'s 1 hour's work $- (A + B)$'s 1 hour's work$]$

$\qquad\qquad = \left(\dfrac{1}{6} - \dfrac{2}{21}\right) = \dfrac{1}{14}$.

$\therefore \quad$ C alone can fill the tank in 14 hours.

EXERCISE 16B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 4) : Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is /are sufficient to answer the given question. Read both the statements and

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. How long will it take to empty the tank if both the inlet pipe A and the outlet pipe B are opened simultaneously ?

   I. A can fill the tank in 16 minutes.

   II. B can empty the full tank in 8 minutes.

2. Two taps A and B, when opened together, can fill a tank in 6 hours. How long will it take for the pipe A alone to fill the tank ?

   I. B alone takes 5 hours more than A to fill the tank.

   II. The ratio of the time taken by A to that taken by B to fill the tank is 2 : 3.

3. A tank is fitted with two inlet pipes A and B. Both the pipes are kept open for 10 minutes so that the tank is two-thirds full and then pipe A is closed. How much time will B take to fill the remaining part of the tank ?

   I. Pipe A is thrice as fast as pipe B.

   II. Pipe B alone can fill the tank in 60 minutes.

4. How much time will the leak take to empty the full cistern ?

   I. The cistern is normally filled in 9 hours.

   II. It takes one hour more than the usual time to fill the cistern because of a leak in the bottom.

Directions (Questions 5-6) : Each of the questions below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question :

5. A tank is fitted with two taps A and B. In how much time will the tank be full if both the taps are opened together ?

   I. A is 50% more efficient than B.

   II. A alone takes 16 hours to fill the tank.

   III. B alone takes 24 hours to fill the tank.

   (a) II and III only   (b) All I, II and III

   (c) I and II only   (d) I and III only

   (e) Any two of the three

6. If both the pipes are opened, how many hours will be taken to fill the tank ?

   I. The capacity of the tank is 400 litres.

   II. The pipe A fills the tank in 4 hours.

   III. The pipe B fills the tank in 6 hours.   (R.B.I. 2003)

   (a) Only I and II   (b) Only II and III

   (c) All I, II and III   (d) Any two of the three

   (e) Even with all the three statements, answer cannot be given.

ANSWERS

1. (e)	2. (c)	3. (c)	4. (e)	5. (e)	6. (b)

SOLUTIONS

1. I. A's 1 minute's filling work $= \dfrac{1}{16}$.

   II. B's 1 minute's emptying work $= \dfrac{1}{8}$.

   (A + B)'s 1 minute's emptying work $= \left(\dfrac{1}{8} - \dfrac{1}{16}\right) = \dfrac{1}{16}$.

   ∴ Tank will be emptied in 16 minutes.

   Thus, both I and II are necessary to answer the question.

   ∴ Correct answer is (e).

2. (A + B)'s 1 hour filling work $= \dfrac{1}{6}$.

   I. Suppose A takes x hours to fill the tank.

   Then, B takes $(x + 5)$ hours to fill the tank.

   ∴ (A's 1 hour work) + (B's 1 hour work) = (A + B)'s 1 hour work

   $\Leftrightarrow \dfrac{1}{x} + \dfrac{1}{(x + 5)} = \dfrac{1}{6}$ $\Leftrightarrow \dfrac{(x + 5) + x}{x(x + 5)} = \dfrac{1}{6}$

   $\Leftrightarrow x^2 - 5x = 12x + 30$ $\Leftrightarrow x^2 - 7x - 30 = 0$

   $\Leftrightarrow x^2 - 10x + 3x - 30 = 0$ $\Leftrightarrow x(x - 10) + 3(x - 10) = 0$

   $\Leftrightarrow (x - 10)(x + 3) = 0$ $\Leftrightarrow x = 10$.

   So, A alone takes 10 hours to fill the tank.

II. Suppose A takes $2x$ hours and B takes $3x$ hours to fill the tank. Then,

$$\frac{1}{2x} + \frac{1}{3x} = \frac{1}{6} \Leftrightarrow \left(\frac{1}{2} + \frac{1}{3}\right) \cdot \frac{1}{x} = \frac{1}{6} \Leftrightarrow \frac{5}{6x} = \frac{1}{6} \Leftrightarrow x = 5.$$

So, A alone takes $(2 \times 5) = 10$ hours to fill the tank.

Thus, each one of I and II gives the answer.

∴ Correct answer is (c).

3.   I. Let B's 1 min. work $= \frac{1}{x}$. Then, A's 1 min. work $= \frac{3}{x}$.

$(A + B)$'s 1 min. work $= \left(\frac{1}{x} + \frac{3}{x}\right) = \frac{4}{x}$.

$(A + B)$'s 10 min. work $= \left(\frac{4}{x} \times 10\right) = \frac{40}{x}$.

∴ $\frac{40}{x} = \frac{2}{3} \Leftrightarrow x = 60$.

∴   B's 1 min. work $= \frac{1}{60}$.

$\frac{1}{60}$ part is filled by B in 1 min.

$\frac{1}{3}$ part is filled by B in $\left(60 \times \frac{1}{3}\right)$ min. = 20 min.

II. B's 1 min. work $= \frac{1}{60}$.

$\frac{1}{60}$ part is filled by B in 1 min.

$\frac{1}{3}$ part is filled by B in $\left(60 \times \frac{1}{3}\right)$ min. = 20 min.

Hence, the correct answer is (c).

4.   I. Time taken to fill the cistern without leak = 9 hours.

Part of cistern filled without leak in 1 hour $= \frac{1}{9}$.

II. Time taken to fill the cistern in presence of leak = 10 hours.

Net filling in 1 hour $= \frac{1}{10}$.

Work done by leak in 1 hour $= \left(\frac{1}{9} - \frac{1}{10}\right) = \frac{1}{90}$.

∴ Leak will empty the full cistern in 90 hours.

Clearly, both I and II are necessary to answer the question.

∴ Correct answer is (e).

5.   II. A's 1 hour work $= \frac{1}{16}$.

Suppose B fills the tank in x hours. Then, B's 1 hour work $= \frac{1}{x}$.

I. Work done by A in 1 hour = 150% of $\frac{1}{x} = \left(\frac{1}{x} \times \frac{150}{100}\right) = \frac{3}{2x}$.

SUB#

$$\therefore \frac{3}{2x} = \frac{1}{16} \Leftrightarrow x = 24.$$

So, B can fill the tank in 24 hours.

$(A + B)$'s 1 hour work $= \left(\frac{1}{16} + \frac{1}{24}\right) = \frac{5}{48}$.

$\therefore$ $(A + B)$ can fill the tank in $\frac{48}{5}$ hrs.

Thus, I & II give the answer.

III. Work done by B in 1 hour $= \frac{1}{24}$.

From II & III, we get the same answer.

From III & I, we get :

A's 1 hour work $= 150\%$ of $\frac{1}{24} = \left(\frac{1}{24} \times \frac{150}{100}\right) = \frac{1}{16}$.

Thus, from III & I, we get the same answer.

$\therefore$ Correct answer is (e).

6. II. Part of the tank filled by A in 1 hour $= \frac{1}{4}$.

III. Part of the tank filled by B in 1 hour $= \frac{1}{6}$.

$(A + B)$'s 1 hour's work $= \left(\frac{1}{4} + \frac{1}{6}\right) = \frac{5}{12}$.

$\therefore$ When both A and B are opened together, they will fill the tank in $\frac{12}{5}$ hrs $= 2$ hrs 24 min.

So, II and III are needed.

$\therefore$ Correct answer is (b).

17. TIME AND DISTANCE

IMPORTANT FACTS AND FORMULAE

1. Speed $= \left(\dfrac{\text{Distance}}{\text{Time}}\right)$, Time $= \left(\dfrac{\text{Distance}}{\text{Speed}}\right)$, Distance $= (\text{Speed} \times \text{Time})$

2. x km/hr $= \left(x \times \dfrac{5}{18}\right)$ m/sec

3. x m/sec $= \left(x \times \dfrac{18}{5}\right)$ km/hr

4. If the ratio of the speeds of A and B is $a : b$, then the ratio of the times taken by them to cover the same distance is $\dfrac{1}{a} : \dfrac{1}{b}$ or $b : a$.

5. Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr. Then, the average speed during the whole journey is $\left(\dfrac{2xy}{x+y}\right)$ km/hr.

SOLVED EXAMPLES

Ex. 1. *How many minutes does Aditya take to cover a distance of 400 m, if he runs at a speed of 20 km/hr ?* (Bank P.O. 2000)

Sol. Aditya's speed $= 20$ km/hr $= \left(20 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{50}{9}$ m/sec.

$\therefore$ Time taken to cover 400 m $= \left(400 \times \dfrac{9}{50}\right)$ sec $= 72$ sec $= 1\dfrac{12}{60}$ min $= 1\dfrac{1}{5}$ min.

Ex. 2. *A cyclist covers a distance of 750 m in 2 min 30 sec. What is the speed in km/hr of the cyclist ?* (R.R.B. 2002)

Sol. Speed $= \left(\dfrac{750}{150}\right)$ m/sec $= 5$ m/sec $= \left(5 \times \dfrac{18}{5}\right)$ km/hr $= 18$ km/hr.

Ex. 3. *A dog takes 4 leaps for every 5 leaps of a hare but 3 leaps of a dog are equal to 4 leaps of the hare. Compare their speeds.*

Sol. Let the distance covered in 1 leap of the dog be x and that covered in 1 leap of the hare be y.

Then, $3x = 4y \implies x = \dfrac{4}{3}y \implies 4x = \dfrac{16}{3}y$.

$\therefore$ Ratio of speeds of dog and hare = Ratio of distances covered by them in the same time

$= 4x : 5y = \dfrac{16}{3}y : 5y = \dfrac{16}{3} : 5 = 16 : 15$.

Ex. 4. *While covering a distance of 24 km, a man noticed that after walking for 1 hour and 40 minutes, the distance covered by him was $\dfrac{5}{7}$ of the remaining distance. What was his speed in metres per second ?* (R.R.B. 2002)

Sol. Let the speed be x km/hr.

Then, distance covered in 1 hr. 40 min. *i.e.*, $1\dfrac{2}{3}$ hrs $= \dfrac{5x}{3}$ km.

Remaining distance $= \left(24 - \dfrac{5x}{3}\right)$ km.

$\dfrac{5x}{3} = \dfrac{5}{7}\left(24 - \dfrac{5x}{3}\right) \Leftrightarrow \dfrac{5x}{3} = \dfrac{5}{7}\left(\dfrac{72 - 5x}{3}\right) \Leftrightarrow 7x = 72 - 5x$

$\Leftrightarrow 12x = 72 \Leftrightarrow x = 6$

Hence, speed $= 6 \text{ km/hr} = \left(6 \times \dfrac{5}{18}\right) \text{ m/sec} = \dfrac{5}{3} \text{ m/sec} = 1\dfrac{2}{3} \text{ m/sec.}$

Ex. 5. *Peter can cover a certain distance in 1 hr. 24 min. by covering two-third of the distance at 4 kmph and the rest at 5 kmph. Find the total distance.*

Sol. Let the total distance be x km. Then,

$\dfrac{\frac{2}{3}x}{4} + \dfrac{\frac{1}{3}x}{5} = \dfrac{7}{5} \Leftrightarrow \dfrac{x}{6} + \dfrac{x}{15} = \dfrac{7}{5} \Leftrightarrow 7x = 42 \Leftrightarrow x = 6.$

∴ Total distance = 6 km.

Ex. 6. *A man travelled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 minutes, find the distance of the post-office from the village.* (S.S.C. 2004)

Sol. Average speed $= \left(\dfrac{2xy}{x + y}\right) \text{ km/hr} = \left(\dfrac{2 \times 25 \times 4}{25 + 4}\right) \text{ km/hr} = \dfrac{200}{29} \text{ km/hr.}$

Distance travelled in 5 hours 48 minutes *i.e.*, $5\dfrac{4}{5}$ hrs $= \left(\dfrac{200}{29} \times \dfrac{29}{5}\right) \text{ km} = 40 \text{ km.}$

∴ Distance of the post-office from the village $= \left(\dfrac{40}{2}\right) = 20 \text{ km.}$

Ex. 7. *An aeroplane flies along the four sides of a square at the speeds of 200, 400, 600 and 800 km/hr. Find the average speed of the plane around the field.*

Sol. Let each side of the square be x km and let the average speed of the plane around the field be y km/hr. Then,

$\dfrac{x}{200} + \dfrac{x}{400} + \dfrac{x}{600} + \dfrac{x}{800} = \dfrac{4x}{y} \Leftrightarrow \dfrac{25x}{2400} = \dfrac{4x}{y} \Leftrightarrow y = \left(\dfrac{2400 \times 4}{25}\right) = 384.$

∴ Average speed = 384 km/hr.

Ex. 8. *Walking at $\dfrac{5}{6}$ of its usual speed, a train is 10 minutes too late. Find its usual time to cover the journey.*

Sol. New speed $= \dfrac{5}{6}$ of the usual speed

∴ New time taken $= \dfrac{6}{5}$ of the usual time

So, $\left(\dfrac{6}{5} \text{ of the usual time}\right) - (\text{usual time}) = 10 \text{ min.}$

⟹ $\dfrac{1}{5}$ of the usual time = 10 min ⟹ usual time = 50 min.

Ex. 9. *If a man walks at the rate of 5 kmph, he misses a train by 7 minutes. However, if he walks at the rate of 6 kmph, he reaches the station 5 minutes before the arrival of the train. Find the distance covered by him to reach the station.*

Sol. Let the required distance be x km.

Difference in the times taken at two speeds $= 12 \text{ min} = \dfrac{1}{5} \text{ hr.}$

$$\therefore \quad \frac{x}{5} - \frac{x}{6} = \frac{1}{5} \quad \Leftrightarrow \quad 6x - 5x = 6 \quad \Leftrightarrow \quad x = 6.$$

Hence, the required distance is 6 km.

Ex. 10. *A and B are two stations 390 km apart. A train starts from A at 10 a.m. and travels towards B at 65 kmph. Another train starts from B at 11 a.m. and travels towards A at 35 kmph. At what time do they meet ?*

Sol. Suppose they meet x hours after 10 a.m. Then,

(Distance moved by first in x hrs) + [Distance moved by second in $(x-1)$ hrs] = 390.

$$\therefore \quad 65x + 35(x-1) = 390 \implies 100x = 425 \implies x = 4\frac{1}{4}.$$

So, they meet 4 hrs. 15 min. after 10 a.m. *i.e.*, at 2.15 p.m.

Ex. 11. *A goods train leaves a station at a certain time and at a fixed speed. After 6 hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.*

Sol. Let the speed of the goods train be x kmph.

Distance covered by goods train in 10 hours

= Distance covered by express train in 4 hours

$$\therefore \quad 10x = 4 \times 90 \text{ or } x = 36.$$

So, speed of goods train = 36 kmph.

Ex. 12. *A thief is spotted by a policeman from a distance of 100 metres. When the policeman starts the chase, the thief also starts running. If the speed of the thief be 8 km/hr and that of the policeman 10 km/hr, how far the thief will have run before he is overtaken ?*

Sol. Relative speed of the policeman = $(10 - 8)$ km/hr = 2 km/hr.

Time taken by policeman to cover 100 m = $\left(\frac{100}{1000} \times \frac{1}{2}\right)$ hr = $\frac{1}{20}$ hr.

In $\frac{1}{20}$ hrs, the thief covers a distance of $\left(8 \times \frac{1}{20}\right)$ km = $\frac{2}{5}$ km = 400 m.

Ex. 13. *I walk a certain distance and ride back taking a total time of 37 minutes. I could walk both ways in 55 minutes. How long would it take me to ride both ways ?*

Sol. Let the distance be x km. Then,

(Time taken to walk x km) + (Time taken to ride x km) = 37 min.

$\implies$ (Time taken to walk $2x$ km) + (Time taken to ride $2x$ km) = 74 min.

But, time taken to walk $2x$ km = 55 min.

$\therefore$ Time taken to ride $2x$ km = (74 − 55) min = 19 min.

EXERCISE 17

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer :*

1. A car moves at the speed of 80 km/hr. What is the speed of the car in metres per second ?   (Hotel Management, 2002)

   (a) 8 m/sec   (b) $20\frac{1}{9}$ m/sec   (c) $22\frac{2}{9}$ m/sec   (d) None of these

2. An athlete runs 200 metres race in 24 seconds. His speed is :   (S.S.C. 2002)

   (a) 20 km/hr   (b) 24 km/hr   (c) 28.5 km/hr   (d) 30 km/hr

3. Which of the following trains is the fastest ?
   (a) 25 m / sec   (b) 1500 m / min   (c) 90 km / hr   (d) None of these
4. A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour ?
   (a) 3.6   (b) 7.2   (c) 8.4   (d) 10
                                                                   (R.R.B. 2003)
5. A man walking at the rate of 5 km / hr crosses a bridge in 15 minutes. The length of
   the bridge (in metres) is :   (S.S.C. 2000)
   (a) 600   (b) 750   (c) 1000   (d) 1250
6. How long will a boy take to run round a square field of side 35 metres, if he runs at
   the rate of 9 km / hr ?   (S.S.C. 1999)
   (a) 50 sec   (b) 52 sec   (c) 54 sec   (d) 56 sec
7. A car is running at a speed of 108 kmph. What distance will it cover in 15 seconds ?
   (a) 45 metres   (b) 55 metres   (c) 450 metres
   (d) Cannot be determined   (e) None of these   (R.B.I. 2003)
8. One of the two buses completes a journey of 300 km in $7\frac{1}{2}$ hours and the other a
   journey of 450 km in 9 hours. The ratio of their average speeds is :   (R.R.B. 2001)
   (a) 2 : 3   (b) 3 : 4   (c) 4 : 5   (d) 8 : 9
9. A truck covers a distance of 550 metres in 1 minute whereas a bus covers a distance
   of 33 kms in 45 minutes. The ratio of their speeds is :   (S.S.C. 2004)
   (a) 3 : 4   (b) 4 : 3   (c) 3 : 5   (d) 50 : 3
10. The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 kms
    in 4 hours, then the speed of the first train is :   (I.M.T. 2002)
    (a) 70 km / hr   (b) 75 km / hr   (c) 84 km / hr   (d) 87.5 km / hr
11. A train travels at an average of 50 miles per hour for $2\frac{1}{2}$ hours and then travels at
    a speed of 70 miles per hour for $1\frac{1}{2}$ hours. How far did the train travel in the entire
    4 hours ?   (IGNOU, 2003)
    (a) 120 miles   (b) 150 miles   (c) 200 miles   (d) 230 miles
12. A man in a train notices that he can count 21 telephone posts in one minute. If they
    are known to be 50 metres apart, then at what speed is the train travelling ?
    (a) 55 km / hr   (b) 57 km / hr   (c) 60 km / hr   (d) 63 km / hr
13. Sound is said to travel in air at about 1100 feet per second. A man hears the axe
    striking the tree, $\frac{11}{5}$ seconds after he sees it strike the tree. How far is the man from
    the wood chopper ?   (M.B.A. 2002)
    (a) 2197 ft   (b) 2420 ft   (c) 2500 ft   (d) 2629 ft
14. An express train travelled at an average speed of 100 km / hr, stopping for 3 minutes
    after every 75 km. How long did it take to reach its destination 600 km from the
    starting point ?   (M.A.T. 2003)
    (a) 6 hrs 21 min   (b) 6 hrs 24 min   (c) 6 hrs 27 min   (d) 6 hrs 30 min
15. A certain distance is covered by a cyclist at a certain speed. If a jogger covers half the
    distance in double the time, the ratio of the speed of the jogger to that of the cyclist
    is :
    (a) 1 : 2   (b) 2 : 1   (c) 1 : 4   (d) 4 : 1
16. A motor car starts with the speed of 70 km / hr with its speed increasing every two
    hours by 10 kmph. In how many hours will it cover 345 kms ?   (Bank P.O. 2003)
    (a) $2\frac{1}{4}$ hrs   (b) 4 hrs 5 min   (c) $4\frac{1}{2}$ hrs
    (d) Cannot be determined   (e) None of these

17. The speed of a car increases by 2 kms after every one hour. If the distance travelled in the first one hour was 35 kms, what was the total distance travelled in 12 hours ?
   (a) 456 kms   (b) 482 kms   (c) 552 kms
   (d) 556 kms   (e) None of these   (Bank P.O. 2003)

18. A train covers a distance of 10 km in 12 minutes. If its speed is decreased by 5 km / hr, the time taken by it to cover the same distance will be :   (S.S.C. 1999)
   (a) 10 min   (b) 11 min 20 sec   (c) 13 min   (d) 13 min 20 sec

19. Anna left for city A from city B at 5.20 a.m. She travelled at the speed of 80 km / hr for 2 hours 15 minutes. After that the speed was reduced to 60 km / hr. If the distance between two cities is 350 kms, at what time did Anna reach city A ?
   (a) 9.20 a.m.   (b) 9.25 a.m.   (c) 9.35 a.m.
   (d) 10.05 a.m.   (e) None of these   (Bank P.O. 1999)

20. An aeroplane covers a certain distance at a speed of 240 kmph in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of :   (S.S.C. 2000)
   (a) 300 kmph   (b) 360 kmph   (c) 600 kmph   (d) 720 kmph

21. A salesman travels a distance of 50 km in 2 hours and 30 minutes. How much faster, in kilometres per hour, on an average, must he travel to make such a trip in $\frac{5}{6}$ hour less time ?   (Hotel Management, 2002)
   (a) 10   (b) 20   (c) 30   (d) None of these

22. A person has to cover a distance of 6 km in 45 minutes. If he covers one-half of the distance in two-thirds of the total time; to cover the remaining distance in the remaining time, his speed (in km / hr) must be :   (S.S.C. 1999)
   (a) 6   (b) 8   (c) 12   (d) 15

23. A man performs $\frac{3}{5}$ of the total journey by rail, $\frac{17}{20}$ by bus and the remaining 6.5 km on foot. His total journey is :
   (a) 65 km   (b) 100 km   (c) 120 km   (d) 130 km

24. A can complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km / hr and second half at the rate of 24 km / hr. Find the total journey in km.
   (a) 220 km   (b) 224 km   (c) 230 km   (d) 234 km
                                                              (Assistant Grade, 1997)

25. A person travels equal distances with speeds of 3 km / hr, 4 km / hr and 5 km / hr and takes a total time of 47 minutes. The total distance (in km) is :   (R.R.B. 2001)
   (a) 2   (b) 3   (c) 4   (d) 5

26. A farmer travelled a distance of 61 km in 9 hours. He travelled partly on foot @ 4 km / hr and partly on bicycle @ 9 km / hr. The distance travelled on foot is :
   (a) 14 km   (b) 15 km   (c) 16 km   (d) 17 km
                                                              (U.P.S.C. 2002)

27. A is faster than B. A and B each walk 24 km. The sum of their speeds is 7 km / hr and the sum of times taken by them is 14 hours. Then, A's speed is equal to :
   (a) 3 km / hr   (b) 4 km / hr   (c) 5 km / hr   (d) 7 km / hr
                                                              (I.A.F. 2002)

28. A person travels from P to Q at a speed of 40 kmph and returns by increasing his speed by 50%. What is his average speed for both the trips ?   (M.B.A. 2003)
   (a) 36 kmph   (b) 45 kmph   (c) 48 kmph   (d) 50 kmph

29. A car driver travels from the plains to the hill station, which are 200 km apart at an average speed of 40 km / hr. In the return trip, he covers the same distance at an average speed of 20 km / hr. The average speed of the car over the entire distance of 400 km is :

(a) 25 km / hr   (b) 26.67 km / hr   (c) 28.56 km / hr   (d) 30 km / hr

30. Mac travels from A to B a distance of 250 miles in $5\frac{1}{2}$ hours. He returns to A in 4 hours 30 minutes. His average speed is :

(a) 44 mph   (b) 46 mph   (c) 48 mph   (d) 50 mph

31. A boy goes to his school from his house at a speed of 3 km / hr and returns at a speed of 2 km / hr. If he takes 5 hours in going and coming, the distance between his house and school is :   (S.S.C. 2004)

(a) 5 km   (b) 5.5 km   (c) 6 km   (d) 6.5 km

32. The average speed of a train in the onward journey is 25% more than that in the return journey. The train halts for one hour on reaching the destination. The total time taken for the complete to and fro journey is 17 hours, covering a distance of 800 km. The speed of the train in the onward journey is :

(a) 45 km / hr   (b) 47.5 km / hr   (c) 52 km / hr   (d) 56.25 km / hr

33. I started on my bicycle at 7 a.m. to reach a certain place. After going a certain distance, my bicycle went out of order. Consequently, I rested for 35 minutes and came back to my house walking all the way. I reached my house at 1 p.m. If my cycling speed is 10 kmph and my walking speed is 1 kmph, then on my bicycle I covered a distance of :

(a) $4\frac{61}{66}$ km   (b) $13\frac{4}{9}$ km   (c) $14\frac{3}{8}$ km   (d) $15\frac{10}{21}$ km

34. A, B and C are on a trip by a car. A drives during the first hour at an average speed of 50 km / hr. B drives during the next 2 hours at an average speed of 48 km / hr. C drives for the next 3 hours at an average speed of 52 km / hr. They reached their destination after exactly 6 hours. Their mean speed was :

(a) 50 km / hr   (b) $50\frac{1}{3}$ km / hr   (c) $51\frac{1}{3}$ km / hr   (d) 52 km / hr

35. A man on tour travels first 160 km at 64 km / hr and the next 160 km at 80 km / hr. The average speed for the first 320 km of the tour is :   (R.R.B. 2003)

(a) 35.55 km / hr   (b) 36 km / hr   (c) 71.11 km / hr   (d) 71 km / hr

36. A boy rides his bicycle 10 km at an average speed of 12 km / hr and again travels 12 km at an average speed of 10 km / hr. His average speed for the entire trip is approximately :   (S.S.C. 1999)

(a) 10.4 km / hr   (b) 10.8 km / hr   (c) 11 km / hr   (d) 12.2 km / hr

37. A man travels 600 km by train at 80 km / hr, 800 km by ship at 40 km / hr, 500 km by aeroplane at 400 km / hr and 100 km by car at 50 km / hr. What is the average speed for the entire distance ?   (S.S.C. 2000)

(a) 60 km / hr   (b) $60\frac{5}{123}$ km / hr   (c) 62 km / hr   (d) $65\frac{5}{123}$ km / hr

38. A car travels the first one-third of a certain distance with a speed of 10 km / hr, the next one-third distance with a speed of 20 km / hr, and the last one-third distance with a speed of 60 km / hr. The average speed of the car for the whole journey is :

(a) 18 km / hr   (b) 24 km / hr   (c) 30 km / hr   (d) 36 km / hr

(Civil Services, 2003)

39. A motorist covers a distance of 39 km in 45 minutes by moving at a speed of x kmph for the first 15 minutes, then moving at double the speed for the next 20 minutes and then again moving at his original speed for the rest of the journey. Then, x is equal to :

   (a) 31.2   (b) 36   (c) 40   (d) 52

40. Mary jogs 9 km at a speed of 6 km per hour. At what speed would she need to jog during the next 1.5 hours to have an average of 9 km per hour for the entire jogging session ?

   (a) 9 kmph   (b) 10 kmph   (c) 12 kmph   (d) 14 kmph

41. A car travelling with $\frac{5}{7}$ of its actual speed covers 42 km in 1 hr 40 min 48 sec. Find the actual speed of the car.   (S.S.C. 2002)

   (a) $17\frac{6}{7}$ km/hr   (b) 25 km/hr   (c) 30 km/hr   (d) 35 km/hr

42. A train running at $\frac{7}{11}$ of its own speed reached a place in 22 hours. How much time could be saved if the train would have run at its own speed ?

   (a) 7 hours   (b) 8 hours   (c) 14 hours   (d) 16 hours

43. A man can reach a certain place in 30 hours. If he reduces his speed by $\frac{1}{15}$ th, he goes 10 km less in that time. Find his speed.   (S.S.C. 2002)

   (a) 4 km/hr   (b) 5 km/hr   (c) $5\frac{1}{2}$ km/hr   (d) 6 km/hr

44. Walking $\frac{6}{7}$ th of his usual speed, a man is 12 minutes too late. The usual time taken by him to cover that distance is :   (R.R.B. 2001)

   (a) 1 hour   (b) 1 hr 12 min. (c) 1 hr 15 min. (d) 1 hr 20 min

45. Starting from his house one day, a student walks at a speed of $2\frac{1}{2}$ kmph and reaches his school 6 minutes late. Next day he increases his speed by 1 kmph and reaches the school 6 minutes early. How far is the school from his house ?   (S.S.C. 2004)

   (a) 1 km   (b) $1\frac{1}{2}$ km   (c) $1\frac{3}{4}$ km   (d) 2 km

46. A train when moves at an average speed of 40 kmph, reaches its destination on time. When its average speed becomes 35 kmph, then it reaches its destination 15 minutes late. Find the length of journey.   (Bank P.O. 2003)

   (a) 30 km   (b) 40 km   (c) 70 km   (d) 80 km

47. Robert is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph; he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M. ?   (D.M.R.C. 2003)

   (a) 8 kmph   (b) 11 kmph   (c) 12 kmph   (d) 14 kmph

48. If a train runs at 40 kmph, it reaches its destination late by 11 minutes but if it runs at 50 kmph, it is late by 5 minutes only. The correct time for the train to complete its journey is :

   (a) 13 min.   (b) 15 min.   (c) 19 min.   (d) 21 min

49. A man covered a certain distance at some speed. Had he moved 3 kmph faster, he would have taken 40 minutes less. If he had moved 2 kmph slower, he would have taken 40 minutes more. The distance (in km) is :   (S.S.C. 2003)

   (a) 35   (b) $36\frac{2}{3}$ (c) $37\frac{1}{2}$ (d) 40

50. A car travels from P to Q at a constant speed. If its speed were increased by 10 km / hr, it would have taken one hour lesser to cover the distance. It would have taken further 45 minutes lesser if the speed was further increased by 10 km / hr. What is the distance between the two cities ?

    (a) 420 km   (b) 540 km   (c) 600 km   (d) 650 km

51. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is :

    (a) 100 kmph   (b) 110 kmph   (c) 120 kmph   (d) 130 kmph

                                                                        (M.A.T. 2003)

52. Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour ?   (N.I.F.T. 2002)

    (a) 9   (b) 10   (c) 12   (d) 20

53. A car covers a distance of 715 km at a constant speed. If the speed of the car would have been 10 km / hr more, then it would have taken 2 hours less to cover the same distance. What is the original speed of the car ?

    (a) 45 km / hr   (b) 50 km / hr   (c) 55 km / hr   (d) 65 km / hr

54. In covering a certain distance, the speeds of A and B are in the ratio of 3 : 4. A takes 30 minutes more than B to reach the destination. The time taken by A to reach the destination is :   (S.S.C. 1999)

    (a) 1 hour   (b) $1\frac{1}{2}$ hours   (c) 2 hours   (d) $2\frac{1}{2}$ hours

55. In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is :

    (a) 5 kmph   (b) 6 kmph   (c) 6.25 kmph   (d) 7.5 kmph

                                                                        (M.A.T. 2003)

56. Three persons are walking from a place A to another place B. Their speeds are in the ratio of 4 : 3 : 5. The time ratio to reach B by these persons will be :

    (a) 4 : 3 : 5   (b) 5 : 3 : 4   (c) 15 : 9 : 20   (d) 15 : 20 : 12

57. With a uniform speed a car covers the distance in 8 hours. Had the speed been increased by 4 km / hr, the same distance could have been covered in $7\frac{1}{2}$ hours. What is the distance covered ?   (Bank P.O. 2003)

    (a) 420 km   (b) 480 km   (c) 640 km

    (d) Cannot be determined   (e) None of these

58. Two men start together to walk to a certain destination, one at 3 kmph and another at 3.75 kmph. The latter arrives half an hour before the former. The distance is :

    (a) 6 km   (b) 7.5 km   (c) 8 km   (d) 9.5 km

59. If a person walks at 14 km / hr instead of 10 km / hr, he would have walked 20 km more. The actual distance travelled by him is :   (R.R.B. 2000)

    (a) 50 km   (b) 56 km   (c) 70 km   (d) 80 km

60. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km / hr and the time of flight increased by 30 minutes. The duration of the flight is :   (M.A.T. 2002)

    (a) 1 hour   (b) 2 hours   (c) 3 hours   (d) 4 hours

61. It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the car is :   (M.B.A. 2001)

    (a) 2 : 3   (b) 3 : 2   (c) 3 : 4   (d) 4 : 3

62. A is twice as fast as B and B is thrice as fast as C is. The journey covered by C in 54 minutes will be covered by B in :

(a) 18 min   (b) 27 min   (c) 36 min   (d) 9 min

63. Two men starting from the same place walk at the rate of 5 kmph and 5.5 kmph respectively. What time will they take to be 8.5 km apart, if they walk in the same direction ?

(a) 4 hrs 15 min   (b) 8 hrs 30 min   (c) 16 hrs   (d) 17 hrs

64. A walks around a circular field at the rate of one round per hour while B runs around it at the rate of six rounds per hour. They start in the same direction from the same point at 7.30 a.m. They shall first cross each other at :   (Civil Services, 2003)

(a) 7.42 a.m.   (b) 7.48 a.m.   (c) 8.10 a.m.   (d) 8.30 a.m.

65. A walks at 4 kmph and 4 hours after his start, B cycles after him at 10 kmph. How far from the start does B catch up with A ?

(a) 16.7 km   (b) 18.6 km   (c) 21.5 km   (d) 26.7 km

66. A thief is noticed by a policeman from a distance of 200 m. The thief starts running and the policeman chases him. The thief and the policeman run at the rate of 10 km and 11 km per hour respectively. What is the distance between them after 6 minutes ?

(a) 100 m   (b) 150 m   (c) 190 m   (d) 200 m

(S.S.C. 2000)

67. A thief steals a car at 2.30 p.m. and drives it at 60 kmph. The theft is discovered at 3 p.m. and the owner sets off in another car at 75 kmph. When will he overtake the thief ?   (R.R.B. 2002)

(a) 4.30 p.m.   (b) 4.45 p.m.   (c) 5 p.m.   (d) 5.15 p.m.

68. Two guns were fired from the same place at an interval of 10 minutes and 30 seconds, but a person in the train approaching the place hears the second shot 10 minutes after the first. The speed of the train (in km / hr), supposing that speed travels at 330 metres per second, is :

(a) 19.8   (b) 58.6   (c) 59.4   (d) 111.80

69. Two cyclists start from the same place in opposite directions. One goes towards north at 18 kmph and the other goes towards south at 20 kmph. What time will they take to be 47.5 km apart ?

(a) $1\frac{1}{4}$ hrs   (b) $2\frac{1}{4}$ hrs   (c) 2 hrs. 23 min.   (d) $2\frac{1}{2}$ hrs

70. The distance between two cities A and B is 330 km. A train starts from A at 8 a.m. and travels towards B at 60 km / hr. Another train starts from B at 9 a.m. and travels towards A at 75 km / hr. At what time do they meet ?   (L.I.C.A.A.O. 2003)

(a) 10 a.m.   (b) 10.30 a.m.   (c) 11 a.m.   (d) 11.30 a.m.

71. The jogging truck in a sports complex is 726 metres in circumference. Deepak and his wife start from the same point and walk in opposite directions at 4.5 km / hr and 3.75 km / hr respectively. They will meet for the first time in :   (M.A.T. 2003)

(a) 4.9 min   (b) 5.28 min   (c) 5.5 min   (d) 6 min

72. A and B walk around a circular track. They start at 8 a.m. from the same point in the opposite directions. A and B walk at a speed of 2 rounds per hour and 3 rounds per hour respectively. How many times shall they cross each other before 9.30 a.m. ?

(a) 5   (b) 6   (c) 7   (d) 8

(U.P.S.C. 2002)

73. Two cars P and Q start at the same time from A and B which are 120 km apart. If the two cars travel in opposite directions, they meet after one hour and if they travel in same direction (from A towards B), then P meets Q after 6 hours. What is the speed of car P ?   (S.B.I.P.O. 2000)

(a) 60 kmph   (b) 70 kmph   (c) 120 kmph

(d) Data inadequate   (e) None of these

74. Two trains starting at the same time from two stations 200 km apart and going in opposite directions cross each other at a distance of 110 km from one of the stations. What is the ratio of their speeds ?

(a) 9 : 20   (b) 11 : 9   (c) 11 : 20   (d) None of these

75. Two trains start from P and Q respectively and travel towards each other at a speed of 50 km/hr and 40 km/hr respectively. By the time they meet, the first train has travelled 100 km more than the second. The distance between P and Q is :

(a) 500 km   (b) 630 km   (c) 660 km   (d) 900 km

(S.S.C. 2000)

76. Bombay Express left Delhi for Bombay at 14.30 hrs, travelling at a speed of 60 kmph and Rajdhani Express left Delhi for Bombay on the same day at 16.30 hrs, travelling at a speed of 80 kmph. How far away from Delhi will the two trains meet ?

(a) 120 km   (b) 360 km   (c) 480 km   (d) 500 km

77. A train M leaves Meerut at 5 a.m. and reaches Delhi at 9 a.m. Another train leaves Delhi at 7 a.m. and reaches Meerut at 10.30 a.m. At what time do the two trains cross each other ?

(a) 7.36 a.m.   (b) 7.56 a.m.   (c) 8 a.m.   (d) 8.26 a.m.

78. A man takes 5 hours 45 min. in walking to a certain place and riding back. He would have gained 2 hours by riding both ways. The time he would take to walk both ways, is :

(a) 3 hrs 45 min   (b) 7 hrs 30 min

(c) 7 hrs 45 min   (d) 11 hrs 45 min

ANSWERS

1. (c)	2. (d)	3. (d)	4. (b)	5. (d)	6. (d)	7. (c)	8. (c)
9. (a)	10. (a)	11. (d)	12. (c)	13. (b)	14. (a)	15. (c)	16. (c)
17. (c)	18. (d)	19. (c)	20. (d)	21. (a)	22. (c)	23. (d)	24. (b)
25. (b)	26. (c)	27. (b)	28. (c)	29. (b)	30. (d)	31. (c)	32. (d)
33. (a)	34. (b)	35. (c)	36. (b)	37. (d)	38. (a)	39. (d)	40. (c)
41. (d)	42. (b)	43. (c)	44. (b)	45. (c)	46. (c)	47. (c)	48. (c)
49. (d)	50. (a)	51. (c)	52. (b)	53. (c)	54. (c)	55. (a)	56. (d)
57. (b)	58. (a)	59. (a)	60. (a)	61. (c)	62. (a)	63. (d)	64. (a)
65. (d)	66. (a)	67. (c)	68. (c)	69. (a)	70. (c)	71. (b)	72. (c)
73. (b)	74. (b)	75. (d)	76. (c)	77. (c)	78. (d)		

SOLUTIONS

1. Speed $= \left(80 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{200}{9}$ m/sec $= 22\dfrac{2}{9}$ m/sec.

2. Speed $= \dfrac{200}{24}$ m/sec $= \dfrac{25}{3}$ m/sec $= \left(\dfrac{25}{3} \times \dfrac{18}{5}\right)$ km/hr $= 30$ km/hr.

3. 25 m/sec $= \left(25 \times \dfrac{18}{5}\right)$ km/hr $= 90$ km/hr.

And, 25 m/sec $= (25 \times 60)$ m/min $= 1500$ m/min.

So, all the three speeds are equal.

4. Speed $= \left(\dfrac{600}{5 \times 60}\right)$ m/sec $= 2$ m/sec $= \left(2 \times \dfrac{18}{5}\right)$ km/hr $= 7.2$ km/hr.

SUB#

5. Speed $= \left(5 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{25}{18}$ m/sec.

Distance covered in 15 minutes $= \left(\dfrac{25}{18} \times 15 \times 60\right)$ m $= 1250$ m.

6. Speed $= 9$ km/hr $= \left(9 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{5}{2}$ m/sec.

Distance $= (35 \times 4)$ m $= 140$ m.

∴ Time taken $= \left(140 \times \dfrac{2}{5}\right)$ sec $= 56$ sec.

7. Speed $= 108$ kmph $= \left(108 \times \dfrac{5}{18}\right)$ m/sec $= 30$ m/sec.

∴ Distance covered in 15 sec. $= (30 \times 15)$ m $= 450$ m.

8. Ratio of speeds $= \left(300 \times \dfrac{2}{15}\right) : \left(\dfrac{450}{9}\right) = 40 : 50 = 4 : 5$.

9. Ratio of speeds $= \left(\dfrac{550}{60} \times \dfrac{18}{5}\right) : \left(\dfrac{33}{45} \times 60\right) = 33 : 44 = 3 : 4$.

10. Let the speeds of two trains be $7x$ and $8x$ km/hr.

Then, $8x = \dfrac{400}{4} = 100 \Rightarrow x = \left(\dfrac{100}{8}\right) = 12.5$.

∴ Speed of first train $= (7 \times 12.5)$ km/hr $= 87.5$ km/hr.

11. Total distance travelled $= \left[\left(50 \times 2\dfrac{1}{2}\right) + \left(70 \times 1\dfrac{1}{2}\right)\right]$ miles $= (125 + 105)$ miles $= 230$ miles.

12. Number of gaps between 21 telephone posts $= 20$.

Distance travelled in 1 minute $= (50 \times 20)$ m $= 1000$ m $= 1$ km.

∴ Speed $= 60$ km/hr.

13. Distance $= \left(1100 \times \dfrac{11}{5}\right)$ feet $= 2420$ feet.

14. Time taken to cover 600 km $= \left(\dfrac{600}{100}\right)$ hrs $= 6$ hrs.

Number of stoppages $= \dfrac{600}{75} - 1 = 7$.

Total time of stoppage $= (3 \times 7)$ min $= 21$ min.

Hence, total time taken $= 6$ hrs 21 min.

15. Let the distance covered by the cyclist be x and the time taken be y. Then,

Required ratio $= \dfrac{\dfrac{1}{2}x}{2y} : \dfrac{x}{y} = \dfrac{1}{4} : 1 = 1 : 4$.

16. Distance covered in first 2 hours $= (70 \times 2)$ km $= 140$ km.

Distance covered in next 2 hours $= (80 \times 2)$ km $= 160$ km.

Remaining distance $= 345 - (140 + 160) = 45$ km.

Speed in the fifth hour $= 90$ km/hr.

Time taken to cover 45 km $= \left(\dfrac{45}{90}\right)$ hr $= \dfrac{1}{2}$ hr.

∴ Total time taken $= \left(2 + 2 + \dfrac{1}{2}\right) = 4\dfrac{1}{2}$ hrs.

17. Total distance travelled in 12 hours = $(35 + 37 + 39 + \ldots$ upto 12 terms).
This is an A.P. with first term, $a = 35$, number of terms, $n = 12$, common difference, $d = 2$.

∴ Required distance $= \dfrac{12}{2}\{2 \times 35 + (12 - 1) \times 2\} = 6(70 + 22) = 552$ km.

18. Speed $= \left(10 \times \dfrac{60}{12}\right)$ km/hr $= 50$ km/hr.

New speed $= (50 - 5)$ km/hr $= 45$ km/hr.

∴ Time taken $= \left(\dfrac{10}{45}\right)$ hr $= \left(\dfrac{2}{9} \times 60\right)$ min $= 13\dfrac{1}{3}$ min $= 13$ min 20 sec.

19. Distance covered in 2 hrs 15 min $i.e.,\ 2\dfrac{1}{4}$ hrs $= \left(80 \times \dfrac{9}{4}\right)$ hrs $= 180$ hrs.

Time taken to cover remaining distance $= \left(\dfrac{350 - 180}{60}\right)$ hrs $= \dfrac{17}{6}$ hrs

$= 2\dfrac{5}{6}$ hrs $= 2$ hrs 50 min.

Total time taken $= (2$ hrs 15 min $+ 2$ hrs 50 min$) = 5$ hrs 5 min.
So, Anna reached city A at 10.25 a.m.

20. Distance $= (240 \times 5)$ km $= 1200$ km.

∴ Required speed $= \left(1200 \times \dfrac{3}{5}\right)$ km/hr $= 720$ km/hr.

21. Time required $= (2$ hrs 30 min $- 50$ min$) = 1$ hr 40 min $= 1\dfrac{2}{3}$ hrs.

∴ Required speed $= \left(50 \times \dfrac{3}{5}\right)$ km/hr $= 30$ km/hr.

Original speed $= \left(50 \times \dfrac{2}{5}\right)$ km/hr $= 20$ km/hr.

∴ Difference in speed $= (30 - 20)$ km/hr $= 10$ km/hr.

22. Remaining distance $= 3$ km and Remaining time $= \left(\dfrac{1}{3} \times 45\right)$ min $= 15$ min $= \dfrac{1}{4}$ hour.

∴ Required speed $= (3 \times 4)$ km/hr $= 12$ km/hr.

23. Let the total journey be x km.

Then, $\dfrac{3x}{5} + \dfrac{7x}{20} + 6.5 = x \Leftrightarrow 12x + 7x + 20 \times 6.5 = 20x \Leftrightarrow x = 130$ km.

24. Let the total distance be x km. Then,

$\dfrac{\frac{1}{2}x}{21} + \dfrac{\frac{1}{2}x}{24} = 10 \Rightarrow \dfrac{x}{21} + \dfrac{x}{24} = 20$

$\Rightarrow 15x = 168 \times 20 \Rightarrow x = \left(\dfrac{168 \times 20}{15}\right) = 224$ km.

25. Let the total distance be $3x$ km.

Then, $\dfrac{x}{3} + \dfrac{x}{4} + \dfrac{x}{5} = \dfrac{47}{60} \Leftrightarrow \dfrac{47x}{60} = \dfrac{47}{60} \Leftrightarrow x = 1$.

∴ Total distance $= (3 \times 1)$ km $= 3$ km.

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26. Let the distance travelled on foot be x km.

Then, distance travelled on bicycle = $(61 - x)$ km.

So, $\dfrac{x}{4} + \dfrac{(61 - x)}{9} = 9 \Leftrightarrow 9x + 4(61 - x) = 9 \times 36 \Leftrightarrow 5x = 80 \Leftrightarrow x = 16$ km.

27. Let A's speed = x km/hr. Then, B's speed = $(7 - x)$ km/hr.

So, $\dfrac{24}{x} + \dfrac{24}{(7 - x)} = 14 \quad \Leftrightarrow \quad 24(7 - x) + 24x = 14x(7 - x)$

$\Leftrightarrow \quad 14x^2 - 98x + 168 = 0 \quad \Leftrightarrow \quad x^2 - 7x + 12 = 0$

$\Leftrightarrow \quad (x - 3)(x - 4) = 0 \quad \Leftrightarrow \quad x = 3 \text{ or } x = 4.$

Since, A is faster than B, so A's speed = 4 km/hr and B's speed = 3 km/hr.

28. Speed on return trip = 150% of 40 = 60 kmph.

$\therefore$ Average speed $= \left(\dfrac{2 \times 40 \times 60}{40 + 60}\right)$ km/hr $= \left(\dfrac{4800}{100}\right)$ km/hr = 48 km/hr.

29. Average speed $= \left(\dfrac{2 \times 40 \times 20}{40 + 60}\right)$ km/hr $= \left(\dfrac{80}{3}\right)$ km/hr = 26.67 km/hr.

30. Speed from A to B $= \left(250 \times \dfrac{2}{11}\right)$ mph $= \left(\dfrac{500}{11}\right)$ mph.

Speed from B to A $= \left(250 \times \dfrac{2}{9}\right)$ mph $= \left(\dfrac{500}{9}\right)$ mph.

$\therefore$ Average speed $= \left(\dfrac{2 \times \dfrac{500}{11} \times \dfrac{500}{9}}{\dfrac{500}{11} + \dfrac{500}{9}}\right)$ mph $= \left(\dfrac{500000}{4500 + 5500}\right)$ mph = 50 mph.

31. Average speed $= \left(\dfrac{2 \times 3 \times 2}{3 + 2}\right)$ km/hr $= \dfrac{12}{5}$ km/hr.

Distance travelled $= \left(\dfrac{12}{5} \times 5\right)$ km = 12 km.

$\therefore$ Distance between house and school $= \left(\dfrac{12}{2}\right)$ km = 6 km.

32. Let the speed in return journey be x km/hr.

Then, speed in onward journey $= \dfrac{125}{100}x = \left(\dfrac{5}{4}x\right)$ km/hr.

Average speed $= \left(\dfrac{2 \times \dfrac{5}{4}x \times x}{\dfrac{5}{4}x + x}\right)$ km/hr $= \dfrac{10x}{9}$ km/hr.

$\therefore \left(800 \times \dfrac{9}{10x}\right) = 16 \Leftrightarrow x = \left(\dfrac{800 \times 9}{16 \times 10}\right) = 45.$

So, speed in onward journey $= \left(\dfrac{5}{4} \times 45\right)$ km/hr = 56.25 km/hr.

33. Time taken = 5 hrs 25 min $= \dfrac{65}{12}$ hrs.

Let the required distance be x km.

Then, $\dfrac{x}{10} + \dfrac{x}{1} = \dfrac{65}{12} \Leftrightarrow 11x = \dfrac{650}{12} \Leftrightarrow x = \dfrac{325}{66} = 4\dfrac{61}{66}$ km.

34. Total distance travelled = (50 × 1 + 48 × 2 + 52 × 3) km = 302 km.
Total time taken = 6 hrs.

∴ Mean speed = $\left(\dfrac{302}{6}\right)$ km/hr = $50\dfrac{1}{3}$ km/hr.

35. Total time taken = $\left(\dfrac{160}{64} + \dfrac{160}{8}\right)$ hrs = $\dfrac{9}{2}$ hrs.

∴ Average speed = $\left(320 \times \dfrac{2}{9}\right)$ km/hr = 71.11 km/hr.

36. Total distance travelled = (10 + 12) km/hr = 22 km/hr.

Total time taken = $\left(\dfrac{10}{12} + \dfrac{12}{10}\right)$ hrs = $\dfrac{61}{30}$ hrs.

∴ Average speed = $\left(22 \times \dfrac{30}{61}\right)$ km/hr = 10.8 km/hr.

37. Total distance travelled = (600 + 800 + 500 + 100) km = 2000 km.

Total time taken = $\left(\dfrac{600}{80} + \dfrac{800}{40} + \dfrac{500}{400} + \dfrac{100}{50}\right)$ hrs = $\dfrac{123}{4}$ hrs.

∴ Average speed = $\left(2000 \times \dfrac{4}{123}\right)$ km/hr = $\left(\dfrac{8000}{123}\right)$ km/hr = $65\dfrac{5}{123}$ km/hr.

38. Let the whole distance travelled be x km and the average speed of the car for the whole journey be y km/hr.

Then, $\dfrac{(x/3)}{10} + \dfrac{(x/3)}{20} + \dfrac{(x/3)}{60} = \dfrac{x}{y}$ ⟺ $\dfrac{x}{30} + \dfrac{x}{60} + \dfrac{x}{180} = \dfrac{x}{y}$

⟺ $\dfrac{1}{18}y = 1$ ⟺ y = 18 km/hr.

39. $x \times \dfrac{15}{60} + 2x \times \dfrac{20}{60} + x \times \dfrac{10}{60} = 39$ ⟹ $\dfrac{x}{4} + \dfrac{2x}{3} + \dfrac{x}{6} = 39$

⟹ 3x + 8x + 2x = 468 ⟹ x = 36.

40. Let speed of jogging be x km/hr.

Total time taken = $\left(\dfrac{9}{6}\text{ hrs} + 1.5\text{ hrs}\right)$ = 3 hrs.

Total distance covered = (9 + 1.5x) km.

∴ $\dfrac{9 + 1.5x}{3} = 9$ ⟺ 9 + 1.5x = 27 ⟺ $\dfrac{3}{2}x = 18$ ⟺ $x = \left(18 \times \dfrac{2}{3}\right)$ = 12 kmph.

41. Time taken = 1 hr 40 min 48 sec = 1 hr $40\dfrac{4}{5}$ min = $1\dfrac{51}{75}$ hrs = $\dfrac{126}{75}$ hrs.

Let the actual speed be x km/hr.

Then, $\dfrac{5}{7}x \times \dfrac{126}{75} = 42$ or $x = \left(\dfrac{42 \times 7 \times 75}{5 \times 126}\right)$ = 35 km/hr.

42. New speed = $\dfrac{7}{11}$ of usual speed.

∴ New time = $\dfrac{11}{7}$ of usual time.

So, $\dfrac{11}{7}$ of usual time = 22 hrs ⟹ usual time = $\left(\dfrac{22 \times 7}{11}\right)$ = 14 hrs.

Hence, time saved = (22 − 14) = 8 hrs.

43. Let the speed be x km/hr. Then,

$$30x - 30 \times \frac{14}{15}x = 10 \iff 2x = 10 \iff x = 5 \text{ km/hr.}$$

44. New speed $= \frac{6}{7}$ of usual speed.

New time $= \frac{7}{6}$ of usual time

$\therefore \left(\frac{7}{6} \text{ of usual time}\right) - (\text{usual time}) = \frac{1}{5}$ hr.

$\Rightarrow \frac{1}{6}$ of usual time $= \frac{1}{5}$ hr $\Rightarrow$ usual time $= \frac{6}{5}$ hr $= 1$ hr 12 min.

45. Let the distance be x km.

Difference in timings $= 12$ min $= \frac{12}{60}$ hr $= \frac{1}{5}$ hr.

$\therefore \frac{2x}{5} - \frac{2x}{7} = \frac{1}{5} \iff 14x - 10x = 7 \iff x = 1\frac{3}{4}$ km.

46. Difference between timings $= 15$ min $= \frac{1}{4}$ hr.

Let the length of journey be x km.

Then, $\frac{x}{35} - \frac{x}{40} = \frac{1}{4} \iff 8x - 7x = 70 \iff x = 70$ km.

47. Let the distance travelled be x km.

Then, $\frac{x}{10} - \frac{x}{15} = 2 \iff 3x - 2x = 60 \iff x = 60$ km.

Time taken to travel 60 km at 10 km/hr $= \left(\frac{60}{10}\right)$ hrs $= 6$ hrs.

So, Robert started 6 hours before 2 P.M. i.e., at 8 A.M.

$\therefore$ Required speed $= \left(\frac{60}{5}\right)$ kmph $= 12$ kmph.

48. Let the correct time to complete the journey be x min.
Distance covered in $(x + 11)$ min. at 40 kmph

$= $ Distance covered in $(x + 5)$ min. at 50 kmph

$\therefore \frac{(x+11)}{60} \times 40 = \frac{(x+5)}{60} \times 50 \iff x = 19$ min.

49. Let distance $= x$ km and usual rate $= y$ kmph.

$\frac{x}{y} - \frac{x}{y+3} = \frac{40}{60}$ or $2y(y+3) = 9x$ ...(i)

And, $\frac{x}{y-2} - \frac{x}{y} = \frac{40}{60}$ or $y(y-2) = 3x$ ...(ii)

On dividing (i) by (ii), we get $x = 40$ km.

50. Let distance $= x$ km and usual rate $= y$ kmph. Then,

$\frac{x}{y} - \frac{x}{y+10} = 1$ or $y(y+10) = 10x$ ...(i)

And, $\frac{x}{y} - \frac{x}{y+20} = \frac{7}{4}$ or $y(y+20) = \frac{80x}{7}$ ...(ii)

On dividing (i) by (ii), we get $y = 60$.
Substituting $y = 60$ in (i), we get : $x = 420$ km.

51. Let speed of the car be x kmph.

Then, speed of the train $= \frac{150}{100} x = \left(\frac{3}{2} x\right)$ kmph.

$\therefore \quad \frac{75}{x} - \frac{75}{\frac{3}{2} x} = \frac{125}{10 \times 60} \leftrightarrow \frac{75}{x} - \frac{50}{x} = \frac{5}{24} \Leftrightarrow x = \left(\frac{25 \times 24}{5}\right) = 120$ kmph.

52. Due to stoppages, it covers 9 km less.

Time taken to cover 9 km $= \left(\frac{9}{54} \times 60\right)$ min $= 10$ min.

53. Let the original speed be x km / hr. Then,

$\frac{715}{x} - \frac{715}{x + 10} = 2 \quad \Leftrightarrow \quad 2x (x + 10) = 7150 \quad \Leftrightarrow \quad x^2 + 10x - 3575 = 0$

$\leftrightarrow \quad (x + 65) (x - 55) = 0 \quad \Leftrightarrow \quad x = 55$ km / hr.

54. Ratio of speeds $= 3 : 4$. Ratio of times taken $= 4 : 3$.

Suppose A takes $4x$ hrs and B takes $3x$ hrs to reach the destination. Then,

$4x - 3x = \frac{30}{60} = \frac{1}{2}$ or $x = \frac{1}{2}$.

$\therefore$ Time taken by A $= 4x$ hrs $= \left(4 \times \frac{1}{2}\right)$ hrs $= 2$ hrs.

55. Let Abhay's speed be x km / hr.

Then, $\frac{30}{x} - \frac{30}{2x} = 3 \leftrightarrow 6x = 30 \Leftrightarrow x = 5$ km / hr.

56. Ratio of speeds $= 4 : 3 : 5$.

$\therefore$ Ratio of times taken $= \frac{1}{4} : \frac{1}{3} : \frac{1}{5} = 15 : 20 : 12$

57. Let the distance be x km. Then,

$\frac{x}{7\frac{1}{2}} - \frac{x}{8} = 4 \leftrightarrow \frac{2x}{15} - \frac{x}{8} = 4 \Leftrightarrow x = 480$ km.

58. Let the distance be x km. Then,

$\frac{x}{3} - \frac{x}{3.75} = \frac{1}{2} \leftrightarrow 2.5x - 2x = 3.75 \leftrightarrow x = \frac{3.75}{0.50} = \frac{15}{2} = 7.5$ km.

59. Let the actual distance travelled be x km. Then,

$\frac{x}{10} = \frac{x + 20}{14} \leftrightarrow 14x = 10x + 200 \leftrightarrow 4x = 200 \leftrightarrow x = 50$ km.

60. Let the duration of the flight be x hours. Then,

$\frac{600}{x} - \frac{600}{x + \frac{1}{2}} = 200 \quad \Leftrightarrow \quad \frac{600}{x} - \frac{1200}{2x + 1} = 200 \leftrightarrow x (2x + 1) = 3$

$\leftrightarrow \quad 2x^2 + x - 3 = 0 \quad \Leftrightarrow \quad (2x + 3) (x - 1) = 0$

$\leftrightarrow \quad x = 1$ hr. [neglecting the $-$ve value of x]

61. Let the speed of the train be x km / hr and that of the car be y km / hr.

Then, $\frac{120}{x} + \frac{480}{y} = 8$ or $\frac{1}{x} + \frac{4}{y} = \frac{1}{15}$ ...(i)

And, $\frac{200}{x} + \frac{400}{y} = \frac{25}{3}$ or $\frac{1}{x} + \frac{2}{y} = \frac{1}{24}$ ...(ii)

Solving (i) and (ii), we get $x = 60$ and $y = 80$.

∴   Ratio of speeds = $60 : 80 = 3 : 4$.

62. Let C's speed = x km / hr. Then, B's speed = $3x$ km / hr and A's speed = $6x$ km / hr.

∴   Ratio of speeds of A, B, C = $6x : 3x : x = 6 : 3 : 1$.

Ratio of times taken = $\frac{1}{6} : \frac{1}{3} : 1 = 1 : 2 : 6$.

If C takes 6 min., then B takes 2 min.

If C takes 54 min., then B takes $\left(\frac{2}{6} \times 54\right)$ min. = 18 min.

63. To be 0.5 km apart, they take 1 hour.

To be 8.5 km apart, they take $\left(\frac{1}{0.5} \times 8.5\right)$ hrs = 17 hrs.

64. Since A and B move in the same direction along the circle, so they will first meet each other when there is a difference of one round between the two.
Relative speed of A and B = $(6 - 1) = 5$ rounds per hour.

Time taken to complete one round at this speed = $\frac{1}{5}$ hr = 12 min.

65. Suppose after x km from the start B catches up with A. Then, the difference in the time taken by A to cover x km and that taken by B to cover x km is 4 hours.

∴ $\frac{x}{4} - \frac{x}{10} = 4$ or $x = 26.7$ km.

66. Relative speed of the thief and p\
oliceman = $(11 - 10)$ km / hr = 1 km / hr.

Distance covered in 6 minutes = $\left(\frac{1}{60} \times 6\right)$ km = $\frac{1}{10}$ km = 100 m.

∴   Distance between the thief and policeman = $(200 - 100)$ m = 100 m.

67. Suppose the thief is overtaken x hrs after 2.30 p.m.
Then, distance covered by the thief in x hrs

= distance covered by the owner in $\left(x - \frac{1}{2}\right)$ hrs.

∴ $60x = 75\left(x - \frac{1}{2}\right)$ ⇔ $15x = \frac{75}{2}$ ⇔ $x = \frac{5}{2}$ hrs.

So, the thief is overtaken at 5 p.m.

68. Let the speed of the train be x m / sec. Then,
Distance travelled by the train in 10 min. = Distance travelled by sound in 30 sec.
⇔ $x \times 10 \times 60 = 330 \times 30$ ⇔ $x = 16.5$.

∴   Speed of the train = 16.5 m/sec = $\left(16.5 \times \frac{18}{5}\right)$ km/ hr = 59.4 km/ hr

69. To be $(18 + 20)$ km apart, they take 1 hour.

To be 47.5 km apart, they take $\left(\frac{1}{38} \times 47.5\right)$ hrs = $1\frac{1}{4}$ hrs.

70. Suppose they meet x hrs after 8 a.m. Then,
(Distance moved by first in x hrs) + [Distance moved by second in $(x - 1)$ hrs] = 330
∴ $60x + 75(x - 1) = 330$ ⇒ $x = 3$.
So, they meet at $(8 + 3)$, i.e. 11 a.m.

71. Clearly, the two will meet when they are 726 m apart.

To be $(4.5 + 3.75) = 8.25$ km apart, they take 1 hour.

To be 726 m apart, they take $\left(\dfrac{100}{825} \times \dfrac{726}{1000}\right)$ hrs $= \left(\dfrac{242}{2750} \times 60\right)$ min $= 5.28$ min.

72. Relative speed $= (2 + 3) = 5$ rounds per hour.

So, they cross each other 5 times in an hour and 2 times in half an hour.

Hence, they cross each other 7 times before 9.30 a.m.

73. Let their speeds be x kmph and y kmph respectively.

Then, $\dfrac{120}{x + y} = 1 \Rightarrow x + y = 120$ ...(i)

Now, when they move in same direction :

(Distance travelled by P in 6 hrs) – (Distance travelled by Q in 6 hrs) = 120 km

$\Rightarrow 6x - 6y = 120 \Rightarrow x - y = 20$ ...(ii)

Solving (i) and (ii), $x = 70$, $y = 50$.

$\therefore$ P's speed = 70 kmph.

74. In the same time, they cover 110 km and 90 km respectively.

$\therefore$ Ratio of their speeds = $110 : 90 = 11 : 9$.

75. At the time of meeting, let the distance travelled by the second train be x km.

Then, distance covered by the first train is $(x + 100)$ km.

$\therefore \dfrac{x}{40} = \dfrac{x + 100}{50} \Leftrightarrow 50x = 40x + 4000 \Leftrightarrow x = 400.$

So, distance between P and Q $= (x + x + 100)$ km $= 900$ km.

76. Suppose they meet x hours after 14.30 hrs.

Then, $60x = 80(x - 2)$ or $x = 8.$

$\therefore$ Required distance $= (60 \times 8)$ km $= 480$ km.

77. Let the distance between Meerut and Delhi be x km and let the trains meet y hours after 7 a.m.

Clearly, M covers x km in 4 hrs and N covers x km in $(7/2)$ hrs.

$\therefore$ Speed of M $= \dfrac{x}{4}$ kmph, Speed of N $= \dfrac{2x}{7}$ kmph.

Distance covered by M in $(y + 2)$ hrs + Distance covered in y hrs $= x.$

$\therefore \dfrac{x}{4}(y + 2) + \dfrac{2x}{7} \times y = x \Leftrightarrow \dfrac{(y + 2)}{4} + \dfrac{2y}{7} = 1$

$\Leftrightarrow y = \dfrac{14}{15}$ hrs $= \left(\dfrac{14}{15} \times 60\right)$ min. $= 56$ min.

Hence, the trains meet at 7.56 a.m.

78. Let the distance be x km. Then,

(Time taken to walk x km) + (Time taken to ride x km) $= \dfrac{23}{4}$ hrs.

$\Rightarrow$ (Time taken to walk $2x$ km) + (Time taken to ride $2x$ km) $= \dfrac{23}{2}$ hrs.

But, time taken to ride $2x$ km $= \dfrac{15}{4}$ hrs.

$\therefore$ Time taken to walk $2x$ km $= \left(\dfrac{23}{2} - \dfrac{15}{4}\right)$ hrs $= \dfrac{31}{4}$ hrs $= 7$ hrs 45 min.

EXERCISE 17B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (*Questions 1 to 7*) : *Each of the questions below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statements is/are sufficient to answer the question. Read both the statements and*

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question; and

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

1. How much time did X take to reach the destination ?
   I. The ratio between the speeds of X and Y is 3 : 4.
   II. Y takes 36 minutes to reach the same destination.

2. What is the usual speed of the train ?   (M.B.A. 2002)
   I. The speed of the train is increased by 25 km / hr to reach the destination 150 km away in time.
   II. The train is late by 30 minutes.

3. Two towns are connected by railway. Can you find the distance between them ?
   I. The speed of mail train is 12 km / hr more than that of an express train.
   II. A mail train takes 40 minutes less than an express train to cover the distance.
   (M.B.A. 2001)

4. The towns A, B and C are on a straight line. Town C is between A and B. The distance from A to B is 100 km. How far is A from C ?   (M.B.A. 2003)
   I. The distance from A to B is 25% more than the distance from C to B.
   II. The distance from A to C is $\frac{1}{4}$ of the distance from C to B.

5. What is the average speed of the car over the entire distance ?
   I. The car covers the whole distance in four equal stretches at speeds of 10 kmph, 20 kmph, 30 kmph and 60 kmph respectively.
   II. The total time taken is 36 minutes.

6. A car and a bus start from city A at the same time. How far is the city B from city A ?
   I. The car travelling at an average speed of 40 km / hr reaches city B at 4:35 p.m.
   II. The bus reaches city B at 6:15 p.m. at an average speed of 60 km / hr.

7. Two cars pass each other in opposite direction. How long would they take to be 500 km apart ?   (M.A.T. 1998)
   I. The sum of their speeds is 135 km / hr.
   II. The difference of their speeds is 25 km / hr.

ANSWERS

1. (e)   2. (e)   3. (d)   4. (c)   5. (a)   6. (e)   7. (a)

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SOLUTIONS

1. I. If Y takes 4 min., then X takes 3 min.

    II. If Y takes 36 min., then X takes $\left(\frac{3}{4} \times 36\right)$ min = 27 min.

    Thus, I and II together give the answer.

    ∴ Correct answer is (e).

2. Let the usual speed of the train be x kmph.

    Time taken to cover 150 km at usual speed = $\frac{150}{x}$ hrs.

    I. Time taken at increased speed = $\frac{150}{(x + 25)}$ hrs.

    II. $\frac{150}{x} - \frac{150}{(x + 25)} = \frac{30}{60}$

    ⇔ $\frac{1}{x} - \frac{1}{(x + 25)} = \frac{1}{300}$ ⇔ $[(x + 25) - x] \times 300 = x(x + 25)$

    ⇔ $x^2 + 25x - 7500 = 0$ ⇔ $(x + 100)(x - 75) = 0$ ⇔ $x = 75$.

    Thus, I and II together give the answer.

    ∴ Correct answer is (e).

3. Let the distance between the two stations be x km.

    I. Let the speed of the express train be y km/hr.

    Then, speed of the mail train = $(y + 12)$ km/hr.

    II. $\frac{x}{y} - \frac{x}{(y + 12)} = \frac{40}{60}$.

    Thus, even I and II together do not give x.

    ∴ Correct answer is (d).

4. Let AC = x km. Then, CB = $(100 - x)$ km.   A x C $(100 - x)$ B

    I. AB = 125% of CB

    ⇔ $100 = \frac{125}{100} \times (100 - x)$ ⇔ $100 - x = \frac{100 \times 100}{125} = 80$ ⇔ $x = 20$ km.

    ∴ AC = 20 km.

    Thus, I alone gives the answer.

    II. AC = $\frac{1}{4}$ CB   ⇔ $x = \frac{1}{4}(100 - x)$ ⇔ $5x = 100$ ⇔ $x = 20$.

    ∴ AC = 20 km.

    Thus, II alone gives the answer.

    ∴ Correct answer is (c).

5. Let the whole distance be $4x$ km.

    I. Total time taken = $\left(\frac{x}{10} + \frac{x}{20} + \frac{x}{30} + \frac{x}{60}\right) = \frac{(6x + 3x + 2x + x)}{60} = \frac{12x}{60} = \frac{x}{5}$.

    ∴ Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{4x}{(x/5)}$ kmph = 20 km/hr.

    ∴ I alone is sufficient to answer the question.

    II alone does not give the answer.

    ∴ Correct answer is (a).

6. Let AB = x km. From I and II, we get :

$$\frac{x}{40} - \frac{x}{60} = 1\frac{40}{60} \qquad [(6{:}15\ p.m.) - (4{:}35\ p.m.) = 1\ hr\ 40\ min]$$

$$\Leftrightarrow \quad \frac{x}{40} - \frac{x}{60} = \frac{100}{60}.\ \text{This gives } x.$$

∴ Correct answer is (e).

7. I gives, relative speed = 135 km / hr.

∴ Time taken = $\dfrac{500}{135}$ hrs.

II does not give the relative speed.

∴ I alone gives the answer and II is irrelevant.

∴ Correct answer is (a).

18. PROBLEMS ON TRAINS

IMPORTANT FACTS AND FORMULAE

1. a km/hr $= \left(a \times \dfrac{5}{18}\right)$ m/s.   2. a m/s $= \left(a \times \dfrac{18}{5}\right)$ km/hr.

3. Time taken by a train of length l metres to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover l metres.

4. Time taken by a train of length l metres to pass a stationary object of length b metres is the time taken by the train to cover $(l + b)$ metres.

5. Suppose two trains or two bodies are moving in the same direction at u m/s and v m/s, where $u > v$, then their relatives speed $= (u - v)$ m/s.

6. Suppose two trains or two bodies are moving in opposite directions at u m/s and v m/s, then their relative speed is $= (u + v)$ m/s.

7. If two trains of length a metres and b metres are moving in opposite directions at u m/s and v m/s, then time taken by the trains to cross each other $= \dfrac{(a + b)}{(u + v)}$ sec.

8. If two trains of length a metres and b metres are moving in the same direction at u m/s and v m/s, then the time taken by the faster train to cross the slower train $= \dfrac{(a + b)}{(u - v)}$ sec.

9. If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take a and b sec in reaching B and A respectively, then
(A's speed) : (B's speed) $= (\sqrt{b} : \sqrt{a})$.

SOLVED EXAMPLES

Ex. 1. *A train 100 m long is running at the speed of 30 km/hr. Find the time taken by it to pass a man standing near the railway line.* (S.S.C. 2001)

Sol. Speed of the train $= \left(30 \times \dfrac{5}{18}\right)$ m/sec $= \left(\dfrac{25}{3}\right)$ m/sec.

Distance moved in passing the standing man $= 100$ m.

Required time taken $= \dfrac{100}{\left(\dfrac{25}{3}\right)} = \left(100 \times \dfrac{3}{25}\right)$ sec $= 12$ sec.

Ex. 2. *A train is moving at a speed of 132 km/hr. If the length of the train is 110 metres, how long will it take to cross a railway platform 165 metres long?*
(Section Officers', 2003)

Sol. Speed of train $= \left(132 \times \dfrac{5}{18}\right)$ m/sec $= \left(\dfrac{110}{3}\right)$ m/sec.

Distance covered in passing the platform $= (110 + 165)$ m $= 275$ m.

∴ Time taken $= \left(275 \times \dfrac{3}{110}\right)$ sec $= \dfrac{15}{2}$ sec $= 7\dfrac{1}{2}$ sec.

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Ex. 3. *A man is standing on a railway bridge which is 180 m long. He finds that a train crosses the bridge in 20 seconds but himself in 8 seconds. Find the length of the train and its speed.*

Sol.   Let the length of the train be x metres.

Then, the train covers x metres in 8 seconds and $(x + 180)$ metres in 20 seconds.

∴ $\dfrac{x}{8} = \dfrac{x+180}{20}$ ⇔ $20x = 8(x+180)$ ⇔ $x = 120$.

∴   Length of the train = 120 m.

Speed of the train = $\left(\dfrac{120}{8}\right)$ m/sec = m/sec = $\left(15 \times \dfrac{18}{5}\right)$ kmph = 54 kmph.

Ex. 4. *A train 150 m long is running with a speed of 68 kmph. In what time will it pass a man who is running at 8 kmph in the same direction in which the train is going ?*

Sol.   Speed of the train relative to man = (68 − 8) kmph

$$= \left(60 \times \dfrac{5}{18}\right) \text{m/sec} = \left(\dfrac{50}{3}\right) \text{m/sec}.$$

Time taken by the train to cross the man

= Time taken by it to cover 150 m at $\left(\dfrac{50}{3}\right)$ m/sec = $\left(150 \times \dfrac{3}{50}\right)$ sec = 9 sec.

Ex. 5. *A train 220 m long is running with a speed of 59 kmph. In what time will it pass a man who is running at 7 kmph in the direction opposite to that in which the train is going ?*

Sol.   Speed of the train relative to man = (59 + 7) kmph

$$= \left(66 \times \dfrac{5}{18}\right) \text{m/sec} = \left(\dfrac{55}{3}\right) \text{m/sec}.$$

Time taken by the train to cross the man

= Time taken by it to cover 220 m at $\left(\dfrac{55}{3}\right)$ m/sec = $\left(220 \times \dfrac{3}{55}\right)$ sec = 12 sec.

Ex. 6. *Two trains 137 metres and 163 metres in length are running towards each other on parallel lines, one at the rate of 42 kmph and another at 48 kmph. In what time will they be clear of each other from the moment they meet ?*

Sol.   Relative speed of the trains = (42 + 48) kmph = 90 kmph

$$= \left(90 \times \dfrac{5}{18}\right) \text{m/sec} = 25 \text{m/sec}.$$

Time taken by the trains to pass each other

= Time taken to cover (137 + 163) m at 25 m/sec = $\left(\dfrac{300}{25}\right)$ sec = 12 seconds.

Ex. 7. *Two trains 100 metres and 120 metres long are running in the same direction with speeds of 72 km/hr and 54 km/hr. In how much time will the first train cross the second ?*   (C.B.I. 1997)

Sol.   Relative speed of the trains = (72 − 54) km/hr = 18 km/hr

$$= \left(18 \times \dfrac{5}{18}\right) \text{m/sec} = 5 \text{m/sec}.$$

Time taken by the trains to cross each other

= Time taken to cover (100 + 120) m at 5 m/sec = $\left(\dfrac{220}{5}\right)$ sec = 44 sec.

Ex. 8. *A train 100 metres long takes 6 seconds to cross a man walking at 5 kmph in a direction opposite to that of the train. Find the speed of the train.*

Sol.   Let the speed of the train be x kmph.

Speed of the train relative to man $= (x + 5)$ kmph $= (x + 5) \times \dfrac{5}{18}$ m/sec.

$\therefore \quad \dfrac{100}{(x + 5) \times \dfrac{5}{18}} = 6 \Leftrightarrow 30(x + 5) = 1800 \Leftrightarrow x = 55.$

$\therefore$ Speed of the train is 55 kmph.

Ex. 9. *A train running at 54 kmph takes 20 seconds to pass a platform. Next it takes 12 seconds to pass a man walking at 6 kmph in the same direction in which the train is going. Find the length of the train and the length of the platform.*

Sol.   Let the length of train be x metres and length of platform be y metres.

Speed of the train relative to man $= (54 - 6)$ kmph $= 48$ kmph

$= \left(48 \times \dfrac{5}{18} \right)$ m/sec $= \dfrac{40}{3}$ m/sec.

In passing a man, the train covers its own length with relative speed.

$\therefore$ Length of train = (Relative speed $\times$ Time) $= \left(\dfrac{40}{3} \times 12 \right)$ m $= 160$ m.

Also, speed of the train $= \left(54 \times \dfrac{5}{18} \right)$ m/sec $= 15$ m/sec.

$\therefore \quad \dfrac{x + y}{15} = 20 \Leftrightarrow x + y = 300 \Leftrightarrow y = (300 - 160)$ m $= 140$ m.

Ex. 10. *A man sitting in a train which is travelling at 50 kmph observes that a goods train, travelling in opposite direction, takes 9 seconds to pass him. If the goods train is 280 m long, find its speed.*

Sol.   Relative speed $= \left(\dfrac{280}{9} \right)$ m/sec $= \left(\dfrac{280}{9} \times \dfrac{18}{5} \right)$ kmph $= 112$ kmph.

$\therefore$ Speed of goods train $= (112 - 50)$ kmph $= 62$ kmph.

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EXERCISE 18A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark* (✓) *against the correct answer :*

1. A train moves with a speed of 108 kmph. Its speed in metres per second is :
   - (a) 10.8
   - (b) 18
   - (c) 30
   - (d) 38.8

2. A speed of 14 metres per second is the same as :
   - (a) 28 km/hr
   - (b) 46.6 km/hr
   - (c) 50.4 km/hr
   - (d) 70 km/hr

3. In what time will a train 100 metres long cross an electric pole, if its speed be 144 km/hr ?   (S.S.C. 2003)
   - (a) 2.5 seconds
   - (b) 4.25 seconds
   - (c) 5 seconds
   - (d) 12.5 seconds

4. A train 280 m long, running with a speed of 63 km/hr will pass a tree in :
   - (a) 15 sec
   - (b) 16 sec
   - (c) 18 sec
   - (d) 20 sec

   (S.S.C. 2003)

5. How long does a train 110 metres long running at the speed of 72 km/hr take to cross a bridge 132 metres in length ?   (R.R.B. 1998)
   - (a) 9.8 sec
   - (b) 12.1 sec
   - (c) 12.42 sec
   - (d) 14.3 sec

SUB#

6. A train 360 m long is running at a speed of 45 km/hr. In what time will it pass a bridge 140 m long ?   **(B.S.F. 2001)**
(a) 40 sec   (b) 42 sec   (c) 45 sec   (d) 48 sec

7. A train travelling at a speed of 75 mph enters a tunnel $3\frac{1}{2}$ miles long. The train is $\frac{1}{4}$ mile long. How long does it take for the train to pass through the tunnel from the moment the front enters to the moment the rear emerges ?
(a) 2.5 min   (b) 3 min   (c) 3.2 min   (d) 3.5 min

8. A train running at the speed of 60 km/hr crosses a pole in 9 seconds. What is the length of the train ?   **(Bank P.O. 2003)**
(a) 120 metres   (b) 180 metres   (c) 324 metres
(d) Cannot be determined   (e) None of these

9. A train 132 m long passes a telegraph pole in 6 seconds. Find the speed of the train.
(a) 70 km/hr   (b) 72 km/hr   (c) 79.2 km/hr   (d) 80 km/hr

10. A train covers a distance of 12 km in 10 minutes. If it takes 6 seconds to pass a telegraph post, then the length of the train is :   **(Bank P.O. 2000)**
(a) 90 m   (b) 100 m   (c) 120 m   (d) 140 m

11. A train 240 m long passed a pole in 24 seconds. How long will it take to pass a platform 650 m long ?   **(R.R.B. 1998)**
(a) 65 sec   (b) 89 sec   (c) 100 sec   (d) 150 sec

12. The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is :   **(Section Officers', 2001)**
(a) 200 m   (b) 225 m   (c) 245 m   (d) 250 m

13. A train 800 metres long is running at a speed of 78 km/hr. If it crosses a tunnel in 1 minute, then the length of the tunnel (in metres) is :   **(S.S.C. 2003)**
(a) 130   (b) 360   (c) 500   (d) 540

14. A goods train runs at the speed of 72 kmph and crosses a 250 m long platform in 26 seconds. What is the length of the goods train ?   **(Bank P.O. 2003)**
(a) 230 m   (b) 240 m   (c) 260 m   (d) 270 m

15. The length of a train and that of a platform are equal. If with a speed of 90 km/hr, the train crosses the platform in one minute, then the length of the train (in metres) is :
(a) 500   (b) 600   (c) 750   (d) 900

16. A train of length 150 metres takes 40.5 seconds to cross a tunnel of length 300 metres. What is the speed of the train in km/hr ?
(a) 13.33   (b) 26.67   (c) 40   (d) 66.67

17. A train crosses a platform 100 m long in 60 seconds at a speed of 45 km/hr. The time taken by the train to cross an electric pole is :
(a) 8 sec   (b) 52 sec   (c) 1 minute   (d) Data inadequate

18. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform ?   **(G.INDOMAT, 1997)**
(a) 120 m   (b) 240 m   (c) 300 m   (d) None of these

19. A 300 metre long train crosses a platform in 39 seconds while it crosses a signal pole in 18 seconds. What is the length of the platform ?
(a) 320 m   (b) 350 m   (c) 650 m
(d) Data inadequate   (e) None of these   **(Bank P.O. 2002)**

20. A train speeds past a pole in 15 seconds and a platform 100 m long in 25 seconds. Its length is :   **(R.R.B. 2003)**
(a) 50 m   (b) 150 m   (c) 200 m   (d) Data inadequate

21. A train moves past a telegraph post and a bridge 264 m long in 8 seconds and 20 seconds respectively. What is the speed of the train ? (S.S.C. 2004)
   (a) 69.5 km / hr　　(b) 70 km / hr　　(c) 79 km / hr　　(d) 79.2 km / hr

22. A train takes 18 seconds to pass completely through a station 162 m long and 15 seconds through another station 120 m long. The length of the train is :
   (a) 70 m　　(b) 80 m　　(c) 90 m　　(d) 100 m

23. How many seconds will a 500 metre long train take to cross a man walking with a speed of 3 km / hr in the direction of the moving train if the speed of the train is 63 km / hr ? (S.S.C. 2000)
   (a) 25　　(b) 30　　(c) 40　　(d) 45

24. A jogger running at 9 kmph alongside a railway track is 240 metres ahead of the engine of a 120 metre long train running at 45 kmph in the same direction. In how much time will the train pass the jogger ? (IGNOU, 2003)
   (a) 3.6 sec　　(b) 18 sec　　(c) 36 sec　　(d) 72 sec

25. A train 110 metres long is running with a speed of 60 kmph. In what time will it pass a man who is running at 6 kmph in the direction opposite to that in which the train is going ? (M.A.T. 2002)
   (a) 5 sec　　(b) 6 sec　　(c) 7 sec　　(d) 10 sec

26. Two trains 200 m and 150 m long are running on parallel rails at the rate of 40 kmph and 45 kmph respectively. In how much time will they cross each other, if they are running in the same direction ?
   (a) 72 sec　　(b) 132 sec　　(c) 192 sec　　(d) 252 sec

27. Two trains 140 m and 160 m long run at the speed of 60 km / hr and 40 km / hr respectively in opposite directions on parallel tracks. The time (in seconds) which they take to cross each other, is : (S.S.C. 2004)
   (a) 9　　(b) 9.6　　(c) 10　　(d) 10.8

28. Two trains are moving in opposite directions @ 60 km / hr and 90 km / hr. Their lengths are 1.10 km and 0.9 km respectively. The time taken by the slower train to cross the faster train in seconds is : (M.B.A. 2002)
   (a) 36　　(b) 45　　(c) 48　　(d) 49

29. A train 125 m long passes a man, running at 5 kmph in the same direction in which the train is going, in 10 seconds. The speed of the train is : (A.A.O. Exam, 2003)
   (a) 45 km / hr　　(b) 50 km / hr　　(c) 54 km / hr　　(d) 55 km / hr

30. A train 110 m long passes a man, running at 6 kmph in the direction opposite to that of the train, in 6 seconds. The speed of the train is :
   (a) 54 km / hr　　(b) 60 km / hr　　(c) 66 km / hr　　(d) 72 km / hr

31. Two goods train each 500 m long, are running in opposite directions on parallel tracks. Their speeds are 45 km / hr and 30 km / hr respectively. Find the time taken by the slower train to pass the driver of the faster one. (M.A.T. 2000)
   (a) 12 sec　　(b) 24 sec　　(c) 48 sec　　(d) 60 sec

32. Two trains of equal length are running on parallel lines in the same direction at 46 km / hr and 36 km / hr. The faster train passes the slower train in 36 seconds. The length of each train is : (M.A.T. 2003)
   (a) 50 m　　(b) 72 m　　(c) 80 m　　(d) 82 m

33. A 270 metres long train running at the speed of 120 kmph crosses another train running in opposite direction at the speed of 80 kmph in 9 seconds. What is the length of the other train ? (S.B.I.P.O. 1999)
   (a) 230 m　　(b) 240 m　　(c) 260 m
   (d) 320 m　　(e) None of these

34. Two trains are running in opposite directions with the same speed. If the length of each train is 120 metres and they cross each other in 12 seconds, then the speed of each train (in km / hr) is : (S.S.C. 2003)
   (a) 10　　(b) 18　　(c) 36　　(d) 72

35. Two trains of equal lengths take 10 seconds and 15 seconds respectively to cross a telegraph post. If the length of each train be 120 metres, in what time (in seconds) will they cross each other travelling in opposite direction ? (S.S.C. 2004)
    (a) 10   (b) 12   (c) 15   (d) 20

36. A train 108 m long moving at a speed of 50 km/hr crosses a train 112 m long coming from opposite direction in 6 seconds. The speed of the second train is
    (a) 48 km/hr   (b) 54 km/hr   (c) 66 km/hr   (d) 82 km/hr

37. A train X speeding with 120 kmph crosses another train Y, running in the same direction, in 2 minutes. If the lengths of the trains X and Y be 100 m and 200 m respectively, what is the speed of train Y ?
    (a) 111 km/hr   (b) 123 km/hr   (c) 127 km/hr   (d) 129 km/hr

38. Two trains travel in opposite directions at 36 kmph and 45 kmph and a man sitting in slower train passes the faster train in 8 seconds. The length of the faster train is :
    (a) 80 m   (b) 100 m   (c) 120 m   (d) 180 m

39. Two trains are running at 40 km/hr and 20 km/hr respectively in the same direction. Fast train completely passes a man sitting in the slower train in 5 seconds. What is the length of the fast train ?   (R.R.B. 2001)
    (a) 23 m   (b) $23\frac{2}{9}$ m   (c) 27 m   (d) $27\frac{7}{9}$ m

40. A train overtakes two persons who are walking in the same direction in which the train is going, at the rate of 2 kmph and 4 kmph and passes them completely in 9 and 10 seconds respectively. The length of the train is :
    (a) 45 m   (b) 50 m   (c) 54 m   (d) 72 m

41. A train overtakes two persons walking along a railway track. The first one walks at 4.5 km/hr. The other one walks at 5.4 km/hr. The train needs 8.4 and 8.5 seconds respectively to overtake them. What is the speed of the train if both the persons are walking in the same direction as the train ?
    (a) 66 km/hr   (b) 72 km/hr   (c) 78 km/hr   (d) 81 km/hr

42. Two trains, each 100 m long, moving in opposite directions, cross each other in 8 seconds. If one is moving twice as fast the other, then the speed of the faster train is :
    (a) 30 km/hr   (b) 45 km/hr   (c) 60 km/hr   (d) 75 km/hr
                                                                      (C.D.S. 2001)

43. A train 150 m long passes a km stone in 15 seconds and another train of the same length travelling in opposite direction in 8 seconds. The speed of the second train is :
    (a) 60 km/hr   (b) 66 km/hr   (c) 72 km/hr   (d) 99 km/hr

44. A train travelling at 48 kmph completely crosses another train having half its length and travelling in opposite direction at 42 kmph, in 12 seconds. It also passes a railway platform in 45 seconds. The length of the platform is
    (a) 400 m   (b) 450 m   (c) 560 m   (d) 600 m

45. Two trains running in opposite directions cross a man standing on the platform in 27 seconds and 17 seconds respectively and they cross each other in 23 seconds. The ratio of their speeds is :   (Hotel Management, 1997)
    (a) 1 : 3   (b) 3 : 2   (c) 3 : 4   (d) None of these

46. Two stations A and B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels towards B at 20 kmph. Another train starts from B at 8 a.m. and travels towards A at a speed of 25 kmph. At what time will they meet ?
    (a) 9 a.m.   (b) 10 a.m.   (c) 10.30 a.m.   (d) 11 a.m.

47. A train X starts from Meerut at 4 p.m. and reaches Ghaziabad at 5 p.m. while another train Y starts from Ghaziabad at 4 p.m. and reaches Meerut at 5.30 p.m. The two trains will cross each other at :
    (a) 4.36 p.m.   (b) 4.42 p.m.   (c) 4.48 p.m.   (d) 4.50 p.m.

48. Two trains, one from Howrah to Patna and the other from Patna to Howrah, start simultaneously. After they meet, the trains reach their destinations after 9 hours and 16 hours respectively. The ratio of their speeds is :   (R.R.B. 2001)

(a) 2 : 3   (b) 4 : 3   (c) 6 : 7   (d) 9 : 16

ANSWERS

1. (c)	2. (c)	3. (a)	4. (b)	5. (b)	6. (a)	7. (b)	8. (e)
9. (c)	10. (c)	11. (b)	12. (c)	13. (e)	14. (d)	15. (c)	16. (c)
17. (b)	18. (b)	19. (b)	20. (b)	21. (d)	22. (c)	23. (b)	24. (c)
25. (b)	26. (d)	27. (d)	28. (c)	29. (b)	30. (b)	31. (c)	32. (a)
33. (a)	34. (c)	35. (b)	36. (d)	37. (a)	38. (d)	39. (d)	40. (b)
41. (d)	42. (c)	43. (d)	44. (a)	45. (b)	46. (b)	47. (a)	48. (b)

SOLUTIONS

1. $108 \text{ kmph} = \left(108 \times \dfrac{5}{18}\right) \text{m/sec} = 30 \text{ m/sec}.$

2. $14 \text{ m/sec} = \left(14 \times \dfrac{18}{5}\right) \text{km/hr} = 50.4 \text{ km/hr}.$

3. $\text{Speed} = \left(144 \times \dfrac{5}{18}\right) \text{m/sec} = 40 \text{ m/sec}.$

   $\text{Time taken} = \left(\dfrac{100}{40}\right) \text{sec} = 2.5 \text{ sec}.$

4. $\text{Speed} = \left(63 \times \dfrac{5}{18}\right) \text{m/sec} = \dfrac{35}{2} \text{ m/sec}.$

   $\text{Time taken} = \left(280 \times \dfrac{2}{35}\right) \text{sec} = 16 \text{ sec}.$

5. $\text{Speed} = \left(72 \times \dfrac{5}{18}\right) \text{m/sec} = 20 \text{ m/sec}.$

   Total distance covered $= (110 + 132) \text{ m} = 242 \text{ m}.$

   ∴ Required time $= \left(\dfrac{242}{20}\right) \text{sec} = 12.1 \text{ sec}.$

6. $\text{Speed} = \left(45 \times \dfrac{5}{18}\right) \text{m/sec} = \dfrac{25}{2} \text{ m/sec}.$

   Total distance covered $= (360 + 140) \text{ m} = 500 \text{ m}.$

   ∴ Required time $= \left(500 \times \dfrac{2}{25}\right) \text{sec} = 40 \text{ sec}.$

7. Total distance covered $= \left(\dfrac{7}{2} + \dfrac{1}{4}\right) \text{miles} = \dfrac{15}{4} \text{ miles}.$

   ∴ Time taken $= \left(\dfrac{15}{4 \times 75}\right) \text{hrs} = \dfrac{1}{20} \text{ hrs} = \left(\dfrac{1}{20} \times 60\right) \text{min}. = 3 \text{ min}.$

18. Speed $= \left(54 \times \dfrac{5}{18}\right)$ m/sec $= 15$ m/sec.

Length of the train $= (15 \times 20)$ m $= 300$ m.

Let the length of the platform be x metres.

Then, $\dfrac{x + 300}{36} = 15 \iff x + 300 = 540 \iff x = 240$ m.

19. Speed $= \left(\dfrac{300}{18}\right)$ m/sec $= \dfrac{50}{3}$ m/sec.

Let the length of the platform be x metres.

Then, $\dfrac{x + 300}{39} = \dfrac{50}{3} \iff 3(x + 300) = 1950 \iff x = 350$ m.

20. Let the length of the train be x metres and its speed be y m/sec.

They, $\dfrac{x}{y} = 15 \implies y = \dfrac{x}{15}$.

$\therefore \quad \dfrac{x + 100}{25} = \dfrac{x}{15} \iff x = 150$ m.

21. Let the length of the train be x metres and its speed by y m/sec.

They, $\dfrac{x}{y} = 8 \implies x = 8y$

Now, $\dfrac{x + 264}{20} = y \iff 8y + 264 = 20y \iff y = 22$.

$\therefore \quad$ Speed $= 22$ m/sec $= \left(22 \times \dfrac{18}{5}\right)$ km/hr $= 79.2$ km/hr.

22. Let the length of the train be x metres.

$\therefore \quad \dfrac{x + 162}{18} = \dfrac{x + 120}{15} \iff 15(x + 162) = 18(x + 120) \iff x = 90$ m.

23. Speed of train relative to man $= (63 - 3)$ km/hr $= 60$ km/hr

$\qquad = \left(60 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{50}{3}$ m/sec.

$\therefore \quad$ Time taken to pass the man $= \left(500 \times \dfrac{3}{50}\right)$ sec $= 30$ sec.

24. Speed of train relative to jogger $= (45 - 9)$ km/hr $= 36$ km/hr

$\qquad = \left(36 \times \dfrac{5}{18}\right)$ m/sec $= 10$ m/sec.

Distance to be covered $= (240 + 120)$ m $= 360$ m.

$\therefore \quad$ Time taken $= \left(\dfrac{360}{10}\right)$ sec $= 36$ sec.

25. Speed of train relative to man $= (60 + 6)$ km/hr $= 66$ km/hr

$\qquad = \left(66 \times \dfrac{5}{18}\right)$ m/sec $= \left(\dfrac{55}{3}\right)$ m/sec.

$\therefore \quad$ Time taken to pass the man $= \left(110 \times \dfrac{3}{55}\right)$ sec $= 6$ sec.

26. Relative speed $= (45 - 40)$ kmph $= 5$ kmph $= \left(5 \times \dfrac{5}{18}\right)$ m/sec $= \left(\dfrac{25}{18}\right)$ m/sec.

SUB#

8. Speed = $\left(60 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{50}{3}\right)$ m/sec.

Length of the train = (Speed × Time) = $\left(\dfrac{50}{3} \times 9\right)$ m = 150 m.

9. Speed = $\left(\dfrac{132}{6}\right)$ m/sec = $\left(22 \times \dfrac{18}{5}\right)$ km/hr = 79.2 km/hr.

10. Speed = $\left(\dfrac{12}{10} \times 60\right)$ km/hr = $\left(72 \times \dfrac{5}{18}\right)$ m/sec = 20 m/sec.

Length of the train = (Speed × Time) = (20 × 6) m = 120 m.

11. Speed = $\left(\dfrac{240}{24}\right)$ m/sec = 10 m/sec.

∴   Required time = $\left(\dfrac{240 + 650}{10}\right)$ sec = 89 sec.

12. Speed = $\left(45 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{25}{2}\right)$ m/sec; Time = 30 sec.

Let the length of bridge be x metres.

Then, $\dfrac{130 + x}{30} = \dfrac{25}{2}$ ⇔ 2 (130 + x) = 750 ⇔ x = 245 m.

13. Speed = $\left(78 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{65}{3}\right)$ m/sec.

Time = 1 minute = 60 sec.

Let the length of the tunnel be x metres.

Then, $\dfrac{800 + x}{60} = \dfrac{65}{3}$ ↔ 3 (800 + x) = 3900 ↔ x = 500.

14. Speed = $\left(72 \times \dfrac{5}{18}\right)$ m/sec = 20 m/sec; Time = 26 sec.

Let the length of the train be x metres.

Then, $\dfrac{x + 250}{26} = 20$ ⇔ x + 250 = 520 ⇔ x = 270.

15. Speed = $\left(90 \times \dfrac{5}{18}\right)$ m/sec = 25 m/sec; Time = 1 min. = 60 sec.

Let the length of the train and that of the platform be x metres.

Then, $\dfrac{2x}{60} = 25$ ⇔ x = $\dfrac{25 \times 60}{2} = 750$.

16. Speed = $\left(\dfrac{150 + 300}{40.5}\right)$ m/sec = $\left(\dfrac{450}{40.5} \times \dfrac{18}{5}\right)$ km/hr = 40 km/hr.

17. Speed = $\left(45 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{25}{2}\right)$ m/sec.

Let the length of the train be x metres.

Then, $\dfrac{x + 100}{\left(\dfrac{25}{2}\right)} = 60$ or $x = 650$ m

∴   Time taken by the train to cross an electric pole = $\left(650 \times \dfrac{2}{25}\right)$ sec = 52 sec.

Total distance covered = Sum of lengths of trains = 350 m.

∴ Time taken = $\left(350 \times \dfrac{18}{25}\right)$ sec = 252 sec.

27. Relative speed = $(60 + 40)$ km/hr = $\left(100 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{250}{9}\right)$ m/sec.

Distance covered in crossing each other = $(140 + 160)$ m = 300 m

Required time = $\left(300 \times \dfrac{9}{250}\right)$ sec = $\dfrac{54}{5}$ sec = 10.8 sec.

28. Relative speed = $(60 + 90)$ km/hr

$= \left(150 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{125}{3}\right)$ m/sec.

Distance covered = $(1.10 + 0.9)$ km = 2 km = 2000 m.

Required time = $\left(2000 \times \dfrac{3}{125}\right)$ sec = 48 sec.

29. Speed of the train relative to man = $\left(\dfrac{125}{10}\right)$ m/sec = $\left(\dfrac{25}{2}\right)$ m/sec.

$= \left(\dfrac{25}{2} \times \dfrac{18}{5}\right)$ km/hr = 45 km/hr.

Let the speed of the train be x kmph. Then, relative speed = $(x - 5)$ kmph.

∴ $x - 5 = 45$ or $x = 50$ kmph.

30. Speed of the train relative to man

$= \left(\dfrac{110}{6}\right)$ m/sec = $\left(\dfrac{110}{6} \times \dfrac{18}{5}\right)$ km/hr = 66 km/hr.

Let the speed of the train be x kmph. Then, relative speed = $(x + 6)$ = kmph.

∴ $x + 6 = 66$ or $x = 60$ kmph.

31. Relative speed = $(45 + 30)$ km/hr = $\left(75 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{125}{6}\right)$ m/sec.

Distance covered = $(500 + 500)$ m = 1000 m.

Required time = $\left(1000 \times \dfrac{6}{125}\right)$ sec = 48 sec.

32. Let the length of each train be x metres.
Then, distance covered = $2x$ metres.

Relative speed = $(46 - 36)$ km/hr = $\left(10 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{25}{9}\right)$ m/sec.

∴ $\dfrac{2x}{36} = \dfrac{25}{9}$ ⟺ $2x = 100$ ⟺ $x = 50$.

33. Relative speed = $(120 + 80)$ km/hr = $\left(200 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{500}{9}\right)$ m/sec.

Let the length of the other train be x metres.

Then, $\dfrac{x + 270}{9} = \dfrac{500}{9}$ ⟺ $x + 270 = 500$ ⟺ $x = 230$.

34. Let the speed of each train be x m/sec.
Then, relative speed of the two trains = $2x$ m/sec.

So, $2x = \dfrac{(120 + 120)}{12} \Leftrightarrow 2x = 20 \Leftrightarrow x = 10.$

$\therefore$ Speed of each train = 10 m/sec = $\left(10 \times \dfrac{18}{5}\right)$ km/hr = 36 km/hr.

35. Speed of the first train = $\left(\dfrac{120}{10}\right)$ m/sec = 12 m/sec.

Speed of the second train = $\left(\dfrac{120}{15}\right)$ m/sec = 8 m/sec.

Relative speed = (12 + 8) = m/sec = 20 m/sec.

$\therefore$ Required time = $\dfrac{(120 + 120)}{20}$ sec = 12 sec.

36. Let the speed of the second train be x km/hr.

Relative speed = $(x + 50)$ km/hr = $\left[(x + 50) \times \dfrac{5}{18}\right]$ m/sec = $\left(\dfrac{250 + 5x}{18}\right)$ m/sec.

Distance covered = (108 + 112) = 220 m.

$\therefore$ $\dfrac{220}{\left(\dfrac{250 + 5x}{18}\right)} = 6 \Leftrightarrow 250 + 5x = 660 \Leftrightarrow x = 82$ km/hr.

37. Let the speed of train Y be x km/hr.
Speed of X relative to Y = $(120 - x)$ km/hr

$= \left[(120 - x) \times \dfrac{5}{18}\right]$ m/sec = $\left(\dfrac{600 - 5x}{18}\right)$ m/sec.

$\therefore$ $\dfrac{300}{\left(\dfrac{600 - 5x}{18}\right)} = 120 \Leftrightarrow 5400 = 120\,(600 - 5x) \Leftrightarrow x = 111.$

38. Relative speed = (36 + 45) km/hr = $\left(81 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{45}{2}\right)$ m/sec.

Length of train = $\left(\dfrac{45}{2} \times 8\right)$ m = 180 m.

39. Relative speed = (40 − 20) km/hr = $\left(20 \times \dfrac{5}{18}\right)$ m/sec = $\left(\dfrac{50}{9}\right)$ m/sec.

Length of faster train = $\left(\dfrac{50}{9} \times 5\right)$ m = $\dfrac{250}{9}$ m = $27\dfrac{7}{9}$ m.

40. 2 kmph = $\left(2 \times \dfrac{5}{18}\right)$ m/sec = $\dfrac{5}{9}$ m/see and 4 kmph = $\dfrac{10}{9}$ m/sec.

Let the length of the train be x metres and its speed be y m/sec.

Then, $\dfrac{x}{\left(y - \dfrac{5}{9}\right)} = 9$ and $\dfrac{x}{\left(y - \dfrac{10}{9}\right)} = 10.$

$\therefore$ $9y - 5 = x$ and $10\,(9y - 10) = 9x \Rightarrow 9y - x = 5$ and $90y - 9x = 100.$
On solving, we get : $x = 50$

$\therefore$ Length of the train is 50 m.

41. $4.5 \text{ km/hr} = \left(4.5 \times \dfrac{5}{18}\right) \text{m/sec} = \dfrac{5}{4} \text{m/sec} = 1.25 \text{ m/sec}$, and

$5.4 \text{ km/hr} = \left(5.4 \times \dfrac{5}{18}\right) \text{m/sec} = \dfrac{3}{2} \text{m/sec} = 1.5 \text{ m/sec}$.

Let the speed of the train be x m/sec.
Then, $(x - 1.25) \times 84 = (x - 1.5) \times 8.5$

$\Leftrightarrow 8.4x - 10.5 = 8.5x - 12.75 \Leftrightarrow 0.1x = 2.25 \Leftrightarrow x = 22.5$.

∴ Speed of the train $= \left(22.5 \times \dfrac{18}{5}\right) \text{km/hr} = 81 \text{ km/hr}$.

42. Let the speed of the slower train be x m/sec.
Then, speed of the faster train $= 2x$ m/sec.
Relative speed $= (x + 2x) \text{ m/sec} = 3x \text{ m/sec}$.

∴ $\dfrac{(100 + 100)}{8} = 3x \Leftrightarrow 24x = 200 \Leftrightarrow x = \dfrac{25}{3}$.

So, speed of the faster train $= \dfrac{50}{3} \text{m/sec} = \left(\dfrac{50}{3} \times \dfrac{18}{5}\right) \text{km/hr} = 60 \text{ km/hr}$.

43. Speed of first train $= \left(\dfrac{150}{15}\right) \text{m/sec} = 10 \text{ m/sec}$.

Let the speed of second train be x m/sec.
Relative speed $= (10 + x) \text{ m/sec}$.

∴ $\dfrac{300}{10 + x} = 8 \Leftrightarrow 300 = 80 + 8x \Leftrightarrow x = \dfrac{220}{8} = \dfrac{55}{2} \text{ m/sec}$.

So, speed of second train $= \left(\dfrac{55}{2} \times \dfrac{18}{5}\right) \text{kmph} = 99 \text{ kmph}$.

44. Let the length of the first train be x metres.

Then, the length of second train is $\left(\dfrac{x}{2}\right)$ metres.

Relative speed $= (48 + 42) \text{ kmph} = \left(90 \times \dfrac{5}{18}\right) \text{m/sec} = 25 \text{ m/sec}$.

∴ $\dfrac{\left(x + \dfrac{x}{2}\right)}{25} = 12$ or $\dfrac{3x}{2} = 300$ or $x = 200$.

∴ Length of first train $= 200$ m.
Let the length of platform be y metres.

Speed of the first train $= \left(48 \times \dfrac{5}{18}\right) \text{m/sec} = \dfrac{40}{3} \text{ m/sec}$.

∴ $(200 + y) \times \dfrac{3}{40} = 45 \Leftrightarrow 600 + 3y = 1800 \Leftrightarrow y = 400$ m.

45. Let the speeds of the two trains be x m/sec and y m/sec respectively. Then,
length of the first train $= 27x$ metres, and length of the second train $= 17y$ metres.

∴ $\dfrac{27x + 17y}{x + y} = 23 \Leftrightarrow 27x + 17y = 23x + 23y \Leftrightarrow 4x = 6y \Leftrightarrow \dfrac{x}{y} = \dfrac{3}{2}$.

46. Suppose they meet x hours after 7 a.m.
   Distance covered by A in x hours = 20x km.
   Distance covered by B in $(x - 1)$ hours = 25 $(x - 1)$ km.
   ∴ $20x + 25 (x - 1) = 110 \Leftrightarrow 45x = 135 \Leftrightarrow x = 3.$
   So, they meet at 10 a.m.

47. Suppose, the distance between Meerut and Ghaziabad is x km.
   Time taken by X to cover x km = 1 hour.
   Time taken by Y to cover x km = $\dfrac{3}{2}$ hours.
   ∴ Speed of X = x kmph, Speed of Y = $\left(\dfrac{2x}{3}\right)$ kmph.
   Let them meet y hours after 4 p.m. Then,
   $$xy + \frac{2xy}{3} = x \Leftrightarrow y\left(1 + \frac{2}{3}\right) = 1 \Leftrightarrow y = \frac{3}{5} \text{ hours} = \left(\frac{3}{5} \times 60\right) \text{ min} = 36 \text{ min}.$$
   So, the two trains meet at 4.36 p.m.

48. Let us name the trains as A and B. Then,
   (A's speed) : (B's speed) = $\sqrt{b} : \sqrt{a} = \sqrt{16} : \sqrt{9} = 4 : 3.$

EXERCISE 18B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. A train running at a certain speed crosses a stationary engine in 20 seconds. To find out the speed of the train, which of the following information is necessary ?
   (a) Only the length of the train
   (b) Only the length of the engine
   (c) Either the length of the train or the length of the engine
   (d) Both the length of the train and the length of the engine

2. A train running at a certain speed crosses another train running in the opposite direction in 4.8 seconds. To find out the speed of the first train, which of the following information P and Q is sufficient ?
   P : The length of the first train   Q : The length of the second train
   (a) Only P is sufficient   (b) Only Q is sufficient
   (c) Either P or Q is sufficient   (d) Both P and Q are needed
   (e) Both P and Q are not sufficient

Directions (*Questions 3 to 12*) : *Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and*

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

3. A train crosses a signal post in x seconds. What is the length of the train ?
   I. The train crosses a platform of 100 metres in y seconds.
   II. The train is running at the speed of 80 km/hr.   (NABARD, 2002)

4. What was the speed of the running train ?   (Bank P.O. 2000)
   I. Length of the train was 120 metres.
   II. The train crossed the other stationary train whose length was 180 m in 4 seconds.

5. What is the speed of a running train which takes 9 seconds to cross a signal post ?
   I. The length of the train is 90 metres.
   II. The train takes 27 seconds to cross a platform of 180 metres. (Bank P.O. 1999)

6. What is the length of a running train ?   (S.B.I.P.O. 1998)
   I. The train crosses a man in 9 seconds.
   II. The train crosses a 240 metre long platform in 24 seconds.

7. What is the speed of the train ?   (Bank P.O. 2003)
   I. 280 metres long train crosses a signal pole in 18 seconds.
   II. 280 metres long train crosses a platform in 45 seconds.

8. What was the speed of a running train X ?
   I. The relative speed of train X and another train Y running in opposite direction is 160 kmph.
   II. The train Y crosses a signal post in 9 seconds.

9. What was the length of a running train crossing another 180 metre long train running in the opposite direction ?   (Bank P.O. 1998)
   I. The relative speed of the two trains was 150 kmph.
   II. The trains took 9 seconds to cross each other.

10. A train crosses another train running in the opposite direction in x seconds. What is the speed of the train ?   (S.B.I.P.O. 2003)
    I. Both the trains have the same length and are running at the same speed.
    II. One train crosses a pole in 5 seconds.

11. A train crosses a pole in 10 seconds. What is the length of the train ?
    I. The train crosses another train running in opposite direction with a speed of 80 km/hr in 22 seconds.
    II. The speed of the train is 108 km/hr.   (Bank P.O. 2003)

12. What is the speed of the train whose length is 210 metres ?   (Bank P.O. 2003)
    I. The train crosses another train of 300 metres length running in opposite direction in 10 seconds.
    II. The train crosses another train running in the same direction at the speed of 60 km/hr in 30 seconds.

Directions (Questions 13 to 17) : Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the question.

13. What is the speed of the train ?   (S.B.I.P.O. 2002)
    I. The train crosses a tree in 13 seconds.
    II. The train crosses a platform of length 250 metres in 27 seconds.
    III. The train crosses another train running in the same direction in 32 seconds.
    (a) I and II only   (b) II and III only   (c) I and III only
    (d) Any two of the three   (e) None of these

14. What is the speed of the train ?   (M.B.A. 2002)
    I. The train crosses 300 metres long platform in 21 seconds.
    II. The train crosses another stationary train of equal length in $19\frac{1}{2}$ seconds.
    III. The train crosses a signal pole in $9\frac{3}{4}$ seconds.
    (a) I and II only   (b) I and either II or III only
    (c) II and either I or II only   (d) III and either I or II only
    (e) None of these   (Bank P.O. 2003)

15. What is the speed of the train ?
    I. The train crosses a signal pole in 18 seconds.
    II. The train crosses a platform of equal length in 36 seconds.
    III. Length of the train is 330 metres.
    (a) I and II only   (b) II and III only   (c) I and III only
    (d) III and either I or II only   (e) Any two of the three

16. What is the length of the train X ?
    I. Train X crosses a telegraph post in 20 seconds.
    II. Train X crosses a platform of length 800 m in 100 seconds.
    III. Train X passes through a tunnel 400 m long in 60 seconds.
    (a) I and either II or III only   (b) II and III only
    (c) II and either I or III only   (d) III and either I or II only
    (e) Any two of the three

17. What is the speed of the train ?
    I. The train passes a man walking at the rate of 3 kmph in 9 seconds.
    II. The train passes a man walking at the rate of 6 kmph in 10 seconds.
    III. The train is moving in the same direction in which the two men are moving.
    (a) I and III only   (b) II and III only
    (c) I and II only   (d) All I, II and III
    (e) Question cannot be answered even with information in all the three statements.

Directions (*Questions 18 to 20*) : *Each of these questions is followed by three statements. You have to study the question and all the three statements given to decide whether any information provided in the statement(s) is redundant and can be dispensed with while answering the given question.*

18. How much time will the train A take to cross another train B running in opposite direction ?
    I. Train A crosses a signal pole in 6 seconds.
    II. Ratio of the speeds of trains A and B is 3 : 2.
    III. Length of the two trains together is 500 metres.
    (a) I only   (b) II only
    (c) III only   (d) I or II only
    (e) Question cannot be answered even with the information in all the three statements.

19. What is the length of a running train P crossing another running train Q ?
    I. These two trains take 18 seconds to cross each other.
    II. These trains are running in opposite directions.
    III. The length of train Q is 180 metres.   (S.B.I.P.O. 1997)
    (a) I only   (b) II only
    (c) III only   (d) All I, II and III are required
    (e) Even with I, II and III, the answer cannot be obtained.

20. At what time will the train reach city X from city Y ?   (S.B.I.P.O. 1999)
    I. The train crosses another train of equal length of 200 metres and running in opposite direction in 15 seconds.
    II. The train leaves city Y at 7.15 a.m. for city X situated at a distance of 558 km.
    III. The 200 metres long train crosses a signal pole in 10 seconds.
    (a) I only   (b) II only   (c) III only
    (d) I or III only   (e) All I, II and III are required.

ANSWERS

1. (d)	2. (e)	3. (c)	4. (e)	5. (a)	6. (e)	7. (a)	8. (d)
9. (e)	10. (d)	11. (b)	12. (e)	13. (a)	14. (b)	15. (d)	16. (e)
17. (d)	18. (e)	19. (e)	20. (a)				

SOLUTIONS

1. Time taken by the train to cross a stationary engine

$$= \frac{\text{(Length of train + Length of engine)}}{\text{(Speed of the train)}}$$

$$\Rightarrow \frac{\text{(Length of train + Length of engine)}}{\text{(Speed of the train)}} = 20 \text{ (given)}$$

Hence, to find the speed of the train, the length of the train and the length of the engine both must be known.

∴ The correct answer is (d).

2. Let two trains of lengths a and b metres be moving in opposite directions at u m/s and v m/s.

Time taken by the trains to cross each other $= \dfrac{(a+b)}{(u+v)}$ sec.

$$\therefore \frac{a+b}{u+v} = 4.8.$$

In order to find u, we must know a, b and v,
i.e., length of first train, length of second train and the speed of the second train.
Thus, P and Q are not sufficient.

∴ The correct answer is (e).

3. Let the length of the train be a metres.

Time taken to cross a singal post $= \dfrac{\text{Length of the train}}{\text{Speed of the train}} \Rightarrow x = \dfrac{l}{\text{Speed.}}$ ...(i)

Time taken to cross the platform $= \dfrac{(l+100)}{\text{Speed}} \Rightarrow y = \dfrac{l+100}{\text{Speed}}$ ...(ii)

Thus, from (i) and (ii), we can find l.

Also, II gives, speed $= \left(80 \times \dfrac{5}{18}\right)$ m/s $= \dfrac{200}{9}$ m/s.

Thus, the data in I or II alone are sufficient to answer the question.

∴ The correct answer is (c).

4. Speed of the first train = $\dfrac{\text{(sum of the lengths of the two trains)}}{\text{Time taken}}$

$= \dfrac{(120 + 180)}{4}$ m/s = 75 m/s.

So, both the statements are necessary to get the answer.
∴ The correct answer is (e).

5. Speed of the train = $\dfrac{\text{Length of the train}}{\text{Time taken to cross the post}} = \dfrac{90}{9}$ m/s = 10 m/s.

Thus, I alone gives the answer.

Time taken to cross a platform = $\dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

→ Speed = $\dfrac{(l + 180)}{27}$

But, l is not given. So, speed cannot be obtained.
So, II alone does not give the answer.
∴ The correct answer is (a).

6. Time taken by train to cross a man = $\dfrac{\text{Length of train}}{\text{Speed of train}}$ ⇒ Speed = $\dfrac{l}{9}$ ...(i)

Time taken by train to cross a platform = $\dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

⇒ Speed = $\dfrac{l + 240}{24}$ ...(ii)

From (i) and (ii), we get $\dfrac{l}{9} = \dfrac{l + 240}{24}$.

Thus, l can be obtained. So both I and II are necessary to get the answer.
∴ The correct answer is (e).

7. Speed = $\dfrac{\text{Length of the train}}{\text{Time taken to cross the pole}} = \dfrac{280}{18}$ m/s = $\dfrac{140}{9}$ m/s.

∴ I alone gives the answer.

Time taken to cross the platform = $\dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

→ Speed = $\dfrac{(280 + p)}{45}$ m/s.

But, p = length of platform, is not given.
∴ II is not sufficient to give the answer.
∴ The correct answer is (a).

8. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s. Then,
I gives, $u + v = 160$.

II gives, $v = \dfrac{b}{9}$.

From these equations, we cannot obtain u.
∴ The correct answer is (d).

9. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s.

Time taken to cross each other $= \dfrac{(a+b)}{(u+v)}$ sec.

Now, $b = 180$, $u + v = \left(150 \times \dfrac{5}{18}\right)$ m/sec $= \dfrac{125}{3}$ m/sec.

$\Rightarrow 9 = \dfrac{a+180}{(125/3)} \Rightarrow a = (375 - 180) = 195$ m.

Thus, both I and II are necessary to get the answer.

∴ The correct answer is (e).

10. Let the two trains of length a metres and b metres be moving in opposite directions at u m/s and v m/s.

Time taken to cross each other $= \dfrac{(a+b)}{(u+v)}$ m/sec. $\Rightarrow x = \dfrac{(a+a)}{(u+u)} = \dfrac{a}{u}$.   ...(i)

Time taken to cross the pole $= \dfrac{\text{Length of the train}}{\text{Speed of the train}} = \dfrac{a}{u} \Rightarrow \dfrac{a}{u} = 5$ ...(ii)

From (i) and (ii) also, we cannot find u.

∴ The correct answer is (d).

11. Time taken to cross a pole $= \dfrac{\text{Length of train}}{\text{Speed of train}} \Rightarrow 10 = \dfrac{\text{Length of train}}{\left(108 \times \dfrac{5}{18}\right)}$

$\Rightarrow$ Length of the train $= 300$ m.

Clearly, II is sufficient to get the answer.

Also, I is not sufficient to get the answer.

∴ The correct answer is (b).

12. Time taken to cross the train, running in opposite directions $= \dfrac{(l_1 + l_2)}{(u+v)}$ sec.

$\Rightarrow 10 = \dfrac{(210 + 300)}{(u+v)} \Rightarrow u + v = 51$.

Time taken to cross the train, running in same direction $= \dfrac{(l_1 + l_2)}{(u-v)}$ sec.

$\Rightarrow 30 = \dfrac{(210 + 300)}{\left(u - 60 \times \dfrac{5}{18}\right)} \Rightarrow u = \left(17 + \dfrac{50}{3}\right)$ m/sec.

Thus, u and v can be obtained.

∴ Correct answer is (e).

13. Let the speed of the train be x metres/sec.

Time taken to cross a tree $= \dfrac{\text{Length of the train}}{\text{Speed of the train}}$

Time taken to cross a platform $= \dfrac{(\text{Length of train} + \text{Length of platform})}{\text{Speed of the train}}$ ...(ii)

I gives, $13 = \dfrac{l}{x} \Rightarrow 13x$

II gives $27 = \dfrac{l + 250}{x} \Rightarrow \dfrac{13x + 250}{x} = 24 \Rightarrow x = \dfrac{125}{7}$ m/sec.

Thus I and II give the speed of the train.

∴ The correct answer is (a)

14. Let the speed of the train be x m/sec.

Time taken to cross a platform $= \dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

Time taken by the train to cross a stationary train

$= \dfrac{\text{(Sum of the lengths of the trains)}}{\text{Speed of moving train}}$

Time taken to cross a signal pole $= \dfrac{\text{Length of train}}{\text{Speed of train}}$

I gives, $21 = \dfrac{(l + 300)}{x}$; II gives, $\dfrac{39}{2} = \dfrac{2l}{x}$; III gives, $\dfrac{39}{4} = \dfrac{l}{x}$.

Thus, (I and II) or (I and III) give x.

∴ Correct answer is (b).

15. Let the speed of the train be x m/sec.

Time taken to cross a signal pole $= \dfrac{\text{Length of train}}{\text{Speed of train}}$.

Time taken to cross a platform $= \dfrac{\text{(Length of train + Length of platform)}}{\text{Speed of the train}}$

Length of train = 330 m.

I and III give, $18 = \dfrac{330}{x} \Rightarrow x = \dfrac{330}{18}$ m/s $= \dfrac{55}{3}$ m/s.

II and III give, $36 = \dfrac{2 \times 330}{x} \Rightarrow x = \dfrac{660}{36}$ m/s $= \dfrac{55}{3}$ m/s.

∴ Correct answer is (d).

16. Time taken to cross a pole $= \dfrac{\text{Length of train}}{\text{Its speed}} \Rightarrow 20 = \dfrac{l}{\text{speed}} \Rightarrow \text{speed} = \dfrac{l}{20}$ ...(i)

Time taken to cross a platform $= \dfrac{(l + 800)}{\text{speed}}$

$\Rightarrow 100 = \dfrac{(l + 800)}{\text{speed}} \Rightarrow \text{speed} = \dfrac{(l + 800)}{100}$ ...(ii)

Time taken to pass through a tunnel $= \dfrac{(l + 400)}{60}$

$\Rightarrow 60 = \dfrac{(l + 400)}{\text{speed}} \Rightarrow \text{speed} = \dfrac{(l + 400)}{60}$ ...(iii)

Equating any two out of three will give us l.

∴ Correct answer is (e).

17. Let the speed of the train be x m/sec.

III gives that the men are moving in the same direction.

I gives, time taken to pass a man $= \dfrac{l}{\left(x - 3 \times \dfrac{5}{18}\right)} = \left(\dfrac{6l}{6x - 5}\right)$ sec.

∴ $\dfrac{6l}{6x - 5} = 9 \Rightarrow 54x - 6l = 45 \Rightarrow 18x - 2l = 15$ ...(

II gives, time taken to pass another man $= \dfrac{l}{\left(x - 6 \times \dfrac{5}{18}\right)}$ sec $= \dfrac{3l}{(3x - 5)}$ sec.

$\therefore \quad \dfrac{3l}{(3x - 5)} = 10 \implies 30x - 3l = 50$ ...(ii)

On solving (i) and (ii), we get : $x = \dfrac{55}{6}$ m/sec.

Thus, all I, II, III are needed to get the answer.

$\therefore$ (d) is correct.

18. II. Let the speeds of A and B be $3x$ m/sec and $2x$ m/sec.

I. Length of train A $= (3x \times 6)$ m $= 18x$ metres.

III. Length of train B $= (500 - 18x)$ m.

Relative speed $= (3x + 2x)$ m/sec $= 5x$ m/sec.

Time taken by A to cross B $= \dfrac{\text{Sum of their lengths}}{\text{Relative speed}} = \dfrac{500}{5x}$ sec.

Thus, even with the information in all the three statements, question cannot be answered.

$\therefore$ Correct answer is (e).

19. Let the length of train P be x metres.

II. These trains are running in opposite directions.

III. Length of train Q is 180 m.

I. Time taken by P to cross Q $= \dfrac{(180 + x)}{\text{Relative speed}} \implies 18 = \dfrac{(180 + x)}{\text{Relative speed}}$

Thus, even with I, II and III, the answer cannot be obtained.

$\therefore$ Correct answer is (e).

20. III gives, speed $= \dfrac{200}{10}$ m/s $= 20$ m/s $= \left(20 \times \dfrac{18}{5}\right)$ km/hr $= 72$ km/hr.

II gives, time taken $= \left(\dfrac{558}{72}\right)$ hrs $= \dfrac{31}{4}$ hrs $= 7\dfrac{3}{4}$ hrs $= 7$ hrs 45 min.

So, the train will reach city X at 3 p.m.

Hence, I is redundant.

19. BOATS AND STREAMS

IMPORTANT FACTS AND FORMULAE

1. In water, the direction along the stream is called *downstream*. And, the direction against the stream is called *upstream*.

2. If the speed of a boat in still water is u km/hr and the speed of the stream is v km/hr, then :

$$\textit{Speed downstream} = (u + v) \text{ km/hr}$$

$$\textit{Speed upstream} = (u - v) \text{ km/hr}.$$

3. If the speed downstream is a km/hr and the speed upstream is b km/hr, then :

$$\textit{Speed in still water} = \frac{1}{2}(a + b) \text{ km/hr}$$

$$\textit{Rate of stream} = \frac{1}{2}(a - b) \text{ km/hr}$$

SOLVED EXAMPLES

Ex. 1. *A man can row upstream at 7 kmph and downstream at 10 kmph. Find man's rate in still water and the rate of current.*

Sol.   Rate in still water = $\frac{1}{2}(10 + 7)$ km/hr = 8.5 km/hr.

Rate of current = $\frac{1}{2}(10 - 7)$ km/hr = 1.5 km/hr.

Ex. 2. *A man takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2 hours 30 minutes to cover a distance of 5 km upstream. Find the speed of the river current in km/hr.*

Sol.   Rate downstream = $\left(\dfrac{15}{3\frac{3}{4}}\right)$ km/hr = $\left(15 \times \dfrac{4}{15}\right)$ km/hr = 4 km/hr.

Rate upstream = $\left(\dfrac{5}{2\frac{1}{2}}\right)$ km/hr = $\left(5 \times \dfrac{2}{5}\right)$ km/hr = 2 km/hr.

∴   Speed of current = $\frac{1}{2}(4 - 2)$ km/hr = 1 km/hr.

Ex. 3. *A man can row 18 kmph in still water. It takes him thrice as long to row up as to row down the river. Find the rate of stream.*

Sol.   Let man's rate upstream be x kmph. Then, his rate downstream = $3x$ kmph.

∴   Rate in still water = $\frac{1}{2}(3x + x)$ kmph = $2x$ kmph.

So, $2x = 18$ or $x = 9$.

∴   Rate upstream = 9 km/hr, Rate downstream = 27 km/hr.

Hence, rate of stream = $\frac{1}{2}(27 - 9)$ km/hr = 9 km/hr.

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Ex. 4. *There is a road beside a river. Two friends started from a place A, moved to a temple situated at another place B and then returned to A again. One of them moves on a cycle at a speed of 12 km/hr, while the other sails on a boat at a speed of 10 km/hr. If the river flows at the speed of 4 km/hr, which of the two friends will return to place A first ?*   (R.R.B. 2001)

Sol.   Clearly, the cyclist moves both ways at a speed of 12 km/hr.

So, average speed of the cyclist = 12 km/hr.

The boat sailor moves downstream @ (10 + 4) *i.e.*, 14 km/hr and upstream @ (10 − 4) *i.e.*, 6 km/hr.

So, average speed of the boat sailor $= \left(\dfrac{2 \times 14 \times 6}{14 + 6} \right)$ km/hr

$= \dfrac{42}{5}$ km/hr = 8.4 km/hr.

Since the average speed of the cyclist is greater, he will return to A first.

Ex. 5. *A man can row $7\frac{1}{2}$ kmph in still water. If in a river running at 1.5 km an hour, it takes him 50 minutes to row to a place and back, how far off is the place ?*   (R.R.B. 2002)

Sol.   Speed downstream = (7.5 + 1.5) kmph = 9 kmph;

Speed upstream = (7.5 − 1.5) kmph = 6 kmph.

Let the required distance be x km. Then,

$\dfrac{x}{9} + \dfrac{x}{6} = \dfrac{50}{60} \Leftrightarrow 2x + 3x = \left(\dfrac{5}{6} \times 18 \right) \Leftrightarrow 5x = 15 \Leftrightarrow x = 3.$

Hence, the required distance is 3 km.

Ex. 6. *In a stream running at 2 kmph, a motorboat goes 6 km upstream and back again to the starting point in 33 minutes. Find the speed of the motorboat in still water.*

Sol.   Let the speed of the motorboat in still water be x kmph. Then,

Speed downstream = $(x + 2)$ kmph; Speed upstream = $(x − 2)$ kmph.

$\therefore \quad \dfrac{6}{x+2} + \dfrac{6}{x-2} = \dfrac{33}{60} \Leftrightarrow 11x^2 - 240x - 44 = 0 \Leftrightarrow 11x^2 - 242x + 2x - 44 = 0$

$\Leftrightarrow (x - 22)(11x + 2) = 0 \Leftrightarrow x = 22.$

Hence, speed of motorboat in still water = 22 kmph.

Ex. 7. *A man can row 40 km upstream and 55 km downstream in 13 hours. Also, he can row 30 km upstream and 44 km downstream in 10 hours. Find the speed of the man in still water and the speed of the current.*

Sol.   Let rate upstream = x km/hr and rate downstream = y km/hr.

Then, $\dfrac{40}{x} + \dfrac{55}{y} = 13$ ...(i)   and $\dfrac{30}{x} + \dfrac{44}{y} = 10$ ...(ii)

Multiplying (ii) by 4 and (i) by 3 and subtracting, we get : $\dfrac{11}{y} = 1$ or $y = 11$.

Substituting $y = 11$ in (i), we get : $x = 5$.

$\therefore$ Rate in still water $= \dfrac{1}{2}(11 + 5)$ kmph = 8 kmph.

Rate of current $= \dfrac{1}{2}(11 - 5)$ kmph = 3 kmph.

EXERCISE 19A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer :*

1. In one hour, a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water (in km / hr) is : (S.S.C. 2000)

   (a) 3   (b) 5   (c) 8   (d) 9

2. A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is :

   (a) 2.5 km / hr   (b) 4.2 km / hr   (c) 5 km / hr   (d) 10.5 km / hr

3. A man rows downstream 32 km and 14 km upstream. If he takes 6 hours to cover each distance, then the velocity (in kmph) of the current is :

   (a) $\frac{1}{2}$ (b) 1   (c) $1\frac{1}{2}$ (d) 2

4. A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed of the boat in still water ? (S.B.I.P.O. 2002)

   (a) 4 km / hr   (b) 6 km / hr   (c) 8 km / hr   (d) Data inadequate

5. A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water ?

   (a) 40 minutes   (b) 1 hour   (c) 1 hr 15 min   (d) 1 hr 30 min

   (R.R.B. 2002)

6. A man can row three-quarters of a kilometre against the stream in $11\frac{1}{4}$ minutes. The speed (in km / hr) of the man in still water is : (L.I.C.A.A.O. 2003)

   (a) 2   (b) 3   (c) 4   (d) 5

7. A man takes twice as long to row a distance against the stream as to row the same distance in favour of the stream. The ratio of the speed of the boat (in still water) and the stream is : (S.S.C. 1998)

   (a) 2 : 1   (b) 3 : 1   (c) 3 : 2   (d) 4 : 3

8. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively ?

   (a) 2 : 1   (b) 3 : 2   (c) 8 : 3

   (d) Cannot be determined   (e) None of these   (Bank P.O. 2003)

9. If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3 kmph, then the speed of the boat in still water is :

   (a) 4.2 km / hr   (b) 9 km / hr   (c) 13 km / hr   (d) 21 km / hr

10. A man's speed with the current is 15 km / hr and the speed of the current is 2.5 km / hr. The man's speed against the current is : (M.A.T. 1997)

    (a) 8.5 km / hr   (b) 9 km / hr   (c) 10 km / hr   (d) 12.5 km / hr

11. If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is :

    (a) 4.25 kmph   (b) 6 kmph   (c) 6.5 kmph   (d) 8.5 kmph

12. A boat can travel with a speed of 13 km / hr in still water. If the speed of the stream is 4 km / hr, find the time taken by the boat to go 68 km downstream. (R.R.B. 2003)

    (a) 2 hours   (b) 3 hours   (c) 4 hours   (d) 5 hours

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13. Speed of a boat in standing water is 9 kmph and the speed of the stream is 1.5 kmph. A man rows to a place at a distance of 105 km and comes back to the starting point. The total time taken by him is :

(a) 16 hours   (b) 18 hours   (c) 20 hours   (d) 24 hours

14. The speed of a boat in still water is 15 km/hr and the rate of current is 3 km/hr. The distance travelled downstream in 12 minutes is :

(a) 1.2 km   (b) 1.8 km   (c) 2.4 km   (d) 3.6 km

15. A man can row at 5 kmph in still water. If the velocity of current is 1 kmph and it takes him 1 hour to row to a place and come back, how far is the place ?

(a) 2.4 km   (b) 2.5 km   (c) 3 km   (d) 3.6 km

                                                                     (S.S.C. 2004)

16. A boat takes 19 hours for travelling downstream from point A to point B and coming back to a point C midway between A and B. If the velocity of the stream is 4 kmph and the speed of the boat in still water is 14 kmph, what is the distance between A and B ?

(a) 160 km   (b) 180 km   (c) 200 km   (d) 220 km

17. A man can row $9\frac{1}{3}$ kmph in still water and finds that it takes him thrice as much time to row up than as to row down the same distance in the river. The speed of the current is :

(a) $3\frac{1}{3}$ km/hr   (b) $3\frac{1}{9}$ km/hr   (c) $4\frac{2}{3}$ km/hr   (d) $4\frac{1}{2}$ km/hr

18. A boat covers a certain distance downstream in 1 hour, while it comes back in $1\frac{1}{2}$ hours. If the speed of the stream be 3 kmph, what is the speed of the boat in still water ?

                                                                     (Bank P.O. 2003)

(a) 12 kmph   (b) 13 kmph   (c) 14 kmph

(d) 15 kmph   (e) None of these

19. A motorboat, whose speed is 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. The speed of the stream (in km/hr) is :

(a) 4   (b) 5   (c) 6   (d) 10

                                                                     (R.R.B. 2002)

20. The speed of a boat in still water is 10 km/hr. If it can travel 26 km downstream and 14 km upstream in the same time, the speed of the stream is :

(a) 2 km/hr   (b) 2.5 km/hr   (c) 3 km/hr   (d) 4 km/hr

21. A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed of the stream is :

                                                                    (M.A.T. 1997)

(a) 2 mph   (b) 2.5 mph   (c) 3 mph   (d) 4 mph

22. A man rows to a place 48 km distant and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. The rate of the stream is :

(a) 1 km/hr   (b) 1.5 km/hr   (c) 1.8 km/hr   (d) 3.5 km/hr

23. A boat covers 24 km upstream and 36 km downstream in 6 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours. The velocity of the current is :

(a) 1 km/hr   (b) 1.5 km/hr   (c) 2 km/hr   (d) 2.5 km/hr

24. At his usual rowing rate, Rahul can travel 12 miles downstream in a certain river in 6 hours less than it takes him to travel the same distance upstream. But if he could double his usual rowing rate for his 24-mile round trip, the downstream 12 miles would then take only one hour less than the upstream 12 miles. What is the speed of the current in miles per hour? (M.A.T. 2001)

(a) $1\frac{1}{3}$ (b) $1\frac{2}{3}$ (c) $2\frac{1}{3}$ (d) $2\frac{2}{3}$

ANSWERS

1. (c)	2. (a)	3. (c)	4. (b)	5. (c)	6. (d)	7. (b)	8. (c)
9. (c)	10. (c)	11. (c)	12. (e)	13. (d)	14. (d)	15. (a)	16. (b)
17. (e)	18. (d)	19. (b)	20. (e)	21. (a)	22. (a)	23. (c)	24. (d)

SOLUTIONS

1. Speed in still water $= \frac{1}{2}(11+5)$ kmph $= 8$ kmph.

2. Speed of stream $= \frac{1}{2}(13-8)$ kmph $= 2.5$ kmph.

3. Rate downstream $= \left(\frac{32}{6}\right)$ kmph; Rate upstream $= \left(\frac{14}{6}\right)$ kmph.

   $\therefore$ Velocity of current $= \frac{1}{2}\left(\frac{32}{6} - \frac{14}{6}\right)$ kmph $= \frac{3}{2}$ kmph $= 1.5$ kmph.

4. Rate downstream $= \left(\frac{16}{2}\right)$ kmph $= 8$ kmph; Rate upstream $= \left(\frac{16}{4}\right)$ kmph $= 4$ kmph.

   $\therefore$ Speed in still water $= \frac{1}{2}(8+4)$ kmph $= 6$ kmph.

5. Rate downstream $= \left(\frac{1}{10} \times 60\right)$ km/hr $= 6$ km/hr; Rate upstream $= 2$ km/hr.

   Speed in still water $= \frac{1}{2}(6+2)$ km/hr $= 4$ km/hr.

   $\therefore$ Required time $= \left(\frac{5}{4}\right)$ hrs $= 1\frac{1}{4}$ hrs $= 1$ hr 15 min.

6. Rate upstream $= \left(\frac{750}{675}\right)$ m/sec $= \frac{10}{9}$ m/sec;

   Rate downstream $= \left(\frac{750}{450}\right)$ m/sec $= \frac{5}{3}$ m/sec.

   $\therefore$ Rate in still water $= \frac{1}{2}\left(\frac{10}{9} + \frac{5}{3}\right)$ m/sec $= \frac{25}{18}$ m/sec $= \left(\frac{25}{18} \times \frac{18}{5}\right)$ km/hr
   $= 5$ km/hr.

7. Let man's rate upstream be x kmph. Then, his rate downstream $= 2x$ kmph.

   $\therefore$ (Speed in still water) : (Speed of stream) $= \left(\frac{2x+x}{2}\right) : \left(\frac{2x-x}{2}\right) = \frac{3x}{2} : \frac{x}{2} = 3 : 1$.

8. Let the man' rate upstream be x kmph and that downstream be y kmph. Then,
   Distance covered upstream in 8 hrs 48 min. = Distance covered downstream in 4 hrs.

   $$\Rightarrow \left(x \times 8\frac{4}{5}\right) = (y \times 4) \Rightarrow \frac{44}{5}x = 4y \Rightarrow y = \frac{11}{5}x.$$

   $\therefore$ Required ratio $= \left(\frac{y+x}{2}\right) : \left(\frac{y-x}{2}\right) = \left(\frac{16x}{5} \times \frac{1}{2}\right) : \left(\frac{6x}{5} \times \frac{1}{2}\right) = \frac{8}{5} : \frac{3}{5} = 8 : 3.$

9. Rate upstream $= \left(\frac{7}{42} \times 60\right)$ kmph $= 10$ kmph.

   Speed of stream $= 3$ kmph.
   Let speed in still water be x km/hr. Then, speed upstream $= (x - 3)$ km/hr.
   $\therefore$ $x - 3 = 10$ or $x = 13$ km/hr.

10. Man's rate in still water $= (15 - 2.5)$ km/hr $= 12.5$ km/hr.
    Man's rate against the current $= (12.5 - 2.5)$ km/hr $= 10$ km/hr.

11. Let the rate along the current be x kmph. Then, $\frac{1}{2}(x + 3.5) = 5$ or $x = 6.5$ kmph.

12. Speed downstream $= (13 + 4)$ km/hr $= 17$ km/hr.

    Time taken to travel 68 km downstream $= \left(\frac{68}{17}\right)$ hrs $= 4$ hrs.

13. Speed upstream $= 7.5$ kmph; Speed downstream $= 10.5$ kmph.

    $\therefore$ Total time taken $= \left(\frac{105}{7.5} + \frac{105}{10.5}\right)$ hours $= 24$ hours.

14. Speed downstream $= (15 + 3)$ kmph $= 18$ kmph.

    Distance travelled $= \left(18 \times \frac{12}{60}\right)$ km $= 3.6$ km.

15. Speed downstream $= (5 + 1)$ kmph $= 6$ kmph; Speed upstream $= (5 - 1)$ kmph $= 4$ kmph.
    Let the required distance be x km.

    Then, $\frac{x}{6} + \frac{x}{4} = 1 \Leftrightarrow 2x + 3x = 12 \Leftrightarrow 5x = 12 \Leftrightarrow x = 2.4$ km.

16. Speed downstream $= (14 + 4)$ km/hr $= 18$ km/hr;
    Speed upstream $= (14 - 4)$ km/hr $= 10$ km/hr.
    Let the distance between A and B be x km. Then,

    $\frac{x}{18} + \frac{(x/2)}{10} = 19 \Leftrightarrow \frac{x}{18} + \frac{x}{20} = 19 \Leftrightarrow \frac{19x}{180} = 19 \Leftrightarrow x = 180$ km.

17. Let speed upstream be x kmph. Then, speed downstream $= 3x$ kmph.

    Speed in still water $= \frac{1}{2}(3x + x)$ kmph $= 2x$ kmph.

    $\therefore$ $2x = \frac{28}{3} \Rightarrow x = \frac{14}{3}$.

    So, Speed upstream $= \frac{14}{3}$ km/hr; Speed downstream $= 14$ km/hr.

    Hence, speed of the current $= \frac{1}{2}\left(14 - \frac{14}{3}\right)$ km/hr $= \frac{14}{3}$ km/hr $= 4\frac{2}{3}$ km/hr.

18. Let the speed of the boat in still water be x kmph. Then,
    Speed downstream $= (x + 3)$ kmph, Speed upstream $= (x - 3)$ kmph.

    $\therefore$ $(x + 3) \times 1 = (x - 3) \times \frac{3}{2} \Leftrightarrow 2x + 6 = 3x - 9 \Leftrightarrow x = 15$ kmph.

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19. Let the speed of the stream be x km/hr. Then,

Speed downstream = $(15 + x)$ km/hr, Speed upstream = $(15 - x)$ km/hr.

$\therefore \quad \dfrac{30}{(15 + x)} + \dfrac{30}{(15 - x)} = 4\dfrac{1}{2} \quad \Leftrightarrow \quad \dfrac{900}{225 - x^2} = \dfrac{9}{2} \quad \Leftrightarrow \quad 9x^2 = 225$

$\Leftrightarrow \quad x^2 = 25 \qquad \Leftrightarrow \quad x = 5$ km/hr.

20. Let the speed of the stream be x km/hr. Then,

Speed downstream = $(10 + x)$ km/hr, Speed upstream = $(10 - x)$ km/hr.

$\therefore \quad \dfrac{26}{(10 + x)} = \dfrac{14}{(10 - x)} \quad \Leftrightarrow \quad 260 - 26x = 140 + 14x \quad \Leftrightarrow \quad 40x = 120 \quad \Leftrightarrow \quad x = 3$ km/hr.

21. Let the speed of the stream be x mph. Then,

Speed downstream = $(10 + x)$ mph, Speed upstream = $(10 - x)$ mph.

$\therefore \quad \dfrac{36}{(10 - x)} - \dfrac{36}{(10 + x)} = \dfrac{90}{60} \quad \Leftrightarrow \quad 72x \times 60 = 90(100 - x^2) \quad \Leftrightarrow \quad x^2 + 48x + 100 = 0$

$\Leftrightarrow \quad (x + 50)(x - 2) = 0 \qquad \Leftrightarrow \quad x = 2$ mph.

22. Suppose he moves 4 km downstream in x hours. Then,

Speed downstream = $\left(\dfrac{4}{x}\right)$ km/hr, Speed upstream = $\left(\dfrac{3}{x}\right)$ km/hr.

$\therefore \quad \dfrac{48}{(4/x)} + \dfrac{48}{(3/x)} = 14$ or $x = \dfrac{1}{2}$.

So, Speed downstream = 8 km/hr, Speed upstream = 6 km/hr.

Rate of the stream = $\dfrac{1}{2}(8 - 6)$ km/hr = 1 km/hr.

23. Let rate upstream = x kmph and rate downstream = y kmph.

Then, $\dfrac{24}{x} + \dfrac{36}{y} = 36$ ...(i) and $\dfrac{36}{x} + \dfrac{24}{y} = \dfrac{13}{2}$ ...(ii)

Adding (i) and (ii), we get : $60\left(\dfrac{1}{x} + \dfrac{1}{y}\right) = \dfrac{25}{2}$ or $\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{5}{24}$ ...(iii)

Subtracting (i) from (ii), we get : $12\left(\dfrac{1}{x} - \dfrac{1}{y}\right) = \dfrac{1}{2}$ or $\dfrac{1}{x} - \dfrac{1}{y} = \dfrac{1}{24}$ ...(iv)

Adding (iii) and (iv), we get : $\dfrac{2}{x} = \dfrac{6}{24}$ or $x = 8$.

So, $\dfrac{1}{8} + \dfrac{1}{y} = \dfrac{5}{24} \quad \Leftrightarrow \quad \dfrac{1}{y} = \left(\dfrac{5}{24} - \dfrac{1}{8}\right) = \dfrac{1}{12} \quad \Leftrightarrow \quad y = 12$.

$\therefore \quad$ Speed upstream = 8 kmph, Speed downstream = 12 kmph.

Hence, rate of current = $\dfrac{1}{2}(12 - 8)$ kmph = 2 kmph.

24. Let the speed in still water be x mph and the speed of the current be y mph. Then,

Speed upstream = $(x - y)$; Speed downstream = $(x + y)$.

$\therefore \quad \dfrac{12}{(x - y)} - \dfrac{12}{(x + y)} = 6 \quad \Leftrightarrow \quad 6(x^2 - y^2) = 24y \quad \Leftrightarrow \quad x^2 - y^2 = 4y$

$\Leftrightarrow \quad x^2 = (4y + y^2)$ ...(i)

And, $\dfrac{12}{(2x - y)} - \dfrac{12}{(2x + y)} = 1 \quad \Leftrightarrow \quad 4x^2 - y^2 = 24y \quad \Leftrightarrow \quad x^2 = \dfrac{24y + y^2}{4}$ ...(ii)

From (i) and (ii), we have :

$$4y + y^2 = \frac{24y + y^2}{4} \quad \Leftrightarrow \quad 16y + 4y^2 = 24y + y^2 \quad \Leftrightarrow \quad 3y^2 = 8y \quad \Leftrightarrow \quad y = \frac{8}{3}.$$

∴ Speed of the current $= \frac{8}{3}$ mph $= 2\frac{2}{3}$ mph.

EXERCISE 19B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (Questions 1 to 6) : *Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and*

Give answer (a) *if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;*

Give answer (b) *if the data in Statement II alone are sufficient to answer the question while the data in statement I alone are not sufficient to answer the question;*

Give answer (c) *if the data either in Statement I or in Statement II alone are sufficient to answer the question;*

Give answer (d) *if the data even in both Statements I and II together are not sufficient to answer the question;*

Give answer (e) *if the data in both Statements I and II together are necessary to answer the question.*

1. What is the speed of the boat in still water ? (Bank P.O. 2003)
   I. It takes 2 hours to cover the distance between A and B downstream.
   II. It takes 4 hours to cover the distance between A and B upstream.

2. What is the speed of the stream ?
   I. The ratio of the speed upstream to the speed downstream of a boat is 2 : 3.
   II. The distance travelled upstream in 2 hours by the boat is more than the distance travelled by it downstream in 1 hour by 4 km.

3. What is the speed of the boat in still water ? (Bank P.O. 2003)
   I. The boat covers a distance of 48 kms in 6 hours while running upstream.
   II. The boat covers the same distance in 4 hours while running downstream.

4. What is the man's speed in still water ?
   I. The speed of the stream is one-third of the man's speed in still water.
   II. In a given time, the man can swim twice as far with the stream as he can against it.

5. A boat takes a total time of three hours to travel downstream from P to Q and upstream back from Q to P. What is the speed of the boat in still water ?
   I. The speed of the river current is 1 km per hour.
   II. The distance between P and Q is 4 km. (S.B.I.P.O. 1997)

6. What is the speed of the boat in still water ?
   I. The speed downstream of the boat is thrice the speed upstream.
   II. The sum of the speeds of the boat, upstream and downstream is 12 kmph.

Directions (Questions 7-8) : *Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is/are necessary to answer the questions.*

7. What is the speed of the boat in still water ?
   I. The speed downstream is 12 kmph.
   II. The speed upstream is 4 kmph.
   III. In a to and fro journey between two points, the average speed of the boat was 6 kmph.
   (a) I and II only   (b) All I, II and III   (c) III, and either I or II
   (d) Any two of the three   (e) None of these
8. What is the speed of stream ?   (Bank P.O. 2004)
   I. The boat covers 24 km in 6 hours moving upstream.
   II. The boat covers 24 km in 3 hours moving downstream.
   III. The ratio between the speed of boat and stream is 3 : 1 respectively.
   (a) Any two of the three   (b) I and II only   (c) II and III only
   (d) I and III only   (e) All I, II and III

ANSWERS

1. (d)   2. (e)   3. (e)   4. (d)   5. (e)   6. (b)   7. (d)   8. (a)

SOLUTIONS

1. Let $AB = x$ km.

   I. Speed downstream $= \dfrac{x}{2}$ km/hr. II. Speed upstream $= \dfrac{x}{4}$ km/hr.

   Speed of boat in still water $= \dfrac{1}{2}\left(\dfrac{x}{2} + \dfrac{x}{4}\right)$ km/hr.

   Thus, I and II both even do not give the answer.
   ∴ Correct answer is (d).

2. I. Let speed upstream $= 2x$ km/hr and speed downstream $= 3x$ km/hr.
   II. $(2 \times 3x) - (1 \times 2x) = 4$ ⟺ $4x = 4$ ⟺ $x = 1$.
   ∴ Speed upstream $= 2$ km/hr, speed downstream $= 3$ km/hr.

   Speed of the stream $= \dfrac{1}{2}(3-2)$ km/hr $= \dfrac{1}{2}$ km/hr.

   Thus, I and II together give the answer.
   ∴ Correct answer is (e).

3. I. Speed upstream $= \dfrac{48}{6}$ km/hr $= 8$ km/hr.

   II. Speed downstream $= \dfrac{48}{4}$ km/hr $= 12$ km/hr.

   Speed of the boat $= \dfrac{1}{2}(8 + 12)$ km/hr $= 10$ km/hr.

   Thus, I and II together give the answer.
   ∴ Correct answer is (e).

4. Let man's speed in still water be x km/hr.

   I. Speed of the stream $= \dfrac{x}{3}$ km/hr.

   Speed downstream $= \left(x + \dfrac{x}{3}\right)$ km/hr $= \dfrac{4x}{3}$ km/hr.

   Speed upstream $= \left(x - \dfrac{x}{3}\right)$ km/hr $= \dfrac{2x}{3}$ km/hr.

20. ALLIGATION OR MIXTURE

IMPORTANT FACTS AND FORMULAE

1. **Alligation** : It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

2. **Mean Price** : The cost price of a unit quantity of the mixture is called the mean price.

3. **Rule of Alligation** : If two ingredients are mixed, then

$$\left(\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}}\right) = \frac{(\text{C.P. of dearer}) - (\text{Mean price})}{(\text{Mean price}) - (\text{C.P. of cheaper})}.$$

We present as under :

C.P. of a unit quantity of cheaper (c) C.P. of a unit quantity of dearer (d)

Mean price (m)

$(d - m)$ $(m - c)$

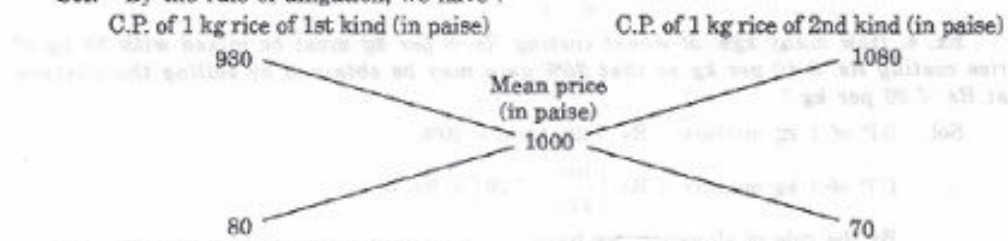∴ (Cheaper quantity) : (Dearer quantity) = $(d - m) : (m - c)$.
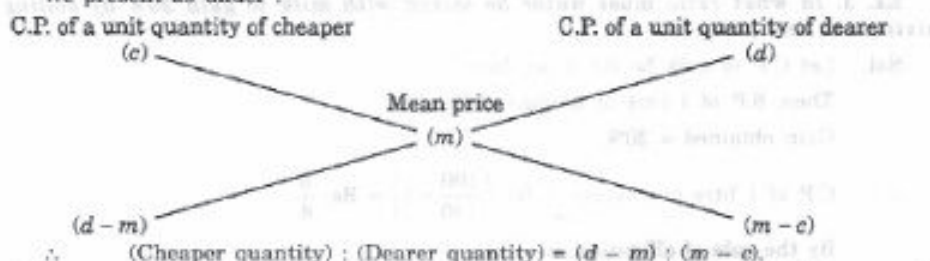
4. Suppose a container contains x units of liquid from which y units are taken out and replaced by water. After n operations, the quantity of pure liquid = $\left[x \left(1 - \dfrac{y}{x} \right)^n \right]$ units.

SOLVED EXAMPLES

Ex. 1. *In what ratio must rice at Rs. 9.30 per kg be mixed with rice at Rs. 10.80 per kg so that the mixture be worth Rs. 10 per kg ?*

Sol. By the rule of alligation, we have :

C.P. of 1 kg rice of 1st kind (in paise)   C.P. of 1 kg rice of 2nd kind (in paise)

930   1080

Mean price (in paise) 1000

80   70

∴ Required ratio = 80 : 70 = 8 : 7.

Ex. 2. *How much water must be added to 60 litres of milk at $1\frac{1}{2}$ litres for Rs. 20 so as to have a mixture worth Rs. $10\frac{2}{3}$ a litre ?*

Sol. C.P. of 1 litre of milk = Rs. $\left(20 \times \dfrac{2}{3} \right)$ = Rs. $\dfrac{40}{3}$.

C.P. of 1 litre of water   C.P. of 1 litre of milk
0   Rs. $\frac{40}{3}$

Mean price
$\left(Rs. \frac{32}{3}\right)$

$\left(\frac{40}{3} - \frac{32}{3}\right) = \frac{8}{3}$ $\left(\frac{32}{3} - 0\right) = \frac{32}{3}$

∴ Ratio of water and milk $= \frac{8}{3} : \frac{32}{3} = 8 : 32 = 1 : 4$.

∴ Quantity of water to be added to 60 litres of milk $= \left(\frac{1}{4} \times 60\right)$ litres $= 15$ litres.

Ex. 3. *In what ratio must water be mixed with milk to gain 20% by selling the mixture at cost price ?*

Sol. Let C.P. of milk be Re. 1 per litre.

Then, S.P. of 1 litre of mixture = Re. 1.

Gain obtained = 20%.

∴ C.P. of 1 litre of mixture = Rs. $\left(\frac{100}{120} \times 1\right)$ = Re. $\frac{5}{6}$.

By the rule of alligation, we have :

C.P. of 1 litre of water   C.P. of 1 litre of milk
0   Re. 1

$\left(Re. \frac{5}{6}\right)$

$\left(1 - \frac{5}{6}\right) = \frac{1}{6}$ $\left(\frac{5}{6} - 0\right) = \frac{5}{6}$

∴ Ratio of water and milk $= \frac{1}{6} : \frac{5}{6} = 1 : 5$.

Ex. 4. *How many kgs. of wheat costing Rs. 8 per kg must be mixed with 36 kg of rice costing Rs. 5.40 per kg so that 20% gain may be obtained by selling the mixture at Rs. 7.20 per kg ?*

Sol. S.P. of 1 kg mixture = Rs. 7.20, Gain = 20%.

∴ C.P. of 1 kg mixture = Rs. $\left(\frac{100}{120} \times 7.20\right)$ = Rs. 6.

By the rule of alligation, we have :

C.P. of 1 kg wheat of 1st kind   C.P. of 1 kg wheat of 2nd kind
(800 p)   (540 p)

Mean price
(600 p)

60   200

Wheat of 1st kind : Wheat of 2nd kind = 60 : 200 = 3 : 10.

Let x kg of wheat of 1st kind be mixed with 36 kg of wheat of 2nd kind.

Then, $3 : 10 = x : 36$ or $10x = 3 \times 36$ or $x = 10.8$ kg.

Ex. 5. *The milk and water in two vessels A and B are in the ratio 4 : 3 and 2 : 3 respectively. In what ratio, the liquids in both the vessels be mixed to obtain a new mixture in vessel C containing half milk and half water ?*

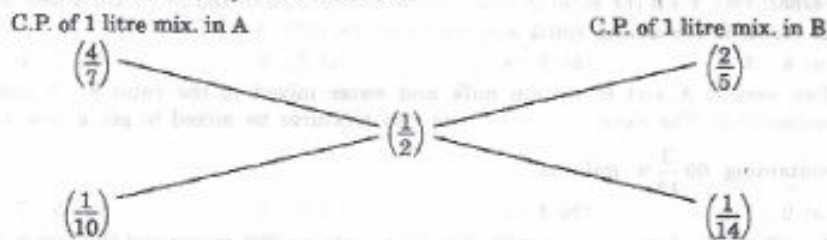**Sol.** Let the C.P. of milk be Re. 1 per litre.

Milk in 1 litre mixture of A = $\frac{4}{7}$ litre; Milk in 1 litre mixture of B = $\frac{2}{5}$ litre;

Milk in 1 litre mixture of C = $\frac{1}{2}$ litre.

$\therefore$ C.P. of 1 litre mixture in A = Re. $\frac{4}{7}$; C.P. of 1 litre mixture in B = Re. $\frac{2}{5}$.

Mean price = Re. $\frac{1}{2}$.

By the rule of alligation, we have :

C.P. of 1 litre mix. in A   C.P. of 1 litre mix. in B

$\left(\frac{4}{7}\right)$ $\left(\frac{2}{5}\right)$

$\left(\frac{1}{2}\right)$

$\left(\frac{1}{10}\right)$ $\left(\frac{1}{14}\right)$

$\therefore$ Required ratio = $\frac{1}{10} : \frac{1}{14} = 7 : 5$.

EXERCISE 20

(OBJECTIVE TYPE QUESTIONS)

Directions : Mark (✓) against the correct answer :

1. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 per kg ?   (R.R.B. 2003)
    (a) 3 : 7   (b) 5 : 7   (c) 7 : 3   (d) 7 : 5
2. Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.   (IGNOU, 2003)
    (a) 1 : 3   (b) 2 : 3   (c) 3 : 4   (d) 4 : 5
3. In what ratio must tea at Rs. 62 per kg be mixed with tea at Rs. 72 per kg so that the mixture must be worth Rs. 64.50 per kg ?
    (a) 3 : 1   (b) 3 : 2   (c) 4 : 3   (d) 5 : 3
4. In what ratio must water be mixed with milk costing Rs. 12 per litre to obtain a mixture worth of Rs. 8 per litre ?
    (a) 1 : 2   (b) 2 : 1   (c) 2 : 3   (d) 3 : 2
5. The cost of Type 1 rice is Rs. 15 per kg and Type 2 rice is Rs. 20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2 : 3, then the price per kg of the mixed variety of rice is :   (M.B.A. 2002)
    (a) Rs. 18   (b) Rs. 18.50   (c) Rs. 19   (d) Rs. 19.50

6. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10% ?

   (a) 3 : 2   (b) 3 : 4   (c) 3 : 5   (d) 4 : 5

   (S.S.C. 2004)

7. How many kilograms of sugar costing Rs. 9 per kg must be mixed with 27 kg of sugar costing Rs. 7 per kg so that there may be a gain of 10% by selling the mixture at Rs. 9.24 per kg ?

   (a) 36 kg   (b) 42 kg   (c) 54 kg   (d) 63 kg

8. In what ratio must water be mixed with milk to gain $16\frac{2}{3}$% on selling the mixture at cost price ?   (L.I.C.A.A.O. 2003)

   (a) 1 : 6   (b) 6 : 1   (c) 2 : 3   (d) 4 : 3

9. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is :

   (a) 4%   (b) $6\frac{1}{4}$%   (c) 20%   (d) 25%

10. Two vessels A and B contain spirit and water mixed in the ratio 5 : 2 and 7 : 6 respectively. Find the ratio in which these mixture be mixed to obtain a new mixture in vessel C containing spirit and water in the ratio 8 : 5 ?

    (a) 4 : 3   (b) 3 : 4   (c) 5 : 6   (d) 7 : 9

11. Two vessels A and B contain milk and water mixed in the ratio 8 : 5 and 5 : 2 respectively. The ratio in which these two mixtures be mixed to get a new mixture containing $69\frac{3}{13}$% milk, is :

    (a) 2 : 7   (b) 3 : 5   (c) 5 : 2   (d) 5 : 7

12. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5 ?

    (a) 4 litres, 8 litres   (b) 6 litres, 6 litres
    (c) 5 litres, 7 litres   (d) 7 litres, 5 litres

13. One quality of wheat at Rs. 9.30 per kg is mixed with another quality at a certain rate in the ratio 8 : 7. If the mixture so formed be worth Rs. 10 per kg, what is the rate per kg of the second quality of wheat ?

    (a) Rs. 10.30   (b) Rs. 10.60   (c) Rs. 10.80   (d) Rs. 11

14. Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be :   (S.S.C. 1999)

    (a) Rs. 169.50   (b) Rs. 170   (c) Rs. 175.50   (d) Rs. 180

15. A merchant has 1000 kg of sugar, part of which he sells at 8% profit and the rest at 18% profit. He gains 14% on the whole. The quantity sold at 18% profit is :

    (a) 400 kg   (b) 560 kg   (c) 600 kg   (d) 640 kg

16. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is :

    (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{2}{5}$ (d) $\frac{3}{5}$

17. A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container ?

    (a) 26.34 litres   (b) 27.36 litres   (c) 28 litres   (d) 29.16 litres

18. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of the water is 16 : 65. How much wine did the cask hold originally ?

(N.I.F.T. 2003)

(a) 18 litres   (b) 24 litres   (c) 32 litres   (d) 42 litres

19. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially ?

(a) 10   (b) 20   (c) 21   (d) 25

20. A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup ?

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{1}{5}$ (d) $\frac{1}{7}$

ANSWERS

1. (c)   2. (b)   3. (a)   4. (a)   5. (a)   6. (a)   7. (d)   8. (a)   9. (c)   10. (d)

11. (a)   12. (b)   13. (c)   14. (c)   15. (c)   16. (b)   17. (d)   18. (b)   19. (c)   20. (c)

SOLUTIONS

1. By the rule of alligation :

Cost of 1 kg pulses of 1st kind   Cost of 1 kg pulses of 2nd kind

Rs. 15   Rs. 20

Mean price
Rs. 16.50

3.50   1.50

∴ Required rate = 3.50 : 1.50 = 35 : 15 = 7 : 3.

2. By the rule of alligation :

Cost of 1 kg rice of 1st kind   Cost of 1 kg rice of 2nd kind

720 p 570 p

Mean price
630 p

60   90

∴ Required ratio = 60 : 90 = 2 : 3.

3. By the rule of alligation :

Cost of 1 kg tea of 1st kind   Cost of 1 kg tea of 2nd kind

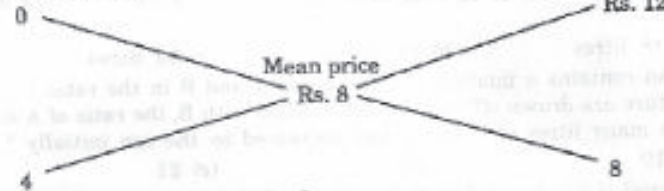6200 p 7200 p

Mean price
6450 p

750   250

∴ Required ratio = 750 : 250 = 3 : 1.

4. By the rule of alligation :

C.P. of 1 litre of water   C.P. of 1 litre of milk

0   Rs. 12

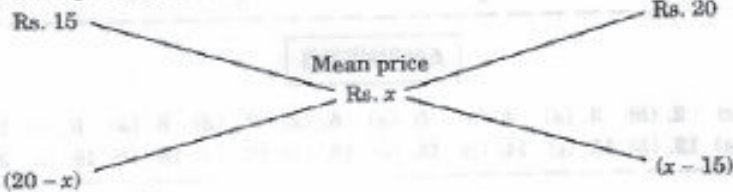Mean price
Rs. 8

4   8

Ratio of water to milk = 4 : 8 = 1 : 2.

5. Let the price of the mixed variety be Rs. x per kg.

By the rule of alligation, we have :

Cost of 1 kg of Type 1 rice   Cost of 1 kg of Type 2 rice

Rs. 15   Rs. 20

Mean price
Rs. x

$(20 - x)$ $(x - 15)$

$\therefore \dfrac{(20 - x)}{(x - 15)} = \dfrac{2}{3} \Rightarrow 60 - 3x = 2x - 30 \Rightarrow 5x = 90 \Rightarrow x = 18.$
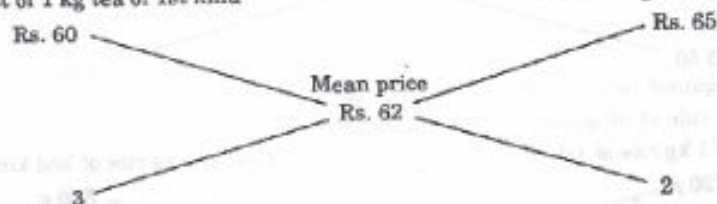
So, price of the mixture is Rs. 18 per kg.

6. S.P. of 1 kg of the mixture = Rs. 68.20, Gain = 10 %.

C.P. of 1 kg of the mixture = Rs. $\left(\dfrac{100}{110} \times 68.20\right)$ = Rs. 62.

By the rule of alligation, we have :

Cost of 1 kg tea of 1st kind   Cost of 1 kg tea of 2nd kind

Rs. 60   Rs. 65

Mean price
Rs. 62

3   2

$\therefore$ Required ratio = 3 : 2.
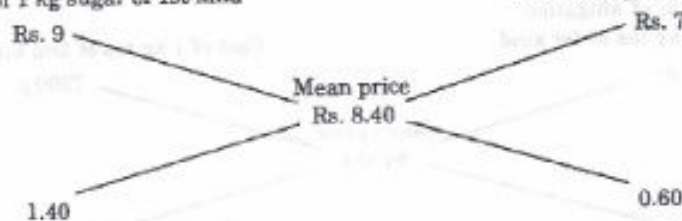
7. S.P. of 1 kg of mixture = Rs. 9.24, Gain = 10%.

$\therefore$ C.P. of 1 kg of mixture = Rs. $\left(\dfrac{100}{110} \times 9.24\right)$ = Rs. 8.40.

By the rule of alligation, we have :

C.P. of 1 kg sugar of 1st kind   Cost of 1 kg sugar of 2nd kind

Rs. 9   Rs. 7

Mean price
Rs. 8.40

1.40   0.60

SUB#

∴ Ratio of quantities of 1st and 2nd kind = 14 : 6 = 7 : 3.
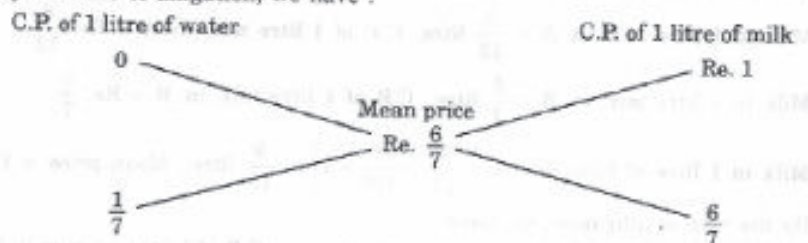Let x kg of sugar of 1st kind be mixed with 27 kg of 2nd kind.

Then, $7 : 3 = x : 27$ or $x = \left(\dfrac{7 \times 27}{3}\right) = 63$ kg.

8. Let C.P. of 1 litre milk be Re. 1.

S.P. of 1 litre of mixture = Re. 1, Gain $= \dfrac{50}{3}$ %.

∴ C.P. of 1 litre of mixture $= \left(100 \times \dfrac{3}{350} \times 1\right) =$ Re. $\dfrac{6}{7}$.

By the rule of alligation, we have :

C.P. of 1 litre of water   C.P. of 1 litre of milk
0   Re. 1

Mean price
Re. $\dfrac{6}{7}$

$\dfrac{1}{7}$ $\dfrac{6}{7}$
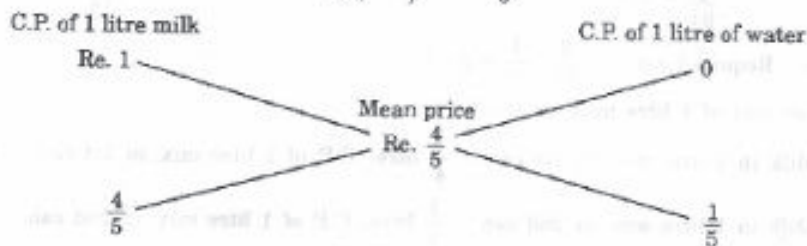
∴ Ratio of water and milk $= \dfrac{1}{7} : \dfrac{6}{7} = 1 : 6$.

9. Let C.P. of 1 litre milk be Re. 1.
Then, S.P. of 1 litre of mixture = Re. 1, Gain = 25%.

C.P. of 1 litre mixture = Re. $\left(\dfrac{100}{125} \times 1\right) =$ Re. $\dfrac{4}{5}$.

C.P. of 1 litre milk   C.P. of 1 litre of water
Re. 1   0

Mean price
Re. $\dfrac{4}{5}$

$\dfrac{4}{5}$ $\dfrac{1}{5}$

∴ Ratio of milk to water $= \dfrac{4}{5} : \dfrac{1}{5} = 4 : 1$.

Hence, percentage of water in the mixture $= \left(\dfrac{1}{5} \times 100\right)$ % = 20%.
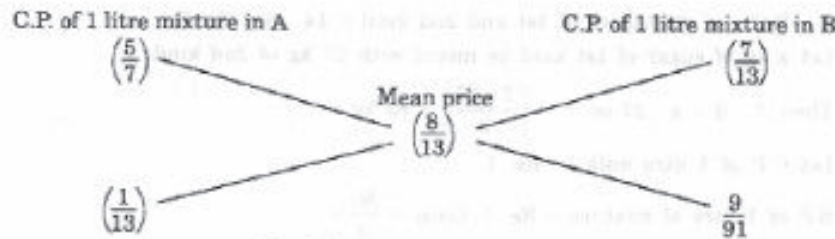
10. Let the C.P. of spirit be Re. 1 per litre.

Spirit in 1 litre mix. of A $= \dfrac{5}{7}$ litre; C.P. of 1 litre mix. in A = Re. $\dfrac{5}{7}$.

Spirit in 1 litre mix. of B $= \dfrac{7}{13}$ litre; C.P. of 1 litre mix. in B = Re. $\dfrac{7}{13}$.

Spirit in 1 litre mix. of C $= \dfrac{8}{13}$ litre; Mean price = Re. $\dfrac{8}{13}$.

By the rule of alligation, we have :

SUB#

C.P. of 1 litre mixture in A $\left(\dfrac{5}{7}\right)$

C.P. of 1 litre mixture in B $\left(\dfrac{7}{13}\right)$

Mean price $\left(\dfrac{8}{13}\right)$

$\left(\dfrac{1}{13}\right)$

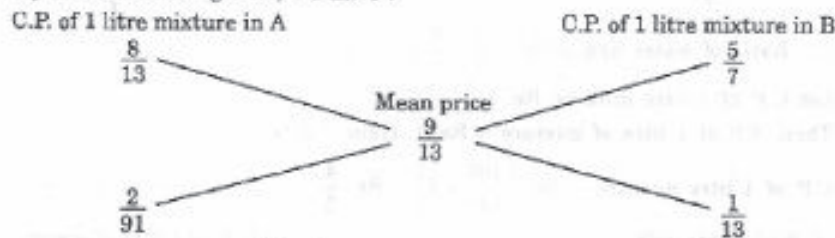$\dfrac{9}{91}$

∴ Required ratio $= \dfrac{1}{13} : \dfrac{9}{91} = 7 : 9$.

11. Let cost of 1 litre milk be Re. 1.

Milk in 1 litre mix. in A $= \dfrac{8}{13}$ litre, C.P. of 1 litre mix. in A $=$ Re. $\dfrac{8}{13}$.

Milk in 1 litre mix. in B $= \dfrac{5}{7}$ litre, C.P. of 1 litre mix. in B $=$ Re. $\dfrac{5}{7}$.

Milk in 1 litre of final mix. $= \left(\dfrac{900}{13} \times \dfrac{1}{100} \times 1\right) = \dfrac{9}{13}$ litre; Mean price $=$ Re. $\dfrac{9}{13}$.

By the rule of alligation, we have :

C.P. of 1 litre mixture in A

$\dfrac{8}{13}$

Mean price $\dfrac{9}{13}$

C.P. of 1 litre mixture in B

$\dfrac{5}{7}$

$\dfrac{2}{91}$

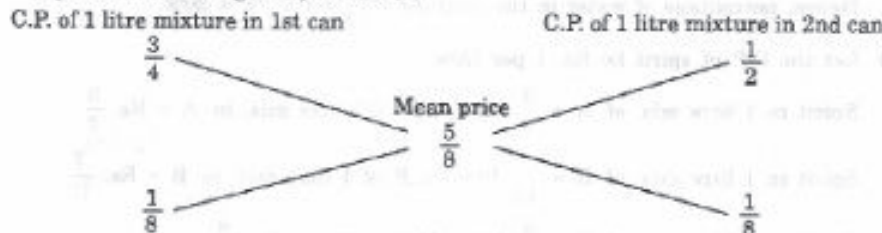$\dfrac{1}{13}$

∴ Required ratio $= \dfrac{2}{91} : \dfrac{1}{13} = 2 : 7$.

12. Let cost of 1 litre milk be Re. 1.

Milk in 1 litre mix. in 1st can $= \dfrac{3}{4}$ litre, C.P. of 1 litre mix. in 1st can $=$ Re. $\dfrac{3}{4}$.

Milk in 1 litre mix. in 2nd can $= \dfrac{1}{2}$ litre, C.P. of 1 litre mix. in 2nd can $=$ Re. $\dfrac{1}{2}$.

Milk in 1 litre of final mix. $= \dfrac{5}{8}$ litre, Mean price $=$ Re. $\dfrac{5}{8}$.

By the rule of alligation, we have :

C.P. of 1 litre mixture in 1st can

$\dfrac{3}{4}$

Mean price $\dfrac{5}{8}$

C.P. of 1 litre mixture in 2nd can

$\dfrac{1}{2}$

$\dfrac{1}{8}$

$\dfrac{1}{8}$
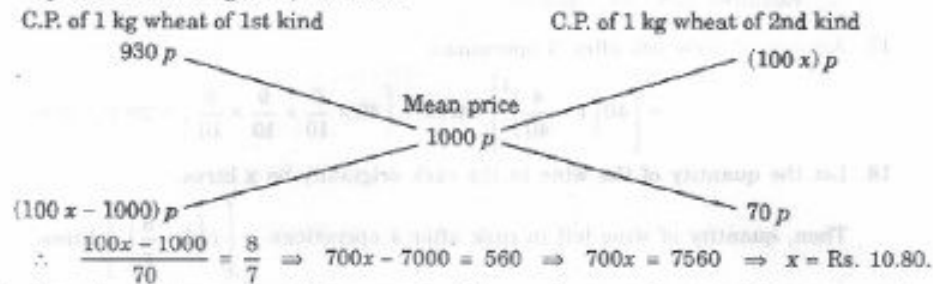
∴ Ratio of two mixtures $= \dfrac{1}{8} : \dfrac{1}{8} = 1 : 1$.

So, quantity of mixture taken from each can $= \left(\dfrac{1}{2} \times 12\right) = 6$ litres.

SUB#
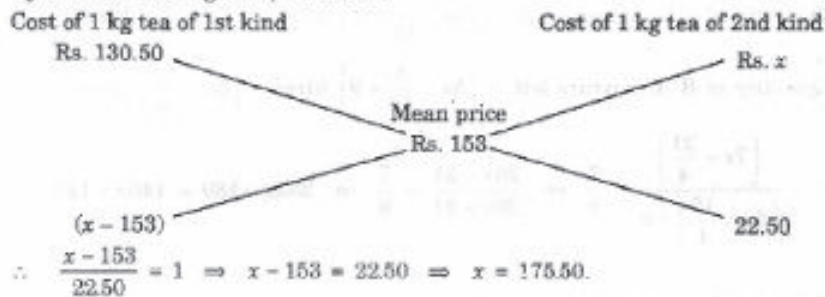
13. Let the rate of the second quality be Rs. x per kg.

By the rule of alligation, we have :

C.P. of 1 kg wheat of 1st kind   C.P. of 1 kg wheat of 2nd kind
          930 p $(100 x) p$

                              Mean price
                                1000 p

$(100 x - 1000) p$ 70 p

∴ $\dfrac{100x - 1000}{70} = \dfrac{8}{7}$ ⇒ $700x - 7000 = 560$ ⇒ $700x = 7560$ ⇒ x = Rs. 10.80.

14. Since first and second varieties are mixed in equal proportions, so their average price

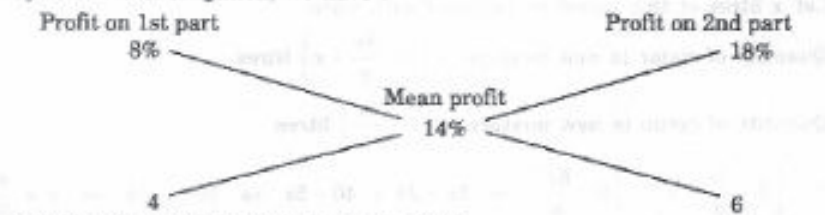$$= Rs. \left(\dfrac{126 + 135}{2}\right) = Rs. 130.50.$$

So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, i.e., 1 : 1. We have to find x.

By the rule of alligation, we have :

Cost of 1 kg tea of 1st kind   Cost of 1 kg tea of 2nd kind
      Rs. 130.50   Rs. x

                              Mean price
                                Rs. 153

      $(x - 153)$ 22.50

∴ $\dfrac{x - 153}{22.50} = 1$ ⇒ $x - 153 = 22.50$ ⇒ $x = 175.50.$

Hence, price of the third variety = Rs. 175.50 per kg.

15. By the rule of alligation, we have :

Profit on 1st part   Profit on 2nd part
        8%   18%

                              Mean profit
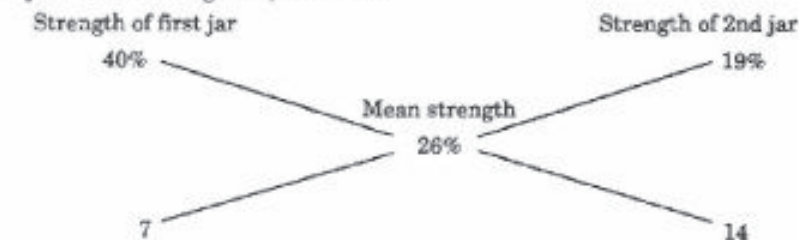   14%

          4   6

Ratio of 1st and 2nd parts = 4 : 6 = 2 : 3.

∴   Quantity of 2nd kind $= \left(\dfrac{3}{5} \times 1000\right)$ kg = 600 kg.

16. By the rule of alligation, we have :

Strength of first jar   Strength of 2nd jar
        40%   19%

                              Mean strength
                                26%

          7   14

So, ratio of 1st and 2nd quantities $= 7 : 14 = 1 : 2$.

∴   Required quantity replaced $= \dfrac{2}{3}$.

17. Amount of milk left after 3 operations

$$= \left[40 \left(1 - \frac{4}{40} \right)^3 \right] \text{litres} = \left(40 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \right) = 29.16 \text{ litres}.$$

18. Let the quantity of the wine in the cask originally be x litres.

Then, quantity of wine left in cask after 4 operations $= \left[x \left(1 - \dfrac{8}{x} \right)^4 \right]$ litres.

∴ $\dfrac{x \left(1 - \dfrac{8}{x} \right)^4}{x} = \dfrac{16}{81} \implies \left(1 - \dfrac{8}{x} \right)^4 = \left(\dfrac{2}{3} \right)^2 \implies \left(\dfrac{x-8}{x} \right) = \dfrac{2}{3}$

$\implies 3x - 24 = 2x \implies x = 24.$

19. Suppose the can initially contains $7x$ and $5x$ litres of mixtures A and B respectively.

Quantity of A in mixture left $= \left(7x - \dfrac{7}{12} \times 9 \right)$ litres $= \left(7x - \dfrac{21}{4} \right)$ litres.

Quantity of B in mixture left $= \left(5x - \dfrac{5}{12} \times 9 \right)$ litres $= \left(5x - \dfrac{15}{4} \right)$ litres.

∴ $\dfrac{\left(7x - \dfrac{21}{4} \right)}{\left(5x - \dfrac{15}{4} \right) + 9} = \dfrac{7}{9} \implies \dfrac{28x - 21}{20x + 21} = \dfrac{7}{9} \implies 252x - 189 = 140x + 147$

$\implies 112x = 336 \implies x = 3.$

So, the can contained 21 litres of A.

20. Suppose the vessel initially contains 8 litres of liquid.

Let x litres of this liquid be replaced with water.

Quantity of water in new mixture $= \left(3 - \dfrac{3x}{8} + x \right)$ litres.

Quantity of syrup in new mixture $= \left(5 - \dfrac{5x}{8} \right)$ litres.

∴ $\left(3 - \dfrac{3x}{8} + x \right) = \left(5 - \dfrac{5x}{8} \right) \implies 5x + 24 = 40 - 5x \implies 10x = 16 \implies x = \dfrac{8}{5}.$

So, part of the mixture replaced $= \left(\dfrac{8}{5} \times \dfrac{1}{8} \right) = \dfrac{1}{5}.$

21. SIMPLE INTEREST

IMPORTANT FACTS AND FORMULAE

1. **Principal** : The money borrowed or lent out for a certain period is called the *principal* or the *sum*.
2. **Interest** : Extra money paid for using other's money is called *interest*.
3. **Simple Interest (S.I.)** : If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called *simple interest*.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then,

(i) $\text{S.I.} = \left(\dfrac{P \times R \times T}{100}\right)$

(ii) $P = \left(\dfrac{100 \times \text{S.I.}}{R \times T}\right)$; $R = \left(\dfrac{100 \times \text{S.I.}}{P \times T}\right)$ and $T = \left(\dfrac{100 \times \text{S.I.}}{P \times R}\right)$.

SOLVED EXAMPLES

Ex. 1. *Find the simple interest on Rs. 68,000 at $16\frac{2}{3}\%$ per annum for 9 months.*

Sol. $P = \text{Rs. } 68000$, $R = \dfrac{50}{3}\%$ p.a and $T = \dfrac{9}{12}$ years $= \dfrac{3}{4}$ years.

$\therefore$ $\text{S.I.} = \left(\dfrac{P \times R \times T}{100}\right) = \text{Rs. } \left(68000 \times \dfrac{50}{3} \times \dfrac{3}{4} \times \dfrac{1}{100}\right) = \text{Rs. } 8500.$

Ex. 2. *Find the simple interest on Rs. 3000 at $6\frac{1}{4}\%$ per annum for the period from 4th Feb., 2005 to 18th April, 2005.*

Sol. Time $= (24 + 31 + 18)$ days $= 73$ days $= \dfrac{73}{365}$ year $= \dfrac{1}{5}$ year.

$P = \text{Rs. } 3000$ and $R = 6\frac{1}{4}\%$ p.a. $= \dfrac{25}{4}\%$ p.a.

$\therefore$ $\text{S.I.} = \text{Rs. } \left(3000 \times \dfrac{25}{4} \times \dfrac{1}{5} \times \dfrac{1}{100}\right) = \text{Rs. } 37.50.$

Remark : The day on which money is deposited is not counted while the day on which money is withdrawn is counted.

Ex. 3. *A sum at simple interest at $13\frac{1}{2}\%$ per annum amounts to Rs. 2502.50 after 4 years. Find the sum.*

Sol. Let sum be Rs. x. Then, $\text{S.I.} = \text{Rs. } \left(x \times \dfrac{27}{2} \times 4 \times \dfrac{1}{100}\right) = \text{Rs. } \dfrac{27x}{50}.$

$\therefore$ Amount $= \text{Rs. } \left(x + \dfrac{27x}{50}\right) = \text{Rs. } \dfrac{77x}{50}.$

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$\therefore \quad \dfrac{77x}{50} = 2502.50 \iff x = \dfrac{2502.50 \times 50}{77} = 1625.$

Hence, sum = Rs. 1625.

Ex. 4. *A sum of Rs. 800 amounts to Rs. 920 in 3 years at simple interest. If the interest rate is increased by 3%, it would amount to how much ?*

Sol.   S.I. = Rs. (920 − 800) = Rs. 120; P = Rs. 800, T = 3 yrs.

$\therefore \qquad R = \left(\dfrac{100 \times 120}{800 \times 3}\right)\% = 5\%.$

New rate = (5 + 3)% = 8%.

New S.I. = Rs. $\left(\dfrac{800 \times 8 \times 3}{100}\right)$ = Rs. 192.

$\therefore \qquad$ New amount = Rs. (800 + 192) = Rs. 992.

Ex. 5. *Adam borrowed some money at the rate of 6% p.a. for the first two years, at the rate of 9% p.a. for the next three years, and at the rate of 14% p.a. for the period beyond five years. If he pays a total interest of Rs. 11, 400 at the end of nine years, how much money did he borrow ?*   (Bank P.O. 1999)

Sol.   Let the sum borrowed be x. Then,

$\left(\dfrac{x \times 6 \times 2}{100}\right) + \left(\dfrac{x \times 9 \times 3}{100}\right) + \left(\dfrac{x \times 14 \times 4}{100}\right) = 11400$

$\iff \left(\dfrac{3x}{25} + \dfrac{27x}{100} + \dfrac{14x}{25}\right) = 11400 \iff \dfrac{95x}{100} = 11400 \iff x = \left(\dfrac{11400 \times 100}{95}\right) = 12000.$

Hence, sum borrowed = Rs. 12,000.

Ex. 6. *A certain sum of money amounts to Rs. 1008 in 2 years and to Rs. 1164 in $3\dfrac{1}{2}$ years. Find the sum and the rate of interest.*

Sol.   S.I. for $1\dfrac{1}{2}$ years = Rs. (1164 − 1008) = Rs. 156.

S.I. for 2 years = Rs. $\left(156 \times \dfrac{2}{3} \times 2\right)$ = Rs. 208.

$\therefore \qquad$ Principal = Rs. (1008 − 208) = Rs. 800.

Now, P = 800, T = 2 and S.I. = 208.

$\therefore \qquad$ Rate = $\left(\dfrac{100 \times 208}{800 \times 2}\right)\%$ = 13%.

Ex. 7. *At what rate percent per annum will a sum of money double in 16 years ?*   (R.R.B. 2003)

Sol.   Let principal = P. Then, S.I. = P and T = 16 yrs.

$\therefore \qquad$ Rate = $\left(\dfrac{100 \times P}{P \times 16}\right)\%$ = $6\dfrac{1}{4}\%$ p.a.

Ex. 8. *The simple interest on a sum of money is $\dfrac{4}{9}$ of the principal. Find the rate percent and time, if both are numerically equal.*   (S.S.C. 2000)

Sol.   Let sum = Rs. x. Then, S.I. = Rs. $\dfrac{4x}{9}$.

Let rate = R% and time = R years.

Then, $\left(\dfrac{x \times R \times R}{100}\right) = \dfrac{4x}{9}$ or $R^2 = \dfrac{400}{9}$ or $R = \dfrac{20}{3} = 6\dfrac{2}{3}$.

∴   Rate = $6\dfrac{2}{3}\%$ and Time = $6\dfrac{2}{3}$ yrs = 6 yrs 8 months.

Ex. 9. *The simple interest on a certain sum of money for $2\dfrac{1}{2}$ years at 12% per annum is Rs. 40 less than the simple interest on the same sum for $3\dfrac{1}{2}$ years at 10% per annum. Find the sum.*

Sol. Let the sum be Rs. x. Then, $\left(\dfrac{x \times 10 \times 7}{100 \times 2}\right) - \left(\dfrac{x \times 12 \times 5}{100 \times 2}\right) = 40$

⇔ $\dfrac{7x}{20} - \dfrac{3x}{10} = 40 \Leftrightarrow x = (40 \times 20) = 800$.

Hence, the sum is Rs. 800.

Ex. 10. *A sum was put at simple interest at a certain rate for 3 years. Had it been put at 2% higher rate, it would have fetched Rs. 360 more. Find the sum.*

Sol. Let sum = P and original rate = R. Then, $\left[\dfrac{P \times (R + 2) \times 3}{100}\right] - \left[\dfrac{P \times R \times 3}{100}\right] = 360$

⇔ $3PR + 6P - 3PR = 36000 \Leftrightarrow 6P = 36000 \Leftrightarrow P = 6000$.

Hence, sum = Rs. 6000.

Ex. 11. *What annual instalment will discharge a debt of Rs. 1092 due in 3 years at 12% simple interest ?*

Sol. Let each instalment be Rs. x. Then, $\left(x + \dfrac{x \times 12 \times 1}{100}\right) + \left(x + \dfrac{x \times 12 \times 2}{100}\right) + x = 1092$

⇔ $\dfrac{28x}{25} + \dfrac{31x}{25} + x = 1092 \Leftrightarrow (28x + 31x + 25x) = (1092 \times 25)$

⇔ $x = \left(\dfrac{1092 \times 25}{84}\right) = 325$.

∴   Each instalment = Rs. 325.

Ex. 12. *A sum of Rs. 1550 is lent out into two parts, one at 8% and another one at 6%. If the total annual income is Rs. 106, find the money lent at each rate.*

(L.I.C. A.A.O. 2003)

Sol. Let the sum lent at 8% be Rs. x and that at 6% be Rs. $(1550 - x)$.

∴ $\left[\dfrac{x \times 8 \times 1}{100}\right] + \left[\dfrac{(1550 - x) \times 6 \times 1}{100}\right] = 106$

⇔ $8x + 9300 - 6x = 10600 \Leftrightarrow 2x = 1300 \Leftrightarrow x = 650$.

∴   Money lent at 8% = Rs. 650. Money lent at 6% = Rs. (1550 – 650) = Rs. 900.

EXERCISE 21A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer* :

1. At the rate of $8\dfrac{1}{2}\%$ p.a. simple interest, a sum of Rs. 4800 will earn how much interest in 2 years 3 months ?

   (a) Rs. 796   (b) Rs. 816   (c) Rs. 918   (d) Rs. 956

2. What will be the simple interest earned on an amount of Rs. 16,800 in 9 months at
    the rate of $6\frac{1}{4}$% p.a. ?

    (a) Rs. 787.50   (b) Rs. 812.50   (c) Rs. 860   (d) Rs. 887.50

3. The simple interest on Rs. 1820 from March 9, 2003 to May 21, 2003 at $7\frac{1}{2}$% rate
    will be :

    (a) Rs. 22.50   (b) Rs. 27.30   (c) Rs. 28.80   (d) Rs. 29

4. A person borrows Rs. 5000 for 2 years at 4% p.a. simple interest. He immediately
    lends it to another person at $6\frac{1}{4}$% p.a. for 2 years. Find his gain in the transaction
    per year.   (S.S.C. 2000)

    (a) Rs. 112.50   (b) Rs. 125   (c) Rs. 150   (d) Rs. 167.50

5. How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at
    4.5% per annum of simple interest ?   (IGNOU, 2003)

    (a) 3.5 years   (b) 4 years   (c) 4.5 years   (d) 5 years

6. A sum of Rs. 12,500 amounts to Rs. 15,500 in 4 years at the rate of simple interest.
    What is the rate of interest ?   (Bank P.O. 2003)

    (a) 3%   (b) 4%   (c) 5%   (d) 6%   (e) None of these

7. A sum of Rs. 1600 gives a simple interest of Rs. 252 in 2 years and 4 months. The
    rate of interest per annum is :

    (a) 6%   (b) $6\frac{1}{4}$%   (c) $6\frac{1}{2}$%   (d) $6\frac{3}{4}$%

8. Reena took a loan of Rs. 1200 with simple interest for as many years as the rate of
    interest. If she paid Rs. 432 as interest at the end of the loan period, what was the
    rate of interest ?   (R.B.I. 2003)

    (a) 3.6   (b) 6   (c) 18

    (d) Cannot be determined   (e) None of these

9. A man took a loan from a bank at the rate of 12% p.a. simple interest. After 3 years
    he had to pay Rs. 5400 interest only for the period. The principal amount borrowed
    by him was :   (S.S.C. 2004)

    (a) Rs. 2000   (b) Rs. 10,000   (c) Rs. 15,000   (d) Rs. 20,000

10. What is the present worth of Rs. 132 due in 2 years at 5% simple interest per annum ?

    (a) Rs. 112   (b) Rs. 118.80   (c) Rs. 120   (d) Rs. 122

                                                                                (C.B.I. 1997)

11. A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years.
    What is the sum ?   (NABARD, 2002)

    (a) Rs. 4462.50   (b) Rs. 8032.50   (c) Rs. 8900

    (d) Rs. 8925   (e) None of these

12. The simple interest at x% for x years will be Rs. x on a sum of :

    (a) Rs. x (b) Rs. $\left(\dfrac{100}{x}\right)$ (c) Rs. 100x (d) Rs. $\left(\dfrac{100}{x^2}\right)$

13. Rs. 800 becomes Rs. 956 in 3 years at a certain rate of simple interest. If the rate
    of interest is increased by 4%, what amount will Rs. 800 become in 3 years ?

    (a) Rs. 1020.80   (b) Rs. 1025   (c) Rs. 1052

    (d) Data inadequate   (e) None of these   (Bank P.O. 2000)

14. A certain amount earns simple interest of Rs. 1750 after 7 years. Had the interest
    been 2% more, how much more interest would it have earned ?   (Bank P.O. 2003)

    (a) Rs. 35   (b) Rs. 245   (c) Rs. 350

    (d) Cannot be determined   (e) None of these

15. In how many years, Rs. 150 will produce the same interest @ 8% as Rs. 800 produce in 3 years @ $4\frac{1}{2}$% ? (R.R.B. 2001)

  (a) 6 (b) 8 (c) 9 (d) 12

16. If Rs. 64 amounts to Rs. 83.20 in 2 years, what will Rs. 86 amount to in 4 years at the same rate percent per annum ?

  (a) Rs. 114.80 (b) Rs. 124.70 (c) Rs. 127.40 (d) Rs. 137.60

17. The simple interest on a certain sum of money at the rate of 5% p.a. for 8 years is Rs. 840. At what rate of interest the same amount of interest can be received on the same sum after 5 years ?

  (a) 6% (b) 8% (c) 9% (d) 10%

18. The interest on a certain deposit at 4.5% p.a. is Rs. 202.50 in one year. How much will the additional interest in one year be on the same deposit at 5% p.a. ?

  (a) Rs. 20.25 (b) Rs. 22.50 (c) Rs. 25 (d) Rs. 42.75

19. A sum invested at 5% simple interest per annum grows to Rs. 504 in 4 years. The same amount at 10% simple interest per annum in $2\frac{1}{2}$ years will grow to :

  (a) Rs. 420 (b) Rs. 450 (c) Rs. 525 (d) Rs. 550
  (C.D.S. 2003)

20. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years ? (Bank P.O. 1998)

  (a) 1 : 3 (b) 1 : 4 (c) 2 : 3
  (d) Data inadequate (e) None of these

21. Nitin borrowed some money at the rate of 6% p.a. for the first three years, 9% p.a. for the next five years and 13% p.a. for the period beyond eight years. If the total interest paid by him at the end of eleven years is Rs. 8160, how much money did he borrow ? (Bank P.O. 2000)

  (a) Rs. 8000 (b) Rs. 10,000 (c) Rs. 12,000
  (d) Data inadequate (e) None of these

22. The simple interest on a sum of money will be Rs. 600 after 10 years. If the principal is trebled after 5 years, what will be the total interest at the end of the tenth year ?

  (a) Rs. 600 (b) Rs. 900 (c) Rs. 1200
  (d) Rs. 1500 (e) Data inadequate

23. The simple interest on Rs. 10 for 4 months at the rate of 3 paise per rupee per month is :

  (a) Rs. 1.20 (b) Rs. 1.60 (c) Rs. 2.40 (d) Rs. 3.60

24. An automobile financier claims to be lending money at simple interest, but he includes the interest every six months for calculating the principal. If he is charging an interest of 10%, the effective rate of interest becomes : (N.I.F.T. 2000)

  (a) 10% (b) 10.25% (c) 10.5% (d) None of these

25. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is : (Section Officers', 2001)

  (a) Rs. 650 (b) Rs. 690 (c) Rs. 698 (d) Rs. 700

26. A sum of money lent out at simple interest amounts to Rs. 720 after 2 years and to Rs. 1020 after a further period of 5 years. The sum is : (S.S.C. 2004)

  (a) Rs. 500 (b) Rs. 600 (c) Rs. 700 (d) Rs. 710

27. A sum of money amounts to Rs. 9800 after 5 years and Rs. 12005 after 8 years at the same rate of simple interest. The rate of interest per annum is : (S.S.C. 2003)

  (a) 5% (b) 8% (c) 12% (d) 15%

28. A certain sum of money at simple interest amounts to Rs. 1012 in $2\frac{1}{2}$ years and to Rs. 1067.20 in 4 years. The rate of interest per annum is :

    (a) 2.5%   (b) 3%   (c) 4%   (d) 5%

29. In how many years will a sum of money double itself at 12% per annum ?

    (a) 6 years 9 months   (b) 7 years 6 months

    (c) 8 years 3 months   (d) 8 years 4 months

30. At what rate percent of simple interest will a sum of money double itself in 12 years ?

    (a) $8\frac{1}{4}$%   (b) $8\frac{1}{3}$%   (c) $8\frac{1}{2}$%   (d) $9\frac{1}{2}$%

                                                                         (S.S.C. 2000)

31. The rate at which a sum becomes four times of itself in 15 years at S.I., will be :

    (a) 15%   (b) $17\frac{1}{2}$%   (c) 20%   (d) 25%

32. If a sum of money at simple interest doubles in 6 years, it will become 4 times in :

    (a) 12 years   (b) 14 years   (c) 16 years   (d) 18 years

33. A sum of money trebles itself in 15 years 6 months. In how many years would it double itself ?

    (a) 6 years 3 months   (b) 7 years 9 months

    (c) 8 years 3 months   (d) 9 years 6 months.

34. Consider the following statements :

    If a sum of money is lent at simple interest, then the

    1. money gets doubled in 5 years if the rate of interest is $16\frac{2}{3}$%.

    2. money gets doubled in 5 years if the rate of interest is 20%.

    3. money becomes four times in 10 years if it gets doubled in 5 years.

    Of these statements,

    (a) 1 and 3 are correct   (b) 2 alone is correct

    (c) 3 alone is correct   (d) 2 and 3 are correct

35. The simple interest on a sum of money at 8% per annum for 6 years is half the sum. The sum is :

    (a) Rs. 4800   (b) Rs. 6000   (c) Rs. 8000   (d) Data inadequate

36. At what rate percent per annum will the simple interest on a sum of money be $\frac{2}{5}$ of the amount in 10 years ?   (S.S.C. 2002)

    (a) 4%   (b) $5\frac{2}{3}$%   (c) 6%   (d) $6\frac{2}{3}$%

37. In how much time would the simple interest on a certain sum be 0.125 times the principal at 10% per annum ?   (Assistant Grade, 1997)

    (a) $1\frac{1}{4}$ years   (b) $1\frac{3}{4}$ years   (c) $2\frac{1}{4}$ years   (d) $2\frac{3}{4}$ years

38. How long will it take a sum of money invested at 5% p.a. S.I. to increase its value by 40% ?

    (a) 5 years   (b) 6 years   (c) 7 years   (d) 8 years

39. A sum of money becomes $\frac{7}{6}$ of itself in 3 years at a certain rate of simple interest. The rate per annum is :   (S.S.C. 1999)

    (a) $5\frac{5}{9}$%   (b) $6\frac{5}{9}$%   (c) 18%   (d) 25%

40. Simple interest on a certain sum at a certain annual rate of interest is $\frac{1}{9}$ of the sum. If the numbers representing rate percent and time in years be equal, then the rate of interest is :

   (a) $3\frac{1}{3}\%$ (b) 5%   (c) $6\frac{2}{3}\%$ (d) 10%

41. Simple interest on a certain amount is $\frac{9}{16}$ of the principal. If the numbers representing the rate of interest in percent and time in years be equal, then time, for which the principal is lent out, is :   (R.R.B. 2003)

   (a) $5\frac{1}{2}$ years   (b) $6\frac{1}{2}$ years   (c) 7 years   (d) $7\frac{1}{2}$ years

42. A lends Rs. 2500 to B and a certain sum to C at the same time at 7% p.a. simple interest. If after 4 years, A altogether receives Rs. 1120 as interest from B and C, then the sum lent to C is :   (S.S.C. 2003)

   (a) Rs. 700   (b) Rs. 1500   (c) Rs. 4000   (d) Rs. 6500

43. Two equal sums of money were lent at simple interest at 11% p.a. for $3\frac{1}{2}$ years and $4\frac{1}{2}$ years respectively. If the difference in interests for two periods was Rs. 412.50, then each sum is :

   (a) Rs. 3250   (b) Rs. 3500   (c) Rs. 3750   (d) Rs. 4250

44. If the simple interest on a certain sum for 15 months at $7\frac{1}{2}\%$ per annum exceeds the simple interest on the same sum for 8 months at $12\frac{1}{2}\%$ per annum by Rs. 32.50, then the sum (in Rs.) is :

   (a) Rs. 3000   (b) Rs. 3060   (c) Rs. 3120   (d) Rs. 3250

45. A man invests a certain sum of money at 6% p.a. simple interest and another sum at 7% p.a. simple interest. His income from interest after 2 years was Rs. 354. One-fourth of the first sum is equal to one-fifth of the second sum. The total sum invested was :

   (a) Rs. 2600   (b) Rs. 2700   (c) Rs. 2880   (d) Rs. 2900

46. A borrowed some money from B at 12% p.a. S.I. for 3 years. He then added some more money to the borrowed sum and lent it to C for the same period at 14% p.a. rate of interest. If A gains Rs. 93.90 in the whole transaction, how much money did he add from his side ?

   (a) Rs. 35   (b) Rs. 55   (c) Rs. 80   (d) Rs. 105

47. A person borrowed Rs. 500 @ 3% per annum S.I. and Rs. 600 @ $4\frac{1}{2}\%$ per annum on the agreement that the whole sum will be returned only when the total interest becomes Rs. 126. The number of years, after which the borrowed sum is to be returned, is :

   (a) 2   (b) 3   (c) 4   (d) 5

48. A lent Rs. 5000 to B for 2 years and Rs. 3000 to C for 4 years on simple interest at the same rate of interest and received Rs. 2200 in all from both of them as interest. The rate of interest per annum is :   (C.B.I. 2003)

   (a) 5%   (b) 7%   (c) $7\frac{1}{8}\%$ (d) 10%

49. A sum of Rs. 725 is lent in the beginning of a year at a certain rate of interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest ?   (Bank P.O. 2003)

(a) 3.6%   (b) 4.5%   (c) 5%   (d) 6%   (e) None of these

50. The difference between the simple interest received from two different sources on Rs. 1500 for 3 years is Rs. 13.50. The difference between their rates of interest is :

(a) 0.1%   (b) 0.2%   (c) 0.3%   (d) 0.4%   (e) None of these
                                                                                    (S.S.C. 1999)

51. Peter invested an amount of Rs. 12,000 at the rate of 10 p.c.p.a. simple interest and another amount at the rate of 20 p.c.p.a. simple interest. The total interest earned at the end of one year on the total amount invested became 14 p.c.p.a. Find the total amount invested.   (S.B.I.P.O. 1999)

(a) Rs. 20,000   (b) Rs. 22,000   (c) Rs. 24,000   (d) Rs. 25,000   (e) None of these

52. What should be the least number of years in which the simple interest on Rs. 2600 at $6\frac{2}{3}$% will be an exact number of rupees ?

(a) 2   (b) 3   (c) 4   (d) 5

53. The rates of simple interest in two banks A and B are in the ratio 5 : 4. A person wants to deposit his total savings in two banks in such a way that he received equal half-yearly interest from both. He should deposit the savings in banks A and B in the ratio :

(a) 2 : 5   (b) 4 : 5   (c) 5 : 2   (d) 5 : 4

54. A sum was put at simple interest at a certain rate for 2 years. Had it been put at 3% higher rate, it would have fetched Rs. 72 more. The sum is :

(a) Rs. 1200   (b) Rs. 1500   (c) Rs. 1600   (d) Rs. 1800

55. If the annual rate of simple interest increases from 10% to $12\frac{1}{2}$%, a man's yearly income increases by Rs. 1250. His principal (in Rs.) is :   (S.S.C. 2004)

(a) 45,000   (b) 50,000   (c) 60,000   (d) 65,000

56. A moneylender finds that due to a fall in the annual rate of interest from 8% to $7\frac{3}{4}$%, his yearly income diminishes by Rs. 61.50. His capital is :   (S.S.C. 2003)

(a) Rs. 22,400   (b) Rs. 23,800   (c) Rs. 24,600   (d) Rs. 26,000

57. What annual payment will discharge a debt of Rs. 6450 due in 4 years at 5% simple interest ?

(a) Rs. 1400   (b) Rs. 1500   (c) Rs. 1550   (d) Rs. 1600

58. A sum of Rs. 10 is lent to be returned in 11 monthly instalments of Re. 1 each, interest being simple. The rate of interest is :

(a) $9\frac{1}{11}$%   (b) 10%   (c) 11%   (d) $21\frac{9}{11}$%

59. A person takes a loan of Rs. 200 at 5% simple interest. He returns Rs. 100 at the end of 1 year. In order to clear his dues at the end of 2 years, he would pay :

(a) Rs. 105   (b) Rs. 110   (c) Rs. 115   (d) Rs. 115.50

60. The price of a T.V. set worth Rs. 20,000 is to be paid in 20 instalments of Rs. 1000 each. If the rate of interest be 6% per annum, and the first instalment be paid at the time of purchase, then the value of the last instalment covering the interest as well will be :   (Hotel Management, 1998)

(a) Rs. 1050   (b) Rs. 2050   (c) Rs. 3000   (d) None of these

SUB#

61. If the rate increases by 2%, the simple interest received on a sum of money increases by Rs. 108. If the time period is increased by 2 years, the simple interest on the same sum increases by Rs. 180. The sum is :
   (a) Rs. 1800   (b) Rs. 3600   (c) Rs. 5400
   (d) Data inadequate   (e) None of these

62. Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 3508, what was the amount invested in Scheme B ?   (R.B.I. 2003)
   (a) Rs. 6400   (b) Rs. 6500   (c) Rs. 7200
   (d) Rs. 7500   (e) None of these

63. A sum of Rs. 2600 is lent out in two parts in such a way that the interest on one part at 10% for 5 years is equal to that on another at 9% for 6 years. The sum lent out at 10% is :
   (a) Rs. 1150   (b) Rs. 1250   (c) Rs. 1350   (d) Rs. 1450

64. A sum of Rs. 1550 was lent partly at 5% and partly at 8% p.a. simple interest. The total interest received after 3 years was Rs. 300. The ratio of the money lent at 5% to that lent at 8% is :
   (a) 5 : 8   (b) 8 : 5   (c) 16 : 15   (d) 31 : 6

65. A man lends Rs. 10,000 in four parts. If he gets 8% on Rs. 2000; $7\frac{1}{2}$% on Rs. 4000 and $8\frac{1}{2}$% on Rs. 1400; what percent must he get for the remainder, if his average annual interest is 8.13% ?
   (a) 7%   (b) 9%   (c) $9\frac{1}{4}$%   (d) $10\frac{1}{2}$%

66. An amount of Rs. 1,00,000 is invested in two types of shares. The first yields an interest of 9% p.a. and the second, 11% p.a. If the total interest at the end of one year is $9\frac{3}{4}$%, then the amount invested in each share was :   (M.B.A. 2002)
   (a) Rs. 52,500; Rs. 47,500   (b) Rs. 62,500; Rs. 37,500
   (c) Rs. 72,500; Rs. 27,500   (d) Rs. 82,500; Rs. 17,500

67. David invested certain amount in three different schemes A, B and C with the rate of interest 10% p.a., 12% p.a. and 15% p.a. respectively. If the total interest accrued in one year was Rs. 3200 and the amount invested in Scheme C was 150% of the amount invested in Scheme A and 240% of the amount invested in Scheme B, what was the amount invested in Scheme B ?   (Bank P.O. 2003)
   (a) Rs. 5000   (b) Rs. 6500   (c) Rs. 8000
   (d) Cannot be determined   (e) None of these

68. A person invested in all Rs. 2600 at 4%, 6% and 8% per annum simple interest. At the end of the year, he got the same interest in all the three cases. The money invested at 4% is :   (S.S.C. 2003)
   (a) Rs. 200   (b) Rs. 600   (c) Rs. 800   (d) Rs. 1200

69. Divide Rs. 2379 into 3 parts so that their amounts after 2, 3 and 4 years respectively may be equal, the rate of interest being 5% per annum at simple interest. The first part is :   (C.B.I. 1997)
   (a) Rs. 759   (b) Rs. 792   (c) Rs. 818   (d) Rs. 828

70. A man invested $\frac{1}{3}$ of his capital at 7%; $\frac{1}{4}$ at 8% and the remainder at 10%. If his annual income is Rs. 561, the capital is :
   (a) Rs. 5400   (b) Rs. 6000   (c) Rs. 6600   (d) Rs. 7200

ANSWERS

1. (c)	2. (a)	3. (b)	4. (a)	5. (b)	6. (d)	7. (d)	8. (b)	9. (c)
10. (c)	11. (d)	12. (b)	13. (c)	14. (d)	15. (c)	16. (d)	17. (b)	18. (b)
19. (c)	20. (c)	21. (a)	22. (c)	23. (a)	24. (b)	25. (c)	26. (b)	27. (e)
28. (c)	29. (d)	30. (b)	31. (c)	32. (d)	33. (b)	34. (b)	35. (d)	36. (a)
37. (a)	38. (d)	39. (a)	40. (a)	41. (d)	42. (b)	43. (c)	44. (c)	45. (b)
46. (d)	47. (b)	48. (d)	49. (e)	50. (c)	51. (a)	52. (b)	53. (b)	54. (a)
55. (b)	56. (c)	57. (b)	58. (d)	59. (c)	60. (d)	61. (d)	62. (a)	63. (c)
64. (c)	65. (b)	66. (b)	67. (a)	68. (d)	69. (d)	70. (c)		

SOLUTIONS

1. Time = 2 yrs 3 mths = $2\frac{1}{4}$ yrs = $\frac{9}{4}$ yrs.

$$\therefore \text{ S.I. = Rs. } \left(4800 \times \frac{17}{2} \times \frac{9}{4} \times \frac{1}{100}\right) = \text{Rs. 918.}$$

2. Time = 9 months = $\frac{3}{4}$ year.

$$\therefore \text{ S.I. = Rs. } \left(16800 \times \frac{25}{4} \times \frac{3}{4} \times \frac{1}{100}\right) = \text{Rs. 787.50.}$$

3. Time = (22 + 30 + 21) days = 73 days = $\frac{1}{5}$ year.

$$\therefore \text{ S.I. = Rs. } \left(1820 \times \frac{15}{2} \times \frac{1}{5} \times \frac{1}{100}\right) = \text{Rs. 27.30.}$$

4. Gain in 2 yrs. = Rs. $\left[\left(5000 \times \frac{25}{4} \times \frac{2}{100}\right) - \left(\frac{5000 \times 4 \times 2}{100}\right)\right]$ = Rs. (625 − 400) = Rs. 225.

$$\therefore \text{ Gain in 1 year = Rs. } \left(\frac{225}{2}\right) = \text{Rs. 112.50.}$$

5. Time = $\left(\frac{100 \times 81}{450 \times 4.5}\right)$ years = 4 years.

6. S.I. = Rs. (15500 − 12500) = Rs. 3000.

$$\text{Rate} = \left(\frac{100 \times 3000}{12500 \times 4}\right)\% = 6\%.$$

7. Time = 2 years 4 months = $2\frac{1}{3}$ years = $\frac{7}{3}$ years.

$$\text{Rate} = \left(\frac{100 \times 252 \times 3}{1600 \times 7}\right)\% = 6\frac{3}{4}\%.$$

8. Let rate = R% and time = R years. Then,

$$\left(\frac{1200 \times R \times R}{100}\right) = 432 \Leftrightarrow 12R^2 = 432 \Leftrightarrow R^2 = 36 \Leftrightarrow R = 6.$$

9. Principal = Rs. $\left(\frac{100 \times 5400}{12 \times 3}\right)$ = Rs. 15000.

10. Let the present worth be Rs. x. Then, S.I. = Rs. $(132 - x)$.

$\therefore \left(\dfrac{x \times 5 \times 2}{100} \right) = 132 - x$ ⇔ $10x = 13200 - 100x$ ⇔ $110x = 13200$ ⇔ $x = 120$.

11. Principal = Rs. $\left(\dfrac{100 \times 4016.25}{9 \times 5} \right)$ = Rs. $\left(\dfrac{401625}{45} \right)$ = Rs. 8925.

12. Sum = $\left(\dfrac{100 \times S.I.}{R \times T} \right)$ = Rs. $\left(\dfrac{100 \times x}{x \times x} \right)$ = Rs. $\left(\dfrac{100}{x} \right)$.

13. S.I. = Rs. $(956 - 800)$ = Rs. 156.

Rate = $\left(\dfrac{100 \times 156}{800 \times 3} \right)\%$ = $6\frac{1}{2}\%$.

New rate = $\left(6\frac{1}{2} + 4 \right)\%$ = $10\frac{1}{2}\%$.

New S.I. = Rs. $\left(800 \times \dfrac{21}{2} \times \dfrac{3}{100} \right)$ = Rs. 252.

$\therefore$ New amount = Rs. $(800 + 252)$ = Rs. 1052.

14. We need to know the S.I., principal and time to find the rate. Since the principal is not given, so data is inadequate.

15. P = Rs. 800, R = $4\frac{1}{2}\%$ = $\frac{9}{2}\%$, T = 3 years. Then,

S.I. = Rs. $\left(800 \times \dfrac{9}{2} \times \dfrac{3}{100} \right)$ = Rs. 108.

Now, P = Rs. 150, S.I. = Rs. 108, R = 8%.

$\therefore$ Time = $\left(\dfrac{100 \times 108}{150 \times 8} \right)$ years = 9 years.

16. P = Rs. 64, S.I. = Rs. $(83.20 - 64)$ = Rs. 19.20, T = 2 years.

So, rate = $\left(\dfrac{100 \times 19.20}{64 \times 2} \right)\%$ = 15%.

Now, P = Rs. 86, R = 15%, T = 4 years.

$\therefore$ S.I. = Rs. $\left(\dfrac{86 \times 15 \times 4}{100} \right)$ = Rs. 51.60.

17. S.I. = Rs. 840, R = 5%, T = 8 years.

Principal = Rs. $\left(\dfrac{100 \times 840}{5 \times 8} \right)$ = Rs. 2100.

Now, P = Rs. 2100, S.I. = Rs. 840, T = 5 years.

$\therefore$ Rate = $\left(\dfrac{100 \times 840}{2100 \times 5} \right)\%$ = 8%.

18. S.I. = Rs. 202.50, R = 4.5%, T = 1 year.

Principal = Rs. $\left(\dfrac{100 \times 202.50}{4.5 \times 1} \right)$ = Rs. 4500.

Now, P = Rs. 4500, R = 5%, T = 1 year.

S.I. = Rs. $\left(\dfrac{4500 \times 5 \times 1}{100} \right)$ = Rs. 225.

$\therefore$ Difference in interest = Rs. $(225 - 202.50)$ = Rs. 22.50.

19. Let the sum be Rs. x. Then, S.I. = Rs. $(504 - x)$.

$\therefore$ $\left(\dfrac{x \times 5 \times 4}{100}\right) = 504 - x$ $\Leftrightarrow$ $20x = 50400 - 100x$ $\Leftrightarrow$ $120x = 50400$ $\Leftrightarrow$ $x = 420$.

Now, P = Rs. 420, R = 10%, T = $\dfrac{5}{2}$ years.

S.I. = Rs. $\left(\dfrac{420 \times 10}{100} \times \dfrac{5}{2}\right)$ = Rs. 105.

$\therefore$ Amount = Rs. $(420 + 105)$ = Rs. 525.

20. Let the principal be P and rate of interest be R%.

$\therefore$ Required ratio = $\dfrac{\left[\left(\dfrac{P \times R \times 6}{100}\right)\right]}{\left[\left(\dfrac{P \times R \times 9}{100}\right)\right]} = \dfrac{6PR}{9PR} = \dfrac{6}{9} = 2 : 3$.

21. Let the sum be Rs. x. Then,

$\left(\dfrac{x \times 6 \times 3}{100}\right) + \left(\dfrac{x \times 9 \times 5}{100}\right) + \left(\dfrac{x \times 13 \times 3}{100}\right) = 8160$

$\Leftrightarrow$ $18x + 45x + 39x = (8160 \times 100)$ $\Leftrightarrow$ $102x = 816000$ $\Leftrightarrow$ $x = 8000$.

22. Let the sum be Rs. x. Now, S.I. = Rs. 600, T = 10 years.

Rate = $\left(\dfrac{100 \times 600}{x \times 10}\right)\% = \left(\dfrac{6000}{x}\right)\%$.

S.I. for first 5 years = Rs. $\left(\dfrac{x \times 5 \times 6000}{x \times 100}\right)$ = Rs. 300.

S.I. for last 5 years = Rs. $\left(3x \times 5 \times \dfrac{6000}{x \times 100}\right)$ = Rs. 900.

$\therefore$ Total interest = Rs. 1200.

23. S.I. = Rs. $\left(10 \times \dfrac{3}{100} \times 4\right)$ = Rs. 1.20.

24. Let the sum be Rs. 100. Then,

S.I. for first 6 months = Rs. $\left(\dfrac{100 \times 10 \times 1}{100 \times 2}\right)$ = Rs. 5.

S.I. for last 6 months = Rs. $\left(\dfrac{105 \times 10 \times 1}{100 \times 2}\right)$ = Rs. 5.25.

So, amount at the end of 1 year = Rs. $(100 + 5 + 5.25)$ = Rs. 110.25.

$\therefore$ Effective rate = $(110.25 - 100)$ = 10.25%.

25. S.I. for 1 year = Rs. $(854 - 815)$ = Rs. 39.

S.I. for 3 years = Rs. (39×3) = Rs. 117.

$\therefore$ Principal = Rs. $(815 - 117)$ = Rs. 698.

26. S.I. for 5 years = Rs. $(1020 - 720)$ = Rs. 300.

S.I. for 2 years = Rs. $\left(\dfrac{300}{5} \times 2\right)$ = Rs. 120.

$\therefore$ Principal = Rs. $(720 - 120)$ = Rs. 600.

27. S.I. for 3 years = Rs. (12005 − 9800) = Rs. 2205.

S.I. for 5 years = Rs. $\left(\dfrac{2205}{3} \times 5\right)$ = Rs. 3675.

∴ Principal = Rs. (9800 − 3675) = Rs. 6125.

Hence, rate = $\left(\dfrac{100 \times 3675}{6125 \times 5}\right)\%$ = 12%.

28. S.I. for $1\dfrac{1}{2}$ years = Rs. (1067.20 − 1012) = Rs. 55.20.

S.I. for $2\dfrac{1}{2}$ years = Rs. $\left(55.20 \times \dfrac{2}{3} \times \dfrac{5}{2}\right)$ = Rs. 92.

∴ Principal = Rs. (1012 − 92) = Rs. 920.

Hence, rate = $\left(\dfrac{100 \times 92 \times 2}{920 \times 5}\right)\%$ = 4%.

29. Let sum = x. Then, S.I. = x.

∴ Time = $\left(\dfrac{100 \times \text{S.I.}}{P \times R}\right) = \left(\dfrac{100 \times x}{x \times 12}\right)$ years = $8\dfrac{1}{3}$ years = 8 years 4 months.

30. Let sum = x. Then, S.I. = x.

∴ Rate = $\left(\dfrac{100 \times \text{S.I.}}{P \times T}\right) = \left(\dfrac{100 \times x}{x \times 12}\right)\% = \dfrac{25}{3}\% = 8\dfrac{1}{3}\%$.

31. Let sum = x. Then, S.I. = 3x.

∴ Rate = $\left(\dfrac{100 \times \text{S.I.}}{P \times T}\right) = \left(\dfrac{100 \times 3x}{x \times 15}\right)\%$ = 20%.

32. Let sum = x. Then, S.I. = x.

∴ Rate = $\left(\dfrac{100 \times x}{x \times 6}\right)\% = \dfrac{50}{3}\%$.

Now, sum = x, S.I. = 3x, Rate = $\dfrac{50}{3}\%$.

∴ Time = $\dfrac{100 \times 3x}{x \times \dfrac{50}{3}}$ = 18 years.

33. Let sum = x. Then, S.I. = 2x, Time = $15\dfrac{1}{2}$ years = $\dfrac{31}{2}$ years.

∴ Rate = $\left(\dfrac{100 \times 2x}{x \times \dfrac{31}{2}}\right)\% = \dfrac{400}{31}\%$.

Now, sum = x, S.I. = x, Rate = $\dfrac{400}{31}\%$.

∴ Time = $\dfrac{100 \times x}{x \times \dfrac{400}{31}} = \dfrac{31}{4}$ years = 7 years 9 months.

34. Let sum be x. Then, S.I. = x.

1. Time = $\dfrac{100 \times x}{x \times \dfrac{50}{3}}$ = 6 years (False)

2. Time $= \dfrac{100 \times x}{x \times 20} = 5$ years (True)

3. Suppose sum $= x$. Then, S.I. $= x$ and Time $= 5$ years.

   Rate $= \left(\dfrac{100 \times x}{x \times 5}\right)\% = 20\%$

   Now, sum $= x$, S.I. $= 3x$ and Rate $= 20\%$.

   ∴ Time $= \left(\dfrac{100 \times 3x}{x \times 20}\right)$ years $= 15$ years (False)

   So, 2 alone is correct.

35. Let sum $= x$. Then, S.I. $= \dfrac{x}{2}$.

   ∴ $\dfrac{x}{2} = \dfrac{x \times 8 \times 6}{100}$. Clearly, data is inadequate.

36. Let sum $= x$. Then, S.I. $= \dfrac{2x}{5}$. Time $= 10$ years.

   ∴ Rate $= \left(\dfrac{100 \times 2x}{x \times 5 \times 10}\right)\% = 4\%$.

37. Let sum $= x$. Then, S.I. $= 0.125x = \dfrac{1}{8} x$, R $= 10\%$.

   ∴ Time $= \left(\dfrac{100 \times x}{x \times 8 \times 10}\right)$ years $= \dfrac{5}{4}$ years $= 1\dfrac{1}{4}$ years.

38. Let the sum be x. Then, S.I. $= 40\%$ of $x = \dfrac{2x}{5}$; Rate $= 5\%$.

   ∴ Time $= \left(100 \times \dfrac{2x}{5} \times \dfrac{1}{x \times 5}\right) = 8$ years.

39. Let sum $= x$. Then, amount $= \dfrac{7x}{6}$.

   S.I. $= \left(\dfrac{7x}{6} - x\right) = \dfrac{x}{6}$; Time $= 3$ years.

   ∴ Rate $= \left(\dfrac{100 \times x}{x \times 6 \times 3}\right)\% = \dfrac{50}{9}\% = 5\dfrac{5}{9}\%$.

40. Let sum $= x$. Then, S.I. $= \dfrac{x}{9}$.

   Let rate $= R\%$ and time $= R$ years.

   ∴ $\left(\dfrac{x \times R \times R}{100}\right) = \dfrac{x}{9} \Leftrightarrow R^2 = \dfrac{100}{9} \Leftrightarrow R = \dfrac{10}{3} = 3\dfrac{1}{3}$.

   Hence, rate $= 3\dfrac{1}{3}\%$.

41. Let sum $= x$. Then, S.I. $= \dfrac{9}{16} x$.

   Let rate $= R\%$ and time $= R$ years.

   ∴ $\left(\dfrac{x \times R \times R}{100}\right) = \dfrac{9x}{16} \Leftrightarrow R^2 = \dfrac{900}{16} \Leftrightarrow R = \dfrac{30}{4} = 7\dfrac{1}{2}$.

   Hence, time $= 7\dfrac{1}{2}$ years.

SUB#

42. Let the sum lent to C be Rs. x. Then, $\left(\dfrac{2500 \times 7 \times 4}{100}\right) + \left(\dfrac{x \times 7 \times 4}{100}\right) = 1120$

$\Leftrightarrow \dfrac{7}{25}x = (1120 - 700) \Rightarrow x = \left(\dfrac{420 \times 25}{7}\right) = 1500.$

43. Let each sum be Rs. x. Then, $\left(\dfrac{x \times 11 \times 9}{100 \times 2}\right) - \left(\dfrac{x \times 11 \times 7}{100 \times 2}\right) = 412.50$

$\Leftrightarrow (99x - 77x) = 82500 \Leftrightarrow 22x = 82500 \Leftrightarrow x = 3750.$

44. Let the sum be Rs. x. Then, $\left(x \times \dfrac{15}{2} \times \dfrac{5}{4} \times \dfrac{1}{100}\right) - \left(x \times \dfrac{25}{2} \times \dfrac{2}{3} \times \dfrac{1}{100}\right) = 32.50$

$\Leftrightarrow \dfrac{75x}{8} - \dfrac{25x}{3} = 3250 \Leftrightarrow 25x = (3250 \times 24) \Leftrightarrow x = \left(\dfrac{3250 \times 24}{25}\right) = 3120.$

45. Let the sums be x and y.

$\dfrac{x \times 6 \times 2}{100} + \dfrac{y \times 7 \times 2}{100} = 354$ or $6x + 7y = 17700.$ ...(i)

Also, $\dfrac{x}{4} = \dfrac{y}{5}$ or $5x - 4y = 0$ ...(ii)

Solving (i) and (ii), we get : $x = 1200$ and $y = 1500.$

$\therefore$ Total sum = Rs. 2700.

46. Let the money added be Rs. x. Then, $\dfrac{(830 + x) \times 14 \times 3}{100} - \dfrac{830 \times 12 \times 3}{100} = 93.90$

$\Leftrightarrow 830 \times 42 + 42x - 830 \times 36 = 9390 \Leftrightarrow 42x + 830 \times (42 - 36) = 9390$

$\Leftrightarrow 42x = 9390 - 4980 \Leftrightarrow x = \dfrac{4410}{42} = 105.$

$\therefore$ Money added = Rs. 105.

47. Let the time be x years. Then, $\left(\dfrac{500 \times 3 \times x}{100}\right) + \left(\dfrac{600 \times 9 \times x}{100 \times 2}\right) = 126$

$\Leftrightarrow 15x + 27x = 126 \Leftrightarrow 42x = 126 \Leftrightarrow x = 3.$

$\therefore$ Required time = 3 years.

48. Let the rate be R% p.a. Then, $\left(\dfrac{5000 \times R \times 2}{100}\right) + \left(\dfrac{3000 \times R \times 4}{100}\right) = 2200$

$\Leftrightarrow 100R + 120R = 2200 \Leftrightarrow R = \left(\dfrac{2200}{220}\right) = 10.$

$\therefore$ Rate = 10%.

49. Let the original rate be R%. Then, new rate = (2R)%.

$\therefore \left(\dfrac{725 \times R \times 1}{100}\right) + \left(\dfrac{362.50 \times 2R \times 1}{100 \times 3}\right) = 33.50$

$\Leftrightarrow (2175 + 725)\,R = 33.50 \times 100 \times 3 = 10050$

$\Leftrightarrow R = \dfrac{10050}{2900} = 3.46.$

$\therefore$ Original rate = 3.46%.

50. $\left(\dfrac{1500 \times R_1 \times 3}{100}\right) - \left(\dfrac{1500 \times R_2 \times 3}{100}\right) = 13.50$

$\Leftrightarrow 4500\,(R_1 - R_2) = 1350 \Leftrightarrow R_1 - R_2 = \dfrac{1350}{4500} = 0.3\%.$

51. Let the second amount be Rs. x. Then,

$$\left(\frac{12000 \times 10 \times 1}{100}\right) + \left(\frac{x \times 20 \times 1}{100}\right) = \left[\frac{(12000 + x) \times 14 \times 1}{100}\right]$$

$\Leftrightarrow$ $12000 + 20x = 168000 + 14x$ $\Leftrightarrow$ $6x = 48000$ $\Leftrightarrow$ $x = 8000$.

$\therefore$ Total investment = Rs. $(12000 + 8000)$ = Rs. 20000.

52. S.I. = Rs. $\left(2600 \times \frac{20}{3} \times \frac{1}{100} \times T\right)$ = Rs. $\left(\frac{520}{3} \times T\right)$,

which is an exact number of rupees when T = 3.

53. Let the savings be X and Y and the rates of simple interest be $5x$ and $4x$ respectively.

Then, $X \times 5x \times \frac{1}{2} \times \frac{1}{100} = Y \times 4x \times \frac{1}{2} \times \frac{1}{100}$ or $\frac{X}{Y} = \frac{4}{5}$, i.e., X : Y = 4 : 5.

54. Let the sum be Rs. x and original rate be R%. Then, $\dfrac{x \times (R + 3) \times 2}{100} - \dfrac{x \times R \times 2}{100} = 72$

$\Leftrightarrow$ $2Rx + 6x - 2Rx = 7200$ $\Leftrightarrow$ $x = 1200$.

55. Let the sum be Rs. x. Then, $\left(x \times \frac{25}{2} \times \frac{1}{100}\right) - \left(\frac{x \times 10 \times 1}{100}\right) = 1250$

$\Leftrightarrow$ $25x - 20x = 250000$ $\Leftrightarrow$ $5x = 250000$ $\Leftrightarrow$ $x = 50000$.

56. Let the capital be Rs. x. Then, $\left(\frac{x \times 8 \times 1}{100}\right) - \left(x \times \frac{31}{4} \times \frac{1}{100}\right) = 61.50$

$\Leftrightarrow$ $32x - 31x = 6150 \times 4$ $\Leftrightarrow$ $x = 24600$.

57. Let the annual instalment be Rs. x. Then,

$$\left[x + \left(\frac{x \times 3 \times 5}{100}\right)\right] + \left[x + \left(\frac{x \times 2 \times 5}{100}\right)\right] + \left[x + \left(\frac{x \times 1 \times 5}{100}\right)\right] + x = 6450$$

$\Leftrightarrow$ $\dfrac{23x}{20} + \dfrac{22x}{20} + \dfrac{21x}{20} + x = 6450$ $\Leftrightarrow$ $86x = 6450 \times 20$ $\Leftrightarrow$ $x = 1500$.

58. Rs. 10 + S.I. on Rs. 10 for 11 months

    = Rs. 11 + S.I. on Re. 1 for $(1 + 2 + 3 + 4 + \dots + 10)$ months

$\Rightarrow$ Rs. 10 + S.I. on Re. 1 for 110 months = Rs. 11 + S.I. on Re. 1 for 55 months

$\Rightarrow$ S.I. on Re. 1 for 55 months = Re. 1.

$\therefore$ Rate = $\left(\dfrac{100 \times 12}{1 \times 55}\right)\%$ = $21\frac{9}{11}\%$.

59. Amount to be paid = Rs. $\left(100 + \dfrac{200 \times 5 \times 1}{100} + \dfrac{100 \times 5 \times 1}{100}\right)$ = Rs. 115.

60. Money paid in cash = Rs. 1000.

    Balance payment = Rs. $(20000 - 1000)$ = Rs. 19000.

61. Let the sum be Rs. x, rate be R% p.a. and time be T years.

Then, $\left[\dfrac{x \times (R + 2) \times T}{100}\right] - \left(\dfrac{x \times R \times T}{100}\right) = 108$ $\Leftrightarrow$ $2xT = 10800$ ...(i)

And, $\left[\dfrac{x \times R \times (T + 2)}{100}\right] - \left(\dfrac{x \times R \times T}{100}\right) = 180$ $\Leftrightarrow$ $2xR = 18000$ ...(ii)

Clearly, from (i) and (ii), we cannot find the value of x.

So, the data is inadequate.

62. Let the sum invested in Scheme A be Rs. x and that in Scheme B be Rs. $(13900 - x)$.

Then, $\left(\dfrac{x \times 14 \times 2}{100}\right) + \left[\dfrac{(13900 - x) \times 11 \times 2}{100}\right] = 3508$

$\leftrightarrow$ $28x - 22x = 350800 - (13900 \times 22)$ $\Leftrightarrow$ $6x = 45000$ $\leftrightarrow$ $x = 7500$.

So, sum invested in Scheme B = Rs. $(13900 - 7500)$ = Rs. 6400.

63. Let the sum lent at 10% be Rs. x and that lent at 9% be Rs. $(2600 - x)$. Then,

$\left(\dfrac{x \times 10 \times 5}{100}\right) = \dfrac{(2600 - x) \times 9 \times 6}{100}$

$\Leftrightarrow$ $50x = (2600 \times 54) - 54x$ $\Rightarrow$ $x = \left(\dfrac{2600 \times 54}{104}\right) = 1350$.

$\therefore$ Sum lent at 10% = Rs. 1350.

64. Let the sum lent at 5% be Rs. x and that lent at 8% be Rs. $(1550 - x)$. Then,

$\left(\dfrac{x \times 5 \times 3}{100}\right) + \left[\dfrac{(1550 - x) \times 8 \times 3}{100}\right] = 300$

$\leftrightarrow$ $15x - 24x + (1550 \times 24) = 30000$ $\Leftrightarrow$ $9x = 7200$ $\Leftrightarrow$ $x = 800$.

$\therefore$ Required ratio = 800 : 750 = 16 : 15.

65. Let the required rate be R. Then,

$\left(\dfrac{20000 \times 8 \times 1}{100}\right) + \left(4000 \times \dfrac{15}{2} \times \dfrac{1}{100}\right) + \left(1400 \times \dfrac{17}{2} \times \dfrac{1}{100}\right)$

$+ \left(2600 \times R \times \dfrac{1}{100}\right) = \left(\dfrac{813}{10000} \times 10000\right)$

$\leftrightarrow$ $160 + 300 + 119 + 26R = 813$ $\leftrightarrow$ $R = 9$.

66. Let the sum invested at 9% be Rs. x and that invested at 11% be Rs. $(100000 - x)$.

Then, $\left(\dfrac{x \times 9 \times 1}{100}\right) + \left[\dfrac{(100000 - x) \times 11 \times 1}{100}\right] = \left(100000 \times \dfrac{39}{4} \times \dfrac{1}{100}\right)$

$\leftrightarrow$ $\dfrac{9x + 1100000 - 11x}{100} = \dfrac{39000}{4} = 9750$

$\leftrightarrow$ $2x = (1100000 - 975000) = 125000$ $\Leftrightarrow$ $x = 62500$.

$\therefore$ Sum invested at 9% = Rs. 62500.

Sum invested at 11% = Rs. $(100000 - 62500)$ = Rs. 37500.

67. Let x, y and z be the amounts invested in schemes A, B and C respectively. Then,

$\left(\dfrac{x \times 10 \times 1}{100}\right) + \left(\dfrac{y \times 12 \times 1}{100}\right) + \left(\dfrac{z \times 15 \times 1}{100}\right) = 3200$

$\leftrightarrow$ $10x + 12y + 15z = 320000$ ...(i)

Now, $z = 240\%$ of $y = \dfrac{12}{5} y$ ...(ii)

And, $z = 150\%$ of $x = \dfrac{3}{2} x$ $\Rightarrow$ $x = \dfrac{2}{3} z = \left(\dfrac{2}{3} \times \dfrac{12}{5}\right) y = \dfrac{8}{5} y$ ...(iii)

From (i), (ii) and (iii), we have :

$16y + 12y + 36y = 320000$ $\Leftrightarrow$ $64y = 320000$ $\Leftrightarrow$ $y = 5000$.

$\therefore$ Sum invested in Scheme B = Rs. 5000.

68. Let the parts be x, y and $[2600 - (x + y)]$. Then,

$\dfrac{x \times 4 \times 1}{100} = \dfrac{y \times 6 \times 1}{100} = \dfrac{[2600 - (x + y)] \times 8 \times 1}{100}$

SUB#

$$\therefore \quad \frac{y}{x} = \frac{4}{6} = \frac{2}{3} \text{ or } y = \frac{2}{3}x.$$

So, $\dfrac{x \times 4 \times 1}{100} = \dfrac{\left(2600 - \dfrac{5}{3}x\right) \times 8}{100}$

$\Leftrightarrow \quad 4x = \dfrac{(7800 - 5x) \times 8}{3} \quad \Leftrightarrow \quad 52x = (7800 \times 8) \quad \Leftrightarrow \quad x = \left(\dfrac{7800 \times 8}{52}\right) = 1200.$

$\therefore$ Money invested at 4% = Rs. 1200.

69. Let the parts be x, y and $[2379 - (x + y)]$.

$$x + \left(x \times 2 \times \frac{5}{100}\right) = y + \left(y \times 3 \times \frac{5}{100}\right) = z + \left(z \times 4 \times \frac{5}{100}\right)$$

$\Rightarrow \quad \dfrac{11x}{10} = \dfrac{23y}{20} = \dfrac{6z}{5} = k \quad \Rightarrow \quad x = \dfrac{10k}{11}, \ y = \dfrac{20k}{23}, \ z = \dfrac{5k}{6}$

But $x + y + z = 2379$

$\Rightarrow \quad \dfrac{10k}{11} + \dfrac{20k}{23} + \dfrac{5k}{6} = 2379 \quad \Rightarrow \quad 1380k + 1320k + 1265k = 2379 \times 11 \times 23 \times 6$

$\Rightarrow \quad k = \dfrac{2379 \times 11 \times 23 \times 6}{3965} = \dfrac{3 \times 11 \times 23 \times 6}{5}$

$\therefore \quad x = \left(\dfrac{10}{11} \times \dfrac{3 \times 11 \times 23 \times 6}{5}\right) = 828.$

Hence, the first part is Rs. 828.

70. Let total capital be Rs. x. Then, $\left(\dfrac{x}{3} \times \dfrac{7}{100} \times 1\right) + \left(\dfrac{x}{4} \times \dfrac{8}{100} \times 1\right) + \left(\dfrac{5x}{12} \times \dfrac{10}{100} \times 1\right) = 561$

$\Leftrightarrow \quad \dfrac{7x}{300} + \dfrac{x}{50} + \dfrac{x}{24} = 561 \quad \Leftrightarrow \quad 51x = (561 \times 600) \quad \Leftrightarrow \quad x = \left(\dfrac{561 \times 600}{51}\right) = 6600.$

71. Let the sum be Rs. 100 be invested for 1 year. Then,

$$\text{S.I.} = \text{Rs.} \left[\left(\frac{40 \times 15 \times 1}{100}\right) + \left(\frac{30 \times 10 \times 1}{100}\right) + \left(\frac{30 \times 18 \times 1}{100}\right)\right] = \text{Rs. } 14.40.$$

$\therefore$ Effective rate = 14.4%.

EXERCISE 21B

(DATA SUFFICIENCY TYPE QUESTIONS)

Directions (*Questions 1 to 6*) : Each of the questions given below consists of a statement and/or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the question. Read both the statements and

Give answer (*a*) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (*b*) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (*c*) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (*d*) if the data in both Statements I and II together are not sufficient to answer the question;

Give answer (*e*) if the data in both Statements I and II together are necessary to answer the question.

1. What is the rate of simple interest ?   (Bank P.O. 2003)
   I. The total interest earned was Rs. 4000.
   II. The sum was invested for 4 years.

2. The simple interest on a sum of money is Rs. 50. What is the sum ? (R.B.I. 2003)
   I. The interest rate is 10% p.a.
   II. The sum earned simple interest in 10 years.

3. How much money did X invest ?

   I. An increase in the rate of interest from $4\frac{7}{8}$% to $5\frac{1}{8}$% per annum increases his
   yearly income by Rs. 25.

   II. The sum invested gets doubled, when invested at 8% p.a. for $12\frac{1}{2}$ years.

4. What percentage of simple interest per annum did Anand pay to Deepak ?
   I. Anand borrowed Rs. 8000 from Deepak for four years.
   II. Anand returned Rs. 8800 to Deepak at the end of two years and settled the loan.
                                                                    (I.B.P.S. 2002)

5. A man borrowed a total sum of Rs. 24000 from two moneylenders. For one loan, he
   paid interest @ $7\frac{1}{2}$% p.a. and for the other 9% p.a. How much money did he borrow
   at each rate ?
   I. The sum of the interests after one year was Rs. 2025.
   II. The interest on one sum was twice that on the other.

6. What is the sum which earned interest ?   (NABARD, 2002)
   I. The total simple interest was Rs. 7000 after 7 years.
   II. The total of sum and simple interest was double of the sum after 5 years.

   Directions (Questions 7-8) : Each of the questions given below consists of a question
followed by three statements. You have to study the question and the statements and
decide which of the statement(s) is/are necessary to answer the question.

7. What is the principal sum ?
   I. The sum amounts to Rs. 690 in 3 years at S.I.
   II. The sum amounts to Rs. 750 in 5 years at S.I.
   III. The rate of interest is 5% p.a.
   (a) I and III only   (b) II and III only
   (c) I and II only   (d) I and III only, or II and III only
   (e) Any two of the three

8. In how many years will a sum of money put at simple interest treble itself ?
   I. The interest earned in 4 years is half the sum.

   II. The rate of interest is $12\frac{1}{2}$%.

   III. The sum doubles itself in 8 years at simple interest.
   (a) Any one of the three   (b) Any two of the three
   (c) All I, II and III   (d) II and III only
   (e) I and II only

ANSWERS

1. (d)   2. (c)   3. (a)   4. (e)   5. (c)   6. (e)   7. (e)   8. (a)

SOLUTIONS

1. We know that, $R = \left(\dfrac{100 \times S.I.}{P \times T}\right)$

   Now, I gives, S.I. = Rs. 4000.

   II gives, T = 4 years.

   But, P is unknown. So, we cannot find R.

   So, given data is insufficient to get R.

   ∴ Correct answer is (d).

2. Given : S.I. = Rs. 50.

   I gives,   R = 10% p.a.

   II gives,   T = 10 years.

   ∴ Sum $= \left(\dfrac{100 \times S.I.}{T \times R}\right) = Rs. \left(\dfrac{100 \times 50}{10 \times 10}\right) = Rs. 50.$

   Thus, I and II together give the answer.

   ∴ Correct answer is (e).

3. Suppose X invests Rs. x.

   I gives : $R_1 = \dfrac{39}{8}\%$, $R_2 = \dfrac{41}{8}\%$.

   Increase in S.I. = Rs. 25.

   $\rightarrow \left(\dfrac{x \times 1 \times \frac{41}{8}}{100}\right) - \left(\dfrac{x \times 1 \times \frac{39}{8}}{100}\right) = 25$

   $\Rightarrow (41x - 39x) = (25 \times 800) \Rightarrow x = \left(\dfrac{25 \times 800}{2}\right) = 10000.$

   Thus, I only gives the answer.

   II gives, S.I. = Rs. x, R = 8% and T = $\dfrac{25}{2}$ years.

   $P = \dfrac{100 \times S.I.}{R \times T} = \left(\dfrac{100 \times x}{8 \times 25} \times 2\right)$

   Thus, P is not obtained.

   ∴ I alone is sufficient to get the answer and II is not sufficient to get the answe

   ∴ Correct answer is (a).

4. Let the rate be R% p.a.

   I gives,   P = Rs. 8000 and T = 4 years.

   II gives, S.I. = Rs. (8800 – 8000) = Rs. 800.

   ∴ $R = \dfrac{100 \times S.I.}{P \times T} = \left(\dfrac{100 \times 800}{8000 \times 4}\right)\% = 2\dfrac{1}{2}\%$ p.a.

   Thus, I and II both are needed to get the answer.

   ∴ Correct answer is (e).

5. Suppose he borrowed Rs. x at $7\dfrac{1}{2}\%$ p.a. and Rs. (24000 – x) at 9% p.a.

   I gives, total interest = Rs. 2025.

$\therefore \left(x \times 1 \times \dfrac{15}{2} \times \dfrac{1}{100}\right) + \left\{(24000 - x) \times 1 \times \dfrac{9}{100}\right\} = 2025.$

This gives x.

II gives Interest on Rs. $(24000 - x) = 2 \times$ (interest on Rs. x)

$\Rightarrow \quad (24000 - x) \times \dfrac{9}{100} \times 1 = \left(2 \times x \times \dfrac{15}{2} \times \dfrac{1}{100}\right)$

This gives x.

Thus, data in I as well as well as in II are sufficient to answer the question.

$\therefore$ Correct answer is (c).

6. Let the sum be Rs. x.

I gives, S.I. = Rs. 7000 and T = 7 years.

II gives, Sum + S.I. for 5 years = 2 × Sum $\Rightarrow$ Sum = S.I. for 5 years

Now, S.I. for 7 years = Rs. 7000

$\therefore$ S.I. for 1 year = Rs. $\dfrac{7000}{7}$ = Rs. 1000.

S.I. for 5 years = Rs. (1000×5) = Rs. 5000.

Thus, I and II both are needed to get the answer.

$\therefore$ Correct answer is (e).

7. Clearly, any of the three will give us the answer.

$\therefore$ Correct answer is (e).

8. Let sum be Rs. x. Then, S.I. = Rs. $(3x - x)$ = Rs. $2x$, T = ?

I gives : When T = 4, then S.I. = Rs. $\dfrac{x}{2}$.

$\therefore \quad R = \dfrac{100 \times S.I.}{P \times T} = \left(100 \times \dfrac{x}{2} \times \dfrac{1}{x} \times \dfrac{1}{4}\right) = 12\dfrac{1}{2}\%$ p.a.

Now, Sum = Rs. x, S.I. = Rs. $2x$, R = $\dfrac{25}{2}\%$ p.a., T = ?

$\therefore \quad T = \dfrac{100 \times S.I.}{P \times R} = \left(\dfrac{100 \times 2x}{x \times 25} \times 2\right) = 16$ years.

Thus, I only gives the answer.

II gives, R = $\dfrac{25}{2}\%$ p.a.

$\therefore \quad T = \dfrac{100 \times S.I.}{P \times R} = \left(\dfrac{100 \times 2x}{x \times 25} \times 2\right) = 16$ years.

Thus, II only also gives the answer.

III gives, R = 5% p.a.

$\therefore \quad T = \dfrac{100 \times S.I.}{P \times R} = \left(\dfrac{100 \times 2x}{x \times 5}\right) = 40$ years.

Thus, III only also gives the answer.

$\therefore$ Correct answer is (a).

22. COMPOUND INTEREST

Compound Interest : Sometimes it so happens that the borrower and the lender agree to fix up a certain unit of time, say *yearly* or *half-yearly* or *quarterly* to settle the previous account.

In such cases, the amount after first unit of time becomes the principal for the second unit, the amount after second unit becomes the principal for the third unit and so on.

After a specified period, *the difference between the amount and the money borrowed is called the Compound Interest (abbreviated as C.I.) for that period.*

IMPORTANT FACTS AND FORMULAE

Let Principal = P, Rate = R% per annum, Time = n years.

I. When interest is compound Annually :

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^n$$

II. When interest is compounded Half-yearly :

$$\text{Amount} = P\left[1 + \frac{(R/2)}{100}\right]^{2n}$$

III. When interest is compounded Quarterly :

$$\text{Amount} = P\left[1 + \frac{(R/4)}{100}\right]^{4n}$$

IV. When interest is compounded Annually but time is in fraction, say $3\frac{2}{5}$ **years.**

$$\text{Amount} = P\left(1 + \frac{R}{100}\right)^3 \times \left(1 + \frac{\frac{2}{5}R}{100}\right)$$

V. When Rates are different for different years, say $R_1\%$, $R_2\%$, $R_3\%$ **for 1st, 2nd and 3rd year respectively.**

$$\text{Then, Amount} = P\left(1 + \frac{R_1}{100}\right)\left(1 + \frac{R_2}{100}\right)\left(1 + \frac{R_3}{100}\right).$$

VI. Present worth of Rs. x **due** n **years hence is given by :**

$$\text{Present Worth} = \frac{x}{\left(1 + \frac{R}{100}\right)^n}.$$

SOLVED EXAMPLES

Ex. 1. *Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.*

Sol. Amount = Rs. $\left[7500 \times \left(1 + \frac{4}{100}\right)^2 \right]$ = Rs. $\left(7500 \times \frac{26}{25} \times \frac{26}{25} \right)$ = Rs. 8112.

∴   C.I. = Rs. (8112 − 7500) = Rs. 612.

Ex. 2. *Find compound interest on Rs. 8000 at 15% per annum for 2 years 4 months, compounded annually.*

Sol. Time = 2 years 4 months = $2\frac{4}{12}$ years = $2\frac{1}{3}$ years.

Amount = Rs. $\left[8000 \times \left(1 + \frac{15}{100}\right)^2 \times \left(1 + \frac{\frac{1}{3} \times 15}{100}\right) \right]$ = Rs. $\left(8000 \times \frac{23}{20} \times \frac{23}{20} \times \frac{21}{20} \right)$

= Rs. 11109.

∴   C.I. = Rs. (11109 − 8000) = Rs. 3109.

Ex. 3. *Find the compound interest on Rs. 10,000 in 2 years at 4% per annum, the interest being compounded half-yearly.*   (S.S.C. 2000)

Sol. Principal = Rs. 10000; Rate = 2% per half-year; Time = 2 years = 4 half-years.

∴   Amount = Rs. $\left[10000 \times \left(1 + \frac{2}{100}\right)^4 \right]$ = Rs. $\left(10000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50} \right)$

= Rs. 10824.32.

∴   C.I. = Rs. (10824.32 − 10000) = Rs. 824.32.

Ex. 4. *Find the compound interest on Rs. 16,000 at 20% per annum for 9 months, compounded quarterly.*

Sol. Principal = Rs. 16000; Time = 9 months = 3 quarters;
Rate = 20% per annum = 5% per quarter.

∴   Amount = Rs. $\left[16000 \times \left(1 + \frac{5}{100}\right)^3 \right]$ = Rs. $\left(16000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right)$ = Rs. 18522.

∴   C.I. = Rs. (18522 − 16000) = Rs. 2522.

Ex. 5. *If the simple interest on a sum of money at 5% per annum for 3 years is Rs. 1200, find the compound interest on the same sum for the same period at the same rate.*

Sol. Clearly, Rate = 5% p.a., Time = 3 years, S.I. = Rs. 1200.

So, Principal = Rs. $\left(\frac{100 \times 1200}{3 \times 5} \right)$ = Rs. 8000.

Amount = Rs. $\left[8000 \times \left(1 + \frac{5}{100}\right)^3 \right]$ = Rs. $\left(8000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} \right)$ = Rs. 9261.

∴   C.I. = Rs. (9261 − 8000) = Rs. 1261.

Ex. 6. *In what time will Rs. 1000 become Rs. 1331 at 10% per annum compounded annually ?*   (S.S.C. 2004)

SUB#

Sol. Principal = Rs. 1000; Amount = Rs. 1331; Rate = 10% p.a.

Let the time be n years. Then,

$$\left[1000\left(1+\frac{10}{100}\right)^n\right] = 1331 \text{ or } \left(\frac{11}{10}\right)^n = \left(\frac{1331}{1000}\right) = \left(\frac{11}{10}\right)^3$$

∴ $n = 3$ years.

Ex. 7. *If Rs. 500 amounts to Rs. 583.20 in two years compounded annually, find the rate of interest per annum.*

Sol. Principal = Rs. 500; Amount = Rs. 583.20; Time = 2 years.

Let the rate be R% per annum. Then,

$$\left[500\left(1+\frac{R}{100}\right)^2\right] = 583.20 \text{ or } \left(1+\frac{R}{100}\right)^2 = \frac{5832}{5000} = \frac{11664}{10000}$$

∴ $\left(1+\frac{R}{100}\right)^2 = \left(\frac{108}{100}\right)^2$ or $1+\frac{R}{100} = \frac{108}{100}$ or R = 8.

So, rate = 8% p.a.

Ex. 8. *If the compound interest on a certain sum at $16\frac{2}{3}$% for 3 years is Rs. 1270, find the simple interest on the same sum at the same rate and for the same period.*

Sol. Let the sum be Rs. x. Then,

$$C.I. = \left[x\times\left(1+\frac{50}{3\times100}\right)^3 - x\right] = \left(\frac{343x}{216} - x\right) = \frac{127x}{216}.$$

∴ $\frac{127x}{216} = 1270$ or $x = \frac{1270\times216}{127} = 2160.$

Thus, the sum is Rs. 2160.

∴ $S.I. = Rs. \left(2160\times\frac{50}{3}\times3\times\frac{1}{100}\right) = Rs. 1080.$

Ex. 9. *The difference between the compound interest and simple interest on a certain sum at 10% per annum for 2 years is Rs. 631. Find the sum.*

Sol. Let the sum be Rs. x. Then,

$$C.I. = x\left(1+\frac{10}{100}\right)^2 - x = \frac{21x}{100}, \quad S.I. = \left(\frac{x\times10\times2}{100}\right) = \frac{x}{5}.$$

∴ $(C.I.) - (S.I.) = \left(\frac{21x}{100} - \frac{x}{5}\right) = \frac{x}{100}.$

∴ $\frac{x}{100} = 631 \leftrightarrow x = 63100.$

Hence, the sum is Rs. 63,100.

Ex. 10. *The difference between the compound interest and the simple interest accrued on an amount of Rs. 18,000 in 2 years was Rs. 405. What was the rate of interest p.c.p.a. ?*   **(Bank P.O. 2003)**

Sol. Let the rate be R% p.a. Then,

$$\left[18000\left(1+\frac{R}{100}\right)^2 - 18000\right] - \left(\frac{18000\times R\times2}{100}\right) = 405$$

$$\Leftrightarrow 18000\left[\frac{(100+R)^2}{10000} - 1 - \frac{2R}{100}\right] = 405$$

SUB#

$\Leftrightarrow \quad 18000\left[\dfrac{(100+R)^2 - 10000 - 200R}{10000}\right] = 405$

$\Leftrightarrow \quad \dfrac{9}{5}R^2 = 405 \quad \Leftrightarrow \quad R^2 = \left(\dfrac{405 \times 5}{9}\right) = 225 \quad \Leftrightarrow \quad R = 15.$

$\therefore \quad$ Rate = 15%.

Ex. 11. *Divide Rs. 1301 between A and B, so that the amount of A after 7 years is equal to the amount of B after 9 years, the interest being compounded at 4% per annum.*

Sol. Let the two parts be Rs. x and Rs. (1301 – x).

$$x\left(1+\dfrac{4}{100}\right)^7 = (1301-x)\left(1+\dfrac{4}{100}\right)^9 \quad \Leftrightarrow \quad \dfrac{x}{(1301-x)} = \left(1+\dfrac{4}{100}\right)^2 = \left(\dfrac{26}{25} \times \dfrac{26}{25}\right).$$

$\Leftrightarrow \quad 625x = 676\,(1301-x) \quad \Leftrightarrow \quad 1301x = 676 \times 1301 \quad \Leftrightarrow \quad x = 676.$

So, the two parts are Rs. 676 and Rs. (1301 – 676) *i.e.* Rs. 676 and Rs. 625.

Ex. 12. *A certain sum amounts to Rs. 7350 in 2 years and to Rs. 8575 in 3 years. Find the sum and rate percent.*

Sol. S.I. on Rs. 7350 for 1 year = Rs. (8575 – 7350) = Rs. 1225.

$\therefore \qquad$ Rate $= \left(\dfrac{100 \times 1225}{7350 \times 1}\right)\% = 16\dfrac{2}{3}\%.$

Let the sum be Rs. x. Then,

$$x\left(1+\dfrac{50}{3 \times 100}\right)^2 = 7350 \quad \Leftrightarrow \quad x \times \dfrac{7}{6} \times \dfrac{7}{6} = 7350 \quad \Leftrightarrow \quad x = \left(7350 \times \dfrac{36}{49}\right) = 5400.$$

$\therefore \qquad$ Sum = Rs. 5400.

Ex. 13. *A sum of money amounts to Rs. 6690 after 3 years and to Rs. 10,035 after 6 years on compound interest. Find the sum.*

Sol. Let the sum be Rs. P. Then,

$$P\left(1+\dfrac{R}{100}\right)^3 = 6690 \qquad ...(i) \qquad \text{and} \qquad P\left(1+\dfrac{R}{100}\right)^6 = 10035 \qquad ...(ii)$$

On dividing, we get $\left(1+\dfrac{R}{100}\right)^3 = \dfrac{10035}{6690} = \dfrac{3}{2}.$

Substituting this value in (i), we get :

$$P \times \dfrac{3}{2} = 6690 \quad \text{or} \quad P = \left(6690 \times \dfrac{2}{3}\right) = 4460.$$

Hence, the sum is Rs. 4460.

Ex. 14. *A sum of money doubles itself at compound interest in 15 years. In how many years will it become eight times ?*

Sol. $P\left(1+\dfrac{R}{100}\right)^{15} = 2P \quad \Rightarrow \quad \left(1+\dfrac{R}{100}\right)^{15} = \dfrac{2P}{P} = 2$ \qquad ...(i)

Let $P\left(1+\dfrac{R}{100}\right)^n = 8P \quad \Rightarrow \quad \left(1+\dfrac{R}{100}\right)^n = 8 = 2^3 = \left\{\left(1+\dfrac{R}{100}\right)^{15}\right\}^3$ \quad [using (i)]

$\Rightarrow \quad \left(1+\dfrac{R}{100}\right)^n = \left(1+\dfrac{R}{100}\right)^{45} \quad \Rightarrow \quad n = 45.$

Thus, the required time = 45 years.

Ex. 15. *What annual payment will discharge a debt of Rs. 7620 due in 3 years at*

$16\frac{2}{3}$% *per annum compound interest ?*

Sol.   Let each instalment be Rs. x. Then,

(P.W. of Rs. x due 1 year hence) + (P.W. of Rs. x due 2 years hence)

+ (P.W. of Rs. x due 3 years hence) = 7620.

$$\therefore \quad \frac{x}{\left(1+\dfrac{50}{3\times100}\right)} + \frac{x}{\left(1+\dfrac{50}{3\times100}\right)^2} + \frac{x}{\left(1+\dfrac{50}{3\times100}\right)^3} = 7620$$

$$\Leftrightarrow \quad \frac{6x}{7} + \frac{36x}{49} + \frac{216x}{343} = 7620 \quad \Leftrightarrow \quad 294x + 252x + 216x = 7620 \times 343$$

$$\Leftrightarrow \quad x = \left(\frac{7620 \times 343}{762}\right) = 3430.$$

$\therefore$ Amount of each instalment = Rs. 3430.

EXERCISE 22A

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark* (✓) *against the correct answer :*

1. Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 p.c.p.a. How much amount will Albert get on maturity of the fixed deposit ?   (Bank P.O. 1999)
   (a) Rs. 8600   (b) Rs. 8620   (c) Rs. 8800
   (d) Rs. 8840   (e) None of these

2. What will be the compound interest on a sum of Rs. 25,000 after 3 years at the rate of 12 p.c.p.a. ?   (S.B.I.P.O. 2003)
   (a) Rs. 9000.30   (b) Rs. 9720   (c) Rs. 10123.20
   (d) Rs. 10483.20   (e) None of these

3. The compound interest on Rs. 20,480 at $6\frac{1}{4}$% per annum for 2 years 73 days, is :

   (a) Rs. 2929   (b) Rs. 3000   (c) Rs. 3131   (d) Rs. 3636

4. A man saves Rs. 200 at the end of each year and lends the money at 5% compound interest. How much will it become at the end of 3 years ?
   (a) Rs. 565.25   (b) Rs. 635   (c) Rs. 662.02   (d) Rs. 666.50
                                                                   (Hotel Management, 2003)

5. Sam invested Rs. 15,000 @ 10% per annum for one year. If the interest is compounded half-yearly, then the amount received by Sam at the end of the year will be :
   (a) Rs. 16,500   (b) Rs. 16,525.50   (c) Rs. 16,537.50
   (d) Rs. 18,150   (e) None of these   (S.B.I.P.O. 2002)

6. A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs. 1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is :   (N.D.A. 2000)
   (a) Rs. 120   (b) Rs. 121   (c) Rs. 122   (d) Rs. 123

7. What is the difference between the compound interests on Rs. 5000 for $1\frac{1}{2}$ years at 4% per annum compounded yearly and half-yearly ?   (S.S.C. 2000)
   (a) Rs. 2.04   (b) Rs. 3.06   (c) Rs. 4.80   (d) Rs. 8.30

8. Find the compound interest on Rs. 15,625 for 9 months at 16% per annum compounded quarterly. **(R.R.B. 2002)**
   (a) Rs. 1851   (b) Rs. 1941   (c) Rs 1951   (d) Rs. 1961

9. If the simple interest on a sum of money for 2 years at 5% per annum is Rs. 50, what is the compound interest on the same sum at the same rate and for the same time ?
   (a) Rs. 51.25   (b) Rs. 52   (c) Rs. 54.25   (d) Rs. 60
   (C.B.I. 1997)

10. What will be the difference between simple and compound interest @ 10% per annum on a sum of Rs. 1000 after 4 years ?   **(Bank P.O. 2002)**
    (a) Rs. 31   (b) Rs. 32.10   (c) Rs. 40.40
    (d) Rs. 64.10   (e) None of these

11. The difference between simple interest and compound interest on Rs. 1200 for one year at 10% per annum reckoned half-yearly is :   **(R.R.B. 2002)**
    (a) Rs. 2.50   (b) Rs. 3   (c) Rs. 3.75
    (d) Rs. 4   (e) None of these

12. The compound interest on Rs. 30,000 at 7% per annum is Rs. 4347. The period (in years) is :   **(L.I.C.A.A.O. 2003)**
    (a) 2   (b) $2\frac{1}{2}$ (c) 3   (d) 4

13. At what rate of compound interest per annum will a sum of Rs. 1200 become Rs. 1348.32 in 2 years ?
    (a) 6%   (b) 6.5%   (c) 7%   (d) 7.5%

14. The principal that amounts to Rs. 4913 in 3 years at $6\frac{1}{4}$% per annum compound interest compounded annually, is :   **(S.S.C. 2000)**
    (a) Rs. 3096   (b) Rs. 4076   (c) Rs. 4085   (d) Rs. 4096

15. The present worth of Rs. 169 due in 2 years at 4% per annum compound interest is :
    (a) Rs. 150.50   (b) Rs. 154.75   (c) Rs. 156.25   (d) Rs. 158

16. In how many years will a sum of Rs. 800 at 10% per annum compounded semi-annually become Rs. 926.10 ?   **(Section Officers', 2001)**
    (a) $1\frac{1}{3}$ (b) $1\frac{1}{2}$ (c) $2\frac{1}{3}$ (d) $2\frac{1}{2}$

17. If the compound interest on a sum for 2 years at $12\frac{1}{2}$% per annum is Rs. 510, the simple interest on the same sum at the same rate for the same period of time is :
    (a) Rs. 400   (b) Rs. 450   (c) Rs. 460   (d) Rs. 480
    (S.S.C. 2004)

18. The compound interest on a certain sum for 2 years at 10% per annum is Rs. 525. The simple interest on the same sum for double the time at half the rate percent per annum is :   **(C.B.I. 1997)**
    (a) Rs. 400   (b) Rs. 500   (c) Rs. 600   (d) Rs. 800

19. The simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is :   **(S.S.C. 2003)**
    (a) Rs. 1550   (b) Rs. 1650   (c) Rs. 1750   (d) Rs. 2000

20. There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate ?   **(SIDBI, 2000)**
    (a) Rs. 2160   (b) Rs. 3120   (c) Rs. 3972
    (d) Rs. 6240   (e) None of these

21. The difference between compound interest and simple interest on an amount of Rs. 15,000 for 2 years is Rs. 96. What is the rate of interest per annum ?

(a) 8   (b) 10   (c) 12

(d) Cannot be determined   (e) None of these   (R.B.I. 2003)

22. The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum (in Rs.) is :

(a) 625   (b) 630   (c) 640   (d) 650

(S.S.C. 2003)

23. The compound interest on a sum of money for 2 years is Rs. 832 and the simple interest on the same sum for the same period is Rs. 800. The difference between the compound interest and the simple interest for 3 years will be :

(a) Rs. 48   (b) Rs. 66.56   (c) Rs. 98.56   (d) None of these

24. The difference between the simple interest on a certain sum at the rate of 10% per annum for 2 years and compound interest which is compounded every 6 months is Rs. 124.05. What is the principal sum ?   (S.B.I.P.O. 2000)

(a) Rs. 6000   (b) Rs. 8000   (c) Rs. 10,000

(d) Rs. 12,000   (e) None of these

25. The difference between compound interest and simple interest on a sum for 2 years at 10% per annum, when the interest is compounded annually is Rs. 16. If the interest were compounded half-yearly, the difference in two interests would be :

(a) Rs. 24.81   (b) Rs. 26.90   (c) Rs. 31.61   (d) Rs. 32.40

26. A sum of money lent at compound interest for 2 years at 20% per annum would fetch Rs. 482 more, if the interest was payable half-yearly than if it was payable annually. The sum is :

(a) Rs. 10,000   (b) Rs. 20,000   (c) Rs. 40,000   (d) Rs. 50,000

27. On a sum of money, the simple interest for 2 years is Rs. 660, while the compound interest is Rs. 696.30, the rate of interest being the same in both the cases. The rate of interest is :   (Hotel Management, 1997)

(a) 10%   (b) 10.5%   (c) 12%   (d) None of these

28. The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is :   (S.S.C. 2000)

(a) 6.06%   (b) 6.07%   (c) 6.08%   (d) 6.09%

29. A person lent out a certain sum on simple interest and the same sum on compound interest at a certain rate of interest per annum. He noticed that the ratio between the difference of compound interest and simple interest of 3 years and that of 2 years is 25 : 8. The rate of interest per annum is :

(a) 10%   (b) 11%   (c) 12%   (d) $12\frac{1}{2}$%

30. Mr. Dua invested money in two schemes A and B offering compound interest @ 8 p.c.p.a. and 9 p.c.p.a. respectively. If the total amount of interest accrued through two schemes together in two years was Rs. 4818.30 and the total amount invested was Rs. 27,000, what was the amount invested in Scheme A ?

(a) Rs. 12,000   (b) Rs. 13,500   (c) Rs. 15,000

(d) Cannot be determined   (e) None of these   (Bank P.O. 2003)

31. A sum of money invested at compound interest amounts to Rs. 800 in 3 years and to Rs. 840 in 4 years. The rate of interest per annum is :   (S.S.C. 2001)

(a) $2\frac{1}{2}$%   (b) 4%   (c) 5%   (d) $6\frac{2}{3}$%

32. A sum of money invested at compound interest amounts to Rs. 4624 in 2 years and to Rs. 4913 in 3 years. The sum of money is :
(a) Rs. 4096   (b) Rs. 4260   (c) Rs. 4335   (d) Rs. 4360

33. A sum of money becomes Rs. 13,380 after 3 years and Rs. 20,070 after 6 years on compound interest. The sum is :
(a) Rs. 8800   (b) Rs. 8890   (c) Rs. 8920   (d) Rs. 9040

34. A sum of Rs. 12,000 deposited at compound interest becomes double after 5 years. After 20 years, it will become :
(a) Rs. 96,000   (b) Rs. 1,20,000   (c) Rs. 1,24,000   (d) Rs. 1,92,000

35. A sum of money placed at compound interest doubles itself in 5 years. It will amount to eight times itself at the same rate of interest in : (Hotel Management, 2003)
(a) 7 years   (b) 10 years   (c) 15 years   (d) 20 years

36. If a sum on compound interest becomes three times in 4 years, then with the same interest rate, the sum will become 27 times in :
(a) 8 years   (b) 12 years   (c) 24 years   (d) 36 years

37. The least number of complete years in which a sum of money put out at 20% compound interest will be more than doubled is : (N.I.F.T. 2003)
(a) 3   (b) 4   (c) 5   (d) 6

38. A man borrows Rs. 2550 to be paid back with compound interest at the rate of 4% per annum by the end of 2 years in two equal yearly instalments. How much will each instalment be ?
(a) Rs. 1275   (b) Rs. 1283   (c) Rs. 1352   (d) Rs. 1377

39. What annual payment will discharge a debt of Rs. 1025 due in 2 years at the rate of 5% compound interest ? (S.S.C. 2000)
(a) Rs. 550   (b) Rs. 551.25   (c) Rs. 560   (d) Rs. 560.75

40. A man borrows Rs. 12,500 at 20% compound interest. At the end of every year he pays Rs. 2000 as part repayment. How much does he still owe after three such instalments ?
(a) Rs. 12,000   (b) Rs. 12,864   (c) Rs. 15,600   (d) None of these

41. A sum of money is borrowed and paid back in two annual instalments of Rs. 882 each allowing 5% compound interest. The sum borrowed was : (A.I.M.A.T.S. 2002)
(a) Rs. 1620   (b) Rs. 1640   (c) Rs. 1680   (d) Rs. 1700

ANSWERS

1. (c)	2. (c)	3. (a)	4. (c)	5. (c)	6. (b)	7. (a)	8. (c)	9. (a)
10. (d)	11. (b)	12. (a)	13. (a)	14. (d)	15. (c)	16. (b)	17. (d)	18. (b)
19. (c)	20. (c)	21. (a)	22. (a)	23. (c)	24. (b)	25. (a)	26. (b)	27. (d)
28. (d)	29. (d)	30. (a)	31. (c)	32. (a)	33. (c)	34. (d)	35. (c)	36. (b)
37. (b)	38. (c)	39. (b)	40. (d)	41. (b)				

SOLUTIONS

1. Amount = Rs. $\left[8000 \times \left(1 + \frac{5}{100}\right)^2\right]$ = Rs. $\left(8000 \times \frac{21}{20} \times \frac{21}{20}\right)$ = Rs. 8820.

2. Amount = Rs. $\left[25000 \times \left(1 + \frac{12}{100}\right)^3\right]$ = Rs. $\left(25000 \times \frac{28}{25} \times \frac{28}{25} \times \frac{28}{25}\right)$ = Rs. 35123.20.

∴ C.I. = Rs. (35123.20 − 25000) = Rs. 10123.20.

3. Time $= 2\frac{73}{365}$ years $= 2\frac{1}{5}$ years.

$\therefore$ Amount $=$ Rs. $\left[20480 \times \left(1 + \frac{25}{4 \times 100}\right)^2 \left(1 + \frac{\frac{1}{5} \times \frac{25}{4}}{100}\right)\right]$

$=$ Rs. $\left[20480 \times \frac{17}{16} \times \frac{17}{16} \times \frac{81}{80}\right] =$ Rs. 23409.

$\therefore$ C.I. $=$ Rs. $(23409 - 20480) =$ Rs. 2929.

4. Amount $=$ Rs. $\left[200\left(1 + \frac{5}{100}\right)^3 + 200\left(1 + \frac{5}{100}\right)^2 + 200\left(1 + \frac{5}{100}\right)\right]$

$=$ Rs. $\left[200 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} + 200 \times \frac{21}{20} \times \frac{21}{20} + 200 \times \frac{21}{20}\right]$

$=$ Rs. $\left[200 \times \frac{21}{20}\left(\frac{21}{20} \times \frac{21}{20} + \frac{21}{20} + 1\right)\right] =$ Rs. 662.02.

5. P = Rs. 15000; R – 10% p.a. = 5% per half-year; T = 1 year = 2 half-years.

$\therefore$ Amount $=$ Rs. $\left[15000 \times \left(1 + \frac{5}{100}\right)^2\right] =$ Rs. $\left(15000 \times \frac{21}{20} \times \frac{21}{20}\right) =$ Rs. 16537.50.

6. Amount $=$ Rs. $\left[1600 \times \left(1 + \frac{5}{2 \times 100}\right)^2 + 1600 \times \left(1 + \frac{5}{2 \times 100}\right)\right]$

$=$ Rs. $\left[1600 \times \frac{41}{40} \times \frac{41}{40} + 1600 \times \frac{41}{40}\right]$

$=$ Rs. $\left[1600 \times \frac{41}{40}\left(\frac{41}{40} + 1\right)\right] =$ Rs. $\left(\frac{1600 \times 41 \times 81}{40 \times 40}\right) =$ Rs. 3321.

$\therefore$ C.I. $=$ Rs. $(3321 - 3200) =$ Rs. 121.

7. C.I. when interest is compounded yearly

$=$ Rs. $\left[5000 \times \left(1 + \frac{4}{100}\right) \times \left(1 + \frac{\frac{1}{2} \times 4}{100}\right)\right] =$ Rs. $\left(5000 \times \frac{26}{25} \times \frac{51}{50}\right) =$ Rs. 5304.

C.I. when interest is compounded half-yearly

$=$ Rs. $\left[5000 \times \left(1 + \frac{2}{100}\right)^3\right] =$ Rs. $\left(5000 \times \frac{51}{50} \times \frac{51}{50} \times \frac{51}{50}\right) =$ Rs. 5306.04.

$\therefore$ Difference – Rs. $(5306.04 - 5304) =$ Rs. 2.04.

8. P = Rs. 15625, n = 9 months – 3 quarters, R – 16% p.a. – 4% per quarter.

Amount $=$ Rs. $\left[15625 \times \left(1 + \frac{4}{100}\right)^3\right] =$ Rs. $\left(15625 \times \frac{26}{25} \times \frac{26}{25} \times \frac{26}{25}\right) =$ Rs. 17576.

$\therefore$ C.I. $=$ Rs. $(17576 - 15625) =$ Rs. 1951.

9. Sum $= Rs. \left(\dfrac{50 \times 100}{2 \times 5}\right) = Rs.\ 500.$

Amount $= Rs. \left[500 \times \left(1 + \dfrac{5}{100}\right)^2\right] = Rs. \left(500 \times \dfrac{21}{20} \times \dfrac{21}{20}\right) = Rs.\ 551.25.$

$\therefore$ C.I. $= Rs.\ (551.25 - 500) = Rs.\ 51.25.$

10. S.I. $= Rs. \left(\dfrac{1000 \times 10 \times 4}{100}\right) = Rs.\ 400.$

C.I. $= Rs. \left[1000 \times \left(1 + \dfrac{10}{100}\right)^4 - 1000\right] = Rs.\ 464.10.$

$\therefore$ Difference $= Rs.\ (464.10 - 400) = Rs.\ 64.10.$

11. S.I. $= Rs. \left(\dfrac{1200 \times 10 \times 1}{100}\right) = Rs.\ 120.$

C.I. $= Rs. \left[1200 \times \left(1 + \dfrac{5}{100}\right)^2 - 1200\right] = Rs.\ 123.$

$\therefore$ Difference $= Rs.\ (123 - 120) = Rs.\ 3.$

12. Amount $= Rs.\ (30000 + 4347) = Rs.\ 34347.$
Let the time be n years. Then,

$30000\left(1 + \dfrac{7}{100}\right)^n = 34347 \Leftrightarrow \left(\dfrac{107}{100}\right)^n = \dfrac{34347}{30000} = \dfrac{11449}{10000} = \left(\dfrac{107}{100}\right)^2.$

$\therefore$ $n = 2$ years.

13. Let the rate be R% p.a. Then,

$1200 \times \left(1 + \dfrac{R}{100}\right)^2 = 1348.32 \Leftrightarrow \left(1 + \dfrac{R}{100}\right)^2 = \dfrac{134832}{120000} = \dfrac{11236}{10000}$

$\therefore \left(1 + \dfrac{R}{100}\right)^2 = \left(\dfrac{106}{100}\right)^2$ or $1 + \dfrac{R}{100} = \dfrac{106}{100}$ or R = 6%.

14. Principal $= Rs. \left[\dfrac{4913}{\left(1 + \dfrac{25}{4 \times 100}\right)^3}\right] = Rs. \left(4913 \times \dfrac{16}{17} \times \dfrac{16}{17} \times \dfrac{16}{17}\right) = Rs.\ 4096.$

15. Present worth $= Rs. \left[\dfrac{169}{\left(1 + \dfrac{4}{100}\right)^2}\right] = Rs. \left(169 \times \dfrac{25}{26} \times \dfrac{25}{26}\right) = Rs.\ 156.25.$

16. Let the time be n years. Then,

$800 \times \left(1 + \dfrac{5}{100}\right)^{2n} = 926.10$ or $\left(1 + \dfrac{5}{100}\right)^{2n} = \dfrac{9261}{8000}$

or $\left(\dfrac{21}{20}\right)^{2n} = \left(\dfrac{21}{20}\right)^3$ or $2n = 3$ or $n = \dfrac{3}{2}.$

$\therefore$ $n = 1\dfrac{1}{2}$ years.

SUB#

17. Let the sum be Rs. P. Then,

$$\left[P\left(1+\frac{25}{2\times100}\right)^2-P\right]=510 \text{ or } P\left[\left(\frac{9}{8}\right)^2-1\right]=510 \text{ or } P=\left(\frac{510\times64}{17}\right)=1920.$$

∴ Sum = Rs. 1920.

So, S.I. = Rs. $\left(\frac{1920\times25\times2}{2\times100}\right)$ = Rs. 480.

18. Let the sum be Rs. P. Then,

$$\left[P\left(1+\frac{10}{100}\right)^2-P\right]=525 \Leftrightarrow P\left[\left(\frac{11}{10}\right)^2-1\right]=525 \Leftrightarrow P=\left(\frac{525\times100}{21}\right)=2500.$$

∴ Sum = Rs. 2500.

So, S.I. = Rs. $\left(\frac{2500\times5\times4}{100}\right)$ = Rs. 500.

19. C.I. = Rs. $\left[4000\times\left(1+\frac{10}{100}\right)^2-4000\right]$ = Rs. $\left(4000\times\frac{11}{10}\times\frac{11}{10}-4000\right)$ = Rs. 840.

∴ Sum = Rs. $\left(\frac{420\times100}{3\times8}\right)$ = Rs. 1750.

20. Let P = Rs. 100. Then, S.I. Rs. 60 and T = 6 years.

∴ R = $\frac{100\times60}{100\times6}$ = 10% p.a.

Now, P = Rs. 12000, T = 3 years and R = 10% p.a.

∴ C.I. = Rs. $\left[12000\times\left\{\left(1+\frac{10}{100}\right)^3-1\right\}\right]$ = Rs. $\left(12000\times\frac{331}{1000}\right)$ = Rs. 3972.

21. $\left[15000\times\left(1+\frac{R}{100}\right)^2-15000\right]-\left(\frac{15000\times R\times2}{100}\right)=96$

$\Leftrightarrow 15000\left[\left(1+\frac{R}{100}\right)^2-1-\frac{2R}{100}\right]=96 \Leftrightarrow 15000\left[\frac{(100+R)^2-10000-200R}{10000}\right]=96$

$\Leftrightarrow R^2=\frac{96\times2}{3}=64 \Leftrightarrow R=8.$

∴ Rate = 8%.

22. Let the sum be Rs. x. Then,

C.I. = $\left[x\left(1+\frac{4}{100}\right)^2-x\right]=\left(\frac{676}{625}x-x\right)=\frac{51}{625}x.$

S.I. = $\left(\frac{x\times4\times2}{100}\right)=\frac{2x}{25}.$

∴ $\frac{51x}{625}-\frac{2x}{25}=1 \text{ or } x=625.$

23. Difference in C.I. and S.I. for 2 years = Rs. 32.

S.I. for one year = Rs. 400.

$\therefore$ S.I. on Rs. 400 for one year = Rs. 32.

So, Rate = $\left(\dfrac{100 \times 32}{400 \times 1}\right)\%$ = 8%.

Hence, difference in C.I. and S.I. for 3rd year

= S.I. on Rs. 832 = Rs. $\left(\dfrac{832 \times 8 \times 1}{100}\right)$ = Rs. 66.56.

Total difference = Rs. (32 + 66.56) = Rs. 98.56.

24. Let the sum be Rs. P. Then

$$P\left[\left(1+\dfrac{5}{100}\right)^4 - 1\right] - \dfrac{P \times 10 \times 2}{100} = 124.05$$

$$\Rightarrow \quad P\left[\left(\dfrac{21}{20}\right)^4 - 1 - \dfrac{1}{5}\right] = 124.05 \quad \Rightarrow \quad P\left[\dfrac{194481}{160000} - \dfrac{6}{5}\right] = \dfrac{12405}{100}$$

$$\Rightarrow \quad P\left[\dfrac{194481 - 192000}{160000}\right] = \dfrac{12405}{100} \quad \Rightarrow \quad P = \left(\dfrac{12405}{100} \times \dfrac{160000}{2481}\right) = 8000.$$

25. For first year, S.I. = C.I.

Now, Rs. 16 is the S.I. on S.I. for 1 year.

Rs. 10 is S.I. on Rs. 100.

$\therefore$ Rs. 16 is S.I. on Rs. $\left(\dfrac{100}{10} \times 16\right)$ = Rs. 160.

So, S.I. on principal for 1 year at 10% is Rs. 160.

$\therefore$ Principal = Rs. $\left(\dfrac{100 \times 160}{10 \times 1}\right)$ = Rs. 1600.

Amount for 2 years compounded half yearly = Rs. $\left[1600 \times \left(1+\dfrac{5}{100}\right)^4\right]$ = Rs. 1944.81.

$\therefore$ C.I. = Rs. (1944.81 − 1600) = Rs. 344.81.

S.I. = Rs. $\left(\dfrac{1600 \times 10 \times 2}{100}\right)$ = Rs. 320.

$\therefore$ (C.I.) − (S.I.) = Rs. (344.81 − 320) = Rs. 24.81.

26. Let the sum be Rs. x. Then,

C.I. when compounded half-yearly = $\left[x \times \left(1+\dfrac{10}{100}\right)^4 - x\right]$ = $\dfrac{4641}{10000}x$.

C.I. when compounded annually = $\left[x \times \left(1+\dfrac{20}{100}\right)^2 - x\right]$ = $\dfrac{11}{25}x$.

$\therefore \dfrac{4641}{10000}x - \dfrac{11}{25}x = 482$ or $x = \dfrac{482 \times 10000}{241} = 20000.$

27. Difference in C.I. and S.I. for 2 years = Rs. (696.30 − 660) = Rs. 36.30.

S.I. for one year = Rs. 330.

$\therefore$ S.I. on Rs. 330 for 1 year = Rs. 36.30.

$\therefore$ Rate = $\left(\dfrac{100 \times 36.30}{330 \times 1}\right)\%$ = 11%.

28. Amount of Rs. 100 for 1 year when compounded half-yearly

$$= Rs. \left[100 \times \left(1 + \frac{3}{100} \right)^2 \right] = Rs.\ 106.09.$$

∴ Effective rate $= (106.09 - 100)\% = 6.09\%.$

29. Let the principal be Rs. P and rate of interest be R% per annum.
Difference of C.I. and S.I. for 2 years

$$= \left[P \times \left(1 + \frac{R}{100} \right)^2 - P \right] - \left(\frac{P \times R \times 2}{100} \right) = \frac{PR^2}{10^4}.$$

Difference of C.I. and S.I. for 3 years

$$= \left[P \times \left(1 + \frac{R}{100} \right)^3 - P \right] - \left(\frac{P \times R \times 3}{100} \right) = \frac{PR^2}{10^4} \left(\frac{300 + R}{100} \right).$$

$$\therefore\ \ \frac{\frac{PR^2}{10^4}\left(\frac{300 + R}{100} \right)}{\frac{PR^2}{10^4}} = \frac{25}{8} \Rightarrow \left(\frac{300 + R}{100} \right) = \frac{25}{8} \Rightarrow R = \frac{100}{8} = 12\frac{1}{2}\%.$$

30. Let the investment in scheme A be Rs. x.
Then, investment in scheme B = Rs. $(27000 - x)$.

$$\therefore\ \left[x \times \left\{ \left(1 + \frac{8}{100} \right)^2 - 1 \right\} + (27000 - x) \left\{ \left(1 + \frac{9}{100} \right)^2 - 1 \right\} \right] = 4818.30.$$

$$\Leftrightarrow \left(x \times \frac{104}{625} \right) + \frac{1881\,(27000 - x)}{10000} = \frac{481830}{100}$$

$$\Leftrightarrow 1664x + 1881\,(27000 - x) = 48183000$$

$$\Leftrightarrow (1881x - 1664x) = (50787000 - 48183000)$$

$$\Leftrightarrow 217x = 2604000 \Leftrightarrow x = \frac{2604000}{217} = 12000.$$

31. S.I. on Rs. 800 for 1 year = Rs. $(840 - 800)$ = Rs. 40.

$$\therefore\ \ Rate = \left(\frac{100 \times 40}{800 \times 1} \right)\% = 5\%.$$

32. S.I. on Rs. 4624 for 1 year = Rs. $(4913 - 4624)$ = Rs. 289.

$$\therefore\ \ Rate = \left(\frac{100 \times 289}{4624 \times 1} \right)\% = 6\frac{1}{4}\%.$$

Now, $x \left(1 + \frac{25}{4 \times 100} \right)^2 = 4624$ or $x \times \frac{17}{16} \times \frac{17}{16} = 4624$

$$\therefore\ \ x = \left(4624 \times \frac{16}{17} \times \frac{16}{17} \right) = Rs.\ 4096.$$

34. $12000 \times \left(1 + \frac{R}{100} \right)^5 = 24000 \Rightarrow \left(1 + \frac{R}{100} \right)^5 = 2$

$$\therefore\ \ \left[\left(1 + \frac{R}{100} \right)^5 \right]^4 = 2^4 = 16 \Rightarrow \left(1 + \frac{R}{100} \right)^{20} = 16 \Rightarrow P \left(1 + \frac{R}{100} \right)^{20} = 16P$$

$$\Rightarrow \quad 12000\left(1+\frac{R}{100}\right)^{20} = 16 \times 12000 = 192000.$$

35. $P\left(1+\frac{R}{100}\right)^5 = 2P \Rightarrow \left(1+\frac{R}{100}\right)^5 = 2$ \qquad ...(i)

Let $P\left(1+\frac{R}{100}\right)^n = 8P \Rightarrow \left(1+\frac{R}{100}\right)^n = 8 = 2^3 = \left\{\left(1+\frac{R}{100}\right)^5\right\}^3$ \qquad [using (i)]

$$\Rightarrow \left(1+\frac{R}{100}\right)^n = \left(1+\frac{R}{100}\right)^{15} \Rightarrow n = 15.$$

∴ Required time = 15 years.

36. $P\left(1+\frac{R}{100}\right)^4 = 3P \Rightarrow \left(1+\frac{R}{100}\right)^4 = 3$ \qquad ...(i)

Let $P\left(1+\frac{R}{100}\right)^n = 27P \Rightarrow \left(1+\frac{R}{100}\right)^n = 27 = (3)^3 = \left\{\left(1+\frac{R}{100}\right)^4\right\}^3$ \qquad [using (i)]

$$\Rightarrow \left(1+\frac{R}{100}\right)^n = \left(1+\frac{R}{100}\right)^{12} \Rightarrow n = 12.$$

∴ Required time = 12 years.

37. $P\left(1+\frac{20}{100}\right)^n > 2P$ or $\left(\frac{6}{5}\right)^n > 2$

Now, $\left(\frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5}\right) > 2$. So, $n = 4$ years.

38. Let the value of each instalment be Rs. x. Then,

(P.W. of Rs. x due 1 year hence) + (P.W. of Rs. x due 2 years hence) = Rs. 2550

$$\Leftrightarrow \frac{x}{\left(1+\frac{4}{100}\right)} + \frac{x}{\left(1+\frac{4}{100}\right)^2} = 2550 \Leftrightarrow \frac{25x}{26} + \frac{625x}{676} = 2550$$

$$\Leftrightarrow 1275x = 2550 \times 676 \Leftrightarrow x = \left(\frac{2550 \times 676}{1275}\right) = 1352$$

∴ Value of each instalment = Rs. 1352.

39. Let each instalment be Rs. x. Then,

$$\frac{x}{\left(1+\frac{5}{100}\right)} + \frac{x}{\left(1+\frac{5}{100}\right)^2} = 1025 \Leftrightarrow \frac{20x}{21} + \frac{400x}{441} = 1025$$

$$\Leftrightarrow 820\,x = 1025 \times 441 \Leftrightarrow x = \left(\frac{1025 \times 441}{820}\right) = 551.25$$

So, value of each instalment = Rs. 551.25.

40. Balance

$$= Rs. \left[\left\{12500 \times \left(1+\frac{20}{100}\right)^3\right\} - \left\{2000 \times \left(1+\frac{20}{100}\right)^2 + 2000 \times \left(1+\frac{20}{100}\right) + 2000\right\}\right]$$

SUB#

$$= \text{Rs.} \left[\left(12500 \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} \right) - \left(2000 \times \frac{6}{5} \times \frac{6}{5} + 2000 \times \frac{6}{5} + 2000 \right) \right]$$

$$= \text{Rs.} \left[21600 - (2880 + 2400 + 2000) \right] = \text{Rs. } 14320.$$

41. Principal

$$= (\text{P.W. of Rs. } 882 \text{ due 1 year hence}) + (\text{P.W. of Rs. } 882 \text{ due 2 years hence})$$

$$\left[\frac{882}{\left(1 + \frac{5}{100} \right)} + \frac{882}{\left(1 + \frac{5}{100} \right)^2} \right] = \left(\frac{882 \times 20}{21} + \frac{882 \times 400}{441} \right) = \text{Rs. } 1640.$$

EXERCISE 22B

(DATA SUFFICIENCY TYPE QUESTIONS)

1. The difference between the compound interest and the simple interest earned on a sum of money at the end of 4 years is Rs. 256.40. To find out the sum, which of the following informations given in the statements P and Q is/are necessary ?

   P : Amount of simple interest accrued after 4 years.

   Q : Rate of interest per annum.

   (a) Only P is necessary   (b) Only Q is necessary

   (c) Either P or Q is necessary   (d) Neither P nor Q is necessary

   (e) Both P and Q are necessary

Directions (Questions 2 to 8) : *Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read both the statements and*

Give answer (a) if the data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question;

Give answer (b) if the data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question;

Give answer (c) if the data either in Statement I or in Statement II alone are sufficient to answer the question;

Give answer (d) if the data even in both Statements I and II together are not sufficient to answer the question;

Give answer (e) if the data in both Statements I and II together are necessary to answer the question.

2. What is the rate of compound interest ?   (Bank P.O. 2003)

   I. The principal was invested for 4 years.

   II. The earned interest was Rs. 1491.

3. What will be the compounded amount ?   (Bank P.O. 1999)

   I. Rs. 200 were borrowed for 192 months at 6% compounded annually.

   II. Rs. 200 were borrowed for 16 years at 6%.

4. What is the compound interest earned by Robert at the end of 2 years ?

   I. Simple interest at the same rate for one year is Rs. 1020 and the rate of interest is 12 p.c.p.a.

   II. The amount invested is Rs. 8500.

5. What is the total compound interest accrued on a sum of money after 5 years ?

    I. The sum was Rs. 20,000.

    II. The total amount of simple interest on the sum after 5 years was Rs. 4000.

6. What was the total compound interest on a sum after 3 years ? **(Bank P.O. 2003)**

    I. The interest after one year was Rs. 100 and the sum was Rs. 1000.

    II. The difference between simple and compound interest on a sum of Rs. 1000 at the end of 2 years was Rs. 10.

7. An amount of money was lent for 3 years. What will be the difference between the simple and the compound interest earned on it at the same rate ?

    I. The rate of interest was 8 p.c.p.a.

    II. The total amount of simple interest was Rs. 1200.

8. What was the rate of interest on a sum of money ? **(S.B.I.P.O. 1998)**

    I. The sum fetched a total of Rs. 2522 as compound interest at the end of 3 years.

    II. The difference between the simple interest and the compound interest at the end of 2 years at the same rate was Rs. 40.

Directions (*Questions 9 to 12*) : *Each of the questions given below consists of a question followed by three statements. You have to study the question and the statements and decide which of the statement(s) is / are necessary to answer the question :*

9. What is the rate of interest p.c.p.a. ? **(R.B.I. 2002)**

    I. An amount doubles itself in 5 years on simple interest.

    II. Difference between the compound interest and the simple interest earned on a certain amount in 2 years is Rs. 400.

    III. Simple interest earned per annum is Rs. 2000.

    (*a*) I only   (*b*) II and III only   (*c*) All I, II and III

    (*d*) Any two of the three   (*e*) I only or II and III only

10. A sum of money is put at compound interest. What is the rate of interest ?

    I. The sum amounts to Rs. 5290 in 2 years.

    II. The sum amounts to Rs. 6083.50 in 3 years.

    III. The sum is Rs. 4000.

    (*a*) I and II only   (*b*) II and III only   (*c*) I and III only

    (*d*) Any two of the three   (*e*) I and III only, or II and III only

11. What will be the compound interest earned on an amount of Rs. 5000 in 2 years ? **(S.B.I.P.O. 2000)**

    I. The simple interest on the same amount at the same rate of interest in 5 years in Rs. 2000.

    II. The compound interest and the simple interest earned in one year is the same.

    III. The amount becomes more than double on compound interest in 10 years.

    (*a*) I only   (*b*) I and II only   (*c*) II and III only

    (*d*) I and III only   (*e*) None of these

12. A sum of money is placed at compound interest. In how many years will it amount to sixteen times of itself ?

    I. The sum doubles itself in 4 years.

    II. The sum amounts to eight times of itself in 12 years.

    III. The sum amounts to four times of itself in 8 years.

    (*a*) I only   (*b*) I and II only   (*c*) II and III only

    (*d*) I and III only   (*e*) Any one of the three

SUB#

Directions (*Questions 13 to 16*) : *In each of the following questions, a question is asked and is followed by three statements. While answering the question, you may or may not require the data provided in all the statements. You have to read, the question and the three statements and then decide whether the question can be answered with any one or two of the statements or all the three statements are required to answer the question. The answer number bearing the statements, which can be dispensed with, if any, while answering the question is your answer.*

13. What would be the difference between the simple interest and the compound interest on a sum of money at the end of four years ?
   I. The rate of interest is 5 p.c.p.a.
   II. The sum fetches a total of Rs. 2000 as simple interest at the end of 8 years.
   III. The difference between the simple interest and the compound interest at the end of 2 years is Rs. 12.50.

   (a) II only   (b) III only   (c) II or III only
   (d) All I, II and III are required   (e) None of these

14. Mr. Gupta borrowed a sum of money on compound interest. What will be the amount to be repaid if he is repaying the entire amount at the end of 2 years ?
                                                                        (Bank P.O. 1999)
   I. The rate of interest is 5 p.c.p.a.
   II. Simple interest fetched on the same amount in one year is Rs. 600.
   III. The amount borrowed is 10 times the simple interest in 2 years.

   (a) I only   (b) III only   (c) I or II only
   (d) I or III only   (e) All I, II and III are required

15. What is the total compound interest earned at the end of 3 years ? (S.B.I.P.O. 2001)
   I. Simple interest earned on that amount at the same rate and for the same period is Rs. 4500.
   II. The rate of interest is 10 p.c.p.a.
   III. Compound interest for 3 years is more than the simple interest for that period by Rs. 465.

   (a) I and II only   (b) II and III only   (c) I and III only
   (d) Either II or III only   (e) Any two of the three

16. What is the rate of interest per annum ?   **(S.B.I.P.O. 1999)**
   I. The amount becomes Rs. 11,025 with compound interest after 2 years.
   II. The same amount with simple interest becomes Rs. 11,000 after 2 years.
   III. The amount invested is Rs. 10,000.

   (a) I or II only   (b) II or III only   (c) I or III only
   (d) I or II or III only   (e) All I, II and III are required

---

ANSWERS

1. (b)   2. (d)   3. (c)   4. (a)   5. (e)   6. (c)   7. (e)   8. (e)   9. (e)
10. (d)   11. (a)   12. (e)   13. (c)   14. (d)   15. (d)   16. (d)

SOLUTIONS

1. To find the sum, difference between C.I. and S.I., the time and the rate of interest are needed.
   ∴ Only Q is necessary.
   ∴ Correct answer is (b).

SUB#

2. Let Principal = Rs. P and Rate = R% p.a. Then,

$$\text{Amount} = \text{Rs.} \left[P\left(1+\frac{R}{100}\right)^4 \right]$$

$$\therefore \text{C.I.} = P\left[\left(1+\frac{R}{100}\right)^4 - 1\right] \Rightarrow P\left[\left(1+\frac{R}{100}\right)^4 - 1\right] = 1491.$$

Clearly, it does not give the answer.

∴ Correct answer is (d).

3. I. Amount = Rs. $\left[200 \times \left(1+\frac{6}{100}\right)^{16} \right]$.

II. Amount = Rs. $\left[200 \times \left(1+\frac{6}{100}\right)^{16} \right]$.

Thus, I as well as II gives the answer.

∴ Correct answer is (c).

4. I. S.I. = Rs. 1020, R = 12% p.a. and T = 1 year.

$$\therefore P = \frac{100 \times S.I.}{R \times T} \Rightarrow P = \text{Rs.} \left(\frac{100 \times 1020}{12 \times 1}\right) = \text{Rs. } 8500.$$

$$\therefore \text{C.I. for 2 years} = \text{Rs.} \left[8500 \times \left\{\left(1+\frac{12}{100}\right)^2 - 1\right\} \right].$$

II gives : only P and T.

∴ II alone does not give the answer.

∴ Correct answer is (a).

5. Given : Time = 5 years.

I gives : Sum = Rs. 20000.

II gives : S.I. = Rs. 4000.

Let the rate be R% p.a. Then,

$$R = \frac{100 \times S.I.}{P \times T} = \left(\frac{100 \times 4000}{5 \times 20000}\right) = 4\% \text{ p.a.}$$

$$\therefore \text{C.I.} = \text{Rs.} \left[20000 \times \left\{\left(1+\frac{4}{100}\right)^5 - 1\right\} \right]$$

∴ Both I and II are needed to get the answer.

So, the correct answer is (e).

6. I gives : P = Rs. 1000 and S.I. for 1 year = Rs. 100.

$$\therefore \text{Rate} = \frac{100 \times S.I.}{P \times T} = \left(\frac{100 \times 100}{1000 \times 1}\right) = 10\% \text{ p.a.}$$

Thus, P = Rs. 1000, T = 3 years and R = 10% p.a.

∴ C.I. may be obtained.

II. Sum = Rs. 1000, [(C.I.) − (S.I.)] for 2 years = Rs. 10.

Let the rate be R% p.a.

$$1000 \times \left[\left(1+\frac{R}{100}\right)^2 - 1\right] - \left(\frac{1000 \times R \times 2}{100}\right) = 10.$$

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From this, we can find R.

Thus P, T and R are given and therefore, C.I. may be calculated.

Thus, I alone as well as II alone is sufficient to get the answer.

∴   Correct answer is (e).

7.   Given : T = 3 years.

I gives : R = 8% p.a.

II gives : S.I. = Rs. 1200.

Thus, P = Rs. 5000, R = 8% p.a. and T = 3 years.

∴   Difference between C.I. and S.I. may be obtained.

So, the correct answer is (e).

8.   I gives : C.I. for 3 years = Rs. 2522.

II gives : (C.I.) – (S.I.) for 2 years at same rate is Rs. 40.

$$P\left[\left(1+\frac{R}{100}\right)^3 - 1\right] = 2522 \qquad \ldots(i)$$

$$P\left[\left(1+\frac{R}{100}\right)^2 - 1\right] - \frac{P \times R \times 2}{100} = 40 \qquad \ldots(ii)$$

On dividing (i) by (ii) we get :

$$\frac{\left(1+\frac{R}{100}\right)^3 - 1}{\left(1+\frac{R}{100}\right)^2 - 1 - \frac{R}{50}} = \frac{2522}{40} \implies \frac{\frac{R^3}{1000000} + \frac{3R}{100} + \frac{3R^2}{10000}}{\frac{R^2}{10000}} = \frac{1261}{20}$$

$$\implies \frac{R}{100} + \frac{300}{R} = \frac{1201}{20} \implies R^2 - 6005R + 30000 = 0$$

$$\implies R^2 - 6000R - 5R + 30000 = 0$$

$$\implies R(R - 6000) - 5(R - 6000) = 0$$

$$\implies (R - 5)(R - 6000) = 0 \implies R = 5.$$

∴   Both I and II are needed to get R.

∴   Correct answer is (e).

9.   I. $\frac{P \times R \times 5}{100} = P \implies R = 20.$

II. $P\left(1+\frac{R}{100}\right)^2 - P - \frac{P \times R \times 2}{100} = 400 \implies PR^2 = 4000000.$

III. $\frac{P \times R \times 1}{100} = 2000 \implies PR = 200000$

∴ $\frac{PR^2}{PR} = \frac{4000000}{200000} \implies R = 20.$

Thus I only or (II & III) give answer.

∴   Correct answer is (e).

10.   I. $P\left(1+\frac{R}{100}\right)^2 = 5290$ ...(i)   II. $P\left(1+\frac{R}{100}\right)^3 = 6083.50$ ...(ii)

On dividing (ii) by (i), we get :

$$\left(1+\frac{R}{100}\right) = \frac{608350}{529000} = \frac{23}{20} \implies \frac{R}{100} = \left(\frac{23}{20} - 1\right) = \frac{3}{20} \implies R = 15$$

Thus, I and II give answer.

III. gives P = 4000.

Putting this value of P in (i), we get the answer.

Putting this value of P in (ii), we get the answer.

∴ (I & II) or (I & III) or (II & III) all give the answer.

Hence, the correct answer is (d).

11.   P = Rs. 5000 & T = 2 years.

I. S.I. on Rs. 5000 in 5 years is Rs. 2000.

$$\frac{5000 \times R \times 5}{100} = 2000 \Rightarrow R = 8$$

Thus I only gives the answer.

∴ Correct answer is (a).

12.   I. $P\left(1+\dfrac{R}{100}\right)^4 = 2P \Rightarrow \left(1+\dfrac{R}{100}\right)^4 = 2$ ...(i)

II. $P\left(1+\dfrac{R}{100}\right)^{12} = 8P \Rightarrow \left(1+\dfrac{R}{100}\right)^{12} = 8$ ...(ii)

III. $P\left(1+\dfrac{R}{100}\right)^8 = 4P \Rightarrow \left(1+\dfrac{R}{100}\right)^8 = 4$ ...(iii)

Let the given sum become 16 times in n years. Then,

$$P\left(1+\frac{R}{100}\right)^n = 16P \Rightarrow \left(1+\frac{R}{100}\right)^n = 16$$ ...(iv)

∴ Any one of (i), (ii) and (iii) with (iv) will give the value of n.

∴ Correct answer is (c).

13.   I and II will give us, R, S.I. and T.

$$\therefore P = \frac{100 \times S.I.}{R \times T} = \left(\frac{100 \times 2000}{5 \times 8}\right) = 5000.$$

[(C.I.) – (S.I.)] for 4 years may be calculated.

In this case, III is redundant.

I and III give us R and P, using.

$$P\left[\left(1+\frac{5}{100}\right)^2 - 1\right] - \frac{P \times 5 \times 2}{100} = 12.50$$

So, [(C.I.) – (S.I.)] for 4 years may be calculated.

∴ Correct answer is (c).

14.   I gives, Rate = 5% p.a.

II gives, S.I. for 1 year = Rs. 600.

III gives, sum = 10 × (S.I. for 2 years).

Now, I and II give the sum.

For this sum, C.I. and hence amount can be obtained.

Thus, III is redundant.

Again, II gives S.I. for 2 years = Rs. (600 × 2) = Rs. 1200.

Now, from III, Sum = Rs. (10 × 1200) = Rs. 12000.

Thus, Rate $- \dfrac{100 \times 1200}{2 \times 12000} = 5\%$ p.a.

Thus, C.I. for 2 years and therefore, amount can be obtained.

Thus, I is redundant.

Hence, I or III redundant.

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15. I gives, S.I. for 3 years, = Rs. 4500
II gives, Rate = 10% p.a.
III gives, (C.I.) – (S.I.) = Rs. 465.

Clearly, using I and III we get C.I. = Rs. (465 + 4500).
Thus, II is redundant.

Also, from I and II, we get sum = $\left(\dfrac{100 \times 4500}{10 \times 3}\right)$ = 15000.

Now C.I. on Rs. 15000 at 10% p.a. for 3 years may be obtained.
Thus, III is redundant.

∴ Either II or III is redundant.

16. I gives, Amount after 2 years = Rs. 11025, when compounded.
II gives, Amount after 2 years at S.I. = Rs. 11000.
III gives, Principal = Rs. 10000.

From II and III, we have :
Principal = Rs. 10000, S.I. = Rs. (11000 – 10000) = Rs. 1000 and Time = 2 years.
Hence, Rate can be obtained.

∴ I is redundant.

From I and III, we get $11025 = 10000 \times \left(1 + \dfrac{R}{100}\right)^2$. This gives R.

∴ II is redundant.

From I and II, we have

$$P\left(1 + \dfrac{R}{100}\right)^2 = 11025 \quad ...(i) \text{ and } P\left[1 + \dfrac{R \times 2}{100}\right] = 11000 \quad ...(ii)$$

On dividing (i) by (ii), we get $\dfrac{\left(1 + \dfrac{R}{100}\right)^2}{(50 + R)} = \dfrac{11025}{550000}$.

This gives R.
Thus, III is redundant.
Hence I or II or III is redundant.

23. LOGARITHMS

IMPORTANT FACTS AND FORMULAE

I. **Logarithm :** If a is a positive real number, other than 1 and $a^m = x$, then we write : $m = \log_a x$ and we say that the value of $\log x$ to the base a is m.

Example :

(i) $10^3 = 1000 \implies \log_{10} 1000 = 3$ (ii) $3^4 = 81 \implies \log_3 81 = 4$

(iii) $2^{-3} = \dfrac{1}{8} \implies \log_2 \dfrac{1}{8} = -3$ (iv) $(.1)^2 = .01 \implies \log_{(.1)} .01 = 2$.

II. **Properties of Logarithms :**

1. $\log_a (xy) = \log_a x + \log_a y$ 2. $\log_a\left(\dfrac{x}{y}\right) = \log_a x - \log_a y$

3. $\log_x x = 1$ 4. $\log_a 1 = 0$

5. $\log_a (x^p) = p\,(\log_a x)$ 6. $\log_a x = \dfrac{1}{\log_x a}$

7. $\log_a x = \dfrac{\log_b x}{\log_b a} = \dfrac{\log x}{\log a}$.

Remember : When base is not mentioned, it is taken as 10.

III. **Common Logarithms :** Logarithms to the base 10 are known as common logarithms.

IV. The logarithm of a number contains two parts, namely *characteristic* and *mantissa*.

Characteristic : The integral part of the logarithm of a number is called its *characteristic*.

Case I : When the number is greater than 1.

In this case, the characteristic is one less than the number of digits in the left of the decimal point in the given number.

Case II : When the number is less than 1.

In this case, the characteristic is one more than the number of zeros between the decimal point and the first significant digit of the number and it is negative.

Instead of -1, -2, etc. we write, $\bar{1}$ (one bar), $\bar{2}$ (two bar), etc.

Example :

Number	Characteristic	Number	Characteristic
348.25	2	0.6173	$\bar{1}$
46.583	1	0.03125	$\bar{2}$
9.2193	0	0.00125	$\bar{3}$

Mantissa : The decimal part of the logarithm of a number is known is its *mantissa*.
For mantissa, we look through log table.

SOLVED EXAMPLES

Ex. 1. *Evaluate :* (i) $\log_3 27$ (ii) $\log_7\left(\dfrac{1}{343}\right)$ (iii) $\log_{100}(0.01)$

Sol. (i) Let $\log_3 27 = n$.

Then, $3^n = 27 = 3^3$ or $n = 3$. $\therefore \log_3 27 = 3$.

(ii) Let $\log_7\left(\dfrac{1}{343}\right) = n$.

Then, $7^n = \dfrac{1}{343} = \dfrac{1}{7^3} = 7^{-3}$ or $n = -3$. $\therefore \log_7\left(\dfrac{1}{343}\right) = -3$.

(iii) Let $\log_{100}(0.01) = n$.

Then, $(100)^n = 0.01 = \dfrac{1}{100} = (100)^{-1}$ or $n = -1$ $\therefore \log_{100}(0.01) = -1$.

Ex. 2. *Evaluate :* (i) $\log_7 1 = 0$ (ii) $\log_{34} 34$ (iii) $36^{\log_6 4}$

Sol. (i) We know that $\log_a 1 = 0$, so $\log_7 1 = 0$.

(ii) We know that $\log_a a = 1$, so $\log_{34} 34 = 0$.

(iii) We know that $a^{\log_a x} = x$.

Now, $36^{\log_6 4} = (6^2)^{\log_6 4} = 6^{2(\log_6 4)} = 6^{\log_6 (4^2)} = 6^{\log_6 16} = 16$.

Ex. 3. *If* $\log_{\sqrt 8} x = 3\dfrac{1}{3}$, *find the value of* x.

Sol. $\log_{\sqrt 8} x = \dfrac{10}{3} \Leftrightarrow x = (\sqrt 8)^{10/3} = (2^{3/2})^{10/3} = 2^{\left(\frac{3}{2} \times \frac{10}{3}\right)} = 2^5 = 32$.

Ex. 4. *Evaluate :* (i) $\log_5 3 \times \log_{27} 25$ (ii) $\log_9 27 - \log_{27} 9$

Sol. (i) $\log_5 3 \times \log_{27} 25 = \dfrac{\log 3}{\log 5} \times \dfrac{\log 25}{\log 27} = \dfrac{\log 3}{\log 5} \times \dfrac{\log (5^2)}{\log (3^3)} = \dfrac{\log 3}{\log 5} \times \dfrac{2 \log 5}{3 \log 3} = \dfrac{2}{3}$.

(ii) Let $\log_9 27 = n$.

Then, $9^n = 27 \Leftrightarrow 3^{2n} = 3^3 \Leftrightarrow 2n = 3 \Leftrightarrow n = \dfrac{3}{2}$.

Again, let $\log_{27} 9 = m$.

Then, $27^m = 9 \Leftrightarrow 3^{3m} = 3^2 \Leftrightarrow 3m = 2 \Leftrightarrow m = \dfrac{2}{3}$.

$\therefore \log_9 27 - \log_{27} 9 = (n - m) = \left(\dfrac{3}{2} - \dfrac{2}{3}\right) = \dfrac{5}{6}$.

Ex. 5. *Simplify :* $\left[\log\dfrac{75}{16} - 2\log\dfrac{5}{9} + \log\dfrac{32}{243}\right]$ (S.S.C. 2000)

Sol. $\log\dfrac{75}{16} - 2\log\dfrac{5}{9} + \log\dfrac{32}{243} = \log\dfrac{75}{16} - \log\left(\dfrac{5}{9}\right)^2 + \log\dfrac{32}{243} = \log\dfrac{75}{16} - \log\dfrac{25}{81} + \log\dfrac{32}{243}$

$= \log\left(\dfrac{75}{16} \times \dfrac{32}{243} \times \dfrac{81}{25}\right) = \log 2$.

Ex. 6. *Find the value of* x *which satisfies the relation*

$\log_{10} 3 + \log_{10} (4x + 1) = \log_{10} (x + 1) + 1$ (M.B.A. 2002)

Sol. $\log_{10} 3 + \log_{10} (4x + 1) - \log_{10} (x + 1) + 1$

$\Leftrightarrow \quad \log_{10} 3 + \log_{10} (4x + 1) - \log_{10} (x + 1) + \log_{10} 10$

$\Leftrightarrow \quad \log_{10} [3 (4x + 1)] = \log_{10} [10 (x + 1)]$

$\Leftrightarrow \quad 3 (4x + 1) = 10 (x + 1) \quad \Leftrightarrow \quad 12x + 3 = 10x + 10 \quad \Leftrightarrow \quad 2x = 7 \quad \Leftrightarrow \quad x = \dfrac{7}{2}$

Ex. 7. *Simplify :* $\left[\dfrac{1}{\log_{xy} (xyz)} + \dfrac{1}{\log_{yz} (xyz)} + \dfrac{1}{\log_{zx} (xyz)} \right]$

Sol.   Given expression $= \log_{xyz} (xy) + \log_{xyz} (yz) + \log_{xyz} (zx)$

$= \log_{xyz} (xy \times yz \times zx) = \log_{xyz} (xyz)^2 \qquad \left[\because \log_a x = \dfrac{1}{\log_x a} \right]$

$= 2 \log_{xyz} (xyz) = 2 \times 1 = 2.$ (C.B.I. 1997)

Ex. 8. *If $\log_{10} 2 = 0.30103$, find the value of $\log_{10} 50$.*

Sol. $\log_{10} 50 = \log_{10} \left(\dfrac{100}{2} \right) = \log_{10} 100 - \log_{10} 2 = 2 - 0.30103 = 1.69897.$

Ex. 9. *If $\log 2 = 0.3010$ and $\log 3 = 0.4771$, find the values of :*
    (i) *$\log 25$*   (ii) *$\log 4.5$*

Sol.   (i) $\log 25 = \log \left(\dfrac{100}{4} \right) = \log 100 - \log 4 = 2 - 2 \log 2 = (2 - 2 \times 0.3010) = 1.398.$

(ii) $\log 4.5 = \log \left(\dfrac{9}{2} \right) = \log 9 - \log 2 = 2 \log 3 - \log 2$

$= (2 \times 0.4771 - 0.3010) = 0.6532.$

Ex. 10. *If $\log 2 = 0.30103$, find the number of digits in 2^{56}.*

Sol. $\log (2^{56}) = 56 \log 2 = (56 \times 0.30103) = 16.85768.$

Its characteristic is 16. Hence, the number of digits in 2^{56} is 17.

EXERCISE 23

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark* (✓) *against the correct answer :*

1. The value of $\log_2 16$ is :   (M.B.A. 2003)

    (a) $\dfrac{1}{8}$ (b) 4   (c) 8   (d) 16.

2. The value of $\log_{343} 7$ is :

    (a) $\dfrac{1}{3}$ (b) -3 (c) $-\dfrac{1}{3}$ (d) 3

3. The value of $\log_5 \left(\dfrac{1}{125} \right)$ is :

    (a) 3   (b) -3 (c) $\dfrac{1}{3}$ (d) $-\dfrac{1}{3}$

4. The value of $\log_{\sqrt{2}} 32$ is :

    (a) $\dfrac{5}{2}$ (b) 5   (c) 10   (d) $\dfrac{1}{10}$

5. The value of $\log_{10} (.0001)$ is :

    (a) $\dfrac{1}{4}$ (b) $-\dfrac{1}{4}$ (c) -4 (d) 4