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QUANT FORMULAE

Ebook For Bank, SSC & Other Govt Exams

Number system

1. When sum and difference of two numbers (X and Y) are given, then

   X = (sum + difference)/2

   Y = (sum + difference)/2

2. Difference between two digits of two digit number is = (Difference in original and interchanged number)/9

3. Sum of first n odd numbers is n^2

4. Sum of first n even numbers n(n+1)

5. Sum of squares of first n natural numbers is n(n+1)(2n+1)/6

6. Sum of cubes of first n natural numbers is $[n(n+1)/2]^2$

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

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/nth of a work in m hours, then to complete the full work A will take nxm 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 $= \pi r^2$ 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 = l x b 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; s = (a+b+c)/2

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)b x h 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 = $(4/3)\ \pi r^3$ 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

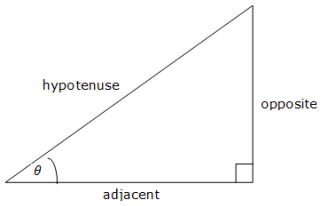
38. TSA = $\pi r(r+l)$ sq. units

Trigonometry

1. **Right Triangle Definition**

Assume that:

$0 < \theta < \frac{\pi}{2}$ or $0° < \theta < 90°$



$\sin\theta = \frac{opp}{hyp}$ $\quad$ $\text{cosec}\theta = \frac{hyp}{opp}$

$\cos\theta = \frac{adj}{hyp}$ $\quad$ $\sec\theta = \frac{hyp}{adj}$

$\cos\theta = \frac{opp}{adj}$ $\quad$ $\cot\theta = \frac{adj}{opp}$

2. Tangent cotangent Identities

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\quad$ $\cot\theta = \frac{\cos\theta}{\sin\theta}$

3. Reciprocal Identities

$\sin\theta = \frac{1}{cosec\,\theta}$ $\quad$ $cosec\theta = \frac{1}{\sin\theta}$

$\cos\theta = \frac{1}{sec\,\theta}$ $\quad$ $sec\theta = \frac{1}{\cos\theta}$

$\tan\theta = \frac{1}{cot\,\theta}$ $\quad$ $cot\theta = \frac{1}{tan\,\theta}$

4. Pythagorean Identities

$\sin^2\theta + \cos^2\theta = 1$

$\tan^2\theta + 1 = sec^2\theta$

$1 + \cot^2\theta = cosec^2\theta$

5. Even and Odd Formulas

$\sin(-\theta) = -\sin\theta$ $\quad$ $cosec(-\theta) = -cosec\,\theta$

$\cos(-\theta) = \cos\theta$ $\quad$ $sec(-\theta) = sec\theta$

$\tan(-\theta) = -\tan\theta$ $\quad$ $\cot(-\theta) = -\cot\theta$

6. Double Angle Formulas

$\sin(2\theta) = 2\sin\theta\cos\theta$

$\cos(2\theta) = \cos^2\theta - \sin^2\theta$

$= 2\cos^2\theta - 1$

$= 1 - 2\sin^2\theta$

$\tan(2\theta) = \frac{2\tan\theta}{1-\tan^2\theta}$

7. Half Angle Formulas

$\sin\theta = \pm\sqrt{\frac{1-\cos(2\theta)}{2}}$

$\cos\theta = \pm\sqrt{\frac{1+\cos(2\theta)}{2}}$

$\tan\theta = \pm\sqrt{\frac{1-\cos(2\theta)}{1+\cos(2\theta)}}$

8. Sum and Difference Formulas

$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

9. Product to Sum Formulas

$\sin A \sin B = \frac{1}{2}[\cos(A - B) - \cos(A + B)]$

$\cos A \cos B = \frac{1}{2}[\cos(A - B) + \cos(A + B)]$

$\sin A \cos B = \frac{1}{2}[\sin(A + B) + \sin(A - B)]$

$\cos A \sin B = \frac{1}{2}[\sin(A + B) - \sin(A - B)]$

10. Sum to Product Formulas

$\sin A + \sin B = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$

$\sin A - \sin B = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$

$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$

$\cos A - \cos B = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$

11. Co function Formulas

$\sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta \qquad \cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta$

$\operatorname{cosec}\left(\frac{\pi}{2} - \theta\right) = \sec\theta \qquad \sec\left(\frac{\pi}{2} - \theta\right) = \operatorname{cosec}\theta$

$\tan\left(\frac{\pi}{2} - \theta\right) = \cot\theta \qquad \cot\left(\frac{\pi}{2} - \theta\right) = \tan\theta$