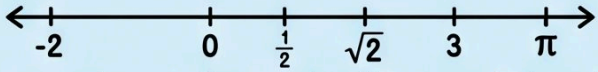
CHAPTER 1: REAL NUMBERS

CLASS 10 MATHS

1. WHAT ARE REAL NUMBERS?



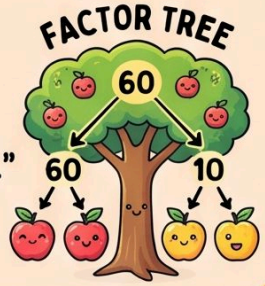
Any number on the number line, consisting of:

🌱 Rational Numbers: Can be written as p/q (q ≠ 0). Ex: 2/3, 4, -0.5, 0.333... (Terminating or repeating decimals).

💥 Irrational Numbers: Cannot be written as p/q. Ex: $\sqrt{2}$, $\sqrt{3}$, π, e. (Non-terminating & non-repeating).

2. FUNDAMENTAL THEOREM OF ARITHMETIC

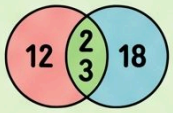
"Every composite number can be uniquely expressed (factorised) as a product of prime numbers, apart from the order in which they occur."



🪵 Ex: $60 = 2 \times 2 \times 3 \times 5 = 2^2 \times 3 \times 5$

3. FINDING HCF & LCM

Using Prime Factorisation:



🔍 HCF (Highest Common Factor): Product of the smallest power of each common prime factor.



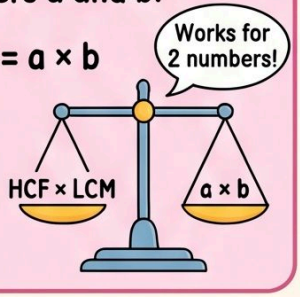
🚀 LCM (Least Common Multiple): Product of the highest power of all prime factors involved.

💡 Tip: Think of HCF as 'common only', and LCM as 'everything'!

4. THE HCF-LCM RELATION

For any two positive integers a and b:

🔑 $HCF(a, b) \times LCM(a, b) = a \times b$



⚠️ Note: This rule only works for TWO numbers, not three!

5. PROVING IRRATIONALITY

Proven using the 'Method of Contradiction'!

1. Assume $\sqrt{5}$ is rational: $\sqrt{5} = \frac{p}{q}$ (p, q are co-prime).
2. Square: $5q^2 = p^2$ ➡ 5 divides p^2 and p.
3. Show 5 also divides q.



🚫 Contradiction! Since both have factor 5, they are NOT co-prime. $\sqrt{5}$ is irrational.

6. REAL-WORLD EXAMPLES

Where do we see this?



⏰ Alarms/Bells ringing together at intervals ➡ LCM

🏃 Runners finishing laps at the same time ➡ LCM

📦 Packing items equally into containers ➡ HCF

📐 Dividing tiles of equal dimensions ➡ HCF



CORE CONCEPTS / THEMES

- 🎯 Classifying number systems.
- 🌳 Unique prime factorisation of integers.
- ⛓️ Proofs by assume-the-opposite (contradiction).
- 📏 Finding patterns, intervals, and shared limits.

IMPORTANT FORMULAS / DEFINITIONS

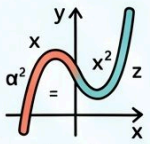
- $HCF(a, b) \times LCM(a, b) = a \times b$
- Co-prime numbers: Have HCF = 1.
- Irrational: Non-terminating, non-repeating decimals.
- Composite Number = product of primes.

KEY TAKEAWAY: Master the Fundamental Theorem of Arithmetic and the 'Method of Contradiction' to easily unlock any Real Numbers problem!

CHAPTER 2: POLYNOMIALS

CLASS 10 MATHS

1. WHAT IS A POLYNOMIAL?



$3x^2 + 5x - 2$
$x^2 = x - 2$
$y = -12x + 4$

An algebraic expression with whole number powers (non-negative integer exponents) of variables.

Example: $3x^2 + 5x - 2$ ✅

Non-example: $\sqrt{x+1}$, $\frac{1}{x}$ ❌

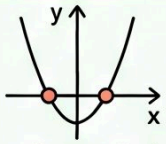
2. DEGREE OF A POLYNOMIAL



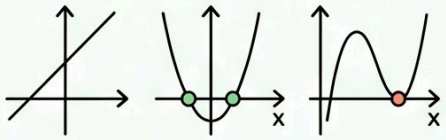
The highest exponent of the variable x in p(x).

Classification:
- Linear (Degree 1): e.g., $2x + 3$
- Quadratic (Degree 2): e.g., $x^2 - 5x + 6$
- Cubic (Degree 3): e.g., $x^3 - 2x^2 + x - 5$

3. GEOMETRICAL MEANING OF ZEROES



The number of times the graph y = p(x) cuts the x-axis is the number of zeroes of the polynomial.



4. RELATION BETWEEN ZEROES & COEFFICIENTS

For Quadratic:
$p(x) = ax^2 + bx + c$ $(a \neq 0)$
with zeroes α (Alpha) and β (Beta).

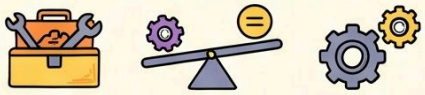
Sum of zeroes:

$$\alpha + \beta = -\frac{b}{a} = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$$

Product of zeroes:

$$\alpha\beta = \frac{c}{a} = \frac{\text{constant}}{\text{coefficient of } x^2}$$

5. FORMING A QUADRATIC POLYNOMIAL



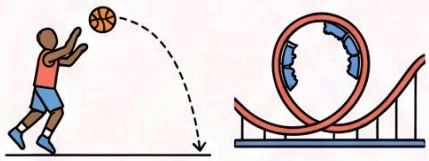
To form a polynomial when Sum ($S = \alpha + \beta$) and Product ($P = \alpha\beta$) of zeroes are known:

$$p(x) = k\,[x^2 - (\alpha + \beta)x + \alpha\beta]$$
$$= k\,[x^2 - Sx + P]$$

(where $k \neq 0$).

Example: If sum = 3, product = 2
➡ $x^2 - 3x + 2$

6. REAL-WORLD EXAMPLES



Where do we see this?
- Basketball Trajectory (Parabola)
- Rollercoaster Curves
- Arch Bridges & structures

CORE CONCEPTS / THEMES

- Type by terms: Monomial (1), Binomial (2), Trinomial (3)
- Value of p(x) at x = k is p(k)
- Zero of p(x) is the value k where p(k) = 0
- A polynomial of degree n has at most n zeroes.

IMPORTANT FORMULAS / DEFINITIONS

For $ax^2 + bx + c$ (Quadratic):

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

For $ax^3 + bx^2 + cx + d$ (Cubic):

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

Value at x = k: p(k)

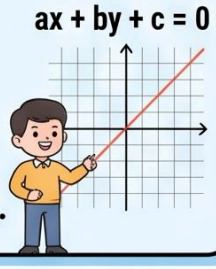
KEY TAKEAWAY: Finding x-intercepts (zeroes) on the graph and linking them to coefficients (α, β & a, b, c) is the key to mastering Polynomials!

CHAPTER 3: PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

CLASS 10 MATHS

1. WHAT IS A LINEAR EQN IN 2 VARIABLES?

- An equation of the form $ax + by + c = 0$, where a, b, and c are real numbers (a and $b \neq 0$).
- Example: $2x + 3y = 5$ $2x + 3y = 5$ (graph is a straight line).



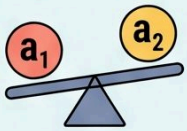
2. PAIR OF LINEAR EQUATIONS

- A set of two linear equations with the same variables x & y

$$a_1x + b_1y + c_1 = 0$$
$$a_2x + b_2y + c_2 = 0$$

- Where $a_1, b_1, c_1, a_2, b_2, c_2$ are real constants.





3. GRAPHICAL METHOD OF SOLUTION

- Plotting both lines on a graph paper.
- The point where they intersect is the common solution (x, y).
- Visualizing lines: Lines can intersect, overlap (coincide), or be parallel.



4. ALGEBRAIC METHODS

- Substitution Method: Express one variable in terms of the other (e.g., $y = 5 - 2x$) & substitute.
- Elimination Method: Multiply equations to make coefficients of one variable equal, then add/subtract to eliminate it.



5. CONSISTENCY OF EQUATIONS

Comparing ratios of ratios of coefficients (a_1/a_2, b_1/b_2, c_1/c_2)

- Unique Solution: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (Intersecting lines, consistent)
- Infinite Solutions: $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Coincident lines, dependent
- No Solution: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$



6. REAL-WORLD EXAMPLES

Where do we see this?

- Speed & Distance (e.g. boats upstream/ downstream)
- Cost & Price (e.g., bat and ball problems)
- Age problems (e.g., "Father's age is 3 times...")

CORE CONCEPTS / THEMES

- Checking for consistency using ratios, simultaneous solutions,
- Converting word problems into algebra, geometric visualization.

IMPORTANT FORMULAS / CONDITIONS

- Standard Form: $ax + by + c = 0$
- Unique: $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ (consistent)
- No Solution: $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ (inconsistent)
- Infinite: $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (consistent)

KEY TAKEAWAY: Intersecting and coincident systems are consistent (with solutions), while parallel systems are inconsistent (no solution). Mastering equation translation is the secret to word problems!

CHAPTER 4:
QUADRATIC EQUATIONS

CLASS 10 MATHS

1. WHAT IS A QUADRATIC EQUATION?

An equation with the highest power (degree) of the variable as 2.

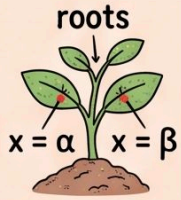
- Standard Form: $ax^2 + bx + c = 0$ (where $a \neq 0$)
- a, b, c are real numbers.
- Example: $2x^2 - 5x + 3 = 0$



2. ROOTS OF A QUADRATIC EQN

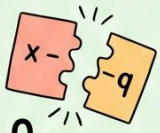
The values of x (say α and β) that satisfy the equation.

- A real number α is a root if $a\alpha^2 + b\alpha + c = 0$.
- A quadratic equation has at most 2 roots.



3. SOLVING BY FACTORISATION

By splitting the middle term 'bx' into two parts.



- Factoring into $(x-p)(x-q) = 0$.
- Example: $x^2 - 5x + 6 = 0 \longrightarrow (x-2)(x-3) = 0 \longrightarrow x = 2, 3$

4. QUADRATIC FORMULA

To find roots when factorisation is difficult:

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

- Here, $b^2 - 4ac$ is called the Discriminant (D).

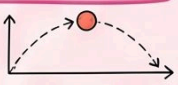
5. NATURE OF ROOTS

The value of Discriminant ($D = b^2 - 4ac$) determines this:

- $D > 0$: 2 distinct real roots (😊/😊)
- $D = 0$: 2 equal real roots (😐=😐)
- $D < 0$: No real roots (😢)

6. REAL-WORLD EXAMPLES

Where do we see this?



- Projectile motion (path of a thrown ball)
- Speed, distance & time problems (trains/boats)
- finding area/dimensions of rectangular fields



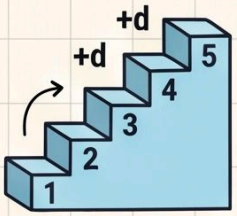
CORE CONCEPTS / THEMES

- Expressing real situations mathematically
- Finding roots of degree-2 equations
- Using factorization vs quadratic formula
- Analyzing real vs imaginary solutions using D

IMPORTANT FORMULAS / DEFINITIONS

- Std Form: $ax^2 + bx + c = 0$
- Discriminant: $D = b^2 - 4ac$
- Roots formula: $x = (-b \pm \sqrt{D}) / 2a$
- If $a = 0$, it is no longer quadratic!

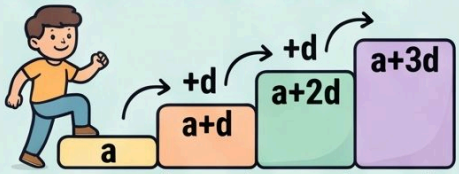
KEY TAKEAWAY: Finding the Discriminant (D) immediately reveals the nature of the roots, making it easy to solve any quadratic equation using the universal formula!



ARITHMETIC PROGRESSIONS

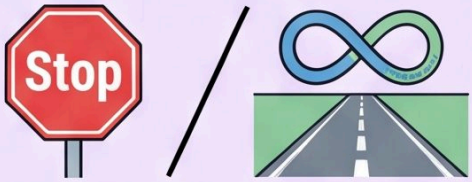
CLASS 10 MATHEMATICS • CHAPTER SUMMARY

01. WHAT IS AN AP?



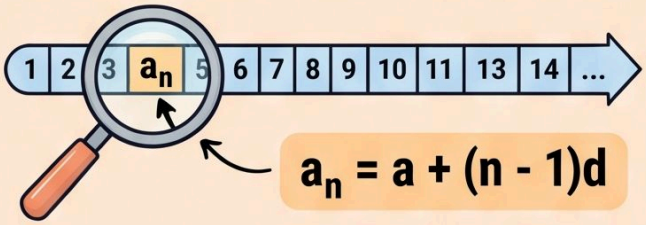
- A sequence of numbers where the difference between consecutive terms is constant.
- **General form: a, a+d, a+2d, a+3d, ...**
- **a** = First Term
- **d** = Common Difference (can be +, -, or 0)
- **Formula: $d = a_k - a_{(k-1)}$**
- **Example:** 2, 5, 8, 11... (here a = 2, d = 3)

02. TYPES OF AP



- **FINITE AP**: Has a limited number of terms. Has a last term (l).
  - **Example**: 3, 6, 9, 12, 15
- **INFINITE AP**: Continues endlessly with no last term.
  - **Example**: 2, 4, 6, 8, ...

03. FINDING THE nth TERM



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

- a_n = nth Term (General Term or Last Term)
- **a** = First Term
- **n** = Number of Terms (or position)
- **d** = Common Difference
- **Handy trick**: If three numbers **a, b, c** are in AP, then **2b = a + c**

04. SUM OF n TERMS



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

(when d is known)

$$S_n = \frac{n}{2}[a + l]$$

(when last term l is known)

- S_n = Sum of the first **n** terms
- **l** = Last term (a_n)
- **Note**: $a_n = S_n - S_{(n-1)}$

CORE THEMES

- Finding specific terms & patterns 🎯
- Summing of linear progressions ➕
- Checking if a sequence is an AP 🧩
- Real-life applications (saving, staircase, rows) 🚀

IMPORTANT FORMULAS

- Common diff: **d = a2 - a1**
- nth Term: $a_n = a + (n - 1)d$
- Sum: $S_n = n/2\,[2a + (n - 1)d] = n/2\,[a + l]$
- Three terms in AP: **(a - d), a, (a + d)**

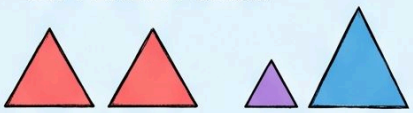
The **common difference 'd'** is the heartbeat of any AP! Once you know the first term **'a'** and the common difference **'d'**, you can unlock any term, and any sum in the entire sequence!

CHAPTER 6: TRIANGLES

CLASS 10 MATHS

1. SIMILAR VS. CONGRUENT

- Congruent (≅): Same shape AND same size. (e.g., identical triangles).
- Similar (~): Same shape, but DIFFERENT sizes.



Congruent ≅ Similar ~

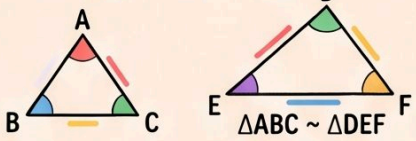
- "All circles, squares, and equilateral triangles are similar!"

2. WHAT ARE SIMILAR TRIANGLES?

Two triangles are similar (~) if:

- 1) Their corresponding angles are equal:
  $\angle A = \angle D, \angle B = \angle E, \angle C = \angle F.$
- 2) Their corresponding sides are in the same ratio:

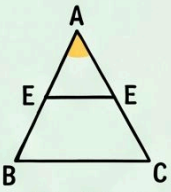
$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$



3. BASIC PROPORTIONALITY THEOREM (BPT)

- Also called 'Thales' Theorem'.
- If a line is drawn parallel to one side of a triangle to intersect the other two sides, it divides them in the same ratio.
- If DE || BC, then:

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



- Converse of BPT: If $\frac{AD}{DB} = \frac{AE}{EC}$, then DE || BC.

4. CRITERIA FOR SIMILARITY

How to prove two triangles are similar (~):

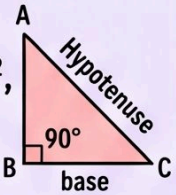
- AA (Angle-Angle): If two pairs of corresponding angles are equal (e.g., ∠A=∠D, ∠B=∠E).
- SSS (Side-Side-Side): If all 3 pairs of corresponding sides are in the same ratio.
- SAS (Side-Angle-Side): If two sides are in ratio and their included angle is equal.



5. PYTHAGORAS THEOREM

In a right-angled triangle, the square of the hypotenuse (longest side) is equal to the sum of squares of other two sides.

- In ΔABC (right-angled at B): $AC^2 = AB^2 + BC^2$ ($H^2 = P^2 + B^2$).
- Converse: If $AC^2 = AB^2 + BC^2$, then ∠B = 90°.



6. REAL-WORLD EXAMPLES

Where do we see similarity and triangles?



- Height of tall trees/buildings using their shadows (Indirect measurement).



- Scaling in maps, blueprints, and architectural models.
- 3D Video game graphics & animation (Triangular mesh).
- Camera lens & movie projection.





CORE CONCEPTS / THEMES

- Similar (same shape) vs. Congruent (same shape & size).
- Match vertices carefully (Order matters!).
- Solving proofs using BPT & Similarity criteria.
- Scale Factor: Ratio of corresponding sides.

IMPORTANT FORMULAS / THEOREMS

- BPT: DE || BC ⇒ $\frac{AD}{DB} = \frac{AE}{EC}$
- Pythagoras: $AC^2 = AB^2 + BC^2$
- Area Ratio: $\frac{\text{Area}(\Delta ABC)}{\text{Area}(\Delta DEF)} = \left(\frac{AB}{DE}\right)^2 = \left(\frac{BC}{EF}\right)^2 = \left(\frac{AC}{DF}\right)^2$
- Criteria: AA, SSS, SAS

KEY TAKEAWAY: Similar triangles have the same shape but different sizes! Keep vertex order (like A↔D) precise to easily apply BPT, Similarity Criteria (AA, SAS, SSS), and solve tricky geometric proofs!

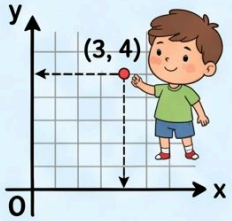
CHAPTER 7: COORDINATE GEOMETRY

CLASS 10 MATHS

1. WHAT IS COORDINATE GEOMETRY?

Position of a point on a 2D plane using a pair of numbers (x, y).

- x-coordinate (Abscissa): dist. from y-axis
- y-coordinate (Ordinate): dist. from x-axis
- Origin: O(0, 0)

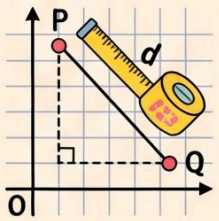


2. DISTANCE FORMULA

Finds the distance (d) between two points $P(x_1, y_1)$ and $Q(x_2, y_2)$.

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

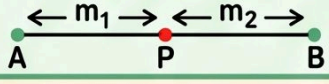
- Distance from Origin O(0,0) is $\sqrt{(x^2 + y^2}$



3. SECTION FORMULA

Finds coordinates of a point P(x, y) that divides a line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$ in the ratio $m_1 : m_2$ internally.

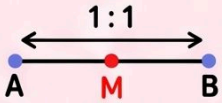
$$P = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$



4. MIDPOINT FORMULA

Finds the exact center of a line segment joining two points.

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

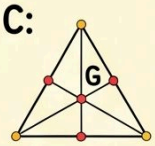


- A special case of Section Formula where ratio is 1 : 1.
- Simply the average of x & y coordinates!

5. CENTROID & COLLINEARITY

Centroid of a Triangle (median intersection) with vertices A, B, C:

$$G = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$$



- Collinearity: Points A, B, C are in a straight line if AB + BC = AC.

6. REAL-WORLD EXAMPLES

Where do we see this?



- 🗺️ Map Navigation & GPS (location tracking).
- 🎮 Video Games (2D positioning).
- 📡 Radar & Air Traffic (pathways).
- 📈 Graphics (shapes on a digital grid).

CORE CONCEPTS / THEMES

- Points on axes: x-axis (x, 0), y-axis (0, y).
- Collinearity test (sum of shorter distances = longest).
- Proving shapes (squares, triangles, rectangles) using distance formula.
- Use ratio k : 1 for section formula to find unknown ratios.

IMPORTANT FORMULAS

- Distance: $d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Section: $P = \left(\frac{m_1x_2 + m_2x_1}{m1+m2}, \frac{m_1y_2 + m_2y_1}{m1+m2}\right)$
- Midpoint: $M = \left(\frac{x_1+x_2}{2}, \frac{y1+y2}{2}\right)$
- Centroid: $G = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3)}{3}\right)$

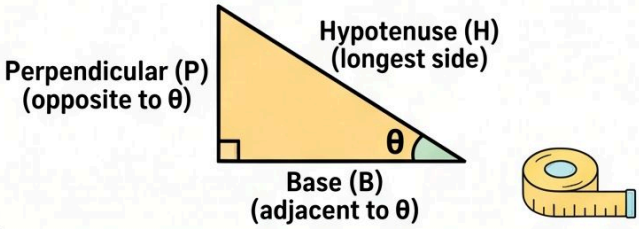
KEY TAKEAWAY: Connecting algebra with geometry, Coordinate Geometry uses (x, y) coordinate points to map, analyze, and measure geometric relationships algebraically!

CHAPTER 8: INTRODUCTION TO TRIGONOMETRY

CLASS 10 MATHS

1. WHAT IS TRIGONOMETRY?

Branch of mathematics that studies the relationship between the angles and sides of right-angled triangles.



2. TRIGONOMETRIC RATIOS (T-RATIOS)

"Pandit Badri Prasad Har Har Bole"

- $\sin\theta = \frac{P}{H}$
- $\cos\theta = \frac{B}{H}$
- $\tan\theta = \frac{P}{B}$
- $\operatorname{cosec}\theta = \frac{H}{P}$
- $\sec\theta = \frac{H}{B}$
- $\cot\theta = \frac{B}{P}$



3. T-RATIOS OF SOME SPECIFIC ANGLES

	0°	30°	45°	60°	90°
sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not Defined (∞)



4. RECIPROCAL & QUOTIENT RELATIONSHIPS

Reciprocals		Quotients
$\sin\theta = \frac{1}{\operatorname{cosec}\theta}$	⟺	$\tan\theta = \frac{\sin\theta}{\cos\theta}$
$\cos\theta = \frac{1}{\sec\theta}$	⟺	$\cot\theta = \frac{\cos\theta}{\sin\theta}$
$\tan\theta = \frac{1}{\cot\theta}$		

5. TRIGONOMETRIC IDENTITIES

The Three Golden Identities

The Three Golden Identities

- $\sin^2\theta + \cos^2\theta = 1$
- $1 + \tan^2\theta = \sec^2\theta$ (or $\sec^2\theta - \tan^2\theta = 1$)
- $1 + \cot^2\theta = \operatorname{cosec}^2\theta$ (or $\operatorname{cosec}^2\theta - \cot^2\theta = 1$)



6. REAL-WORLD EXAMPLES

Where do we see this?



- Measuring heights (e.g., finding the height of a tall tower, tree, or monument without climbing)
- Navigation & Astronomy (finding distances of ships/stars)
- Architecture & engineering (slopes, bridges, and roofs)





CORE CONCEPTS / THEMES

- Concise bullets on Theta (θ) as the reference angle
- How Base and Perpendicular change based on the chosen angle
- The ranges of T-ratios

IMPORTANT FORMULAS / DEFINITIONS

- Pythagoras Theorem ($H^2 = P^2 + B^2$)
- Reciprocal relations
- Fundamental trigonometric identity transformations

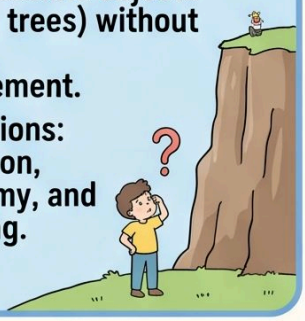
KEY TAKEAWAY: ALWAYS identify the reference angle (θ) first to correctly determine the Perpendicular (opposite) and Base (adjacent)!

CHAPTER 9: SOME APPLICATIONS OF TRIGONOMETRY

CLASS 10 MATHS

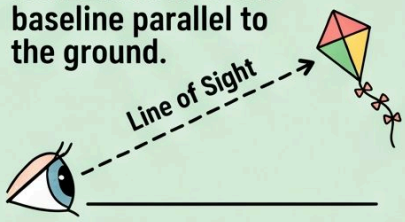
1. WHAT IS IT USED FOR?

- Find heights and distances of inaccessible objects (towers, trees) without actual measurement.
- Applications: Navigation, astronomy, and surveying.



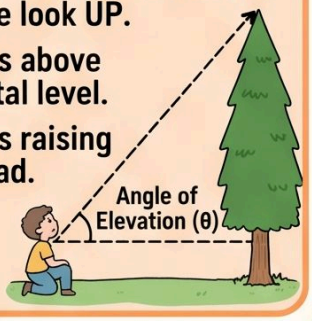
2. LINE OF SIGHT

- The straight line drawn from the observer's eye to the point in the object being viewed.
- Horizontal Line: The baseline parallel to the ground.



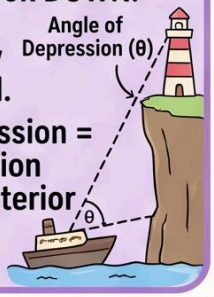
3. ANGLE OF ELEVATION

- Formed between the line of sight and the horizontal line when we look UP.
- Object is above horizontal level.
- Requires raising your head.



4. ANGLE OF DEPRESSION

- Formed between the line of sight and the horizontal line when we look DOWN.
- Object is below horizontal level.
- Angle of Depression = Angle of Elevation (as alternate interior angles!).



5. HOW TO SOLVE PROBLEMS

1. Draw a labeled diagram based on the question.
2. Identify the right-angled triangle(s).
3. Choose the correct T-ratio ratio (usually sin, cos, tan).
4. Substitute values and solve for the unknown!



6. REAL-WORLD EXAMPLES

- Measuring height of towers, trees, or buildings
- Height of a flying kite
- Distance of a ship from a lighthouse
- Broken tree tops touching the ground

CORE CONCEPTS / THEMES

- Visualizing word problems as 2D right triangles
- Identifiying horizontal vs vertical components
- Multiple triangles sharing a height or base
- Height of the observer is neglected unless specified
- Distance between observers or moving objects

IMPORTANT FORMULAS / DEFINITIONS

- In a right Δ:
  - tan θ = Perpendicular / Base (P / B) → [Most Common!]
  - sin θ = Perpendicular / Hypotenuse (P / H)
  - cos θ = Base / Hypotenuse (B / H)
- Use T-Ratios of Standard Angles:
  - tan 30° = $1/\sqrt{3}$, tan 45° = 1, tan 60° = $\sqrt{3}$
  - sin 30° = 1/2, sin 45° = $1/\sqrt{2}$, sin 60° = $\sqrt{3}/2$
  - cos 30° = $\sqrt{3}/2$, cos 45° = $1/\sqrt{2}$, cos 60° = $\frac{1}{2}$

KEY TAKEAWAY: Drawing an accurate, labelled diagram based on the question is 90% of the work! Translate the problem into right-angled triangles and apply standard trigonometric ratios to solve easily!

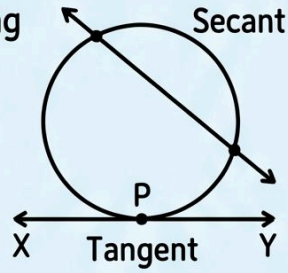
CHAPTER 10: CIRCLES

CLASS 10 MATHS

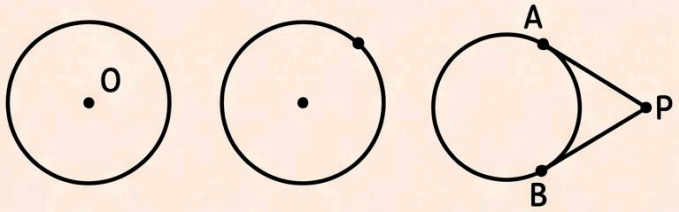
1. BASIC TERMS: LINES & CIRCLES

Secant: A line intersecting a circle at two points.

Tangent: A line touching the circle at exactly one point, called the **Point of Contact.**



2. TANGENTS FROM A POINT



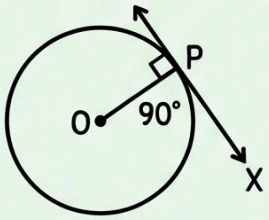
Inside: 0 tangents

On the circle: Exactly 1 tangent

Outside: Exactly 2 tangents

3. THEOREM 10.1: TANGENT & RADIUS

The tangent at any point is perpendicular (90°) to the radius through the point of contact.

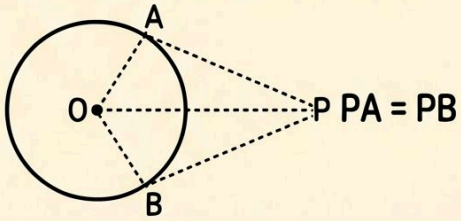


$OP \perp XY$

$\angle OPY = 90°$

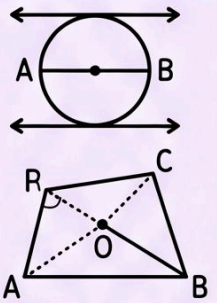
4. THEOREM 10.2: EQUAL TANGENTS

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



5. KEY GEOMETRIC RESULTS

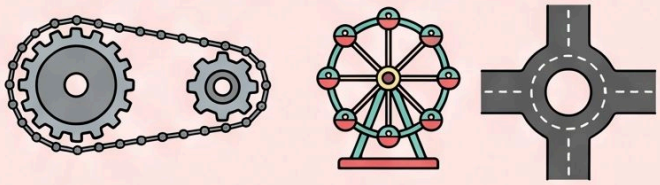
- Tangents at the ends of a diameter are parallel.
- The angle between two tangents and the angle subtended by the radii at the center are supplementary (add up to 180°).



$\angle APB + \angle AOB = 180°$

6. REAL-WORLD EXAMPLES

Where do we see these concepts?



Ferris wheels / spinning wheels

Road intersections / Roundabouts

CORE CONCEPTS / THEMES

- Identifying tangents, secants, & points of contact
- RHS Congruence to prove tangent properties
- Concentric circles and chord bisection
- Quadrilaterals circumscribing a circle

IMPORTANT FORMULAS / DEFINITIONS

- $OP \perp$ Tangent at contact point P
- Tangents from external point: $PA = PB$
- Pythagoras link: $OP^2 = AP^2 + OA^2$
- Opposite sides of circumscribed quad: $AB + CD = AD + BC$
- Supplementary angles: $\angle APB + \angle AOB = 180°$

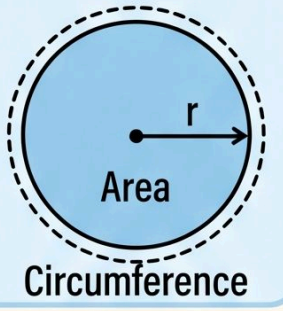
KEY TAKEAWAY: The tangent is always perpendicular to the radius at its point of contact, and tangents from an external point are equal – the golden rules of Circle geometry!

CHAPTER 11: AREAS RELATED TO CIRCLES
CLASS 10 MATHS

1. PERIMETER & AREA OF A CIRCLE

Recap of the basics.

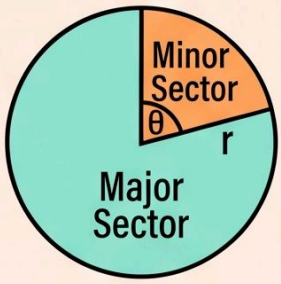
- Radius (r)
- Diameter (d = 2r)
- Circumference (Perimeter) = $2\pi r$
- Area = πr^2



2. SECTOR OF A CIRCLE 😍

"Like a pizza slice!"
A region enclosed by 2 radii and an arc.

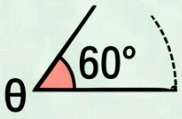
- Minor Sector
- Major Sector



3. AREA OF A SECTOR 😄

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

- Based on a fraction of the full 360° circle.



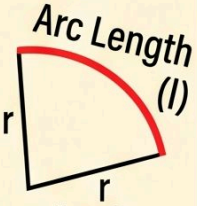
if $\theta = 60^\circ$

$$\text{Area} = \frac{60}{360^\circ} \times \pi r^2 = \frac{1}{6} \times \pi r^2$$

4. LENGTH OF AN ARC 😍

Length of the boundary of a sector.

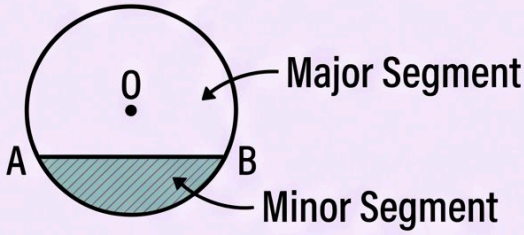
$$\text{Arc Length } (l) = \frac{\theta}{360^\circ} \times 2\pi r$$



Quick Tip: Perimeter of Sector = l + 2r (arc length plus two radii)

5. SEGMENT OF A CIRCLE

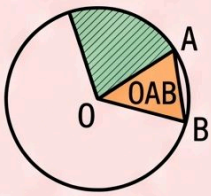
A region enclosed by a chord and an arc. (Minor Segment & Major Segment)



6. AREA OF A SEGMENT

Area of Minor Segment =
Area of Sector OAPB − Area of Triangle OAB

Shortcut:
Triangle Area = $\frac{1}{2} r^2 * \sin(\theta)$
(for $\theta = 60^\circ, 90^\circ, 120^\circ$)



Area of Major Segment =
Area of Circle − Area of Minor Segment

CORE CONCEPTS / THEMES

- Portion of a circle based on central angle θ
- Sectors (pizza slice) vs. Segments (slice cut by a chord)
- Boundary (length) vs. Internal region (area)
- Solving composite figures (adding/subtracting shapes)

IMPORTANT FORMULAS / DEFINITIONS

- Area of Circle = πr^2
- Circumference = $2\pi r$
- Arc Length (l) = $(\theta / 360^\circ) \times 2\pi r$
- Area of Sector = $(\theta / 360^\circ) \times \pi r^2$
- Area of Segment = $(\theta/360^\circ \times \pi r^2) - (1/2 * r^2 \sin \theta)$

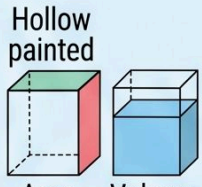
KEY TAKEAWAY: Always identify whether you need "Length" (perimeter/boundary) or "Area" (shaded space) and use the sector-minus-triangle formula to conquer any segment problem! 🤩

CHAPTER 12: SURFACE AREAS AND VOLUMES

CLASS 10 MATHS

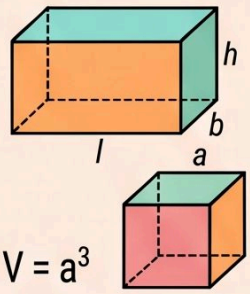
1. SURFACE AREA VS VOLUME

- **Curved/Lateral Surface Area (CSA/LSA):** Area of outer boundary (excluding top & bottom)
- **Total Surface Area (TSA):** Includes all outer faces, including top/bottom bases
- **Volume (V):** Space occupied inside a 3D object / Capacity



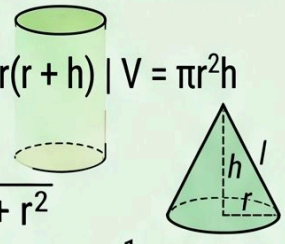
2. CUBOID & CUBE

- **Cuboid (l, b, h):**
  - CSA/LSA = $2h(l + b)$
  - TSA = $2(lb + bh + lh)$
  - V = $l \times b \times h$
- **Cube (side a):**
  - LSA = $4a^2$ | TSA = $6a^2$ | V = a^3



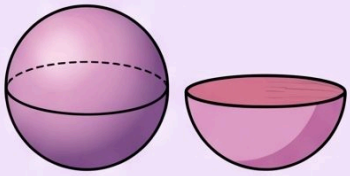
3. CYLINDER & CONE

- **Cylinder (r, h):**
  - CSA = $2\pi rh$ | TSA = $2\pi r(r + h)$ | V = $\pi r^2 h$
- **Cone (r, h, l):**
  - Slant height: $l = \sqrt{h^2 + r^2}$
  - CSA = πrl | TSA = $\pi r(l + r)$ | V = $\frac{1}{3}\pi r^2 h$



4. SPHERE & HEMISPHERE

- **Sphere (r):**
  - SA/TSA = $4\pi r^2$
  - V = $\frac{4}{3}\pi r^3$
- **Hemisphere (r):**
  - CSA = $2\pi r^2$ | TSA = $3\pi r^2$ (includes flat base)
  - V = $\frac{2}{3}\pi r^3$



5. COMBINATION OF SOLIDS

- Crucial Class 10 Concept! Calculating SA and Volume of combined shapes.
- **Volume of Combination:** Simply ADD the individual volumes of the constituent shapes. $V_{total} = V1 + V2$
- **Surface Area of Combination:** Calculate only the VISIBLE, outer exposed areas! (Be careful: hidden joint faces must be excluded!)



6. REAL-WORLD EXAMPLES

Where do we see this?

- **Medicine Capsules** (Cylinder + 2 Hemispheres)
- **Amusement/Circus Tents** (Cone + Cylinder)
- **Ice Cream Cones** (Hemisphere + Cone)
- **Storage Silos** / Toy models





CORE CONCEPTS / THEMES

- Decomposing complex 3D shapes into basic ones
- Watch out for units! Always convert to the same unit (e.g., cm, m) before calculating
- Recognize exposed vs. hidden boundaries
- Concept of 'Recasting' or 'melting' (noting volume remains constant)

IMPORTANT FORMULAS / DEFINITIONS

- Slant Height of Cone: $l = \sqrt{h^2 + r^2}$
- Surface Area of sphere is always equal to its total surface area (no CSA distinction)
- Unit of Area: sq. units (cm^2, m^2) | Unit of Volume: cubic units (cm^3, m^3, litres)
- 1 m^3 = 1000 litres | 1 litre = 1000 cm^3

KEY TAKEAWAY: Visualize the solid first, decompose it into basic shapes, and be careful to calculate ONLY the visible outer surfaces for Total Surface Area!

STATISTICS

CLASS 10 MATHEMATICS

01 | GROUPED DATA & TERMS



1	2	4
2	8	2
3	9	2
4	10	4

- 📊 **Grouped Data:** Raw data organized into Class Intervals (e.g., 10-20).
- 🎯 **Class Mark (x_i):** Mid-point of an interval. $x_i = \frac{\text{Upper limit + Lower limit}}{2}$
- 📈 **Cumulative Frequency (cf):** Running total of frequencies used for Median.

02 | MEAN ($\bar{x}$) - THE AVERAGE



- ⚖️ **The Average:** Represents the central value of data.
- **Three Calculation Methods:**
  - 🔷 **Direct Method:** $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$
  - 🔷 **Assumed Mean:** $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$, where $d_i = x_i - a$
  - 🔷 **Step-Deviation:** $\bar{x} = a + h \times \frac{\sum f_i u_i}{\sum f_i}$, where $u_i = \frac{x_i - a}{h}$

03 | MEDIAN - THE MIDDLE VALUE



- 📍 **Middle Value:** Splits the data into two equal halves.
- 🔍 **Median Class:** The class where cumulative frequency (cf) is just greater than N/2 (where $N = \sum f_i$).
- 📏 **Formula:** $\text{Median} = \ell + \left[\frac{N/2 - cf}{f}\right] \times h$

  ℓ = lower limit, cf = preceding cumulative freq, f = freq, h = class size.

04 | MODE - MOST FREQUENT



- 🔥 **Most Popular:** The value that occurs most frequently.
- 🎯 **Modal Class:** The class interval with the highest frequency.
- 📏 **Formula:** $\text{Mode} = \ell + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$

  ℓ = lower limit, f_1 = modal class freq, f_0 = preceding freq, f_2 = succeeding freq, h = class size.

CORE CONCEPTS & THEMES

- 📌 **Measures of Central Tendency:** Single values that find the middle (Mean, Median, Mode).
- 📊 **Continuous Distributions:** Moving beyond ungrouped data to analyze continuous intervals.
- 📉 **Data Handling:** Creating frequency distributions to visually organize chaos.

IMPORTANT RELATIONSHIP

Highlighting the legendary empirical formula

✨ **Empirical Formula:**
Mode = 3 Median - 2 Mean

- 📝 **Total Frequency (N):** $\sum f_i$
- 📝 **Class Size (h):** Upper Limit - Lower Limit

KEY TAKEAWAY: Mastering Statistics helps us simplify massive, chaotic real-world data into three key numbers—Mean, Median, and Mode—to find trends, make comparison, and unlock smart decision-making! 💡

CHAPTER 14

PROBABILITY

CLASS 10 MATHEMATICS

01 | BASIC TERMS & DEFINITIONS



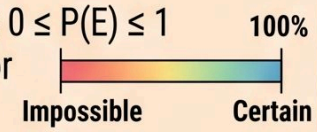
- **Probability:** Ra... of favorable out... number of possible o...

$$P(E) = \frac{\text{Number of outcomes favorable to E}}{\text{Total number of possible outcomes}}$$

- **Outcome:** The possible result of a random experiment.
- **Sample Space (S):** The set of all possible outcomes.
- **Event (E):** A subset of the sample space.

02 | RANGE & SPECIAL EVENTS

- **Range of Probability:** $0 \le P(E) \le 1$ (cannot be negative or greater than 1).



- **Impossible Event:** $P(E) = 0$ (e.g., rolling a 7 on a 6-sided die).
- **Sure/Certain Event:** $P(E) = 1$ (e.g., rolling a number < 7).
- **Complementary Events:** Events E and Not E ($\bar{E}$). $P(E) + P(\text{not } E) = 1$" or "$P(\bar{E}) = 1 - P(E)$

03 | COIN & DICE EXPERIMENTS



- **Tossing Coins (2^n outcomes):**
  - **1 Coin**: {H, T} (Total = 2)
  - **2 Coins**: {HH, HT, TH, TT} (Total = 4)
  - **3 Coins**: 8 possible outcomes (e.g., HHH to TTT).
- **Rolling Dice (6^n outcomes):**



  - **1 Die**: {1, 2, 3, 4, 5, 6} (Total = 6)
  - **2 Dice**: 36 outcomes, (1,1) to (6,6).

💡 **Tip:** 1 is NOT a prime number; primes on a die are {2, 3, 5}.

04 | DECK OF CARDS (52 CARDS)



- **Total Cards** = 52 (divided into 4 suits of 13 cards each):
  - **Red (26)**: 13 Hearts (♥), 13 Diamonds (♦)
  - **Black (26)**: 13 Spades (♠), 13 Clubs (♣)
- **Face Cards (12):** Kings (4), Queens (4), Jacks (4).
- 🚨 **Trap Alert:** Aces (4) are NOT face cards!
- Each suit has: Ace, 2-10, Jack, Queen, King.

CORE CONCEPTS & THEMES

- 🎲 **Equally Likely Outcomes**: Every outcome has the exact same chance of occurring (unbiased).
- 🔮 **Sum of Probabilities:** The sum of the probabilities of all elementary events in an experiment is 1.

IMPORTANT TIPS & TRICKS

- 🔠 **Representation:** Always simplify fractions or write as a decimal (0 to 1) / percentage (0% to 100%).
- ⚠️ **Word Alert:** Look closely at 'at least' (≥) and 'at most' (≤).

KEY TAKEAWAY: Probability calculates how likely something is to happen, based on the ratio of desired outcomes to all possible outcomes. It is the perfect bridge between math and real-life chances! 💡