

**HANDWRITTEN NOTES**  
(Quantitative Aptitude )

**EQUATIONS**

# Equations

- Any mathematical statement which states that left hand side is equal to right hand side; LHS = RHS.

## # Degree Of Equations

Highest power of variable is known as degree of equation.

## # Types of Equations on the basis of degree

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| (i) Linear               | (ii) Quadratic           | (iii) Cubic              |
| $\Rightarrow$ Degree = 1 | $\Rightarrow$ Degree = 2 | $\Rightarrow$ Degree = 3 |

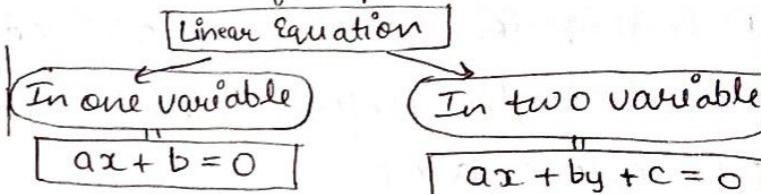
## # Solutions of the Equation

The value of variable which satisfy the equation is known as root of equation or solution of the equation.

Eg:-  $3x + 7 = 5x + 3$

$x = 2$  is a solution of this equation because if we put  $x = 2$ , LHS & RHS will become equal.

$$\begin{array}{l|l} \text{LHS} = 3(2) + 7 & \text{RHS} = 5(2) + 3 \\ = 13 & = 13 \end{array}$$



## # Methods of Solving Linear Equation in Two Variables

- (i) Substitution Method      (ii) Elimination Method

## # Substitution Method

- Two equations will be given.
- Find the value of  $x$  in terms of  $y$  in both equations.
- Equate two equations.

## # Elimination Method

- Two equations are given.
- Select one variable & make its coefficient same in both equations.
- Then eliminate that variable using addition or subtraction.

## # Quadratic Equation

$$ax^2 + bx + c = 0 \text{ where } a \neq 0.$$

It can have maximum two roots which are generally denoted by  $\alpha$  &  $\beta$ .

$$\text{Sum of Two Roots} = \alpha + \beta = -\frac{b}{a}$$

$$\text{Product of Two Roots} = \alpha \cdot \beta = \frac{c}{a}$$

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

$$\alpha^3 + \beta^3 = (\alpha + \beta)(\alpha^2 + \beta^2 - 2\alpha\beta)$$

$$[(\alpha+\beta)^2 - (\alpha-\beta)^2 = 4\alpha\beta]$$

# When one root is the reciprocal of other root Then  $a=c$

# When sign of two roots is opposite but magnitude is same then  $b=0$

# If one irrational root is  $m+n\sqrt{n}$ . Then other irrational root will be  $m-n\sqrt{n}$ .

If sum of roots and product of roots is given. Then Quadratic equation  $x^2 - (\text{sum of roots})x + \text{Product} = 0$ .

Eg: find Q.E whose roots are 3 & 8.

$$\Rightarrow \text{Sum of roots} = 3+8 = 11; \text{Product of roots} = 3 \times 8 = 24$$

Q.E will be:  $x^2 - 11x + 24 = 0$

## # Methods of Solving Quadratic Equation

- 1) Factorization Method
- 2) Quadratic formula

### => Factorization Method (Middle Term Splitting)

- Calculate  $a \times c$
- Find Two factors of  $ac$  such that their sum or difference is equal to  $b$

### 2) Quadratic formula

Find  $a, b$  &  $c \rightarrow$  Apply formula:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Eg:  $2x^2 + 11x + 14 = 0$

$$\Rightarrow a = 2, b = 11 \text{ & } c = 14$$

$$x = \frac{-11 \pm \sqrt{121 - 4(2)(14)}}{2(2)} = \frac{-11 \pm \sqrt{121 - 112}}{4} = \frac{-11 \pm \sqrt{9}}{4}$$

$$x = \frac{-11 + 3}{4} \text{ or } \frac{-11 - 3}{4} \Rightarrow -\frac{8}{4} \text{ or } -\frac{14}{4} \Rightarrow -2 \text{ or } -\frac{7}{2}$$

Discriminant =  $D \Rightarrow b^2 - 4ac$ ] - Tell nature of roots

If  $D = b^2 - 4ac > 0$  (Roots are real & different)

If  $D = b^2 - 4ac = 0$  (Roots are real & equal)

If  $D = b^2 - 4ac < 0$  (Roots are not real)

If  $D$  is a positive perfect square then root can be rational.

If  $D$  isn't positive perfect square. Then roots can be irrational.

## # Cubic Equation

$$ax^3 + bx^2 + cx + d = 0 \text{ where } a \neq 0$$

It can have maximum 3 roots  $\alpha, \beta \text{ & } \gamma$

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$$

$$\alpha\beta\gamma = -\frac{d}{a}$$

## Cubic equation

$$x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma = 0.$$