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QUANT FORMULAE

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Number system

1. When Sum and Diff of two numbers (X and Y) are given, then
   X = (sum + diff)/2
   Y = (sum - diff)/2
2. Diff between two digits of two digit number is =
   (Diff in original and interchanged number)/9
3. Sum of first n odd nos is n^2
4. Sum of first n even nos n(n+1)
5. Sum of squares of first n natural no's is n(n+1)(2n+1)/6
6. Sum of cubes of first n natural numbers is $[n(n+1)/2]^2$
7. If the sum of squares of two numbers is x and the square of their diff is y, then the product of the two numbers is [(x-y)/2]

Algebra

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $(a+b)^2 = (a-b)^2 + 4ab$
4. $(a-b)^2 = (a+b)^2 - 4ab$
5. $(a+b)^3 = a^3+b^3+3ab(a+b)$
   $= a^3+b^3+3a^2b+3ab^2$
6. $(a-b)^3 = a^3- b^3-3ab(a-b)$
   $= a^3- b^3 - 3a^2b + 3ab^2$
7. $a^3+b^3 =(a+b)^3 - 3ab(a+b)$
8. $a^3- b^3 =(a-b)^3 + 3ab(a-b)$
9. $a^2-b^2 = (a-b)(a+b)$
10. $a^3+b^3 = (a+b)(a^2-ab+b^2)$
11. $a^3- b^3 = (a-b)(a^2+ab+b^2)$
12. $a^m \times a^n = a^{m+n}$
13. $a^m / a^n = a^{m-n}$
14. $(a/b)^{(m/n)} =(b/a)^{-(m/n)}$
15. $a^m / b^{-n} = a^m \times b^n$

Ratio and Proportion

1. If four quantities are in proportion, then Product of Means = Product of Extremes.
   In the proportion a:b::c:d, we have bc = ad
2. If a:b::c:x, x is called the fourth proportional of a, b, c.
   a/b = c/x or, x = bc/a.
3. If two numbers are in a:b ratio and the sum of these numbers is x, then numbers will be ax/ (a+b) and bx/(a+b) respectively
4. If three numbers are in the ratio a:b:c and the sum of these numbers is x, then these numbers will be ax/(a+b+c) , bx/(a+b+c) and cx/(a+b+c) respectively
5. The ratio of two numbers is a : b. If n is added to each of these numbers, the ratio becomes c : d. The two numbers will be given as an(c-d)/(ad-bc) and bn(c-d)/(ad-bc) respectively
6. The ratio of two numbers is a : b. If n is subtracted from each of these numbers, the ratio becomes c : d. The two numbers are given as an(d-c)/(ad-bc) and bn(d-c)/(ad- bc) respectively
7. If the ratio of two numbers is a: b, then the numbers that should be added to each of the numbers in order to make this ratio c:d is given by (ad-bc)/(c-d)
8. If the ratio of two numbers is a:b, then the number that should be subtracted from each of the numbers in order to make this ratio c:d is given by (bc-ad)/(c-d)
9. The CP of the item that is cheaper is $CP_{cheaper}$ and the CP of the item that is costlier (dearer) is CP_{Dearer}. The CP of unit quantity of the final mixture is called the Mean Price and is given by
   $CP_{mean\ price} = \frac{CP_{cheaper} - CP_{mean\ price}}{CP_{mean\ price} - CP_{cheaper}}$

Percentage

1. a % of b = a x b/100
2. If A is x% more than B, then B is less than A by
   $\left[\frac{x}{100+x}\times 100\right]\%$
3. If A is x% less than B, then B is more than A by
   $\left[\frac{x}{100-x}\times 100\right]\%$

4. If A is x% of C and B is y% of C, then A = x/y × B
5. If two numbers are respectively x% and y% more than a third number, then first number is $\left(\frac{100+x}{100+y}\times 100\right)\%$ of the second number and the second number is $\left(\frac{100+y}{100+x}\times 100\right)\%$ of the first number
6. If two numbers are respectively x% and y% less than a third number, then the first number is $\left(\frac{100-x}{100-y}\times 100\right)\%$ of the second number and the second number is $\left(\frac{100-y}{100-x}\times 100\right)\%$ of the first number
7. If the price of a commodity decreases by P %, then the increase in consumption so that the expenditure remains same is $\left(\frac{P}{100-P}\times 100\right)\%$
8. If the price of a commodity increases by P%, then the reduction in consumption so that the expenditure remains same is $\left(\frac{P}{100+P}\times 100\right)\%$
9. If a number is changed (increased/decreased) successively by x% and y%, then net% change is given by [x+y+(xy/100)]%, which represents increase or decrease in value according as the sign is positive or negative
10. If two parameters A and B are multiplied to get a product and if A is changed by x% and another parameter B is changed by y%, then the net% change in the product (A × B) is given [x+y+(xy/100)]%
11. In an examination, the minimum pass percentage is x%. If a student secures y marks and fails by z marks, then the maximum marks in the examination is 100(y+z)/x
12. If the present population of a town (or value of an item) be P and the population (or value of item) changes at r% per annum, then population (or value of item) after n years = $P\left(1+\frac{r}{100}\right)^n$ and the Population (or value of item) n years ago = $\frac{P}{\left(1+\frac{r}{100}\right)^n}$
13. If a number A is increased successively by x% followed by y% and then by z%, then the final value of A will be $A\left(1+\frac{x}{100}\right)\left(1+\frac{y}{100}\right)\left(1+\frac{z}{100}\right)$

Averages and Mixtures

1. Average = Sum of quantities/ Number of quantities
2. Sum of quantities = Average × Number of quantities
3. The average of first n natural numbers is (n +1)/2
4. The average of the squares of first n natural numbers is (n +1)(2n+1)/6
5. The average of cubes of first n natural numbers is $n(n+1)^2/4$
6. The average of first n odd numbers is given by (last odd number +1)/2
7. The average of first n even numbers is given by (last even number + 2)/2
8. The average of first n consecutive odd numbers is n
9. The average of squares of first n consecutive even numbers is 2(n+1)(2n+1)/3
10. The average of squares of consecutive even numbers till n is (n+1)(n+2)/3
11. The average of squares of squares of consecutive odd numbers till n is n(n+2)/ 3.
12. If the average of n consecutive numbers is m, then the difference between the smallest and the largest number is 2(m-1)
13. If the number of quantities in two groups be n_1 and n_2 and their average is x and y respectively, the combined average is $(n_1x + n_2y)/(n_1 + n_2)$
14. The average of n quantities is equal to x. When a quantity is removed, the average becomes y. The value of the removed quantity is n(x-y) + y
15. The average of n quantities is equal to x. When a quantity is added, the average becomes y. The value of the new quantity is n(y-x) + y

Profit and Loss

1. Gain = SP- CP
2. Loss = CP- SP
3. Gain on Rs. 100 is Gain per cent
4. Gain% = (Gain × 100)/CP
5. Loss on Rs. 100 is Loss per cent
6. Loss% = (Loss × 100)/CP
7. When the Cost Price and Gain per cent are given:
   SP = [(100+Gain %)/100] x CP
8. When the Cost Price and Loss per cent are given:
   SP = [(100-Loss %)/100] x CP
9. When the Selling Price and Gain per cent are given:
   CP = [100/(100+Gain %)] x SP
10. When the Selling Price and Loss per cent are given:
    CP = [100/(100-Loss %)] x SP

11. When p articles are sold at the cost of q similar articles, the Profit/Loss % = [(q-p)/p]x100
12. If two articles are sold at the same price with a profit of x % on one and a loss of x % on the other, the net loss % = $(x^2/100)\%$
13. If two articles bought at the same price are sold with a profit of x % on one and a loss of x % on the other, then overall there will be No Profit No Loss

Simple and Compound Interest

1. Simple Interest, SI = PTR/100
2. Principal, P = 100 × SI/RT
3. Rate, R = 100 × SI/PT
4. Time, T = 100 × SI/RP
5. Amount, A = P + SI
   = P + (PTR)/100
6. If a certain sum of money becomes n times itself at R% p.a. simple interest in T years, then
   T = [(n-1)/R] × 100 years
7. If a certain sum of money becomes n times itself in T years at a simple interest, then the time T' in which it will become m times itself is given by T' = (m-1/n-1) × T years
8. If a certain sum of money P lent out at SI amounts to A_1 in T_1 years and to A_2 in T_2 years, then
   $P = (A_1T_2-A_2T_1)/(T_2-T_1)$
   $R = (A_1 – A_2)/(A_1T_2 - A_2T_1) \times 100\%$
9. If a certain sum of money P lent out for a certain time T amounts to A_1 at R_1% per annum and to A_2 at R_2% per annum, then
   $P = (A_2R_1-A_1R_2)/(R_1-R_2)$
   $T = (A_1-A_2)/(A_2R_1-A_1R_2) \times 100$ years
10. Compound Interest,
    $CI = P\left[1+\frac{R}{100}\right]^n - P$
    $= P\left[\left[1+\frac{R}{100}\right]^n - 1\right]$
11. Amount, $A = P\left[1+\frac{R}{100}\right]^n$, if interest is payable annually
12. Amount, $A = P\left[1+\frac{R'}{100}\right]^{n'}$, R'= R/2, n' = 2n; if interest is payable half-yearly
13. Amount, $A = P\left[1+\frac{R''}{100}\right]^{n''}$, R'' = R/4, n'' = 4n; if interest is payable quarterly
14. When time is fraction of a year, say $4\frac{3}{4}$ years, then Amount,
    $A = P\left[1+\frac{R}{100}\right]^4 \times \left[1+\frac{\frac{3}{4}R}{100}\right]$
15. When Rates are different for different years, say, R_1, R_2, R_3 for 1st, 2nd & 3rd years respectively, then, Amount =
    $P\left[1+\frac{R_1}{100}\right]\left[1+\frac{R_2}{100}\right]\left[1+\frac{R_3}{100}\right]$
16. In general, interest is considered to be Simple unless otherwise stated.

Time and Work

1. If 1/n of a work is done by A in one day, then A will take n days to complete the full work.
2. If A can do a piece do a piece of work in X days and B can do the same work in Y days, then both of them working together will do the same work in XY/(X+Y) days
3. If A, B and C, while working alone, can complete a work in X, Y and Z days respectively, then they will together complete the work in XYZ/(XY+YZ+ZX) days
4. If A does $1/n^{th}$ of a work in m hours, then to complete the full work A will take n/m hours.
5. If A and B can together finish a piece of work in X days, B and C in Y days and C and A in Z days, then
   a) A, B and C working together will finish the job in (2XYZ/XY+YZ+ZX) days.
   b) A alone will finish the job in (2XYZ/XY+YZ- ZX) days.
   c) B alone will finish the job in (2XYZ/ZX+XY- YZ) days.
   d) C alone will finish the job in (2XYZ/ZX+YZ- XY) days.
6. If A can finish a work in X days and B is k times efficient than A, then the time taken by both A and B working together to complete the work is X/(1+k).
7. If A and B working together can finish a work in X days and B is k times efficient than A, then the time taken by A working alone to complete the work is (k+1)X and B working alone to complete the work is (k+1/k)X.

Time and Distance

1. 1 Kmph = (5/18) m/s
2. 1 m/s = (18/5) Kmph
3. Speed(S) = Distance(d)/Time(t)
4. Average Speed = Total distance/Total Time = $(d_1+d_2)/(t_1+t_2)$
5. When $d_1 = d_2$, Average speed = $2S_1S_2/(S_1+S_2)$, where S_1 and S_2 are the speeds for covering d1 and d2 respectively
6. When $t_1 = t_2$, Average speed = $(S_1+S_2)/2$, where S_1 and S_2 are the speeds during t_1 and t_2 respectively
7. Relative speed when moving in opposite direction is $S_1 + S_2$
8. Relative speed when moving in same direction is $S_1 - S_2$

9. A person goes certain distance (A to B) at a speed of S_1 kmph and returns back (B to A) at a speed of S_2 kmph. If he takes T hours in all, the distance between A and B is $T(S_1S_2/S_1+S_2)$
10. When two trains of lengths l_1 and l_2 respectively travelling at the speeds of s_1 and s_2 respectively cross each other in time t, then the equation is given as $s_1+s_2 = (l_1+l_2)/t$
11. When a train of lengths l_1 travelling at a speed s_1 overtakes another train of length l_2 travelling at speed s_2 in time t, then the equation is given as $s_1 - s_2 = (l_1+l_2)/t$
12. When a train of lengths l_1 travelling at a speed s_1 crosses a platform/bridge/tunnel of length l_2 in time t, then the equation is given as $s_1 = (l_1+l_2)/t$
13. When a train of lengths l travelling at a speed s crosses a pole/pillar/flag post in time t, then the equation is given as $s = l/t$
14. If two persons A and B start at the same time from two points P and Q towards each other and after crossing they take T_1 and T_2 hours in reaching Q and P respectively, then (A's speed)/(B's speed) $=\sqrt{T_2}/\sqrt{T_1}$

Mensuration

Circle:

1. Diameter, D = 2R
2. Area = πR^2 sq. units
3. Circumference = $2\pi R$ units

Square:

4. Area = a^2 sq. units
5. Perimeter = 4a units
6. Diagonal, d = $\sqrt{2}$ a units

Rectangle:

7. Area = LxB sq. units
8. Perimeter = 2(L+B) units
9. Diagonal, d = $\sqrt{L^2 + B^2}$ units

Scalene Triangle:

10. Area = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units
11. Perimeter = (a+b+c) units

Isosceles Triangle:

12. Area = $\frac{b}{4}\sqrt{4a^2 - b^2}$ sq units
13. Perimeter = 2a + b units

b = base length; a = equal side length

Equilateral Triangle:

14. Area = $\frac{\sqrt{3}}{4}a^2$ sq. units
15. Perimeter = 3a units

a = side of the triangle

Right-angled triangle:

16. Area = (½)bxh sq. units
17. Perimeter = b + h + hypotenuse
18. Hypotenuse = $\sqrt{b^2 + h^2}$ units

Cuboid:

19. Volume = (Cross section area × height) = L × B × H cubic units
20. Lateral Surface Area (LSA) = 2[(L+B)H] sq. units
21. Total surface area (TSA) = 2(LB+BH+HL) sq. units
22. Length of the diagonals = $\sqrt{L^2 + B^2 + H^2}$ units

Cube:

23. Volume = a^3 cubic units
24. LSA = 4 a^2 sq. units
25. TSA = $6a^2$ sq. units
26. Length of diagonal = $a\sqrt{3}$ units

Sphere:

27. Volume = (4/3) πR^3 cubic units
28. Surface Area = $4\pi R^2$ sq. units
29. If R and r are the external and internal radii of a spherical shell, then its Volume = $4/3[R^3-r^3]$ cubic units

Hemisphere:

30. Volume = $(2/3)\pi R^3$ cubic units
31. TSA = $3\pi R^2$ sq. units

Cylinder:

32. Volume = $\pi R^2 h$ cubic units
33. Curved surface Area (CSA) (excludes the areas of the top and bottom circular regions) = $2\pi Rh$ sq. units
34. TSA = Curved Surface Area + Areas of the top and bottom circular regions = $2\pi RH + 2\pi R^2 = 2\pi R[R+h]$ sq. units

Cone:

35. Volume = $(1/3)\pi R^2 h$ cubic Units)
36. Slant Height of cone L = $\sqrt{R^2 + H^2}$ units
37. CSA = πRL sq. units
38. TSA = $\pi R(R + L)$ sq. units