PlacementSeason

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Quant
Formula Book

"Aptitude plus obssesion
equals greatness"

- Josh Bezoni

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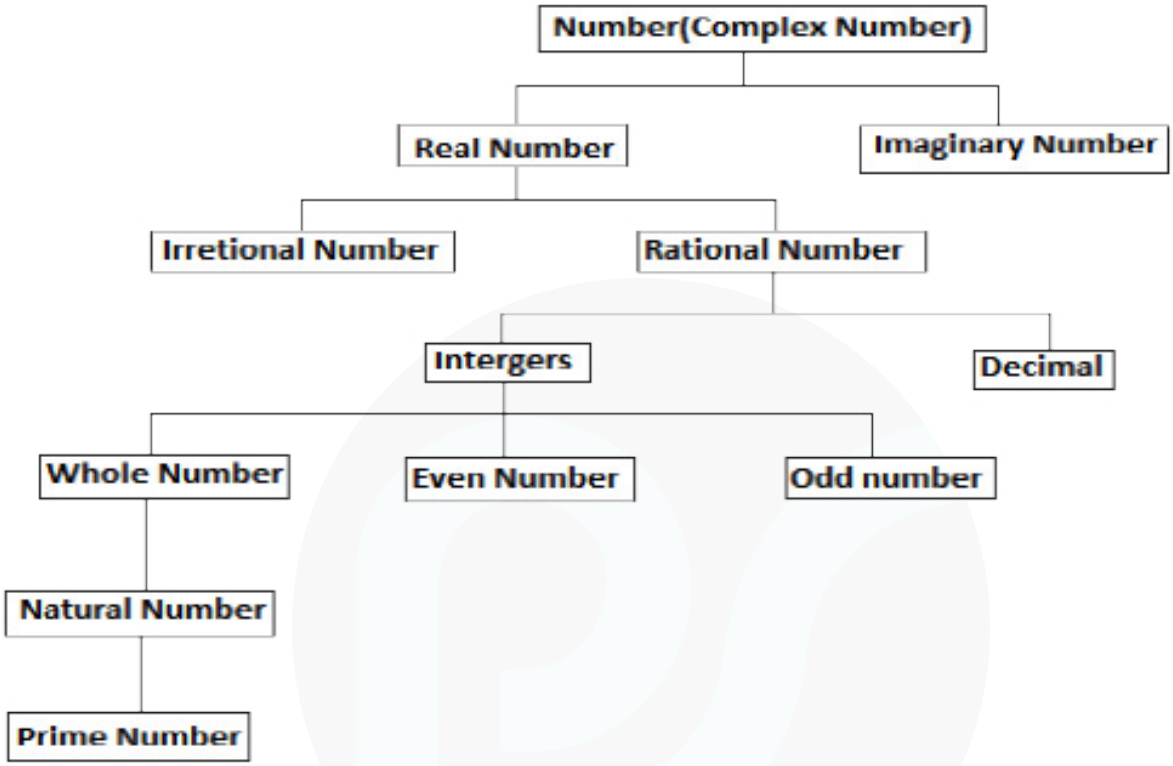
Number System



Real numbers: Numbers which can be quantified and represented by a unique point on thenumber line are called real numbers.

Rational numbers: Numbers of the form p/q, where p and q are integers and q≠0 are calledrational numbers.

Irrational numbers: Numbers which are not rational but can be represented on the number line are called irrational numbers.

Integers: Rational numbers of the form p/q, where p and q are integers and q= ±1 are called

integers.

Decimal: Fractions are a type of rational numbers, which are of the form p/q, where p and q are integers and q≠0 and whose numerator is less than the denominator and both are in the lowest terms.

Whole numbers: Whole numbers are the set of positive integers from 0. They do not have any decimal or fractional part.

Natural numbers: Natural numbers are the set of positive integers, that is, integers from 1 to ∞, excluding fractional n decimal part. They are whole numbers excluding zero.

Even numbers: Numbers divisible by 2 are called even numbers.

Odd numbers: Numbers which are not divisible by 2 are called odd numbers. Odd numbers leave 1 as the remainder when divided by 2.

Prime numbers: Any number other than 1 which does not have any factor apart from one and the number itself is called a prime number.

Co-prime/relatively prime numbers: Two numbers are said to be coprime or relatively prime if they do not have any common factor other than one.

Composite numbers: A number that has more than two distinct factors is called a composite number.

Perfect numbers: A number is said to be a perfect number if the sum of all its factors, excludingitself (but including 1) is equal to the number itself.

Divisibility Rule

Divisible by 2: A number is divisible by 2, if its unit's digit is any of 0, 2, 4, 6, 8.

Divisible by 3: A number is divisible by 3, if the sum of its digits is divisible by 3.

Divisible by 4: A number is divisible by 4, if the number formed by the last two digits isdivisible by 4.

Divisible by 5: A number is divisible by 5, if its unit's digit is either 0 or 5.

Divisible by 6: A number is divisible by 6, if it is divisible by both 2 and 3.

Divisible by 7: To find out if a number is divisible by seven, take the last digit, double it, and subtract it from the rest of the number. If you get an answer divisible by 7 (including zero), then the original number is divisible by seven.

Divisible by 13: Add four times the last digit to the remaining leading truncated number. If the result is divisible by 13, then so was the first number.

Important Formulas

- $(a + b)(a - b) = (a^2 - b^2)$
- $(a + b)^2 = (a^2 + b^2 + 2ab)$
- $(a - b)^2 = (a^2 + b^2 - 2ab)$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
- $(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$
- $(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$
- $(a^3 + b^3 + c^3 - 3abc) = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ac)$
- When $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$
- $(a + b)^n = a^n + ({}^nC_1)a^{n-1}b + ({}^nC_2)a^{n-2}b^2 + \ldots + ({}^nC_{n-1})ab^{n-1} + b^n$

Law of Indices

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$

- $(ab)^n = a^n b^n$
- $a^0 = 1$

H.C.F. and L.C.M. of Fractions:

- H.C.F. = (H.C.F. of Numerators / L.C.M. of Denominators)
- L.C.M. = (L.C.M. of Numerators / H.C.F. of Denominators)
- Product of two numbers = Product of their H.C.F. and L.C.M.

Remainder Based Problem

- If r is the remainder in each case when N is divided by x, y, z then the general format of the number is N = K * [LCM (x, y, z)] + r here K is a natural number
- If $x1, y1, z1$ are the remainders when N is divided by x, y, z and $x - x_1 = y - y_1 = z - z_1 = a$ then the general format of the number is given by N = K * [LCM (x, y, z)] - a

Averages

Average = Sum of all given values / No. of Values

Average of different group

		Group A	Group B
No. of items		P	Q
Average		X	Y
Sum of item		PX	QY
Combined Average	=	(PX + QY) / (P + Q)	

Tips: If a number x added to or subtracted from all the number, then average is also added or subtracted by x.

Percentages

Percentage means out of hundred. Percentage is a way to expressing the number in term of fraction of 100 by using the sign %.

Percentage Value = (ActualValue / Base) x 100

Percentages Fraction

Percentages	Fraction	Value divided by
100	1	1
50	1/2	2
33.33	1/3	3

Percentages	Fraction	Value divided by
25	1/4	4
20	1/5	5
16.66	1/6	6
14.28	1/7	7
12.5	1/8	8
11.11	1/9	9
10	1/10	10
9.09	1/11	11
8.33	1/12	12

Percentage Change

Percentage Change = (Actual Change)/ (Initial Value) x100

Percentage Increase/Decrease = [(Actual Increase / Decrease) / Initial Value] x100

Tips: If a number is increased by (1/n) times then it should decrease by [1 / (n +1)] times to bring it back to the original value or vice versa.

Profit & Loss

Terminology

Cost Price (CP): The cost born by seller.

Selling Price (SP): Price at which item sold by seller

Marked Price (MP): The price at which the article is marked. If the article is sold at this price, then the selling price is equal to marked price. But generally some discount might be available on the marked price.

- Profit/Gain = SP-CP
- Loss = CP-SP
- Gain % = (Gain÷CP) x 100
- Loss % = (Loss ÷CP) x 100
- SP = CP x [(100 + Gain%) / 100] or CP x [(100 - Loss%) / 100]
- CP = SP x [100 / (100 + Gain%)] or SP x [100 / (100 - Loss%)]
- Discount = MP – SP

Tips:

- Profit and loss are always calculated with CP, as the base.
- If two items are sold, Each at same price, one at gain of x% and other at loss of x%, then the net result is always a loss which is equal to $x^2/100$ %.

Simple & Compound Interest

Let Principal = P, Rate = R% per annum, Time = n years.

Simple Interest = PNR/100

Compound Interest

- When interest is compound Annually:

$$\text{Amount} = P\left[1+\frac{R}{100}\right]^{n}$$

- When interest is compounded Half-yearly:

$$\text{Amount} = P\left[1+\frac{R/2}{100}\right]^{2n}$$

- When interest is compounded Quarterly:

$$\text{Amount} = P\left[1+\frac{R/4}{100}\right]^{4n}$$

- When interest is compounded Annually but time is in fraction, say 3(2/5) years.

$$\text{Amount} = P[1+\frac{R}{100}]^{3} \times [1+\frac{(2/5)R}{100}]$$

- When Rates are different for different years, say R_1%, R_2%, R_3% for 1st, 2nd and 3rd year respectively.

$$\text{Then, Amount} = P(1+\frac{R_1}{100})(1+\frac{R_2}{100})(1+\frac{R_3}{100})$$

- Present worth of Rs. x due n years hence is given by: Present Worth = $\dfrac{X}{1+\frac{R}{100}}$

Time & Work

If A can do a piece of work in n days, work done by A in 1 day = 1/n

- If A does 1/n work in a day, A can finish the work in n days

- If M1 men can do W1 work in D1 days working H1 hours per day and M2 men can do W2 work in D2 days working H2 hours per day (where all men work at the same rate), then (M1 D1 H1) / W1 = (M2 D2 H2) / W2

- If A can do a piece of work in p days and B can do the same in q days, A and B together can finish it in pq / (p+q) days

- If A is thrice as good as B in work, then
  Ratio of work done by A and B = 3 : 1
  Ratio of time taken to finish a work by A and B = 1 : 3

Pipes & Cisterns

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 cistern or reservoir, emptying it, is known as an outlet.

- If a pipe can fill a tank in x hours, then:

  Part filled in 1 hour = $\frac{1}{x}$

- If a pipe can empty a tank in y hours, then:

  Part emptied in 1 hour = $\frac{1}{y}$

- 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, then

  The net part filled in 1 hour = $\frac{1}{x} - \frac{1}{y}$

- 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, then
  the net part emptied in 1 hour = $\frac{1}{y} - \frac{1}{x}$

Time, Speed & Distance

- Speed = Distance/Time
- Time = Distance/speed
- Distance = Speed × Time
- 1km/hr = 5/18 m/s
- 1m/s = 18/5 km/hr
- If the ratio of the speed of A and B is a : ba : b, then the ratio of the time taken by them to cover the same distance is 1a : 1b1a : 1b or b : a

Average Speed

- If the Distance is constant

$$\text{Average speed} = \frac{2(Speed1 + Speed2)}{Speed1 + Speed2} \quad \text{(Harmonic mean)}$$

- If time is constant

$$\text{Average speed} = \frac{speed1 + speed2}{2} \quad \text{(Arithmetic Mean)}$$

Relative Speed

- Two bodies are moving in opposite directions at speed V1 & V2 respectively.

The relative speed is defined as $V_r = V_1 + V_2$

- Two bodies are moving in same directions at speed V_1 & V_2 respectively. The relative speed is defined as $V_r = |V_1 - V_2|$

Train Problems

- Time taken by a train x meters long to pass a pole or standing man or a post

= Time taken by the train to travel x meters.

• Time taken by a train x meters long to pass an object of length y meters = Time taken by the train to travel (x + y) metres.

• Suppose two trains or two objects are moving in the same direction at v_1 m/s and v_2 m/s where $v_1 > v_2$, then their relative speed = $(v_1 – v_2)$ m/s

• Suppose two trains or two objects are moving in opposite directions at v_1 m/s and v_2 m/s ,then their relative speed = $(v_1 + v_2)$ m/s

• Assume two trains of length x meters and y meters are moving in opposite directions at v_1 m/s and v_2 m/s, Then The time taken by the trains to cross each other = $(x+y) / (v_1+v_2)$ seconds

• Assume two trains of length x meters and y meters are moving in the same direction at v_1 m/s and v_2 m/s where $v_1 > v_2$, Then The time taken by the faster train to cross the slower train = $(x + y) / (v_1 - v_2)$ seconds.

• Assume that two trains (objects) start from two points P and Q towards each other at the same time and after crossing they take p and q seconds to reach Q and P respectively. Then, A's speed: B's speed = $\sqrt{p} : \sqrt{q}$

Boats & Streams

Let,

U = Velocity of the boat in still water

V = Velocity of the stream.

Upstream:

While moving in upstream, distance covered, distance covered, $S = (U-V)T$

Downstream:

In case of downstream, distance covered, distance covered, $S = (U+V)T$