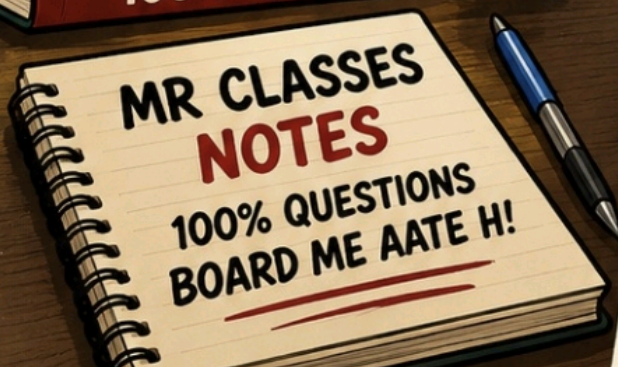
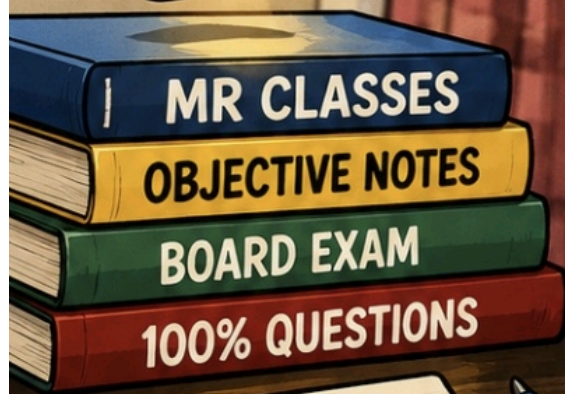


PADH LE BETA
OBJECTIVES
SE HI
PAAS HO JAYEGA
QUESTIONS
TERE BAS KA
NAHI H



EXERCISE 1.1

MR CLASSES BY RAHIM SIR

* lcm and HCF OF 6, 15 = $\boxed{\text{HCF} = 3, \text{LCM} = 30}$

* the LCM and HCF of 6 and 20 = $\boxed{\text{HCF} = 2, \text{LCM} = 60}$

* for any two positive integers a and b,

$$\boxed{\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b.}$$

(LCM $\times$ HCF = PRODUCT OF TWO NO.)

* Find the HCF and LCM of 6, 72 and 120, using the prime factorisation method.

$$\boxed{\text{HCF} = 6, \text{LCM} = 360}$$

$$6 = 2 \times 3$$

$$\begin{array}{r|l} 2 & 6 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$72 = 2^3 \times 3^2$$

$$\begin{array}{r|l} 2 & 72 \\ 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ 3 & 3 \\ \hline & 1 \end{array}$$

$$120 = 2^3 \times 3 \times 5$$

$$\begin{array}{r|l} 2 & 120 \\ 2 & 60 \\ 2 & 30 \\ 3 & 15 \\ 5 & 5 \\ \hline & 1 \end{array}$$

HCF = product of common prime factors with smallest powers
 $= 2^1 \times 3^1 = 6$

LCM = product of all prime factors with greatest powers
 $= 2^3 \times 3^2 \times 5 = 360$

EXERCISE 1.2

* $\sqrt{2}, \sqrt{3}, \sqrt{5}, 7\sqrt{5}, 3 + \sqrt{5}, \dots$ ARE IRRATIONAL NO.

* p be a prime number. If p divides a^2 , then p divides a , where a is a positive integer.

QUADRATIC EQUATION

$$ax^2 + bx + c = 0$$

($a \neq 0$)

PARABOLA IS THE GRAPH OF A QUADRATIC EQUATION IN THE FORM

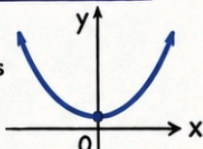
$$y = ax^2 + bx + c$$

($a \neq 0$)

TYPES OF PARABOLA

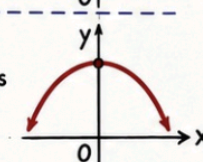
$a > 0$

Parabola opens upwards



$a < 0$

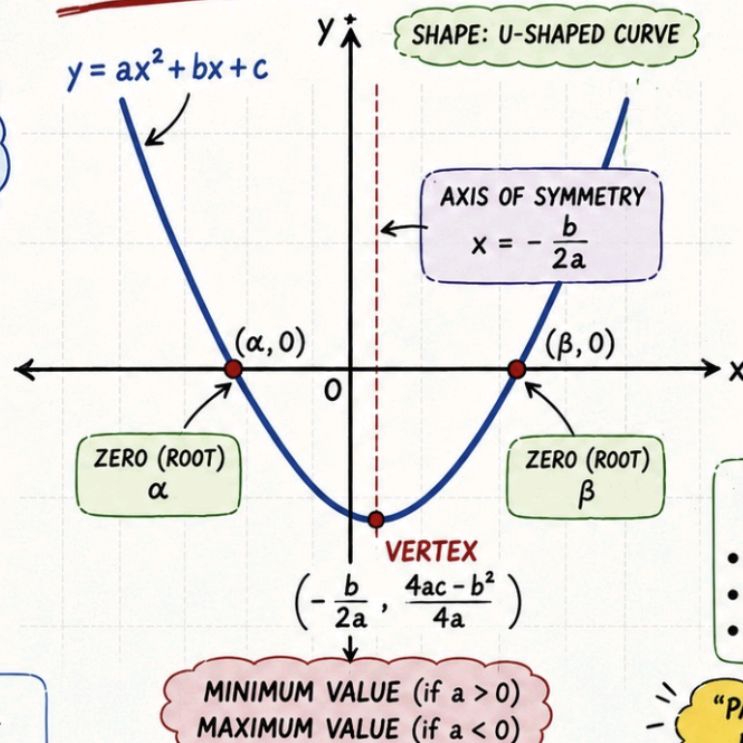
Parabola opens downwards



SUMMARY FORMULAS

- Sum of zeroes: $(\alpha + \beta) = -\frac{b}{a}$
- Product of zeroes: $(\alpha\beta) = \frac{c}{a}$
- Axis of symmetry: $x = -\frac{b}{2a}$
- Vertex: $(-\frac{b}{2a}, \frac{4ac-b^2}{4a})$

QUADRATIC EQUATION PARABOLA



KEY POINTS

- Shape depends on the value of a .
- It cuts the x -axis at two points (α, β) (real and distinct roots) if $b^2 - 4ac > 0$
- It touches the x -axis at one point (real and equal root:) if $b^2 - 4ac = 0$
- It does not cut the x -axis (no real roots) if $b^2 - 4ac < 0$

DISCRIMINANT (D)

$$D = b^2 - 4ac$$

- $D > 0 \rightarrow$ Two distinct real roots
- $D = 0 \rightarrow$ Two equal real roots
- $D < 0 \rightarrow$ No real roots

MINIMUM VALUE (if $a > 0$)
MAXIMUM VALUE (if $a < 0$)

"PARABOLA KI TARAH
FOCUS KAR, TOP
TOH MILKE RAHEGA!"

YE PARABOLA SAMJH LEGA TOH QUADRATIC EQUATION KO **MASTER** KAR LEGA!

★ ——— MR CLASSES BY RAHIM SIR ——— ★

CLASS 10th

LINEAR EQUATIONS

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

PAIR OF LINEAR EQUATION WITH TWO VARIABLES

$a_1, a_2 \rightarrow$ Coeff. of x

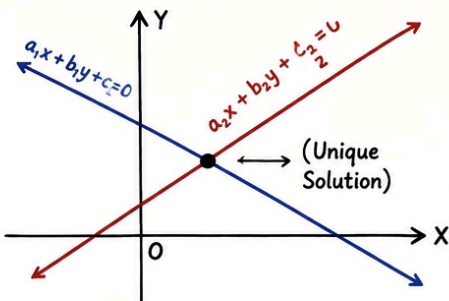
$b_1, b_2 \rightarrow$ Coeff. of y

$c_1, c_2 \rightarrow$ Constant term

1. EQUATION HAS UNIQUE SOLUTION

- ✓ LINES ARE INTERSECTING
- ✓ CONSISTENT PAIR OF EQUATION

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$



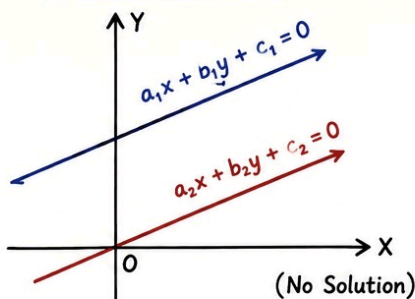
KEY POINT

The two lines intersect at one point.
So, the pair of linear equations
has unique solution.

2. EQUATION HAS NO SOLUTIONS

- ✓ LINES ARE PARALLEL
- ✓ INCONSISTENT PAIR OF EQUATION

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

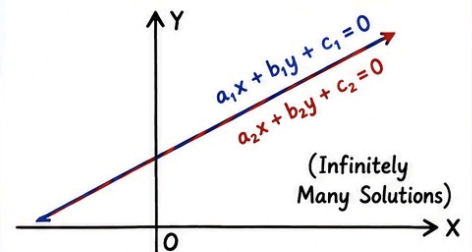


KEY POINT

The two lines are parallel.
So, the pair of linear equations
has **no solution**.

3. EQUATION HAS INFINITELY MANY SOLUTION

- ✓ $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
- ✓ LINES ARE COINCIDENT
- ✓ CONSISTENT AND DEPENDENT PAIR OF EQUATION



KEY POINT

The two lines are coincident.
So, the pair of linear equations
has **infinitely many solutions**.

★ Important Formulas at a Glance!

CHAPTER 4 QUADRATIC EQUATION

Score 100% with Concepts! ★

1 GENERAL FORM OF QUADRATIC EQUATION

$$ax^2 + bx + c = 0$$

Where :

- a, b, c are real numbers
- $a \neq 0$
- a = coefficient of x^2
- b = coefficient of x
- c = constant term

2 QUADRATIC FORMULA (FORMULA METHOD)

If the equation is : $ax^2 + bx + c = 0$

Then roots are :

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This is called the **Quadratic Formula.**

SHRIDHARACHARYA FORMULA

3 DISCRIMINANT (D)

$$D = b^2 - 4ac$$

The discriminant tells us the nature of roots.

5 CONDITION FOR REAL ROOTS

For real roots :

$$b^2 - 4ac \geq 0$$

4 NATURE OF ROOTS (USING DISCRIMINANT)

Case 1 :

If $D = b^2 - 4ac > 0$



Two distinct real roots

Case 2 :

If $D = b^2 - 4ac = 0$



Two equal real roots

Case 3 :

If $D = b^2 - 4ac < 0$



No real roots (imaginary roots)

6 SUM AND PRODUCT OF ROOTS

If roots are α and β , then :

➤ Sum of roots : $\alpha + \beta = \frac{-b}{a}$

➤ Product of roots : $\alpha \beta = \frac{c}{a}$



7 FORMING QUADRATIC EQUATION (WHEN ROOTS ARE GIVEN)

If roots are α and β , then equation is :

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



Remember :

Sum = $\alpha + \beta$

Product = $\alpha\beta$

KEY POINTS

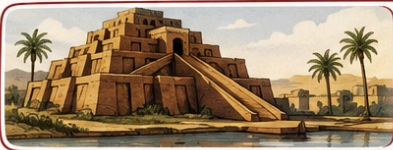
- ✓ Quadratic Equation is of degree 2.
- ✓ Discriminant (D) decides the nature of roots.
- ✓ Use Quadratic Formula to find roots.
- ✓ Learn formulas and apply smartly in board exam.



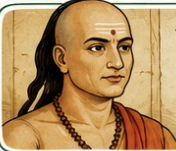


≡ HISTORY OF QUADRATIC EQUATIONS ≡

$$ax^2 + bx + c = 0$$
$$x = ?$$



- ★ Many people believe that **Babylonians** were the first to solve quadratic equations.


$$\text{कुटक} = ax^2 + bx = c$$
$$x = \frac{-b \pm \sqrt{b^2 + 4ac}}{2a}$$

- ★ **Brahmagupta** (C.E. 598–665) gave an explicit formula to solve a quadratic equation of the form

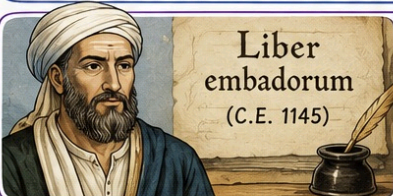
$$ax^2 + bx = c$$



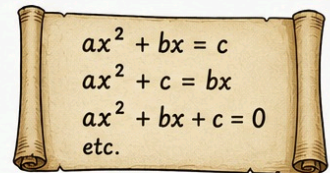
- ★ **Sridharacharya** (C.E. 1025) derived a formula, now known as the **quadratic formula**, (as quoted by Bhaskara II)

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



- ★ **Abraham bar Hiyya Ha-Nasi**, in his book 'Liber embadorum' published in Europe in C.E. 1145 gave complete solutions of different quadratic equations.


$$ax^2 + bx = c$$
$$ax^2 + c = bx$$
$$ax^2 + bx + c = 0$$

etc.

- ★ $ax^2 + bx + c = 0$, $a \neq 0$ is called the **standard form** of a quadratic equation.

Where,

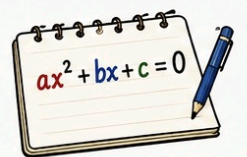
a, b, c are real numbers

$a \neq 0$

a = coefficient of x^2

b = coefficient of x

c = constant term


$$ax^2 + bx + c = 0$$

Ch 5 ARITHMETIC PROGRESSION (AP)

★ Each of the numbers in the list is called a term.

★ $a, a + d, a + 2d, a + 3d, \dots$

GENERAL FORM OF AN AP

AP – Arithmetic Progression (AP) is a sequence of numbers in which the **difference** between two consecutive terms is **always the same**.



EXAMPLE

2, 5, 8, 11, 14, ...
 $+3 \quad +3 \quad +3 \quad +3$

COMMON DIFFERENCE (d)

The common difference is the fixed number that is added (or subtracted) to get the next term in an AP.

$$\text{Formula : } d = a_2 - a_1$$

Where :

a_1 = First term

a_2 = Second term

d = Common difference

★ The common difference of the AP can be **positive**, **negative** or **zero**.

FINITE AND INFINITE AP

- **Finite AP** : An arithmetic progression that has **LAST TERM** of terms.

Example : 2, 4, 6, 8, 10

- **Infinite AP** : An arithmetic progression that has no last term and continues forever.

Example : 3, 7, 11, 15, 19, ...

★ EX 1, 2 are important for questions (Objective purposes).



IMPORTANT FORMULAS OF AP

1 NTH TERM OF AN AP

$$a_n = a + (n - 1)d$$

- a_n is also called the **general term** of the AP.

2 SUM OF N TERMS OF AN AP

$$S_n = \frac{n}{2} [2a + (n - 1)d]$$

- S_n = Sum of first n terms
- a = First term
- d = Common difference
- n = Number of terms

3 SUM OF N POSITIVE INTEGERS

$$S_n = \frac{n(n+1)}{2}$$

Example : $1 + 2 + 3 + \dots + n$
 $= \frac{n(n+1)}{2}$

4 RELATION BETWEEN a_n AND S_n

$$a_n = S_n - S_{n-1}$$

Where :

S_n = Sum of first n terms

S_{n-1} = Sum of first $(n - 1)$ terms

5 GENERAL TERM (REPEAT)

$$a_n = a + (n - 1)d$$

This formula gives the n^{th} term directly without writing all the previous terms.

QUICK SUMMARY

- AP has a constant difference (d) between consecutive terms.
- $d = a_2 - a_1$
- AP can be **finite** (has last term) or **infinite** (no last term).
- Use $a_n = a + (n - 1)d$ to find any term.
- Use $S_n = \frac{n}{2} [2a + (n - 1)d]$ to find sum of first n terms.
- Use $S_n = \frac{n(n+1)}{2}$ for sum of first n positive integers.
- Also, $a_n = S_n - S_{n-1}$ is a very useful relation.

KEY POINTS

- ✓ Constant difference
- ✓ General term
- ✓ Sum formulas
- ✓ Very useful in exams (Shortcuts & Applications)

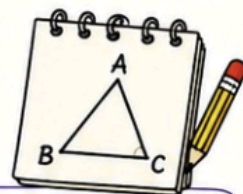


"Practice AP daily – It makes your Maths **strong!**"

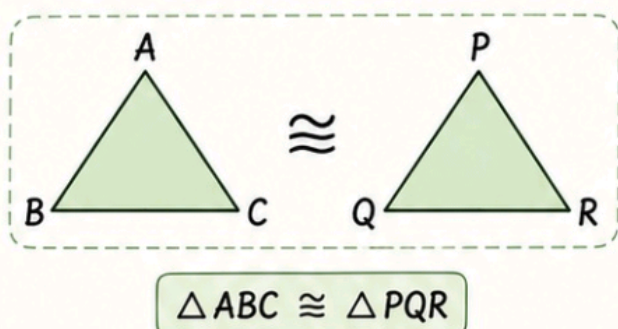
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Ch 6 TRIANGLES

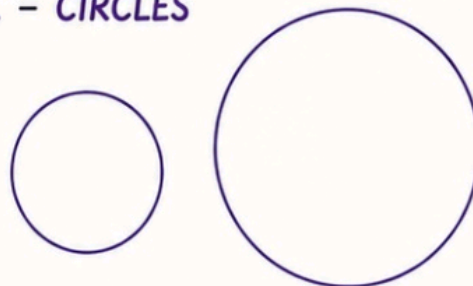


★ Two figures are said to be **CONGRUENT**, if they have the **same shape** and the **same size**.



★ **SIMILAR FIGURE** – Two figures having the same shape (and not necessarily the same size) are called similar figures.

EX. – CIRCLES

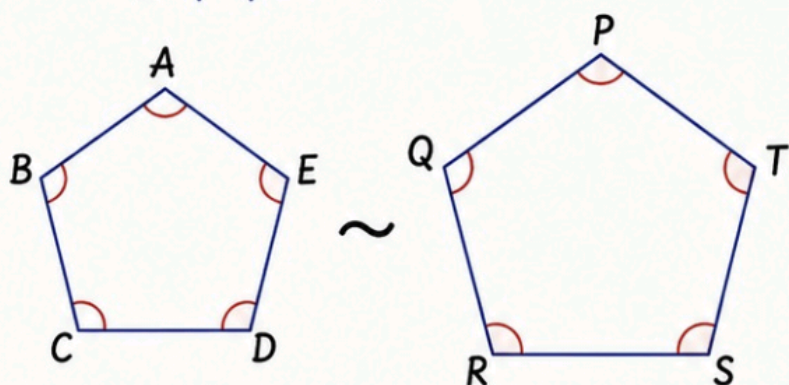


★ All **CONGRUENT FIGURES** are **SIMILAR** but the **SIMILAR FIGURES** need not be **CONGRUENT**.



★ **SIMILAR POLYGON** – Two polygons of the same number of sides are similar, if

- (i) their corresponding **angles** are equal and
- (ii) their corresponding **sides** are in the same ratio (or **proportion**.)



Then,

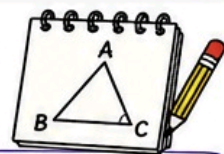
$$\angle A = \angle P, \angle B = \angle Q, \angle C = \angle R, \angle D = \angle S, \angle E = \angle T$$

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CD}{RS} = \frac{DE}{ST} = \frac{EA}{TP}$$

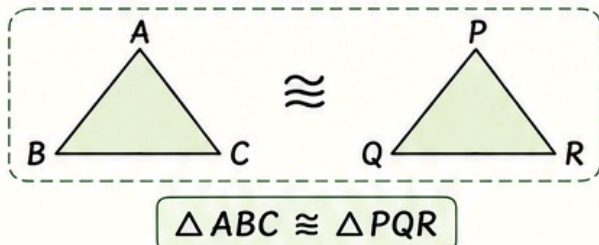
(corresponding sides are in the same ratio)

★ **MR CLASSES BY RAHIM SIR** ★

Concept Clear ★ Score High ★ Always Ahead

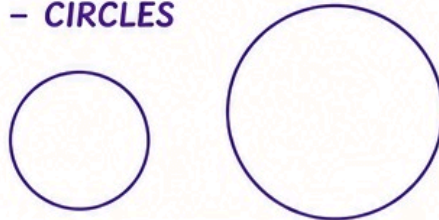


- ★ Two figures are said to be **CONGRUENT**, if they have the **same shape** and the **same size**.



- ★ **SIMILAR FIGURE** – Two figures having the same shape (and not necessarily the same size) are called similar figures.

EX. – CIRCLES



- ★ All **CONGRUENT FIGURES** are **SIMILAR** but the **SIMILAR FIGURES** need not be **CONGRUENT**.

Important Point!

QUICK CHECK

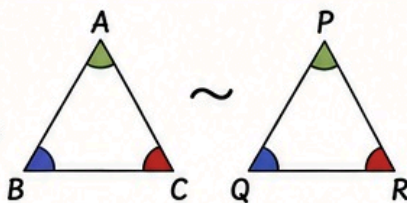
- All circles are (congruent, similar)
- All squares are (similar, congruent)
- All triangles are similar. (isosceles, equilateral)
- Two polygons of the same number of sides are similar, if
 - their corresponding angles are and
 - their corresponding sides are (EQUAL./proportional)



CONDITION FOR SIMILAR TRIANGLES

Two triangles are similar, if

- their corresponding **angles** are equal and
- their corresponding **sides** are in the same ratio (or **proportion**)



Then,

$$\angle A = \angle P, \angle B = \angle Q, \angle C = \angle R$$

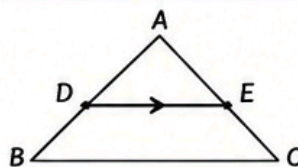
$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{PR}$$

(corresponding sides are in the same ratio)

IMPORTANT THEOREMS

1 Thales (640 – 546 B.C.)

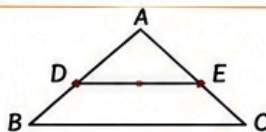
If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.
THALES (BPT)



If $DE \parallel BC$,

then $\frac{AD}{DB} = \frac{AE}{EC}$

2 If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side. **CONVERSE OF THALES (CBPT)**



If $\frac{AD}{DB} = \frac{AE}{EC}$,

then $DE \parallel BC$

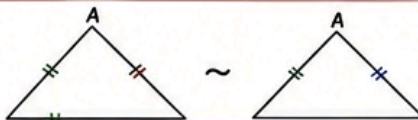
3 If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio and hence the two triangles are similar. **(AAA similarity criterion)**



4 If in two triangles, two angles of one triangle are respectively equal to the two angles of the other triangle, then the two triangles are similar. **(AA similarity criterion)**



5 If in two triangles, corresponding sides are in the same ratio, then their corresponding angles are equal and hence the triangles are similar. **(SSS similarity criterion)**

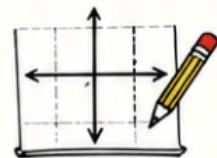


6 If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are in the same ratio (proportional), then the triangles are similar. **(SAS similarity criterion)**



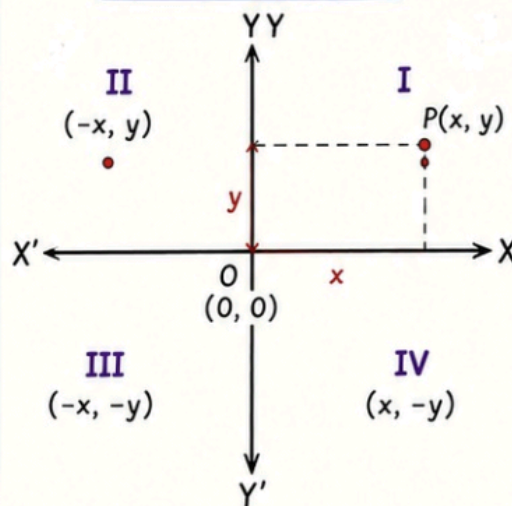
Ch 7

COORDINATE GEOMETRY



- ★ The distance of a point from the y-axis is called its **x-coordinate**, or **abscissa**.
- ★ The distance of a point from the x-axis is called its **y-coordinate**, or **ordinate**.
- ★ The coordinates of a point on the x-axis are of the form **(x, 0)**,
- ★ and of a point on the y-axis are of the form **(0, y)**.

COORDINATE PLANE



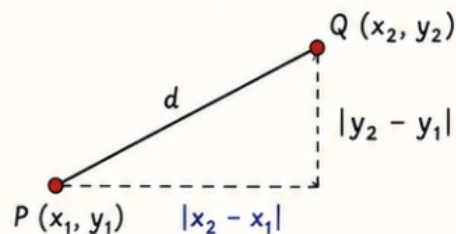
x-coordinate (abscissa)
Distance of the point from the y-axis.

y-coordinate (ordinate)
Distance of the point from the x-axis.

1 DISTANCE FORMULA (Distance between two points)

If $P(x_1, y_1)$ and $Q(x_2, y_2)$ are two points in the plane, then the distance between them is given by:

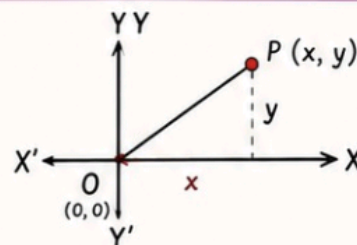
$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



2 DISTANCE OF A POINT FROM ORIGIN (OR) DISTANCE BETWEEN (0, 0) AND (x, y)

If $P(x, y)$ is any point, then its distance from the origin $O(0, 0)$ is:

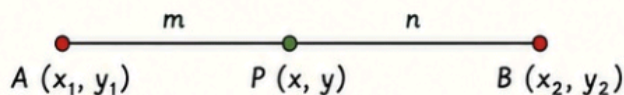
$$OP = \sqrt{x^2 + y^2}$$



3 SECTION FORMULA (INTERNAL DIVISION)

If the point $P(x, y)$ divides the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $m : n$ (i.e., $AP : PB = m : n$), then:

$$x = \frac{mx_2 + nx_1}{m + n}, \quad y = \frac{my_2 + ny_1}{m + n}$$



Special Cases:

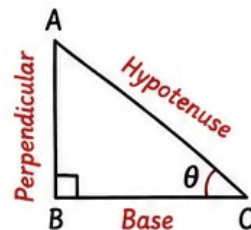
- If $m = n$, then P is the midpoint of AB .

$$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

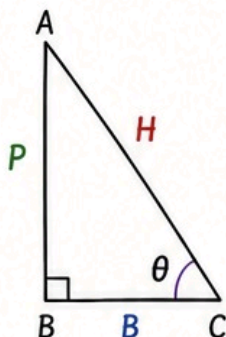


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**1. BASIC TRIGONOMETRIC RATIOS**

- $\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$
- $\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}}$
- $\tan \theta = \frac{\text{Perpendicular}}{\text{Base}}$
- $\cot \theta = \frac{\text{Base}}{\text{Perpendicular}}$
- $\sec \theta = \frac{\text{Hypotenuse}}{\text{Base}}$
- $\csc \theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}}$

**2. RECIPROCAL AND QUOTIENT RELATIONS**

- $\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$
- $\sin \theta \times \csc \theta = 1 \quad \cos \theta \times \sec \theta = 1$
- $\tan \theta \times \cot \theta = 1$

3. COMPLEMENTARY ANGLES ($90^\circ - \theta$)

- $\sin(90^\circ - \theta) = \cos \theta$
- $\cos(90^\circ - \theta) = \sin \theta$
- $\tan(90^\circ - \theta) = \cot \theta$
- $\cot(90^\circ - \theta) = \tan \theta$
- $\sec(90^\circ - \theta) = \csc \theta$
- $\csc(90^\circ - \theta) = \sec \theta$

IMPORTANT IDENTITIES

- $\sin^2 \theta + \cos^2 \theta = 1$
- $1 + \tan^2 \theta = \sec^2 \theta$
- $1 + \cot^2 \theta = \csc^2 \theta$
- $\sin \theta = \frac{1}{\csc \theta}, \quad \csc \theta = \frac{1}{\sin \theta}$
- $\cos \theta = \frac{1}{\sec \theta}, \quad \sec \theta = \frac{1}{\cos \theta}$

4. VALUES OF TRIGONOMETRIC RATIOS

Ratios	0°	30°	45°	60°	90°
$\sin \theta$	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1
$\cos \theta$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0
$\tan \theta$	0	$1/\sqrt{3}$	1	$\sqrt{3}$	n.d.
$\csc \theta$	n.d.	2	$\sqrt{2}$	$2/\sqrt{3}$	1
$\sec \theta$	1	$2/\sqrt{3}$	$\sqrt{2}$	2	n.d.
$\cot \theta$	n.d.	$\sqrt{3}$	1	$1/\sqrt{3}$	0

KEY POINTS

- ★ P = Perpendicular
- ★ B = Base
- ★ H = Hypotenuse
- ★ θ = Angle

NOTE

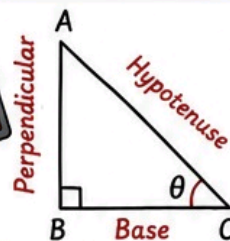
All ratios are based on the sides with respect to the given angle θ .

REMEMBER

- ★ Learn formulas carefully.
- ★ Use identities to simplify.
- ★ Practice regularly to score better.



APPLICATION OF TRIGONOMETRY

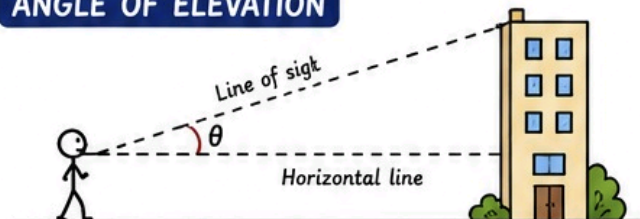


★ **Angle of Elevation** – The angle formed when we look **upward** at an object from the horizontal line.

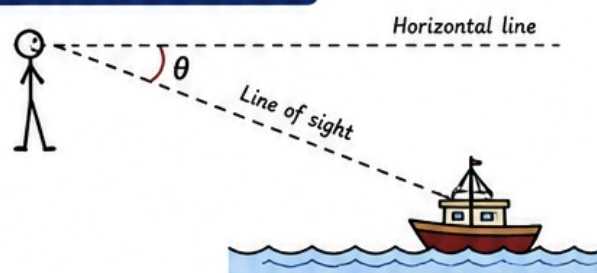
★ **Angle of Depression** – The angle formed when we look **downward** at an object from the horizontal line.

★ **Line of Sight** – The straight line between the observer's eye and the object being seen.

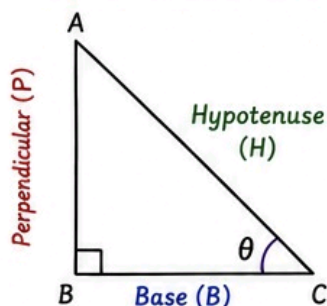
ANGLE OF ELEVATION



ANGLE OF DEPRESSION



TRIGONOMETRIC RATIOS IN RIGHT TRIANGLE



$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{P}{H}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{B}{H}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{P}{B}$$

$$\cot \theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{B}{P}$$

$$\sec \theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{H}{B}$$

$$\text{cosec } \theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{H}{P}$$

IMPORTANT RELATIONS

- $\tan \theta = \frac{\sin \theta}{\cos \theta}$
- $\cot \theta = \frac{\cos \theta}{\sin \theta}$
- $\sin \theta \times \text{cosec } \theta = 1$
- $\cos \theta \times \sec \theta = 1$
- $\tan \theta \times \cot \theta = 1$
- $\sin A / \cos A = \tan A$
- $\cos A / \sin A = \cot A$

COMPLEMENTARY ANGLES

$(90^\circ - \theta)$

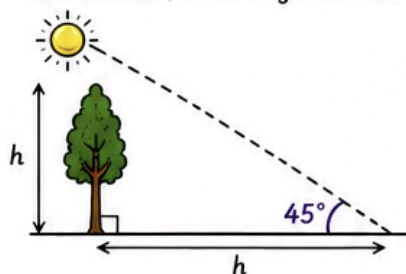
- $\sin (90^\circ - \theta) = \cos \theta$
- $\cos (90^\circ - \theta) = \sin \theta$
- $\tan (90^\circ - \theta) = \cot \theta$
- $\cot (90^\circ - \theta) = \tan \theta$
- $\sec (90^\circ - \theta) = \text{cosec } \theta$
- $\text{cosec } (90^\circ - \theta) = \sec \theta$

TRIGONOMETRIC IDENTITIES

- $\sin^2 \theta + \cos^2 \theta = 1$
- $1 + \tan^2 \theta = \sec^2 \theta$
- $1 + \cot^2 \theta = \text{cosec}^2 \theta$
- $\tan^2 \theta = \sec^2 \theta - 1$
- $\tan \theta = \sqrt{\sec^2 \theta - 1}$
- $\tan^2 \theta - \sec^2 \theta = -1$
- $\sin^2 \theta = 1 - \cos^2 \theta$
- $\cos^2 \theta = 1 - \sin^2 \theta$
- $\sin \theta = \sqrt{1 - \cos^2 \theta}$
- $\cos \theta = \sqrt{1 - \sin^2 \theta}$

SPECIAL CASES

- If **HEIGHT OF TREE** and **LENGTH OF SHADOW** are **EQUAL**, then angle will be 45° .



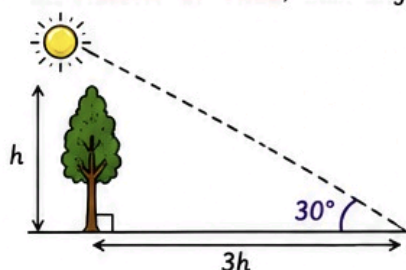
In Right Δ ,

$$\tan \theta = \frac{h}{h}$$

$$\tan \theta = 1$$

$$\theta = 45^\circ$$

- If **LENGTH OF SHADOW** is **THREE TIMES** the **HEIGHT OF TREE**, then angle will be 30° .



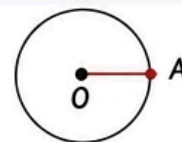
In Right Δ ,

$$\tan \theta = \frac{h}{3h}$$

$$\tan \theta = \frac{1}{3}$$

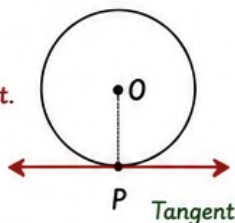
$$\theta = 30^\circ$$





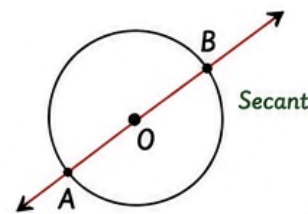
1. TANGENT

- A tangent to a circle is a line that intersects the circle at **only one point**.
- There is only **one tangent** at a point of the circle.



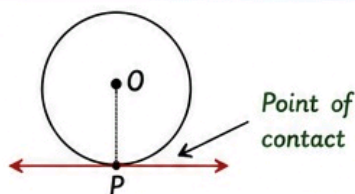
2. SECANT

The tangent to a circle is a special case of the secant, when the two end points of its corresponding chord coincide.



3. POINT OF CONTACT

The common point of the tangent and the circle is called the **point of contact**.

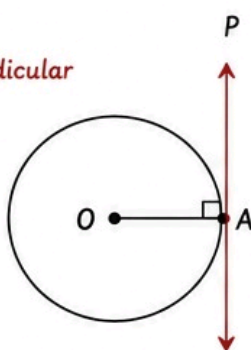


4. THEOREM 10.1 :

The tangent at any point of a circle is perpendicular to the radius through the point of contact.

Given : PA is a tangent to the circle with centre O, touching the circle at A.

To Prove : $OA \perp PA$



Proof :

Join OA. Since PA is a tangent at A, OA is a radius.

Suppose OA is not $\perp$ PA.

Then $\angle OAP$ is either acute or obtuse.

Draw another radius OB making $\angle AOB = 90^\circ$.

Then $\angle OAP \neq \angle OBP$.

But tangents at a circle from an external point are equal in length.

So, $AP \neq BP$ (Contradiction)

$\therefore$ Our supposition is wrong.

Hence, **$OA \perp PA$** .



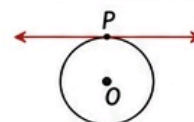
QUICK FACTS

- How many tangents can a circle have?
Ans. **Infinite**
- Fill in the blanks :
 - A tangent to a circle intersects it in**1**..... point (s).
 - A line intersecting a circle in two points is called a**SECANT**.....
 - A circle can have parallel tangents at the most**TWO**.....

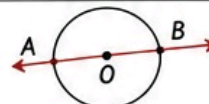


Useful Note

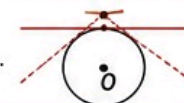
A tangent touches the circle at one point.



A secant cuts the circle at two points.



At a point on the circle, only one tangent can be drawn.

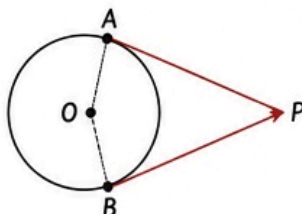


5. THEOREM 10.2 :

The lengths of tangents drawn from an external point to a circle are equal.

Given : From an external point P, PA and PB are tangents to a circle with centre O, touching the circle at A and B.

To Prove : $PA = PB$



Proof :

Join OA, OB and OP.

In $\triangle OAP$ and $\triangle OBP$,

$OA = OB$ (radii)

$\angle OAP = \angle OBP$ (each 90°)

$OP = OP$ (common side)

$\therefore \triangle OAP \cong \triangle OBP$ (RHS congruence rule)

$\therefore PA = PB$ (By CPCT)

Remember

- ✓ Tangent touches — Secant cuts.
- ✓ Tangent at a point is unique.
- ✓ Radius is perpendicular to the tangent at the point of contact.
- ✓ Tangents from an external point are equal in length.

Key Terms

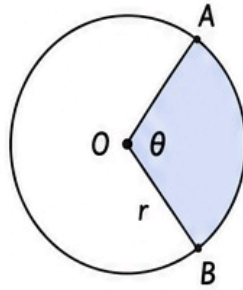
- ★ Tangent — Touches at one point
- ★ Secant — Intersects at two points
- ★ Point of Contact — Common point of tangent and circle

Ch 11 AREAS RELATED TO CIRCLE

1. AREA OF A SECTOR

The area of the sector of angle θ (in degrees) is :

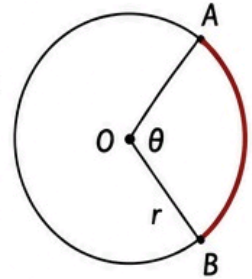
$$\text{Area of sector} = \frac{\theta}{360} \times \pi r^2$$



2. LENGTH OF AN ARC

The length of an arc of a sector of angle θ (in degrees) is :

$$\text{Length of arc} = \frac{\theta}{360} \times 2\pi r$$

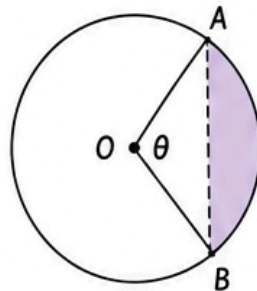


3. AREA OF A SEGMENT

The area of a segment of angle θ (in degrees) is :

$$\text{Area of segment} = \frac{\theta}{360} \times \pi r^2$$

– Area of the corresponding triangle

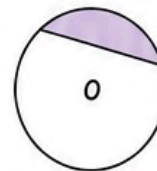


$$\text{Segment Area} = \text{Area of sector} - \text{Area of triangle OAB}$$

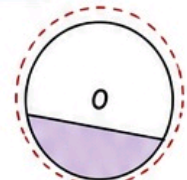
What is a Segment?

A segment of a circle is the region bounded by an arc and its corresponding chord.

TYPES OF SEGMENTS



Minor Segment

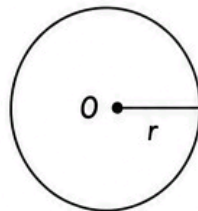


Major Segment

4. AREA OF CIRCLE

The area of a circle with radius r is :

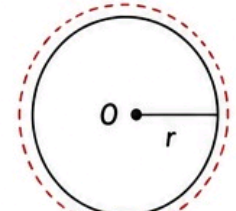
$$A = \pi r^2$$



5. CIRCUMFERENCE OF CIRCLE

The circumference (or perimeter) of a circle with radius r is :

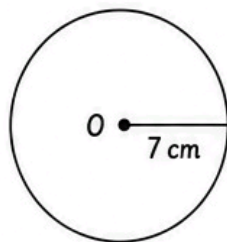
$$C = 2\pi r$$



6. EXAMPLE

If radius of a circle is 7 cm, then area of the circle is :

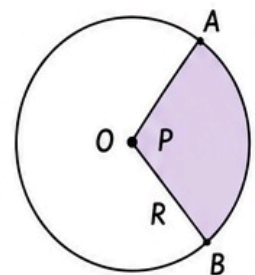
$$\begin{aligned} A &= \pi r^2 \\ &= \frac{22}{7} \times 7^2 \\ &= 154 \text{ cm}^2 \end{aligned}$$



7. GENERAL FORMULA

If angle is P (in degrees) and radius of circle is R , then area of sector is :

$$\text{Area of sector} = \frac{P}{360} \times \pi R^2$$



IMPORTANT FORMULAS AT A GLANCE

- Area of sector (θ) = $\frac{\theta}{360} \times \pi r^2$
- Length of arc (θ) = $\frac{\theta}{360} \times 2\pi r$
- Area of segment (θ) = $\frac{\theta}{360} \times \pi r^2$ – Area of triangle

- Area of circle = πr^2
- Circumference = $2\pi r$
- Area of sector (P) = $\frac{P}{360} \times \pi R^2$

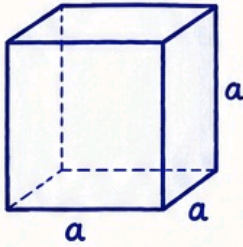
QUICK FACTS

- ★ Total angle around a point = 360°
- ★ $\pi \approx \frac{22}{7}$ or 3.14
- ★ 1° of sector = $\frac{1}{360}$ of circle

CH 12 : SURFACE AREA AND VOLUMES

1 CUBE

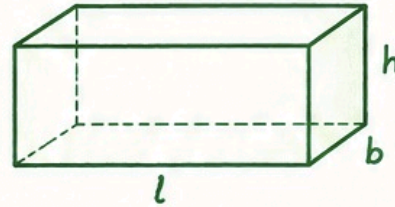
Let side = a



- Volume = a^3
- Total Surface Area (TSA) = $6a^2$
- Lateral Surface Area (LSA) = $4a^2$

2 CUBOID

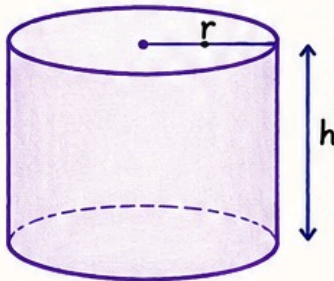
Let length = l , breadth = b , height = h



- Volume = $l \times b \times h$
- Total Surface Area (TSA) = $2(lb + bh + hl)$
- Lateral Surface Area (LSA) = $2h(l + b)$

3 CYLINDER

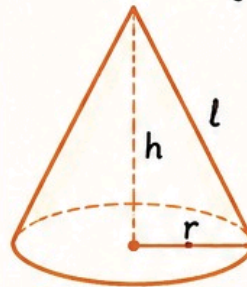
Let radius = r , height = h



- Curved Surface Area (CSA) = $2\pi rh$
- Total Surface Area (TSA) = $2\pi r(h + r)$
- Volume = $\pi r^2 h$

4 CONE

Let radius = r , height = h ,
slant height = l



- Curved Surface Area (CSA) = πrl
- Volume = $\frac{1}{3} \pi r^2 h$

Slant Height (l)

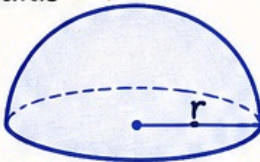
$$l^2 = h^2 + r^2$$

$$l = \sqrt{h^2 + r^2}$$

- ★ Volume of cone = $\frac{1}{3}$ rd of volume of cylinder.
- *** Volume of cylinder = 3 times to the volume of cone.
- *** Ratio of volume of cylinder : volume of cone = 3 : 1
- *** Ratio of volume of cone : volume of cylinder = 1 : 3

5 HEMISPHERE

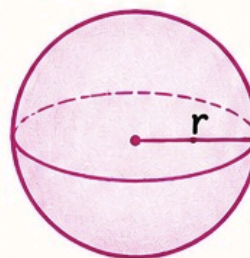
Let radius = r



- Curved Surface Area (CSA) = $2\pi r^2$
- Total Surface Area (TSA) = $3\pi r^2$
- Volume = $\frac{2}{3} \pi r^3$

6 SPHERE

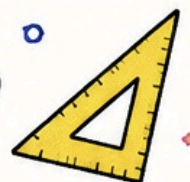
Let radius = r

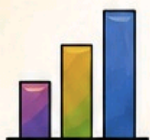


- Curved Surface Area (CSA) = $4\pi r^2$
- Total Surface Area (TSA) = $4\pi r^2$
- Volume = $\frac{4}{3} \pi r^3$



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CH 13: STATISTICS



1 MEAN (Arithmetic Mean)

✓ (A) Direct Method



$$\hat{x} = \frac{\sum f_i x_i}{\sum f_i}$$

Where:

f_i = frequency

x_i = class mark

$\sum f_i$ = total frequency

✓ (B) Assumed Mean Method



$$\hat{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

Where:

a = assumed mean

$d_i = x_i - a$

f_i = frequency

✓ (C) Step Deviation Method



$$\hat{x} = a + \left(\frac{\sum f_i u_i}{\sum f_i} \right) \times h$$

Where:

a = assumed mean

$$u_i = \frac{x_i - a}{h}$$

h = class width

2 MEDIAN Formula

$$\text{Median} = l + \left(\frac{\frac{N}{2} - cf}{f} \right) \times h$$

Where:

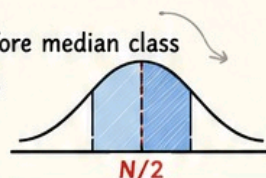
l = lower boundary of median class

N = total frequency

cf = cumulative frequency before median class

f = frequency of median class

h = class width



3 MODE Formula

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

Where:

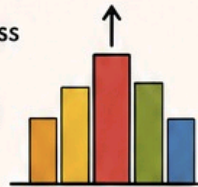
l = lower boundary of modal class

f_1 = frequency of modal class

f_0 = frequency before modal class

f_2 = frequency after modal class

h = class width



4 RANGE

★ Formula:

Range = Highest Value - Lowest Value

★ Example:

If highest marks = 95

Lowest marks = 40

Range = 95 - 40 = **55**



★★ ① Class belongs to the highest frequency called:

✓ Modal Class

✓ Highest frequency is called: Modal Frequency



② Find Mode and Modal Frequency

Given data:

2, 3, 4, 1, 2, 2, 2, 3, 2

Step 1: Arrange data

1, 2, 2, 2, 2, 3, 3, 4

Step 2: Count frequency

Value (x_i)	1	2	3	4
Frequency (f_i)	1	4	2	1

✓ Mode = 2

✓ Modal Frequency = 4

③ What is Median Frequency?

✓ The cumulative frequency just greater than $\frac{N}{2}$ helps us find the median class.

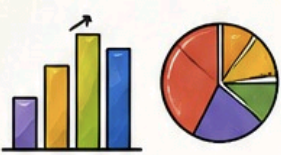
✓ The class that contains the median is called Median Class.



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CH 13 : STATISTICS



4 FIND MEAN

Data: 0, 1, 2, 3, 4

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Total observations}}$$

- Sum = $0 + 1 + 2 + 3 + 4 = 10$
- Total numbers = 5

$$\text{Mean} = \frac{10}{5} = 2$$

✓ Mean = 2



(B) When N is EVEN

Data: 2, 4, 5, 2, 1, 2

Arrange: 1, 2, 2, 2, 4, 5 (N = 6)

$$\text{FORMULA } M = \frac{1}{2} \left[\frac{n}{2} \text{th} + \left(\frac{n}{2} + 1 \right) \text{th} \right]$$

$$M = \frac{1}{2} \left[\frac{6}{2} + \left(\frac{6}{2} + 1 \right) \right]$$

$$\text{Median} = \frac{(3\text{rd term} + 4\text{th term})}{2}$$

$$M = 2 + 2 / 2 = 4 / 2$$

$$M = 2$$



5 FIND MEDIAN

(A) When N is ODD

Data: 2, 3, 1, 6, 2

Arrange: 1, 2, 2, 3, 6 (n = 5)

$$\text{Median Position} = \frac{N + 1}{2} = \frac{5 + 1}{2} = 3$$

3rd term = 2

✓ Median = 2



RELATION B/W MEAN, MODE AND MEDIAN

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

----- Or -----

$$3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$$



Q. If median of given data is 4 and mean is 1 find mode.

We use the relation:

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$



Given:

Median = 4

Mean = 1

$$\begin{aligned} \text{Mode} &= 3(4) - 2(1) \\ &= 12 - 2 \\ &= 10 \end{aligned}$$

✓ Mode = 10



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CH 14: PROBABILITY



THEORY OF PROBABILITY

— Pierre Simon Laplace (1749 – 1827)

★ The sum of the probabilities of all the elementary events of an experiment is **1**.

★ In general, The event E $P(E) + P(E \text{ Not}) = 1$

which gives us $P(E) = 1 - P(E \text{ NOT})$

★ The probability of an event which is impossible to occur is **0**. Such an event is called an **impossible event**.

★ The probability of an event which is sure (or certain) to occur is **1**. Such an event is called a **sure event** or a **certain event**.

★ Kings, queens and jacks are called **face cards**.

RANGE OF PROBABILITY

The probability of any event E is

$$0 \leq P(E) \leq 1$$



Face Cards

K Q J



Probability of an event E + Probability of the event 'not E' = 1

(i)

$$E + \text{not } E = 1$$

Probability of an event E + Probability of the event 'not E' = 1

(ii)



The probability of an event that cannot happen is0, called**IMPOSSIBLE EVENT**.

(iii)



The probability of an event that is certain to happen is ... 1, Such an event is called**SURE EVENT**.

(iv)



The sum of the probabilities of all the elementary events of an experiment is1.

(v)



The probability of an event is greater than or equal to0 and less than or equal to1.



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POLYNOMIALS



* The highest power of x in $p(x)$ is called the **degree of the polynomial** $p(x)$.

** A polynomial of **degree 1** is called a **linear polynomial**.

For example, $2x - 3$, are all linear polynomials.

** A polynomial of **degree 2** is called a **quadratic polynomial**.

** A polynomial of **degree 3** is called a **cubic polynomial**.

Ex... $2 - x^3$, x^3

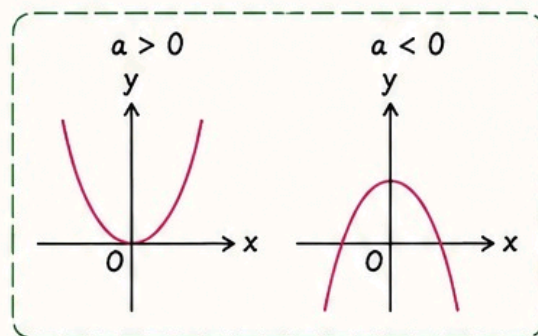
*** $y = ax^2 + bx + c$ has one of the two shapes

either open upwards like 

or open downwards like 

depending on whether $a > 0$ or $a < 0$.

(These curves are called **parabolas**.)



NO OF ZEROES

• **LINEAR** POLYNOMIAL -----> **ONE**

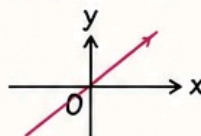
• **QUADRATIC** POLYNOMIAL IS ----> **TWO**

• **CUBIC** POLYNOMIAL IS -----> **THREE**

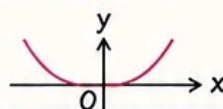
GRAPH OF POLYNOMIALS

• 1. **LINEAR** POLYNOMIAL IS -> **LINEAR**

(2026 BOARD)



• 2. **QUADRATIC** POLYNOMIAL IS -> **PARABOLA**



**** **Example 1** and **Q1** of Ch ex **2.1** is very imp in which zeros has to be find.



FOR QUADRATIC POLYNOMIAL

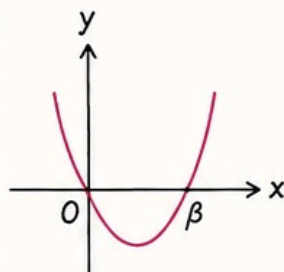
For a quadratic polynomial $ax^2 + bx + c$ ($a \neq 0$)
Let the zeroes be α and β .

Sum of zeroes:

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

Product of zeroes:

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



FOR CUBIC POLYNOMIAL

For a cubic polynomial (cubic equation),
the general form is:

$$ax^3 + bx^2 + cx + d = 0, \quad a \neq 0$$

Let the three zeroes (roots) be α , β , γ .

1. Sum of the zeroes

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

2. Sum of the product of zeroes
taken two at a time

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

3. Product of the zeroes

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



Maths is not about numbers,
it's about understanding.



MR CLASSES
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