

APSC Prelim CSAT Paper

Number system

- Natural Numbers: 1, 2, 3, 4.....
- Whole Numbers: 0, 1, 2, 3, 4.....
- Integers:-2, -1, 0, 1, 2
- Rational Numbers: Any number which can be expressed as a ratio of two integers for example a p/q format where 'p' and 'q' are integers. Proper fraction will have (p<q) and improper fraction will have (p>q)
- Factors: A positive integer 'f' is said to be a factor of a given positive integer 'n' if f divides n without leaving a remainder. e.g. 1, 2, 3, 4, 6 and 12 are the factors of 12.
- Prime Numbers: A prime number is a positive number which has no factors besides itself and unity.
- Composite Numbers: A composite number is a number which has other factors besides itself and unity.
- Factorial: For a natural number 'n', its factorial is defined as: n! = 1 x 2 x 3 x 4 x x n (Note: 0! = 1)
- Absolute value: Absolute value of x (written as |x|) is the distance of 'x' from 0 on the number line. |x| is always positive. |x| = x for x > 0 OR -x for x <0

Sum of n numbers

- Sum of first n natural numbers = n(n+1)/2
- Sum of the squares of first n natural numbers = n(n+1)(2n+1)/6
- Sum of the cubes of first n natural numbers = [n(n+1)/2]2
- Sum of first n natural odd numbers = n^2
- Average = (Sum of Observation / Number of Observations)
- If a car cover a certain Distance at X kmph and an equal distance at Y kmph. Then, the average speed during the whole journey is [2XY / (X+Y)]



BODMAS Rule

• This Rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of a given expression.

Calculation should be done the following order:

- B Bracket
- O Of
- D Division
- M Multiplications
- A Addition
- S Subtractions

Arithmetic Progression (A.P.)

An A.P. is of the form a, a+d, a+2d, a+3d, ... where a is called the 'first term' and d is called the 'common difference'

- nth term of an A.P. tn = a + (n-1)d
- Sum of the first n terms of an A.P. Sn = n/2[2a+(n-1)d] or Sn = n/2(first term + last term)





Geometrical Progression (G.P.)

- A G.P. is of the form a, ar, ar², ar³, ... where a is called the 'first term' and r is called the 'common ratio'.
- 1.nth term of a G.P. tn = arⁿ⁻¹
- 2.Sum of the first n terms in a G.P. Sn = $S_n = a(r^n 1) / (r 1)$
- [OR] Sn = $a(1 r^n) / (1 r)$, if $r \neq 1$.
- The sum of GP (of n terms) is: $S_n = na$, when r = 1.
- The sum of GP (of infinite terms) is: $S_{\infty} = a/(1-r)$, when |r| < 1.

Divisibility Rules

A number is divisible by:

- 2, 4 & 8 when the number formed by the last, last two, last three digits are divisible by 2, 4 & 8 respectively.
- 3 & 9 when the sum of the digits of the number is divisible by 3 & 9 respectively.
- 6, 12 & 15 when it is divisible by 2 and 3, 3 and 4 & 3 and 5 respectively.
- 7, if the number of tens added to five times the number of units is divisible by 7.
- A number is divisible by 10 if the units digit is 0.
- 11 when the difference between the sum of the digits in the odd places and of those in even places is 0 or a multiple of 11.
- 13, if the number of tens added to four times the number of units is divisible by 13.
- 19, if the number of tens added to twice the number of units is divisible by 19.

HCF and LCM

- H.C.F stands for Highest Common Factor. The H.C.F. of two or more numbers is the greatest number that divides each one of them exactly.
- The least number which is exactly divisible by each one of the given numbers is called their L.C.M.
- Two numbers are said to be co-prime if their HCF is 1.
- HCF of fractions = (HCF of numerators)/(LCM of denominators)
- LCM of fractions = (LCM of numerators)/(HCF of denominators)
- Product of two numbers = Product of their HCF and LCM

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PERCENTAGES

- To express x% as a fraction: We have, x% = x/100
- To express a/b as a percentage: We have, a/b %= (a/b x 100)
- If A is R% more than B, then B is less than A by R / (100+R) * 100
- If A is R% less than B, then B is more than A by R / (100-R) * 100
- If the price of a commodity increases by R%, then reduction in consumption, not to increase the expenditure is : R/(100+R)*100
- If the price of a commodity decreases by R%, then the increase in consumption, not to decrease the expenditure is : R/(100-R)*100

PROFIT & LOSS

- Gain = Selling Price(S.P.) Cost Price(C.P)
- Loss = C.P. S.P.
- Gain % = Gain * 100 / C.P.
- Loss % = Loss * 100 / C.P.
- S.P. = (100+Gain%)/100*C.P.
- S.P. = (100-Loss%)/100*C.P.
- C.P. = [100/ (100 + Gain%)] x S.P
- C.P. = [100/ (100 Loss%)] x S.P
- When a shopkeeper sell two similar items , one at a gain of say x% , and other at a loss of x% then the seller always incure a loss given by Loss % = (Common loss & gain % / 10)²
- If a trader sell his goods at cost price, but uses false weight , then Gain% = [Error / (True value Error)] x 100 %

SIMPLE & COMPOUND INTERESTS

Let P be the principal, R be the interest rate percent per annum, and N be the time period.

- 1.Simple Interest = (P*N*R)/100
- 2.Compound Interest = P(1 + R/100)N P
- 3.Amount = Principal + Interest
- When interest is compound Annually, Amount = P(1 + R/100)ⁿ
- > When interest is compounded Half-yearly: Amount = $P[1 + (R/2)/100]^{2n}$
- > Population after n years : $P(1 + R / 100)^n$, R is the population growth rate
- > Population before n years : P(1 R /100)ⁿ, R is the population growth rate



- The ratio a:b represents a fraction a/b. a is called antecedent and b is called consequent.
- The equality of two different ratios is called proportion.
- If a : b = c : d then a, b, c, d are in proportion. This is represented by a : b :: c : d.
- In a : b = c : d, then we have a* d = b * c.
- If a/b = c/d then (a + b) / (a b) = (d + c) / (d c).

TIME & DISTANCE

Distance = Speed * Time

- 1 km/hr = 5/18 m/sec
- 1 m/sec = 18/5 km/hr
- Suppose a man covers a certain distance at x kmph and an equal distance at y kmph. Then, the average speed during the whole journey is 2xy/(x+y) kmph

Upstream & Downstream

In water, the direction along the stream is called downstream. And, the direction against the stream is called upstream.

- If the speed of a boat in still water is u km/hr and the speed of the stream is v km/hr:
 Speed downstream = (u + v) km/hr
 Speed upstream= (u v) km/hr
- If the speed downstream is a km/hr and the speed upstream is b km/hr:
 Speed in strill water = 1/2 (a + b) km/hr
 Rate of stream = 1/2 (a b) km/hr

TIME & WORK

- If A can do a piece of work in n days, then A's 1 day's work = 1/n
- If A and B work together for n days, then (A+B)'s 1 days's work = 1/n
- If A is twice as good workman as B, then ratio of work done by A and B = 2:1

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Area & Volume

- Sum of the angle of a triangle is = 180 degree
- The sum of any two side of a triangle is greater than the third side .
- Pythagorous Theorem = Hypotenuse² =(Base) ² + (Height)²
- Area of a rectangle = (Length x Breadth)
- Perimeter of a rectangle = 2 (Length + Breadth)
- Area of a square = $(side)^2 = 1/2 (diagonal)^2$
- Area of an equilateral triangle = $\sqrt{3}/4$ (Side)²
- Area of 4 walls of a room = 2 (Length + Breadth) x Height
- Area of a triangle =1/2 x Base x Height
- Area of a circle = πR^2 , where R is the radius
- Circumference of a circle = $2\pi R$, thus, Circumference of a semi-circle = πR .

CUBE

Let each edge of a cube be of length a. Then, Volume = a3 cubic units.

CUBOID

Let length = I, breadth = b and height = h units. Then Volume = (I x b x h) cubic units



Types of Angle

- Acute angle = 0° 90°
- Right Angle = 90°
- Obtuse angle = 90° 180°
- Straight Angle = 180°
- Reflex Angle = 180° 360°
- Complete angle = 360°
- Complementary Angle = sum of two angles = 90°
- Supplementary angle = sum of two angles = 180°

Triangle Properties

Based on sides

- A. Equilateral Triangle : All three sides equal
- B. Isosceles Triangle : Two sides equal
- C. Scalene Triangle : all three sides different

Based on Angles

- Right Angle Triangle : One angle 90°
- Obtuse Angle Triangle : One angle more than 90°
- Acute Angle Triangle : All angles less than 90°
- When AC2 < AB2 + BC2 (Acute angle triangle)
- When AC2 > AB2 + BC2 (Obtuse angle triangle)
- When AC2 = AB2 +BC2 (Right angle triangle)

Some Basic Formulae

- $(a+b)(a-b) = (a^2 b^2)$
- $(a + b)^2 = (a^2 + b^2 + 2ab)$
- $(a b)^2 = (a^2 + b^2 2ab)$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
- $(a^3 + b^3) = (a + b)(a^2 ab + b^2)$
- $(a^3 b^3) = (a b)(a^2 + ab + b^2)$
- $(a^3 + b^3 + c^3 3abc) = (a + b + c)(a^2 + b^2 + c^2 ab bc ac)$
- When a + b + c = 0, then $a^3 + b^3 + c^3 = 3abc$.



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