SECTION A: DATA INTERPRETATION AND QUANTITATIVE ABILITY

Note: All units of measurement are in centimetres, unless otherwise specified.

1. Four digits of the number 29138576 are omitted so that the result is as large as possible. The largest omitted digit is

(A) 9 (B) 8 (C) 7 (D) 6 (E) 5

Solution:

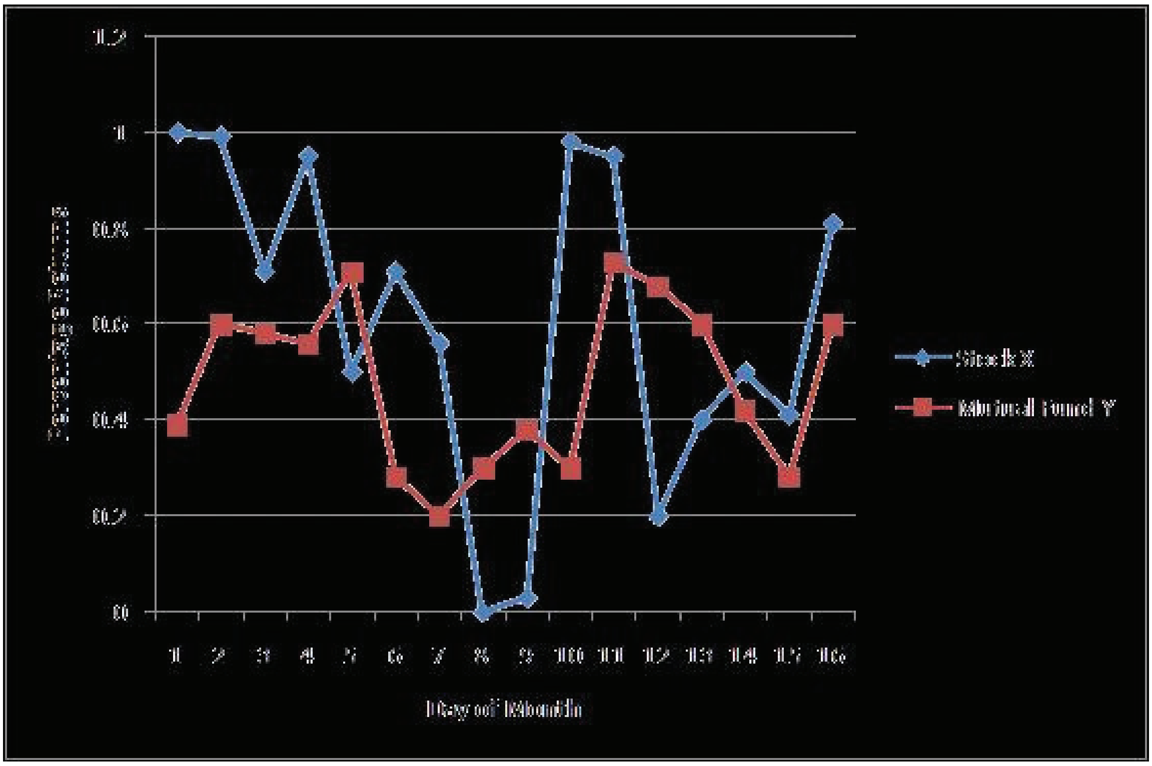
We have to omit four digits in such a manner that we get the largest possible number as the result.

∴We will omit 2, 1, 3 and 5 and the result will be 9876.

∴ The largest omitted digit will be 5.

Hence, option E.

2. Interpret relationship between the returns of stock X and Mutual Fund Y based on the following graph, where percentage return of Stock X and Mutual Fund Y are given for sixteen days of a month.



(A) Returns of stock X are directly proportional to Mutual Fund Y.

(B) Average returns from Stock X and Mutual Fund Y are the same.

(C) Stock X is less volatile than Mutual Fund Y.

(D) Stock X is inversely proportional to Mutual Fund Y.

(E) Stock X is more volatile than Mutual Fund Y.

Solution:

It can be seen from the line graph that the minimum value obtained by the graph of stock X is less than that of the graph of Mutual Fund Y; and the maximum value obtained by the graph of stock X is greater than that of the graph of Mutual Fund Y.

Hence, option E.

For questions 3 and 4, a statement is followed by three conclusions. Select the answer from the following options.

A. Using the given statement, only conclusion I can be derived.

B. Using the given statement, only conclusion II can be derived.

C. Using the given statement, only conclusion III can be derived.

D. Using the given statement, all conclusions can be derived.

E. Using the given statement, none of the three conclusions I, II and III can be derived.

3. An operation "#" is defined by

□ # □□ = $1 - \frac{□}{□}$

Conclusion I. (2 # 1) # (4 # 3) = 1

Conclusion II. (3 # 1) # (4 # 2) = 2

Conclusion III. (2 # 3) # (1 # 3) = 0

Solution:

$2 \# 1 = 1 - \frac{1}{2} = \frac{1}{2}$

$4 \# 3 = 1 - \frac{3}{4} = \frac{1}{4}$

∴ $(2 \# 1) \# (4 \# 3) = \frac{1}{2} \# \frac{1}{4} = 1 - \frac{\frac{1}{4}}{\frac{1}{2}} = 1 - \frac{1}{2} = \frac{1}{2}$

∴ Conclusion I cannot be derived.

$3 \# 1 = 1 - \frac{1}{3} = \frac{2}{3}$

$4 \# 2 = 1 - \frac{2}{4} = \frac{1}{2}$

$\therefore$ $(3 \# 1) \# (4 \# 2) = \frac{2}{3} \# \frac{1}{2} = 1 - \frac{\frac{1}{2}}{\frac{2}{3}} = 1 - \frac{3}{4} = \frac{1}{4}$

$\therefore$ Conclusion II cannot be derived.

$2 \# 3 = 1 - \frac{3}{2} = -\frac{1}{2}$

$1 \# 3 = 1 - \frac{3}{1} = -2$

$\therefore$ $(2 \# 3) \# (1 \# 3) = -\frac{1}{2} \# -2 = 1 - \frac{-2}{-\frac{1}{2}} = 1 - 4 = -3$

$\therefore$ Conclusion III cannot be derived.

Hence, option E.

4. A, B, C and D are whole numbers such that

A + B + C = 118

B + C + D = 156

C + D + A = 166

D + A + B = 178

Conclusion I. A is the smallest number and A = 21.

Conclusion II. D is the largest number and D = 88.

Conclusion III. B is the largest number and B = 56.

Solution:

A + B + C = 118 … (i)

B + C + D = 156 … (ii)

C + D + A = 166 … (iii)

D + A + B = 178 … (iv)

If we add equations (i), (ii), (iii) and (iv), we get,

3(A + B + C + D) = 618

$\therefore$ A + B + C + D = 206 … (v)

Subtracting equation (i) from equation (v), we get,

D = 88

Subtracting equation (ii) from equation (v), we get,

A = 50

Subtracting equation (iii) from equation (v), we get,

B = 40

$\therefore$ C = 28

$\therefore$ Only conclusion II can be derived.

Hence, option B.

5. If [*X*] denotes the greatest integer less than or equal to *X*, then

$\left[\frac{1}{3}\right] + \left[\frac{1}{3} + \frac{1}{99}\right] + \left[\frac{1}{3} + \frac{2}{99}\right] + \cdots + \left[\frac{1}{3} + \frac{98}{99}\right] =$

(A) 33 (B) 34 (C) 66 (D) 67 (E) 98

Solution:

[*X*] denotes the greatest integer less than or equal to *X*.

$\therefore \left[\frac{1}{3}\right] = 0, \left[\frac{1}{3} + \frac{1}{99}\right] = 0, \left[\frac{1}{3} + \frac{2}{99}\right] = 0, \ldots, \left[\frac{1}{3} + \frac{65}{99}\right] = 0$

($\because$ for [*X*] to be 1, *X* must be ≥ 1)

$\therefore \left[\frac{1}{3} + \frac{66}{99}\right] = 1, \left[\frac{1}{3} + \frac{67}{99}\right] = 1, \ldots, \left[\frac{1}{3} + \frac{98}{99}\right] = 1$

$\therefore \left[\frac{1}{3}\right] + \left[\frac{1}{3} + \frac{1}{99}\right] + \left[\frac{1}{3} + \frac{2}{99}\right] + \cdots + \left[\frac{1}{3} + \frac{98}{99}\right] = 0 + 0 + \cdots$ 66 terms $+ 1 + 1 + \cdots$ 33 terms $= 33$

Hence, option A.

6. ABCD is a square. P is the midpoint of AB. The line passing through A and perpendicular to DP intersects the diagonal at Q and BC at R. If AB = 2 then PR = ______ ?

A $\frac{1}{2}$

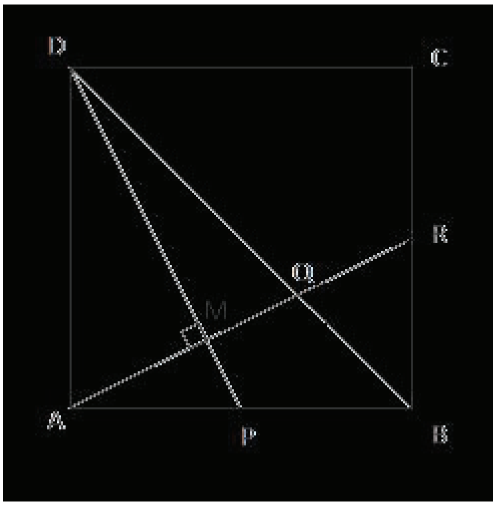
B $\frac{3}{2}$

C 2

(D) 1

(E) None of the above

Solution:



The above image can be drawn from the data given.

Consider ΔAQD,

m□ ADP + m□ DAM = 90°

Also,

m□ DAM + m□ MAP = 90°

□ m□ ADP = m□ MAP

□ By A-A-A test of similarity, ΔADP □ ΔARB

□ $\frac{AB}{AD} = \frac{BR}{AP} = \frac{BR}{1} = 1$

□ BR = 1

Consider ΔPBR,

BR = 1 and PB = 1

By Pythagoras theorem,

$PR^2 = BR^2 + PB^2$

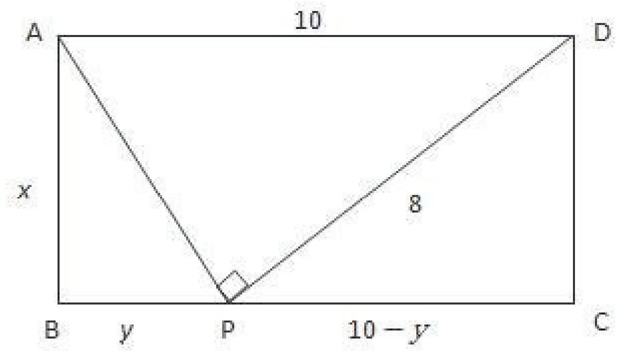
□ $PR = \sqrt{2}$

Hence, option C.

7. ABCD is a rectangle with AD = 10. P is a point on BC such that $\angle$APD = 90°. If DP = 8 then the length of BP is

(A) 6.4 (B) 5.2 (C) 4.8 (D) 3.6 (E) None of the above

Solution:



Consider ΔAPD:

By Pythagoras‟ theorem, $AD^2 = AP^2 + PD^2$

$\Rightarrow$ AP = 6

Consider ΔABP:

By Pythagoras‟ theorem, $AB^2 + BP^2 = AP^2$

$\Rightarrow x^2 + y^2 = 36$ … (i)

Consider ΔDPC:

By Pythagoras‟ theorem, $DC^2 + PC^2 = DP^2$

$\Rightarrow x^2 + (10 - y)^2 = 64$

$\Rightarrow x^2 + y^2 + 100 - 20y = 64$

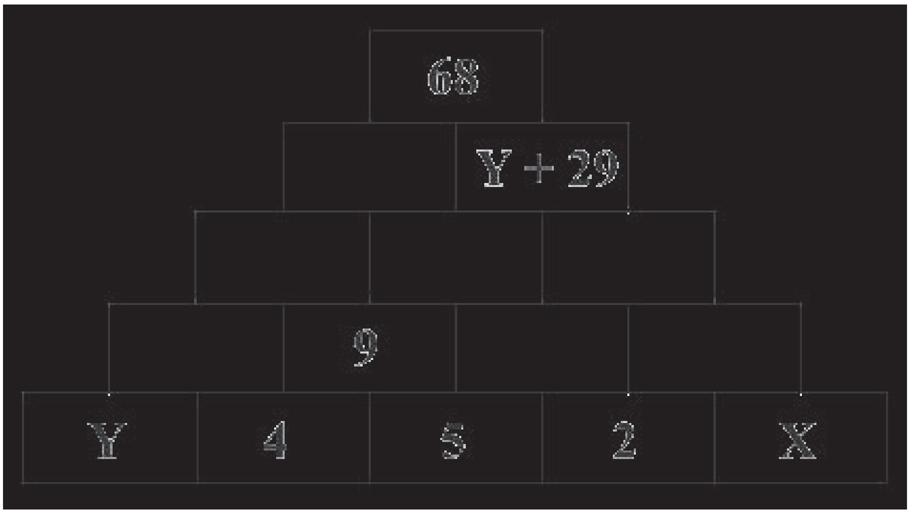
From equation (i), we get,

$36 + 100 - 64 = 20y$

$\Rightarrow y = 3.6$

Hence, option D.

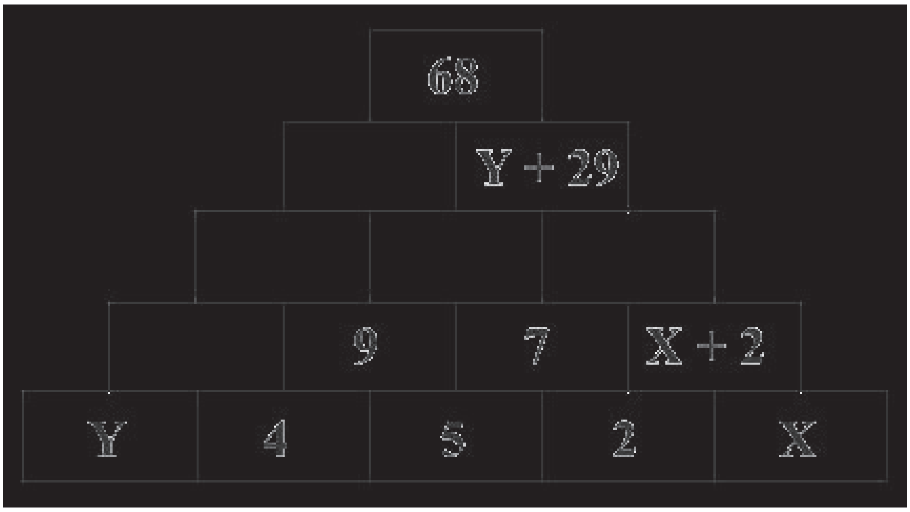
8. In the figure, number in any cell is obtained by adding two numbers in the cells directly below it. For example, 9 in the second row is obtained by adding the two numbers 4 and 5 directly below it. The value of $X - Y$ is



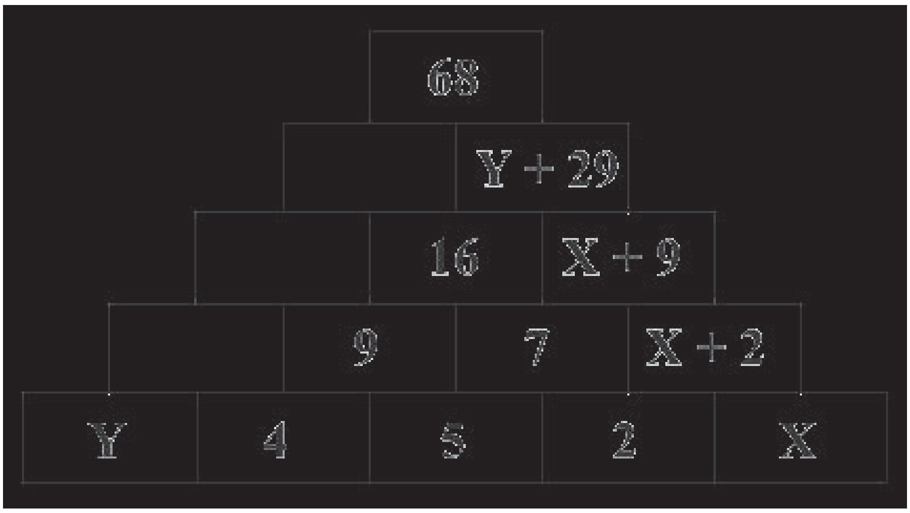
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

Solution:

Working upward to the second row from the bottom by filling the cells above 5 and 2, and 2 and X, we get,



Similarly, working up to the 3rd row from the bottom, we get,



If we go further up, we get,

X + 9 + 16 = Y + 29

X + 25 = Y + 29

□ X   Y = 4

Hence, option C.

Directions for Questions 9 and 10:

In second year, students at a business school can opt for Systems, Operations or HR electives only. The number of girls opting for Operations and the number of boys opting for Systems elective is 37. Twenty two students opt for operations elective. Twenty girls opt for Systems and Operations electives. The number of students opting for Systems elective and the number of boys opting for Operations electives is 37. Twenty-five students opt for HR electives.

9. The number of students in the second year is

(A) 73 (B) 74 (C) 75 (D) 76 (E) 77

Solution:

	Systems	Operations	HR
Boys	a	c	
Girls	b	$20-b$	
Students	d	22	25

From the given data, we have,

$20 - b + a = 37$ … (i)

$c + d = 37$ … (ii)

$a + b = d$ … (iii)

$c - b = 2$ … (iv)

On solving these equations, we get,

$a = 23$, $b = 6$, $c = 8$ and $d = 29$

□ Total number of students in second year = 29 + 25 + 22 = 76

Hence, option D.

10. If 20% of the girls opt for HR electives, then the total number of boys in the second year is

(A) 54 (B) 53 (C) 52 (D) 51 (E) 50

Solution:

	Systems	Operations	HR
Boys	23	8	x
Girls	6	14	y
Students	29	22	25

Now, y = 20% of total number of girls.

□ 16 + 4 = 20 = 80% of total number of girls.

□ Total number of girls = 25

As total number of students = 76 and total number of girls = 25

□ Total number of boys = 76 – 25 = 51

Hence, option D.

Question Nos. 11-12 are followed by two statements labeled as I and II. You have to decide if these statements are sufficient to conclusively answer the question. Choose the appropriate answer from options given below:

A. If statement I alone is sufficient to answer the question.

B. If statement II alone is sufficient to answer the question.

C. If statement I and statement II together are sufficient but neither of the two alone is sufficient to answer the question.

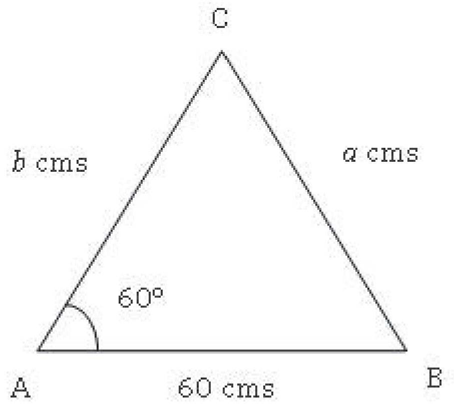
D. If either statement I or statement II alone is sufficient to answer the question.

E. Both statement I and statement II are insufficient to answer the question.

11. The base of a triangle is 60 cms, and one of the base angles is 60°. What is length of the shortest side of the triangle?

I. The sum of lengths of other two sides is 80 cms.
II. The other base angle is 45°.

Solution:



Let AB be the base of the triangle, let *a* be the length of side BC and *b* be the length of side AC.

Using statement I:

$a + b = 80$

$a = 80 - b$ …(i)

According to the cosine rule:

$$\cos A = \frac{c^2 + b^2 - a^2}{2bc}$$

$$\Rightarrow \cos 60 = \frac{60^2 + b^2 - a^2}{120b}$$

$$\Rightarrow \frac{1}{2} = \frac{3600 + b^2 - a^2}{120b}$$

$\Rightarrow 60b = 3600 + b^2 - a^2$ (ii)

Set D

Substituting equation (i) in (ii), we get,

$\Rightarrow 60b = 3600 + b^2 - (80 - b)^2$

$\Rightarrow 60b = 3600 + b^2 - (b^2 + 6400 - 160b)$

$\Rightarrow 60b = 160b - 2800$

$\Rightarrow b = 28$

From equation (i), we get,

$a = 52$

$\therefore$ Using statement I alone, the length of the shortest side can be determined.

Using statement II:

□ B = 45°

□ □ C = 75°

According to the sine rule:

□ □ □

sin □□ = sin □□ = sin

□□ 60

□ □ □□

sin 60 = sin 45 = sin 75

□ Values of all the sides can be determined.

□ Statement II alone is also sufficient to answer the question.

□ The question can be answered using either of the statements alone.

Hence, option D.

12. A, B, C, D, E and F are six integers such that E < F, B > A, A < D < B. C is the greatest integer. Is A the smallest integer?

I. E + B < A + D
II. D < F

Solution:

It is given that A < D < B, E < F and also C is the greatest integer.

□ To determine if A is the smallest integer, we need to find the relation between A and E

Using statement I:

E + B < A + D

E + B can be less than A + D only when E is less than A (□ B > D .

□ A is not the smallest integer.

□ Statement I alone is sufficient to answer the question.

Using statement II:

D < F

This statement is also not sufficient to determine the relation between A and E

□ Statement II alone is not sufficient to answer the question.

Hence, option A.

13. Rajiv is a student in a business school. After every test he calculates his cumulative average. QT and OB were his last two tests. 83 marks in QT increased his average by 2. 75 marks in OB further increased his average by 1. Reasoning is the next test, if he gets 51 in Reasoning, his average will be _____?

(A) 63 (B) 62 (C) 61 (D) 60 (E) 59

Solution:

Let the total marks of Rajiv and the number of tests he gave before giving QT be x and n respectively.

□ 83 marks in QT increased his average by 2,

□ □ (□□ + 83) / (□□ + 1) (i)

□ + 2 =

75 marks in OB further increased his average by 1,

□ (□□ + 83) (□□ + 83 + 75) / (□□ + 2) (ii)

(□□ + 1) +

1 =

He gets 51 in his next test – Reasoning,

□ Average = (□□ + 3) (iii)

(□□ + 158 +

51)

Solving equations (i) and (ii), we get the value of $n = 10$ and $x = 610$

□ From (iii), we get Average = 63

Hence, option A.

Alternatively,

Let Rajiv"s average marks and the number of tests he gave before giving QT be A and n respectively. Now, since the average of n tests is A, let"s assume that in each of the n tests, Rajiv scored A marks.

83 marks in QT increased his average by 2. This will be possible if for each of the $(n + 1)$ tests, Rajiv scores $(A + 2)$ marks. However, we already know that for the first n tests, he only scored A marks. So, to compensate this, he should have scored $[(A + 2) + 2n]$ marks.

□ $A + 2 + 2n = 83$

□ $A + 2n = 81$ … (i)

Similarly, 75 marks in OB further increased his average by 1. This will be possible if for each of the $(n + 2)$ tests, Rajiv scores $(A + 3)$ marks. However, we already know that for the first n tests, he only scored A marks and for the second-last test (QT), he scored 83 marks. So, to compensate this, he should have scored $[(A + 3) + 3n + (A + 3 – 83)]$ marks.

□ $(A + 3) + 3n + (A + 3 – 83) = 75$

□ $2A + 3n = 152$

Solving equation (i) and (ii) simultaneously, we get, $n = 10$ and $A = 61$

Hence, average after Rajiv scores 51 in Reasoning is given by,

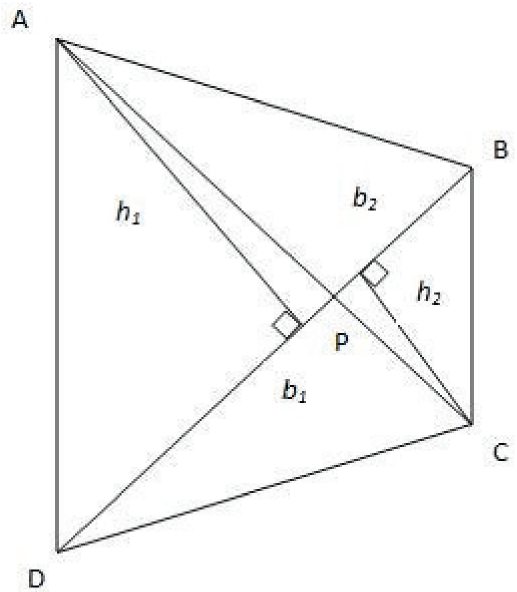
$$\text{Average} = \frac{610 + 83 + 75 + 51}{13} = \frac{819}{13} = 63$$

Hence, option A.

14. ABCD is a quadrilateral. The diagonals of ABCD intersect at the point P. The area of the triangles APD and BPC are 27 and 12 respectively. If the areas of the triangles APB and CPD are equal then the area of triangle APB is

(A) 21 (B) 18 (C) 16 (D) 15 (E) 12

Solution:



Let the height of the Δ APD be h_1 and the height of Δ BPC be h_2

Let the length of DP be b_1 and the length of BP be b_2

$$\frac{A(\Delta APD)}{A(\Delta BPC)} = \frac{h_1 \times b_1}{h_2 \times b_2} = \frac{27}{12} \qquad \text{(i)}$$

Now, A(Δ APB) = A(Δ CPD)

$\therefore h_1 \times b_2 = h_2 \times b_1$

$\therefore \frac{h_1}{h_2} = \frac{b_1}{b_2}$

$\therefore$ From (i), we get,

$$\frac{(\square\square_1)2}{(\square\square_2)2} = \frac{27}{12}$$

$$\square \frac{\square_1}{\square_2} = \frac{27}{12}$$

Now,

$$\frac{A(\ APD)}{A(\ APB)} = \frac{h_1 \times \square\square_1}{h_1 \times \square\square_2}$$

$$\square \frac{27}{A(\ APB)} = \frac{27}{12}$$

$\square$ A(Δ APB) = 18

Hence, option B.

15. If F(x, n) be the number of ways of distributing “x” toys to “n” children so that each child receives at the most 2 toys then F(4, 3) = _______?

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

Solution:

$\square$ We have to find the number of ways in which 4 toys can be distributed to 3 children so that each child receives at the most 2 toys.

There are two possible cases:

Case 1: Two of them receive 2 toys each and one of them doesn‟t get any toy.

There are 3 possible ways to distribute the toys in this case i.e., the three possible ways of selecting the child who will not get any toy.

Case 2: Two of them receive 1 toy each and one of them receives 2 toys.

Again there are 3 possible ways to distribute the toys in this case i.e., the three possible ways of selecting the child who will get 2 toys.

$\square$ There are a total of 6 possible ways.

Hence, option E.

16. In a cricket match, Team A scored 232 runs without losing a wicket. The score consisted of byes, wides and runs scored by two opening batsmen: Ram and Shyam. The runs scored by the two batsmen are 26 times wides. There are 8 more byes than wides. If the ratio of the runs scored by Ram and Shyam is 6:7, then the runs scored by Ram is

(A) 88 (B) 96 (C) 102 (D) 112 (E) None of the above

Solution:

Let the number of runs scored by byes, wides and runs be x, y and z respectively.

□ $x + y + z = 232$ …(i)

□ The runs scored by the two batsmen are 26 times the wides

□ $z = 26y$ …(ii)

□ There are 8 more byes than wides

□ $x = y + 8$ …(iii)

Substituting equations (iii) and (ii) in equation (i), we get,

$y = 8$

□ $z = 208$

□ The runs scored by Ram and Shyam were in the ratio 6 : 7

Let the runs scored by Ram be $6r$ and by Shyam be $7r$.

□ $13r = 208$

□ $r = 16$

□ Runs scored by Ram is 96.

Hence, option B.

17. Let X = {a, b, c} and Y = {l, m}. Consider the following four subsets of X × Y.

F_1 = {(a, l), (a, m), (b, l), (c, m)}

F_2 = {(a, l), (b, l), (c, l)}

F_3 = {(a, l), (b, m), (c, m)}

F_4 = {(a, l), (b, m)}

Which one, amongst the choices given below, is a representation of functions from X to Y?

(A) F_1, F_2 and F_3 (B) F_2, F_3 and F_4 (C) F_2 and F_3 (D) $F_3$and F_4 (E) None of the above

Solution:

□ We are supposed to find the representation of functions from X to Y,

□ X will be considered as the domain and Y will be considered as the range.

We will consider functions satisfying only many-to-one and one-to-one relationships.

In F1, □ a is paired with l and m, □ it satisfies one-to-many relationship and hence is not a representation of function from X to Y.

Elements in F_2 only satisfy many-to-one relationship and hence F_2 is valid.

Elements in F_3 satisfy one-to-one and many-to-one relationship and hence F_3 is valid.

Elements in F_4 only satisfy one-to-one relationship and hence F_4 is valid.

□ F_2, F_3 and F_4 are representation of functions from X to Y.

Hence, option B.

Questions 18 - 20: A, B, C, D, E and F are six positive integers such that

$B + C + D + E = 4A$

$C + F = 3A$

$C + D + E = 2F$

$F = 2D$

$E + F = 2C + 1$

If A is a prime number between 12 and 20, then

18. The value of C is

(A) 23 (B) 21 (C) 19 (D) 17 (E) 13

Solution:

It is given that:

$B + C + D + E = 4A$ … (i)

$C + F = 3A$ … (ii)

$C + D + E = 2F$ … (iii)

$F = 2D$ … (iv)

$E + F = 2C + 1$ … (v)

From equations (iii) and (iv), we get,

$C + E = 3D$ … (vi)

From equations (iv) and (v) we get,

$E = 2C \quad 2D + 1$ … (vii)

□ $3C – 2D + 1 = 3D$

□ $3C + 1 = 5D$ … (viii)

□ From equation (iv) we get $3C + 1 = 5F/2$

□ $(6C + 2)/5 = F$ … (ix)

□ From equations (ix) and (ii) we get,

$11C + 2 = 15A$ … (x)

It is given that A is a prime number between 12 and 20.

□ A can have the values 13 or 17 or 19

□ A, B, C, D, E and F are all positive integers.

□ From equation (x), we get integer value for C only when A is 17.

□ $A = 17$ and $C = 23$

Substituting the value of C in equation (ix), we get,

$F = 28$

From equation (viii), we get $D = 14$

From equation (vii), we get $E = 19$

And from equation (i), we get $B = 12$

□ The value of C is 23,

Hence, option A.

19. The value of F is

(A) 14 (B) 16 (C) 20 (D) 24 (E) 28

Solution:

Set D

From the solution of the first question of the set we get that the value of F is 28

Hence, option E.

20. Which of the following must be true?

(A) D is the lowest integer and $D = 14$

(B) C is the greatest integer and $C = 23$

(C) B is the lowest integer and B = 12

(D) F is the greatest integer and F = 24

(E) A is the lowest integer and A = 13

Solution:

Referring to the solution of the first question of the set, we get that only the statement:

„B is the lowest integer and B = 12‟ is true

Hence, option C.

□□. For each □□ > 1, sequence A□ is defined by A_0= 1 and A□ = □□ + −1 □ A□−1 for □□ ≥ 1.

For how many integer values of *p*, 1000 is a term of the sequence?

(A) 8 (B) 7 (C) 5 (D) 4 (E) None of the above

Solution:

We have, A_0 = 1

And A□ = □□□□ + −1 □ A□−1 for □□ ≥ 1

□ □□$_1$= □□ + −1 × □□$_0$= □□ − 1

Now, A_2= 2□□ + −1 2 × A_1= 2□□ + □□ − 1 = 3□□ − 1

Also, A_3= 3□□ + −1 3 × A_2= 3□□ − 3□□ − 1 = 1

Also, A_4= 4□□ + −1 4 × A_3= 4□□ + 1 = 4□□ + 1

□□□□, □□$_5$= 5□□ + −1 5 × □□$_4$= 5□□ − 4□□ + 1 = □□ − 1

Also, A_6= 6□□ + −1 6 × A_5= 6□□ + □□ − 1 = 7□□ − 1

Also, A_7= 7□□ + −1 7 × A_6= 7□□ − 7□□ − 1 = 1

Also, A_8= 8□□ + −1 8 × A_7= 8□□ + 1

Also, A_9= 9□□ + −1 9 × A_8= 9□□ − 8□□ + 1 = □□ − 1

Also, A_{10}= 10□□ + −1 10 × A_9= 10□□ + □□ − 1 = 11□□ − 1

1000 can be obtained for *p*   1, 3*p*   1, 7*p*   1, 11*p*   1, 15*p*   1, 19*p*   1, 23*p*   1 and so on.

We find out divisors of 1001 = 1, 7, 11, 13, 77, 91, 143, 1001

Out of these divisors, only $7p$ 1, $11p$ 1, $91p$ 1, $143p$ 1 and $1001p$ 1 falls under these sequence thus resulting into 1000.

So there are 5 values of p for which sequence will result into 1000.

Hence, option C.

□□. If 0 < □□ < 1, then roots of the equation (1 − □□)□□ 2 + 4□□ + □□ = 0 are

(A) Both 0
(B) Imaginary
(C) Real and both positive
(D) Real and of opposite sign
(E) Real and both negative

Solution:

We have,

(1 − □□)□□2 + 4□□ + □□ = 0

□ = 42 − 4 × □□ 1 − □□ = 16 − 4□□ + 4□□2

□ > 0 for ′□′ lying between 0 and 1.

□ Roots are real and after checking for the arbitrary values of p (say 0.5), we get that both roots will be negative.

Hence, option E.

23. If $x > 0$, then minimum value of

6
□ +1 − □□6 +1
□ 3
□ +1 □6 − 2 is
+ □□3 +1
□ □3

(A) 6 (B) 3 (C) 2 (D) 1 (E) None of the above

Solution:

We have, −

For □□ > 0, the minimum value of □ will be 2 for □□ = 1

□□ +1

Set D

□ +^{1} ^{6} − □□6 +^{1} □ +^{1} ^{6} − □□3 +^{1} ^{2}

□   □6^{+2} = □   □3 = □□ + −1 ^{3} − □□3 +^{1}

□ +^{1} ^{3} + □□3 +^{1} □□ ^{3} + □□3 +^{1} □   □□3

−   —   −+^{1}

□   □3   □   □3

1

□□ +^{1}^{3} − □□3 □3 = 3 □□ + −

+^{1}

□   □□

□ The minimum value of 3 □ = 3 × 2 = 6 for □□ = 1

□□ +^{1}

Hence, option A.

24. The number of possible real solution(s) of y in equation y^2 $2y\cos x + 1 = 0$ is

(A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above

Solution:

We have,

y^2 $2y\cos x + 1 = 0$

$\Delta = 4\cos^2 x$ 4

For real values of y, we should have Δ greater than or equal to 0.

But here, Δ cannot be greater than 0.

□ $\Delta = 0$ for the real values of y

□ $4\cos^2 x$ $4 = 0$ gives $\cos x = \pm 1$

□ $\cos x = 0°$ or $180°$

So for these 2 values of x, we get 2 real solutions.

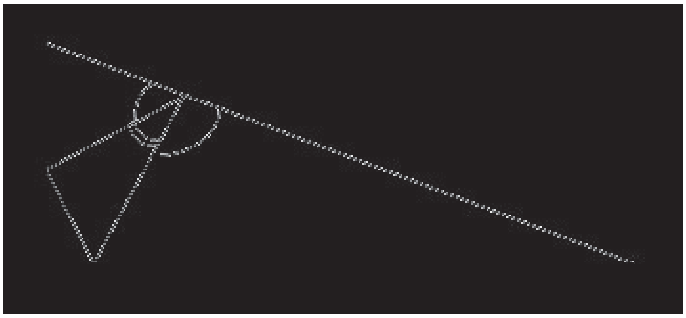
Hence, option C.

25. In a triangle ABC, AB = 3, BC = 4 and CA = 5. Point D is the midpoint of AB, point E is on segment AC and point F is on segment BC. If AE = 1.5 and BF = 0.5, then □DEF =

(A) 30° (B) 45° (C) 60° (D) 75° (E) Cannot be determined

Solution:

We know that □ABC = □FBD = 90° as 3-4-5 form a Pythagorean triplet. So, we have,



Let ∠DEF = y, ∠AED = x, and ∠FEC = z

∠AED + ∠DEF + ∠FEC = $x + y + z = 180°$ … (i)

In ΔAED, AE = AD = 1.5 and in ΔCEF, CE = CF = 3.5

So ∠AED = ∠ADE = x and ∠CEF = ∠CFE = z

In quadrilateral BDEF, ∠DEF + ∠EFB + ∠FBD + ∠BDE = 360°

$y + (180° - z) + 90° + (180° - x) = 360°$

$450° + y - (x + z) = 360°$

$450° + y - (180° - y) = 360°$ … From (i)

$2y = 90°$

$y = 45°$

Hence, option B.

. If $3 \quad + 2 + \frac{1}{4} \quad + 2 = 4 \quad$, $\neq -2$, then 4 is

(A) $\frac{7}{52}$

(B) $\frac{7}{?}$

(C) $\frac{8}{56}$

(D) 7

(E) None of the above

Solution:

$3 \quad + 2 + \frac{1}{4} \quad + 2 = 4$

Putting $y = x + 2$, we get,

3□□ □□ + □ = 4 □□ − 2 (i)

4□□ 1

Putting □□ □ + 2 , we get,

=1

□ □□ = 1

− 2□□

□

3□□ 1 1 − 2□□

□ + 4□□ □□ = 4 □ (ii)

Adding (i) and (ii), we get,

7 □□ □□ + □□ 1 1 − 2□□

□ = 4 □□ − 2 + 4 □

□ □□ □□ + □□ 14 1 − 2□□

□ = 7 □□ − 2 + □

Putting this value in equation (ii), we get,

1 − 2□□

12 1 − 2□□

7 □□ − 2 + □ + □□ □□ = □ iii

1 − 2□□

□ □□ □□ = 4 1 − 4

12

2□□

□ − 7 □□ − 2 + □

Putting $y = 4$, we get,

□ □□ 4 = − 52

7

Hence, option E.

Alternatively,

You could have substituted $x = 2$ and $x = -7/4$ in the given equation to get,

3□□ 4 + 4 = 8

4□□ 1

3□ □ 1

$4 + 4\square\square 4 = -7$

Solving these two equations simultaneously, we get $f\,4 = -^{52}$ 1 53

Hence, option E.

Set D

7 and f $_4$ $=_7$

27. A train left station X at A hour B minutes. It reached station Y at B hour C minutes on the same day, after travelling C hours A minutes (clock shows time from 0 hours to 24 hours). Number of possible value(s) of A is

(A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above

Solution:

A hours + C hours = B hours … (i)

 A, C and B cannot have values greater than or equal to 24

 B minutes + A minutes = C minutes … (ii)

Looking at the two equations, we get that no value of A satisfies both the equations.

Hence, option A.

28. Two circles of radius 1 cm touch at point P. A third circle is drawn through the points A, B and C such that PA is the diameter of the first circle, and BC - perpendicular to AP - is the diameter of the second circle. The radius of the third circle is

A $\frac{9}{5}$

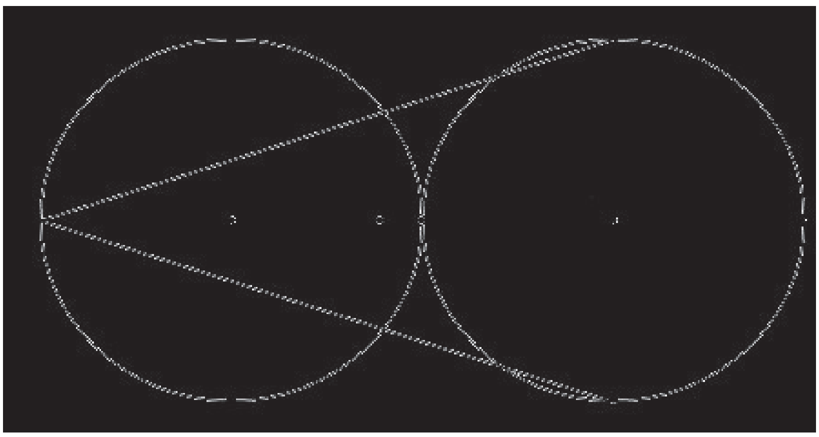
B $\frac{7}{4}$

C $\frac{5}{3}$

D $\frac{10}{2}$

(E) 2

Solution:



As third circle is passing through the points A, B and C, the center (say G) of the third circle must lie on the segment AD.

Let AG = BG = CG = x cm

□ $AG^2 = BG^2$

□ $x^2 = BD^2 + GD^2$

□ $x^2 = 1^2 + (3 - x)^2$

Solving this, we get,

□ $= \frac{5}{3}$ cm

Hence, option C.

Answer the question nos. 29 to 33 on the basis of the data given below.

Area/Month		January	February	March
Sales in Bistupur				
	Television	900	1050	1200
	Ipods	15750	16800	17850
Sales in Sakchi				
	Television	1800	2100	2400
	Ipods	9450	10080	10710
Sales in Kadma				
	Television	6300	7350	8400
	Ipods	6300	6720	7140

Units ordered=Units Sold + Ending Inventory – Begining Inventory
All sales figure are in Rupees thousand
All other things are constant.
All Rupees figures are in thousands.

29. In a period from January to March, Jamshedpur Electronics sold 3150 units of Television, having started with a beginning inventory of 2520 units and ending with an inventory of 2880. What was the value of order placed (Rupees in thousands) by Jamshedpur Electronics during the three months period?
[Profits are 25% of cost price, uniformly.]

(A) 2808 (B) 26325 (C) 22320 (D) 25200 (E) 28080

Solution:

Units ordered = Units sold + Ending Inventory – Beginning Inventory

= 3150 + 2880 – 2520

= 3510

Total sales of Television in Rs. Thousand = 900 + 1800 + 6300 + 1050 + 2100 + 7350 + 1200 + 2400 + 8400 = 31500

Sales Price per unit of Television in Rs. Thousand = 31500/3150 = 10

Profits are 25% of the cost price.

 Sales Price = Cost Price + Profits = Cost Price + 0.25 × Cost Price = 1.25 × Cost Price

 Cost Price per unit of Television = Sales Price per unit/1.25 = 10/1.25 = 8

 The value of the order placed in Rs. Thousand = Units ordered × Cost Price per unit = 3510 × 8 = 28080

Hence, option E.

30. What was the total value of surcharge paid - at the rate of 14% of sales value - by Jamshedpur Electronics, over the period of 3 months?

(A) 18522 (B) 18548 (C) 18425 (D) 18485 (E) Cannot be determined

Solution:

Total sales of Television and IPods in Rs. Thousand = 31500 + 100800 = 132300

But the surcharge paid is 14% of the total sales

 Surcharge paid in Rs. Thousand = 132300 × 0.14 = 18522

Hence, option A.

31. 10% of sales price of IPods and 20% of sales price of Television contribute to the profits of Jamshedpur Electronics. How much profit did the company earn in the month of January from Bistupur and Kadma from the two products?

(A) 513 (B) 4410 (C) 3645 (D) 5230 (E) 5350

Solution:

In the month of January,

Sales of Television in Rs. Thousand = 22050

And sales of IPods in Rs. Thousand = 7200

Hence,

20% of the sales of Television in Rs. Thousand = 7200 × 0.20 = 1440

And 10% of the sales of IPods in Rs. Thousand = 22050 × 0.10 = 2205

 Profit earned by the company in the month of January from Bistupur and Kadma

= 2205 + 1440

= 3645

Hence, option C.

32. In the period from January to March, consider that Jamshedpur Electronics ordered 7560 units of IPods for all three areas put together. What was unit sales price of IPod during the period? The ending inventory was 6120 units and the beginning inventory stood at 5760.

(A) 14.00 (B) 14.65 (C) 14.80 (D) 13.00 (E) 13.60

Solution:

Units ordered = Units sold + Ending Inventory – Beginning Inventory

7560 = Units Sold + 6120 – 5760

 Units sold = 7200

 Sales price of IPod during this 3 month period in Rs. Thousand = 100800/7200 = 14

Hence, option A.

33. For Jamshedpur Electronics Beginning inventory was 720 for Televisions and 1800 for IPods and Ending inventory was 840 for Televisions and 1920 for IPods in the month of January. How many units of Televisions and IPods did Jamshedpur Electronics order for the month of January?

Additional Data: In the month of February, 1050 units of Television and 2400 units IPods were sold in all three areas put together.

(A) 1020, 2270

(B) 1020, 2370

(C) 2270, 1030

(D) 1030, 2370

(E) 1020, 2280

Solution:

In a month of February, 1050 units of Television and 2400 units of IPods were sold in all three areas.

Sell price of Television per unit in Rs. Thousand = 10500/1050 = 10

And price of IPod per unit in Rs. Thousand = 33600/2400 = 14

This Price per unit is from a month of January.

□ No of Units of Television sold in the month of January = 9000/10 = 900

And no of Units of IPods sold in the month of January = 31500/14 = 2250

Now, Units ordered = Units sold + Ending Inventory – Beginning Inventory

For Television: Units ordered = 900 + 840 – 720 = 1020

For IPod: Units ordered = 2250 + 1920 – 1800 = 2370

Hence, option B.

34. Consider a sequence 6, 12, 48, 24, 30, 36, 42 … If sum of the first *n* terms of the sequence is 132, then the value of *n* is?

(A) 11 (B) 13 (C) 18 (D) 22 (E) 24

Solution:

6, 12, 48, 24, 30, 36, 42, …

From the fifth number onwards,

The ratio of each number and its preceding number in the series is of the form $\frac{5}{4}, \frac{6}{5}, \frac{7}{6}$, etc.

That is, $\frac{30}{24} = \frac{5}{4}; \frac{36}{30} = \frac{6}{5}; \frac{42}{36} = \frac{7}{6}$ and so on.

Also, the signs follow a pattern of –, –, +, +, –, –, +, + and so on

So, continuing the series in this manner, we have,

6, 12, 48, 24,

30, 36, 42, 48,

54, 60, 66, 72,

78, 84, 90, 96, …

Except for the first 4 numbers in the series, each set of four numbers adds up to 24

(i.e. –30 – 36 + 42 + 48 = –54 – 60 + 66 + 72 = –78 – 84 + 90 + 96 = 24)

So, the sum of the series will progress in this way:

(–6 – 12 + 48 + 24) + 24 + 24 + 24 + …

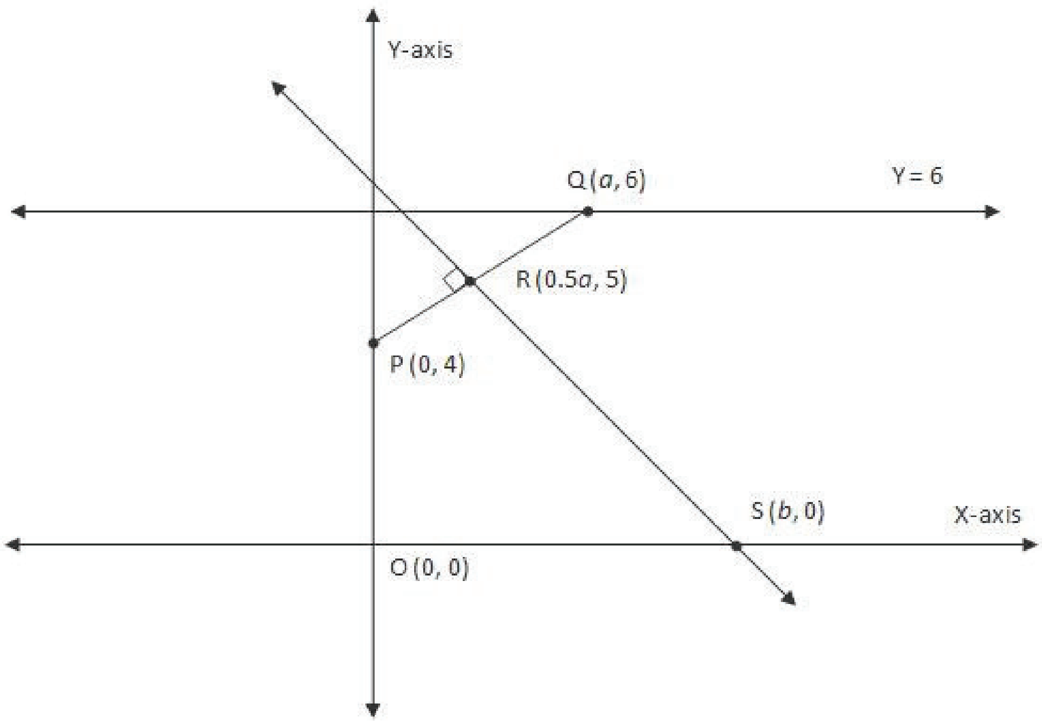
However, 54 + 24 + 24 + 24 = 126 and 54 + 24 + 24 + 24 + 24 = 150. Thus, the sum can never be 132.

Hence, no solution exists.

35. The co-ordinates of P and Q are (0, 4) and (a, 6), respectively. R is the midpoint of PQ. The perpendicular bisector of PQ cuts X-axis at point S(b, 0). For how many integers value(s) of “a”, b is an integer?

(A) 4 (B) 3 (C) 2 (D) 1 (E) 0

Solution:



P (0, 4) and Q (a, 6)

□ Co-ordinates of midpoint of PQ, R will be (0.5a, 5).

□ – 4

Equation of line PQ is □ – □□₁□ – □□₁□ – 0

□₁– □□₂= □₁– □□₂= 0 – □□ = 4 – 6

□ Equation of line PQ is □ □ + 4

□□ = 2

□ Equation of perdicular bisector of PQ will be 2 □ + □□

□□ = –□□

As R is the midpoint of PQ, it will lie on the perpendicular bisector of PQ and S will also lie on this line.

□ Co-ordinates of both R and S will satisfy this equation.

Substituting the co-ordinates of S (b, 0) we get,

0 = 2 □ + □□

−□

□

□ □□ = □□

2

Substituting the value of c and co-ordinates of R in the equation of the perpendicular to PQ, we get,

5 = □ □□

−□□

2 $2^{+}2$

□ 20 = $a^2 + 2ab$

□ □□ = $\frac{^2 + 20}{2□□}$

□ 10

□ □□ =

□

2^{+}□

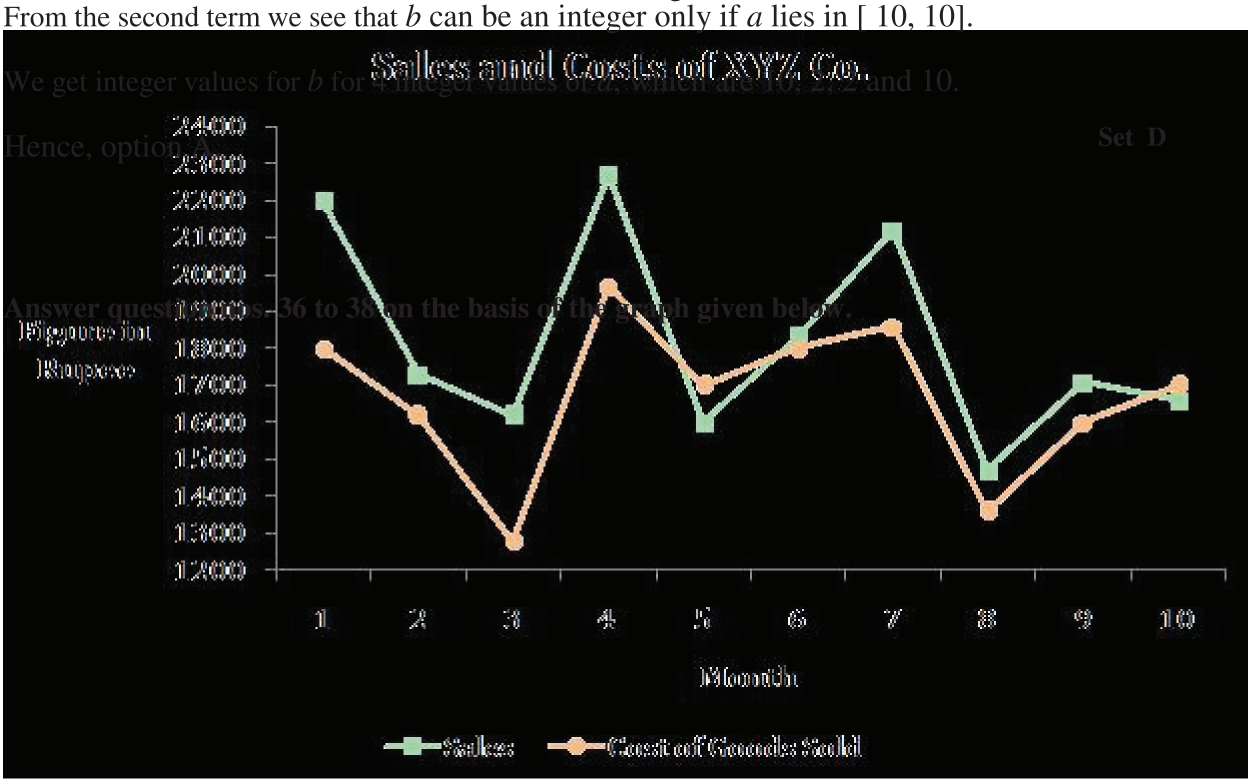
Now, from the first term we can see that for b to be integer, a has to be even.
From the second term we see that b can be an integer only if a lies in [10, 10].

We get integer values for b for 4 integer values of a, which are 10, 2, 2 and 10.

Hence, option A

Set D

Answer questions 36 to 38 on the basis of the graph given below.



36. In which month did the company earn maximum profits?

(A) 5 (B) 4 (C) 3 (D) 2 (E) 1

Solution:

The values in the table are approximate as it is difficult to figure out the exact values given in the graph.

Month	Sales	Cost	Profit
1	2200	1800	400
2	1750	1625	125
3	1625	1250	375
4	2250	1975	275
5	1700	1575	125
6	1825	1800	25
7	2100	1825	275
8	1450	1350	100
9	1700	1600	100
10	1650	1700	−50
	18250	16500	1750

As it can be seen from the table above, the maximum profit was earned in month 1.

Hence, option E.

37. In which month did the company witness maximum sales growth?

(A) 9 (B) 6 (C) 7 (D) 1 (E) 4

Solution:

It can be seen from the graph itself that the maximum growth in sales was observed in month 4.

Hence, option E.

38. What were average sales and costs of figures for XYZ Co. over the period of ten months?

(A) 1819, 1651

(B) 1919, 1751

(C) 1969, 1762

(D) 1719, 1601

(E) 1619, 1661

Solution:

As we are getting average to be 1825 and only option A has average of sale in 1800s, we can confidently say that option A is correct.

Hence, option A.

Answer question nos. 39 to 42 on the basis of the data given below.

Gender bias is defined as disproportion in percentage of drop-out rate of the two genders.

Drop Out Rates, in percentage, at Primary, Elementary and Secondary Classes in India

Year	Primary (I-V) Classes			Elementary (I-VIII) Classes			Secondary (I-X) Classes		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1996-97	39.7	40.9	40.2	54.3	59.5	56.5	67.3	73.7	70.0
1997-98	37.5	41.5	39.2	53.8	59.3	56.1	66.6	73	69.3
1998-99	40.9	41.3	41.5	54.2	59.2	56.3	64.5	69.8	66.7
1999-00	38.7	42.3	40.3	52.0	58.0	54.5	66.6	70.6	68.3
2000-01	39.7	41.9	40.7	50.3	57.7	53.7	66.4	71.5	68.6
2001-02	38.4	39.9	39.0	52.9	56.9	54.6	64.2	68.6	66
2002-03	35.8	33.7	34.8	52.3	53.5	52.8	60.7	65.0	62.6
2003-04	33.7	28.6	31.5	51.9	52.9	52.3	61.0	64.9	62.7
2004-05	31.8	25.4	29.0	50.4	51.2	50.8	60.4	63.8	61.9

39. Based on the data above, choose the true statement from the following alternatives:

A. Gender bias in primary education has consistently decreased over the years.

B. Gender bias decreases as students move from primary to secondary classes.

C. Total drop-out rate decreased consistently for primary classes children from 1996-97 to 2004-05.

D. Gender bias was consistently highest for secondary classes.

E. None of the above.

Solution:

As can be seen from the given table, none of the first four options is correct.

Hence, option E.

40. Assume that girls constituted 55% of the students entering school. In which year, as compared to the previous year, number of boys in secondary education would be more than the number of girls?

(A) 1996-97 (B) 1997-98 (C) 2000-01 (D) 1998-99 (E) 2001-02

Solution:

Data is ambiguous.

41. Suppose, every year 7,000 students entered Class I, out of which 45% were boys. What was the average number (integer value) of girls, who remained in educational system after elementary classes, from 1996-97 to 2004-05?

(A) 1475 (B) 1573 (C) 1743 (D) 1673 (E) 3853

Solution:

Year	Drop out rate	Entry	Remaining
1996-97	59.5	3850	1559.25
1997-98	59.3	3850	1566.95
1998-99	59.2	3850	1570.8
1999-00	58	3850	1617
2000-01	57.7	3850	1628.55
2001-02	56.9	3850	1659.35
2002-03	53.5	3850	1790.25
2003-04	52.9	3850	1813.35
2004-05	51.2	3850	1878.8
		Average	1676.0333

From the data given in the question we can form the table given above.

Hence, option D.

42. Suppose the total number of students in 1996-97 were 1000 and the number of students increased every year by 1000, up to 2004-05. The total number of drop outs from primary classes, from 1996-97 to 2004-05, were (approximately)?

(A) 18500 (B) 24500 (C) 19500 (D) 16000 (E) 11500

Solution:

Year	Dropout ratio	Students	Dropouts
1996-97	40.2	1000	402
1997-98	39.2	2000	784
1998-99	41.5	3000	1245
1999-00	40.3	4000	1612
2000-01	40.7	5000	2035
2001-02	39	6000	2340
2002-03	34.8	7000	2436
2003-04	31.5	8000	2520
2004-05	29	9000	2610
		Total	15984

From the data given in the question we can form the table given above.

As seen from the table option D is correct.

Hence, option D.

In the questions 43-44, one statement is followed by three conclusions.

Select the appropriate answer from the options given below.

(A) Using the given statement, only conclusion I can be derived.

(B) Using the given statement, only conclusion II can be derived.

(C) Using the given statement, only conclusion III can be derived.

(D) Using the given statement, all conclusions can be derived.

(E) Using the given statement, none of the three conclusions I, II and III can be derived.

43. $A_0, A_1, A_2, \ldots$ is a sequence of numbers with $A_0 = 1$, $A_1 = 3$ and $A_t = (t + 1)A_{(t-1)}{}^{t}(A_{(t-2)})$ for $t = 2, 3, 4, \ldots$

Conclusion I. $A_8 = 77$

Conclusion II. $A_{10} = 121$

Conclusion III. $A_{12} = 145$

Solution:

$A_0 = 1$ and $A_1 = 3$

 $A_1 - A_0 = 2$

$A_2 = 3\ \ 3\ \ 2\ \ 1 = 7$

□ $A_2 - A_1 = 4 = 2 \times 2 = 2 \times (A_1 - A_0)$

$A_3 = 4 \quad 7 \quad 3 \quad 3 = 19$

□ $A_3 - A_2 = 12 = 3 \times (A_2 - A_1)$

$A_4 = 5 \quad 19 \quad 4 \quad 7 = 67$

□ $A_4 - A_3 = 48 = 4 \times (A_3 - A_2)$

$A_5 = 307$

□ We can observe a pattern which is followed by the terms of the sequence,

According to the pattern we observe that the value of the terms is increasing and as 307 is greater than the given value of A_8, A_{10} and A_{12} in the conclusions, we can say that none of the conclusions can be derived.

Hence, option E.

44. A, B, C be real numbers satisfying $A < B < C$, $A + B + C = 6$ and $AB + BC + CA = 9$

Conclusion I. $1 < B < 3$

Conclusion II. $2 < A < 3$

Conclusion III. $0 < C < 1$

Solution:

$A + B + C = 6$

□ $C = 6 - A - B$

□ $AB + B(6 - A - B) + A(6 - A - B) = 9$

□ $AB + 6B - AB - B^2 + 6A - A^2 - AB = 9$

□ $A^2 + B^2 \quad 6B \quad 6A + AB + 9 = 0$

□ $A^2 + A\ (B - 6) + B^2 - 6B + 9 = 0$

If we consider this equation in terms of A, then

□ = $\dfrac{-\,□□ - 6 \pm \sqrt{(□□ - 6)^2 - 4 \times 1 \times (□□^2 - 6□□ + 9)}}{2 \times 1}$

□ = $\dfrac{-(□□ - 6) + \sqrt{-3□□^2 + 12□□}}{2}$

But we can also substitute A in terms of C initially.

□ We will get same equation in C and C will also have same roots.

To satisfy the condition $A < B < C$,

− □□ − 6 − −3□□2 + 12□□ < □□ < − □□ − 6 + 2 + 12□□
−3□□
2 2

− □□ − 6 − −3□□2 + 12□□ < 2□□ < − □□ − 6 + −3□□2 + 12□□

Adding $(B - 6)$ to all sides,

− −3□□2 + 12□□ < 3□□ − 6 < −3□□2 + 12□□

□ 3□□ − 6 < −3□□2 + 12□□

Squaring both sides, we get

$(3B - 6)^2 < 3B^2 + 12B$

□ $9B^2 - 36B + 36 < 3B^2 + 12B$

□ $12B^2 - 48B + 36 < 0$

□ $B^2 - 4B + 3 < 0$

□ $(B - 3)(B - 1) < 0$

□ $1 < B < 3$

Hence, Conclusion I is valid.

Conclusion II is not valid because if $A > 2$ then B and C also have to be greater than 2.

□ $A + B + C = 6$ is not satisfied.

Conclusion III is also not valid, because if $C < 1$ then A and B will also be less than 1.

□ $A + B + C = 6$ is not satisfied.

□ Only conclusion I can be derived.

Hence, option 1.