

$$\sin(0^\circ) = 0$$

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

Class 10 Mathematics Formula Book

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

$$\frac{x^a}{x^b} = x^{a-b}$$

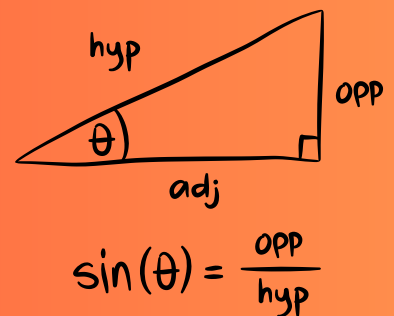




Table of Contents

Chapter 1 – Real Numbers	2
Chapter 2 – Polynomials	4
Chapter 3 – Pair of Linear Equations in Two Variable	9
Chapter 4 – Quadratic Equations	12
Chapter 5 – Arithmetic Progressions	15
Chapter 6 – Triangles	18
Chapter 7 – Coordinate Geometry	22
Chapter 8 – Introduction to Trigonometry	24
Chapter 9 – Applications of Trigonometry	27
Chapter 10 – Circles	30
Chapter 11 – Areas Related to Circles	32
Chapter 12 – Surface Areas and Volumes	35
Chapter 13 – Statistics	37
Chapter 14 – Probability	40

Class 10 Maths – Real Numbers (Formula & Key Notes)

◆ 1. HCF (Highest Common Factor)

 **Definition:** The **largest number** that divides two or more given numbers exactly.

✦ **How to Find HCF:**

-  **Prime Factorization Method** → Take **lowest powers** of common prime factors.
-  **Euclid's Division Algorithm** → Keep dividing until remainder = 0. Last divisor = HCF.

✓ **Example:**

$$48 = 2^4 \times 3, 72 = 2^3 \times 3^2$$

👉 $\text{HCF} = 2^3 \times 3 = \mathbf{24}$

◆ 2. LCM (Lowest Common Multiple)

 **Definition:** The **smallest number** that is a multiple of two or more given numbers.

✦ **How to Find LCM:**

-  **Prime Factorization Method** → Take **highest powers** of all prime factors.

✓ **Example:**

$$48 = 2^4 \times 3, 72 = 2^3 \times 3^2$$

👉 $\text{LCM} = 2^4 \times 3^2 = \mathbf{144}$

◆ 3. Relation between HCF & LCM

$\text{HCF} \times \text{LCM} = \text{Product of the Numbers}$

✓ **Example:** $24 \times 144 = 48 \times 72$ ✓

◆ 4. When to Use HCF & LCM in Word Problems

- ✦ **HCF → "Greatest Division" Problems**
 - Cutting rope into equal parts

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- Grouping items into maximum size groups
- ✨ LCM → “Common Multiple” Problems
 - Finding when two bells ring together
 - Repetition cycles (like traffic lights, wheels)

💡 **Tip:** If the problem says **maximum / largest size** → HCF.
 If it says **first / minimum common time or multiple** → LCM.

◆ 5. Irrational Numbers Proof

👉 $\sqrt{2}, \sqrt{3}, \sqrt{5} \dots$ are **irrational**.

Method:

1. Assume $\sqrt{p} = a/b$ (lowest terms).
2. Square → p divides a^2 → p divides a .
3. Contradiction → $\sqrt{p}$ cannot be rational.

◆ 6. Decimal Expansions of Rational Numbers

If p/q ($q \neq 0$, in lowest form):

- ✓ **Terminating Decimal** → If denominator q has only **2 or 5** as prime factors.
 Example: $1/8 = 0.125$
- ✓ **Non-Terminating, Recurring Decimal** → If denominator q has prime factors **other than 2 or 5**.
 Example: $1/7 = 0.142857\dots$ (repeats)

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Class 10 Maths – Polynomials (Formula & Key Notes)

◆ 1. Polynomial Basics

A polynomial in x is an expression of the form:

$$p(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0, a_n \neq 0$$

Where:

- ◆ $a_i \rightarrow$ coefficients (real numbers)
- ◆ $n \rightarrow$ degree of polynomial (highest power of x)

Types of Polynomials:

- ◆ Linear (degree 1): $ax + b$
 - ◆ Quadratic (degree 2): $ax^2 + bx + c$
 - ◆ Cubic (degree 3): $ax^3 + bx^2 + cx + d$
-

◆ 2. Zeros (Roots) of a Polynomial

- Definition: Zero of a polynomial = value of x for which $p(x) = 0$
 - 💡 Meaning: Zeros are x -coordinates where polynomial graph intersects x -axis
-

◆ 3. Relationships Between Coefficients & Zeros

(i) Quadratic Polynomial ($ax^2 + bx + c$) with zeros α & β

- Sum of roots: $\alpha + \beta = -b / a$
- Product of roots: $\alpha \times \beta = c / a$

✓ Tip: Useful for solving word problems & MCQs

(ii) Cubic Polynomial ($ax^3 + bx^2 + cx + d$) with zeros α, β, γ

- Sum of roots: $\alpha + \beta + \gamma = -b / a$
 - Sum of product of roots taken two at a time: $\alpha\beta + \beta\gamma + \gamma\alpha = c / a$
 - Product of roots: $\alpha\beta\gamma = -d / a$
-

(iii) General Rule (Degree n Polynomial)

- For $x^n + a_1x^{n-1} + a_2x^{n-2} + \dots + a_n$
 - Relations between roots and coefficients are given by Vieta's Formula
-

◆ 4. Division Algorithm (VERY IMPORTANT)

If $p(x)$ and $g(x)$ are polynomials, $g(x) \neq 0$, then:

$$p(x) = g(x) \cdot q(x) + r(x), \deg(r) < \deg(g)$$

Where:

- $q(x)$ = quotient
- $r(x)$ = remainder

✓ Used in questions like: "Find remainder when $p(x)$ is divided by $(x - a)$ "

◆ 5. Graphs of Polynomials

- Linear Polynomial ($ax + b$): Straight line, cuts x-axis at 1 point
- Quadratic Polynomial: Parabola, cuts x-axis at 0, 1, or 2 points

- Cubic Polynomial: Can cut x-axis at 1 or 3 points
-
-

♦ 7. Commonly Asked in Exams

- Find polynomial when zeros are given
 - Verify relation between zeros & coefficients
 - Division algorithm-based remainder/factor problems
 - Graph-based reasoning (number of zeros)
 - Word problems: Sum/product of roots given, form equation
-

♦ 8. Key Tips

- ✓ Always reduce polynomial to standard form before applying formulas
 - ✓ Don't forget signs in $\alpha + \beta = -b/a$
 - ✓ For cubic, carefully check middle term (common exam mistake)
 - ✓ In graphs, number of x-axis intersections = number of real zeros
-

✨ Notes Tip: This is exam-focused & meaningful — connects formulas + usage in

Quadratic Polynomial

◆ 1. Standard Form

A quadratic polynomial is written as:

$$p(x) = ax^2 + bx + c, a \neq 0$$

Where:

- ◆ $a \rightarrow$ coefficient of x^2
 - ◆ $b \rightarrow$ coefficient of x
 - ◆ $c \rightarrow$ constant term
-

◆ 2. Shape of the Parabola (Based on 'a')

-  $a > 0 \rightarrow$ Parabola opens $\uparrow$ upwards
 -  $a < 0 \rightarrow$ Parabola opens $\downarrow$ downwards
-

◆ 3. Vertex & Axis of Symmetry

- ✨ Vertex: $x = -b / 2a$
 - ✨ Axis of Symmetry: Vertical line through vertex
-

◆ 4. Zeros (Roots) & Coefficient Relation

Let roots = α, β

- 💡 Sum of roots: $\alpha + \beta = -b / a$

- 💡 Product of roots: $\alpha \times \beta = c / a$
-

◆ 5. Discriminant (D) & Nature of Roots

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

- ✅ $D > 0 \rightarrow$ Two distinct real roots (cuts x-axis at 2 points)
 - ✅ $D = 0 \rightarrow$ Two equal roots (touches x-axis at 1 point)
 - ✅ $D < 0 \rightarrow$ No real roots (does not cut x-axis)
-

◆ 6. Effect of Coefficients on Graph

- ◆ $a \rightarrow$ Opening direction ($\uparrow$ or $\downarrow$)
 - ◆ $b \rightarrow$ Shifts vertex left/right
 - ◆ $c \rightarrow$ y-intercept (where graph cuts y-axis)
-

◆ 7. Exam-Oriented Tips

- ✓ Always check sign of a first
 - ✓ Use discriminant D to find number of real roots quickly
 - ✓ Use $\alpha + \beta = -b/a$ and $\alpha\beta = c/a$ for forming equations
 - ✓ Word problems may ask:
 - Form quadratic from roots
 - Verify sum/product of roots
 - Decide nature of root
-

Class 10 Maths – Pair of Linear Equations in Two Variables

◆ 1. Standard Form of a Linear Equation in Two Variables

A linear equation in two variables x and y is written as:

$$ax + by + c = 0, a \neq 0, b \neq 0$$

Where:

- ◆ $a, b, c \rightarrow$ constants
- ◆ $x, y \rightarrow$ variables

Graphical Meaning: The equation represents a **straight line** in the xy -plane

◆ 2. Pair of Linear Equations

- Two linear equations in two variables:

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

- The solution is the point (x, y) where **both lines intersect**
-

◆ 3. Methods to Solve a Pair of Linear Equations

(i) Substitution Method

1. Solve one equation for one variable
2. Substitute into the other equation
3. Solve for the second variable
4. Substitute back to find the first variable

(ii) Elimination Method

1. Multiply equations if needed to make coefficients equal
2. Add/subtract to eliminate one variable
3. Solve for the remaining variable
4. Substitute back to find the eliminated variable

✓ Quick method when both equations are in standard form

◆ 4. Condition for Number of Solutions

Condition	Meaning
$a_1/a_2 \neq b_1/b_2$	✓ Unique solution → lines intersect at one point
$a_1/a_2 = b_1/b_2 \neq c_1/c_2$	✗ No solution → lines are parallel
$a_1/a_2 = b_1/b_2 = c_1/c_2$	◆ Infinite solutions → lines are coincident

◆ 5. Word Problem Tips

- Represent situations algebraically → form **two linear equations**
- Check if **lines intersect, parallel, or coincident** → solution type
- Solve using **substitution / elimination / cross-multiplication**

💡 **Hint:** Use ratios $a_1:a_2$, $b_1:b_2$, $c_1:c_2$ to quickly check number of solutions

◆ 6. Special Notes for Exams

- Always reduce equations to **standard form**: $ax + by + c = 0$
- Label variables clearly ($x = ?$, $y = ?$) in word problems
- Check consistency (unique, none, infinite) before solving

- Verify solution by **substituting in both equations**
-

◆ 7. Key Tips & Tricks

- ✓ Substitution: use when one variable has coefficient ± 1
- ✓ Elimination: use when coefficients can be easily matched
- ✓ Cross-multiplication: fast for standard form equations
- ✓ Always double-check signs to avoid mistakes in ratios



Class 10 Maths – Quadratic Equations

◆ 1. Standard Form

A quadratic equation in variable x is written as:

$$ax^2 + bx + c = 0, a \neq 0$$

Where:

- ◆ $a \rightarrow$ coefficient of x^2
 - ◆ $b \rightarrow$ coefficient of x
 - ◆ $c \rightarrow$ constant term
-

◆ 2. Roots (Solutions) of Quadratic Equation

- The values of x which satisfy $ax^2 + bx + c = 0$ are called roots of the equation.
 - Roots can be real or complex depending on discriminant.
-

◆ 3. Discriminant (D) and Nature of Roots

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

Discriminant (D) Nature of Roots

$D > 0$ Two distinct real roots

$D = 0$ Two equal real roots

$D < 0$ Two complex conjugate roots

◆ 4. Quadratic Formula

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

- Use this formula to **find exact roots** of any quadratic equation.

◆ 5. Factorization Method

- Express quadratic as a product of two linear factors:

$$ax^2 + bx + c = (px + q)(rx + s) = 0$$

- Then solve: $px + q = 0$ or $rx + s = 0$

◆ 6. Relationship Between Roots & Coefficients

Let roots = α, β

- 💡 Sum of roots: $\alpha + \beta = -b / a$
- 💡 Product of roots: $\alpha \times \beta = c / a$

✓ Very useful in forming equations or solving word problems.

◆ 7. Word Problem Tips

- Represent problem in the form $ax^2 + bx + c = 0$
- Check if you can factorize easily; otherwise use quadratic formula

- Use sum/product of roots for shortcut solutions
 - Verify roots by substituting back into equation
-

◆ 8. Key Exam Tips

- ✓ Always check if the quadratic can be factorized first (simpler & faster)
- ✓ Discriminant D tells number & type of roots instantly
- ✓ Use sum/product of roots for equations from word problems
- ✓ Watch out for sign mistakes with b and c

Class 10 Maths – Arithmetic Progression (AP)

◆ 1. Definition of AP

An **Arithmetic Progression (AP)** is a sequence of numbers in which the **difference between consecutive terms is constant**.

- **Common Difference:** $d = \text{second term} - \text{first term} = a_2 - a_1$
- **First term:** $a_1 = a$
- **n-th term:** $a_n = a + (n - 1)d$

 **Tip:** Always check if difference is **positive (increasing)** or **negative (decreasing)**

◆ 2. Formulae of AP

(i) n-th term

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

- a = first term
- d = common difference
- n = position of the term

•

(ii) Sum of first n terms

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

Or, using first term and last term:

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

- $l = n\text{-th term} = \text{last term}$

(iii) Difference between consecutive sums

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

- Useful to find a particular term if sum of n terms is given

◆ 3. Tips for Special Term Patterns

✓ 3-Term AP → $a-d, a, a+d$

- Middle term = average of first and third
- Sum of 3 terms = $3a$

✓ 4-Term AP → $a-3d, a-d, a+d, a+3d$

- Pair terms from ends: $(a-3d + a+3d), (a-d + a+d)$
- Sum = $4a$

✓ 5-Term AP → $a-2d, a-d, a, a+d, a+2d$

- Symmetric pattern → sum = $5a$
- Middle term = a

💡 **Tip:** Sum of n -term symmetric AP = $n \times \text{middle term}$

◆ 4. Relations and Tricks

- **Sum of terms equidistant from ends = constant** → always $2a$ for symmetric AP
 - **If sum of n terms and common difference known** → can find a or d
 - **Word problems:** Often sum of terms given → identify first term or common difference using formulas
-

◆ 5. Examples for Quick Reference

1. **Given 3-term AP:** $a-d, a, a+d \rightarrow \text{sum} = 3a$
2. **Given 4-term AP:** $a-3d, a-d, a+d, a+3d \rightarrow \text{sum} = 4a$
3. **Given 5-term AP:** $a-2d, a-d, a, a+d, a+2d \rightarrow \text{sum} = 5a$

✓ Useful shortcut: For **odd number of terms** → **sum = number of terms $\times$ middle term**

◆ 6. Key Exam Tips

- ✓ Check if terms are **symmetrically arranged around middle term**
- ✓ Use $a_n = S_n - S_{n-1}$ for problems with **sum given**
- ✓ Always write **first term, common difference clearly**
- ✓ For sums → pair first & last, second & second-last etc. to simplify
- ✓ Check signs of d carefully for decreasing AP

Class 10 Maths – Triangles (Chapter 6: CBSE) – Quick Notes

◆ 1. Congruence of Triangles – Quick Recall

Two triangles are **congruent** → same shape & same size

Criteria (Shortcut Formulas for Exams):

Rule Check / Use

SSS All three sides equal → triangles congruent

SAS Two sides + included angle equal → congruent

ASA Two angles + included side equal → congruent

AAS Two angles + non-included side → congruent

RHS Right triangle: hypotenuse + one side equal → congruent

 **Exam Tip:**

- Congruence → **exact matching sides & angles**
 - Use when **lengths are given** or to **prove equal sides/angles**
-

◆ 2. Similarity of Triangles – Quick Recall

Two triangles are **similar** → same shape, different size

- **Corresponding angles equal**
- **Corresponding sides proportional**

Shortcut Criteria:

Rule Check / Use

AA Two angles equal → triangles similar

AAA All angles equal → triangles similar

SAS One angle equal + sides around it in same ratio → similar

SSS Corresponding sides in same ratio → similar

💡 Exam Tip:

- Similarity → **ratios of sides** → quickly solve lengths & ratios
- If angles given → use **AA/AAA**
- If sides given → use **SAS/SSS**

◆ 3. Basic Proportionality Theorem (BPT)

- Line parallel to one side of triangle divides other two sides proportionally

Formula / Shortcut:

$$\frac{AE}{EB} = \frac{AF}{FC} \quad (\text{If } DE \parallel BC)$$

💡 Exam Tip:

- Look for **parallel line** in figure
- Apply ratio → find **unknown lengths**
- Often combined with **similarity**

•

◆ 4. Quick Step-by-Step for Questions

1. **Identify type:** Congruence (equal size) or Similarity (same shape)

2. Choose rule:

- Congruence $\rightarrow$ SSS, SAS, ASA, AAS, RHS
- Similarity $\rightarrow$ AA, AAA, SAS, SSS

3. **Check sides/angles given** $\rightarrow$ pick correct criterion

4. **Apply ratios (similar) or equal sides/angles (congruent)**

5. **Use BPT if parallel line exists** $\rightarrow$ shortcut for lengths

6. **Write final answer clearly (length/ratio/equality)**

 **Tip:** Always look for triangles inside triangles for ratios

- Pair angles / sides **symmetrically**
- Draw **parallel lines mentally** if not shown

◆ 5. High-Yield Exam Patterns

- **Prove triangles are similar** $\rightarrow$ usually AA or SAS
- **Find unknown sides** $\rightarrow$ use **similarity ratios / BPT**
- **Check congruence to prove equality of sides/angles** $\rightarrow$ SSS, SAS, ASA
- **Word problems** $\rightarrow$ triangle in ladder, poles, shadows $\rightarrow$ **similarity + ratios**

Concept	Criteria / Formula	Use in Questions
Congruence	SSS, SAS, ASA, AAS, RHS	Prove triangles exactly same $\rightarrow$ find equal sides/angles
Similarity	AA, AAA, SAS, SSS	Find unknown sides, ratio of lengths
BPT	Line	

✨ Pro Tips

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- **Always look for parallel lines** → use BPT
 - **Angle equality first** → decide similarity quickly
 - **Sides given** → check SSS/SAS first
 - **Symmetry in triangle** → look for shortcuts in ratios
 - **Draw small sketch mentally** → speeds up exam solving
-



Class 10 Maths – Chapter 7: Coordinate Geometry – Quick Notes

◆ 1. Basics of Coordinate Geometry

- A point in a plane is written as (x, y)
- $x \rightarrow$ x-coordinate (abscissa)
- $y \rightarrow$ y-coordinate (ordinate)

👉 On X-axis: $y = 0$

👉 On Y-axis: $x = 0$

◆ 2. Distance Formula

For two points $A(x_1, y_1)$ and $B(x_2, y_2)$:

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

💡 Use in exams:

- To check if triangle is isosceles, equilateral, or right-angled
 - To find length of sides
-

◆ 3. Midpoint Formula

For midpoint $M(x, y)$ of line joining $A(x_1, y_1)$ and $B(x_2, y_2)$:

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

💡 Use in exams:

- To prove diagonals bisect each other (parallelogram, rhombus)
-

◆ 4. Section Formula

If a point $P(x, y)$ divides the line joining $A(x_1, y_1)$ and $B(x_2, y_2)$ in ratio $m : n$:

$$P \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

⚡ **Special Case (Internal Division, Ratio $k : 1$):**

$$P \left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1} \right)$$

💡 **Use in exams:**

- To find coordinates of a point dividing a line in given ratio
- To find ratio when coordinates are given (reverse use)

◆ 5. Centroid of a Triangle

For triangle with vertices $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$:

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

💡 **Use in exams:**

- To find centroid directly
- To check if point lies inside triangle

◆ 6. How to Decide Which Formula to Use

- Length of line / side → Distance Formula
- Middle point of line → Midpoint Formula
- Point dividing in ratio → Section Formula ($m:n$ or $k:1$)
- Triangle centroid → Centroid Formula



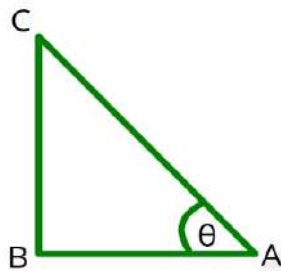
Class 10 Maths – Chapter 8: Trigonometry

Quick Notes & Formulas

◆ 1. Trigonometric Ratios (for a right-angled $\triangle ABC$, right angle at B)

If $\angle A = \theta$:

- Base (adjacent to θ) = AB
- Perpendicular (opposite to θ) = BC
- Hypotenuse = AC



$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{AB}{BC}$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{AC}{AB}$$

$$\csc \theta = \frac{1}{\sin \theta} = \frac{AC}{BC}$$

✓ **Tip:** Remember — “Soh-Cah-Toa”

- $\sin = \text{Opp/Hyp}$
- $\cos = \text{Adj/Hyp}$
- $\tan = \text{Opp/Adj}$

◆ 2. Trigonometric Values of Standard Angles

θ (degrees)	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	$\sqrt{3}$	∞
$\cot \theta$	∞	$\sqrt{3}$	1	$1/\sqrt{3}$	0
$\sec \theta$	1	$2/\sqrt{3}$	$\sqrt{2}$	2	∞
$\csc \theta$	∞	2	$\sqrt{2}$	$2/\sqrt{3}$	1

◆ 3. Reciprocal Relations

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

◆ 4. Quotient Relations

$$\tan \theta = \frac{\sin \theta}{\cos \theta}, \quad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

◆ 5. Pythagorean Identities

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

✓ **Tip:** Always start from these for identity proof questions.

◆ 6. Trigonometric Ratios of Complementary Angles

$$\sin(90^\circ - \theta) = \cos \theta, \quad \cos(90^\circ - \theta) = \sin \theta$$

$$\tan(90^\circ - \theta) = \cot \theta, \quad \cot(90^\circ - \theta) = \tan \theta$$

$$\sec(90^\circ - \theta) = \csc \theta, \quad \csc(90^\circ - \theta) = \sec \theta$$

◆ 7. Key Exam Identities to Prove / Use

$$✓ \frac{1 - \cos \theta}{\sin \theta} = \frac{\sin \theta}{1 + \cos \theta}$$

$$✓ \sec^2 \theta - \tan^2 \theta = 1$$

$$✓ \csc^2 \theta - \cot^2 \theta = 1$$

$$✓ \frac{1 + \cos \theta}{\sin \theta} = \csc \theta + \cot \theta$$

$$✓ \frac{1 - \cos \theta}{\sin \theta} = \csc \theta - \cot \theta$$

◆ 8. How to Approach Exam Questions

- **Direct Formula Use** → ratio values, reciprocal, quotient
- **Proof Questions** → always start with LHS and simplify using identities
- **Word Problems** → convert height & distance into right-angled triangle → apply sin, cos, tan

Class 10 Maths – Chapter 9: Applications of Trigonometry

Quick Revision Formulae

◆ 1. Important Terms

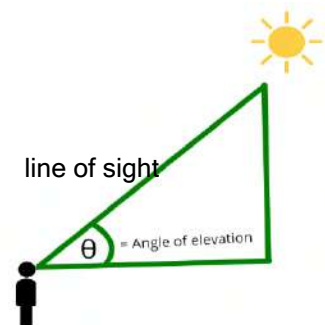
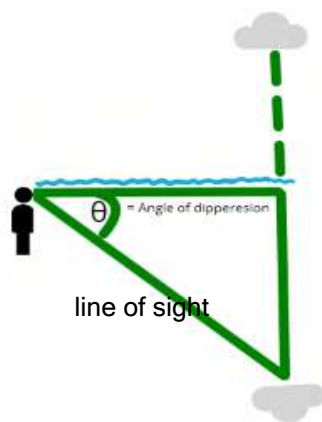
- **Line of Sight:** The straight line drawn from the eye of an observer to the top (or bottom) of an object.
- **Angle of Elevation (θ):** The angle formed when we look **upward** at an object from the horizontal line.
- **Angle of Depression (θ):** The angle formed when we look **downward** at an object from the horizontal line.

 In both cases, the reference line is **horizontal**.

◆ 2. Right Triangle Formation

In every height & distance problem:

- Object (building, tower, tree, pole, mountain, etc.) $\rightarrow$ forms **perpendicular**
- Distance on ground $\rightarrow$ forms **base**
- Line of sight $\rightarrow$ forms **hypotenuse**
- Then use: **sin, cos, tan**



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◆ 3. Key Formulas

For a right-angled triangle:

$$\tan \theta = \frac{\text{Perpendicular (height)}}{\text{Base (distance)}}$$

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

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

💡 In CBSE problems → Tan ratio is most used.

◆ 4. Standard Cases

✓ Case 1: Height of Object (Building/Tower/Pole)

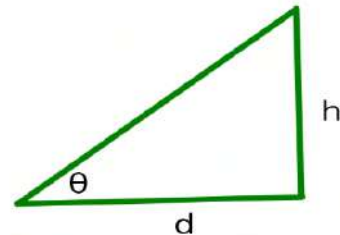
If angle of elevation θ and distance d are known:

$$\text{Height} = d \cdot \tan \theta$$

✓ Case 2: Distance from Object

If height h and angle θ are known:

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



✓ Case 3: Two Observations at Different Angles

If observer sees top of object at angles θ_1 and θ_2 from two different points:

- Form **two right triangles**
- Apply **tan formula twice**
- Solve equations simultaneously

✓ **Case 4: Angle of Depression (from top of building/tower to object on ground)**

- Draw horizontal line from observer's eye
 - Angle of depression = angle of elevation (alternate interior angles)
 - Use same tan/cos/sin formulas
-

◆ **5. Exam Tips**

- ✓ Always draw a **neat diagram** → marks for diagram too
 - ✓ Mark angle clearly as **elevation (↑) or depression (↓)**
 - ✓ Convert **word to math**: "height of tower", "distance from object", etc.
 - ✓ If observer's eye level is given (say 1.5 m), **subtract/add it** from total height accordingly
 - ✓ Use **tan θ** wherever possible → simplest ratio for height/distance
 - ✓ Keep answer in **meters (m)** or as per unit given
-

◆ **6. What CBSE Asks (2025)**

- **1 Mark / 2 Marks**: Direct formula-based (height/distance with one angle).
- **3 Marks**: Two-step problems (two angles of elevation/depression).
- **4 Marks**: Application type with real life context (airplane, lighthouse, balloon, building, mountain)

Class 10 Maths – Chapter 10: Circles – Quick Notes

◆ 1. Key Concepts

- A **circle** is the set of all points in a plane at a fixed distance (radius) from a fixed point (centre).



- A **tangent** to a circle is a line that touches the circle at exactly **one point**.



- The point where the tangent touches the circle is called the **point of contact**.

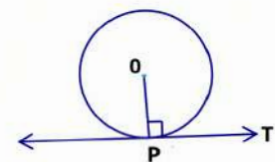
👉 Tangent $\neq$ Secant (secant cuts circle at 2 points, tangent touches at 1 point).

◆ 2. Important Theorems

Theorem 1:

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

$$OP \perp \text{Tangent at } P$$

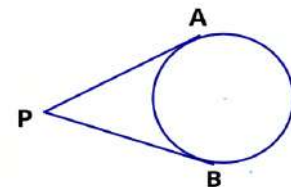


Theorem 2:

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

$$PA = PB$$

(where P is an external point, A and B are points of contact)



◆ 3. Properties of Tangents

- From an external point, **exactly two tangents** can be drawn to a circle.
- If **OP** is distance from external point O to centre of circle, and radius is r :

$$\text{Length of each tangent} = \sqrt{OP^2 - r^2}$$

◆ 4. Number of Tangents Possible

- Point on circle → 1 tangent
- Point outside circle → 2 tangents
- Point inside circle → 0 tangents

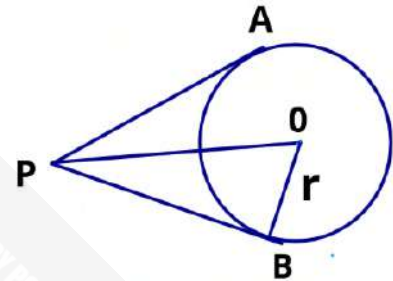


Fig. 3

◆ 6. How to Apply in Questions

- ✓ Use radius $\perp$ tangent to form right triangle → apply Pythagoras.
- ✓ If two tangents from external point → take them equal.
- ✓ If tangent length asked → use $\sqrt{OP^2 - r^2}$.
- ✓ In exam, always draw circle + tangent + radius before solving.

◆ 7. CBSE Question Types (2025)

1. **Prove tangent $\perp$ radius** (Theorem based).
2. **Find length of tangent** given radius & distance from centre.
3. **Two tangents from external point** → form isosceles triangle, solve.
4. **Application sums** (circle in real life: wheel, park, etc.).

CBSE Class 10 Mathematics – Chapter 12: Areas Related to Circles

◆ Basic Formulas

1. Area of Circle

$$A = \pi r^2$$

2. Circumference of Circle (Perimeter)

$$C = 2\pi r$$

3. Length of Arc (l):

If arc subtends angle θ at center (θ in degrees)

$$l = \frac{\theta}{360^\circ} \times 2\pi r$$

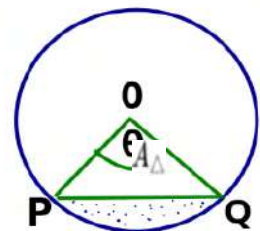
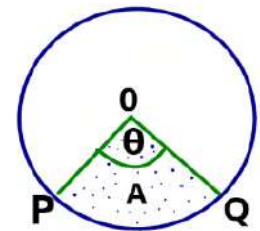
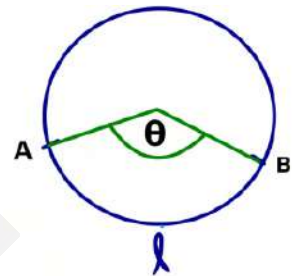
4. Area of Sector (A_{sector}):

$$A = \frac{\theta}{360^\circ} \times \pi r^2$$

5. Area of Segment (A_{segment}):

$$A = A_{\text{sector}} - A_{\Delta}$$

(Here A_{Δ} is area of triangle formed by radii and chord)



◆ Special Cases

1. Semicircle:

$$\text{Area} = \frac{1}{2}\pi r^2, \text{ Perimeter} = \pi r + 2r$$

2. Quadrant (Quarter Circle):

$$\text{Area} = \frac{1}{4}\pi r^2, \text{ Perimeter} = \frac{1}{2}\pi r + 2r$$

◆ Important Tips

✓ Whenever angle θ is given in **radians**, use:

$$l = r\theta, \quad A = \frac{1}{2}r^2\theta$$

✓ To find **shaded region**, always calculate:

Area of big figure – Area of small figure(s)

✓ For questions with **two circles (concentric or overlapping)**:

- Area of ring = $\pi(R^2 - r^2)$ (R = outer radius, r = inner radius)

✓ In word problems (fields, gardens, roads, etc.), convert into **sector/segment/sum of circle parts**.



◆ Quick Diagram References (Text-Mode)

1. Circle with Radius r

- Center O , arc AB subtends angle θ at O
- Sector $OAB = \frac{\theta}{360^\circ} \pi r^2$
- Arc length $AB = \frac{\theta}{360^\circ} 2\pi r$

2. Segment

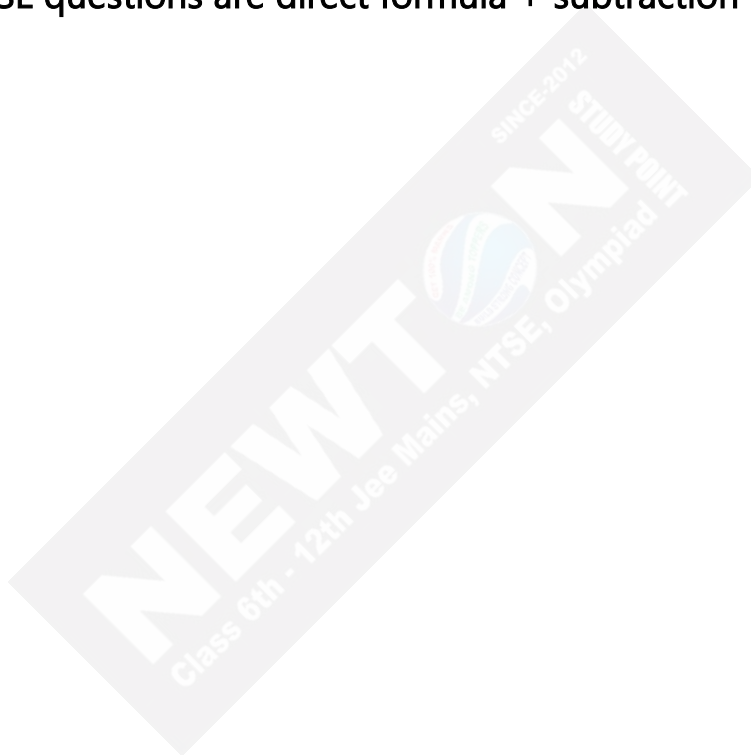
- Segment = Sector – Triangle OAB

◆ Theorems / Results Used

1. Angle at center = $2 \times$ angle at circumference
(Sometimes used in finding θ)
2. Perpendicular from center to chord bisects chord
(Helps in finding triangle area inside circle)

✦ Final Exam Tip:

- Always check whether θ is given in degrees or radians.
- Read carefully if question is about sector, segment, semicircle, or shaded part.
- Most CBSE questions are direct formula + subtraction method.



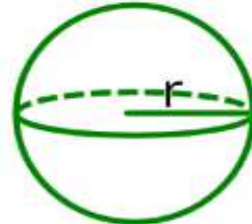
CBSE Class 10 Mathematics – Chapter 12

SURFACE AREA AND VOLUME

1. Surface Area Formulas

Sphere

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



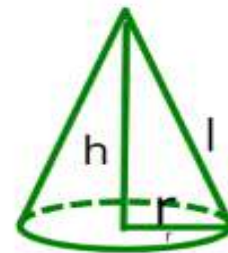
Hemisphere

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



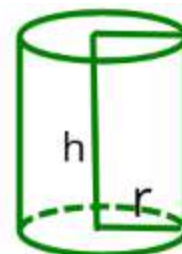
Cone

- Slant height (l) = $\sqrt{r^2 + h^2}$
- CSA = $\pi r l$
- TSA = $\pi r l + \pi r^2$
- Volume = $\frac{1}{3}\pi r^2 h$



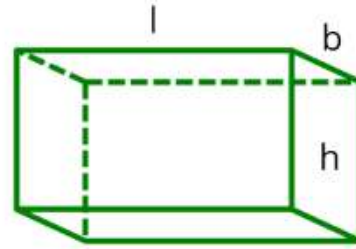
Cylinder

- CSA = $2\pi r h$
- TSA = $2\pi r(h + r)$
- Volume = $\pi r^2 h$



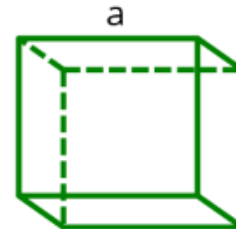
Cuboid

- $TSA = 2(lb + bh + hl)$
- $Volume = l \times b \times h$



Cube

- $TSA = 6a^2$
- $Volume = a^3$



2. Conversion of Solids

- Melting / Reshaping Questions:

$$\text{Volume of old solid} = \text{Volume of new solid(s)}$$

Example: A sphere melted into cones/cylinders → equate volumes.

3. Important Tips & Tricks

- ✓ Surface Area problems → focus on **outer covering/painting**
- ✓ Volume problems → focus on **capacity / amount of material**
- ✓ In **combined solids** → Break into parts (sphere + cylinder + cone, etc.)
- ✓ In **hollow objects** (pipes, rings) →

$$Volume = \pi h(R^2 - r^2)$$

CBSE Class 10 – Chapter 13: Statistics

1. What is Statistics?

It deals with **collection, classification, representation, and interpretation** of numerical data.

2. Mean of Grouped Data

(i) Direct Method

$$\bar{x} = \frac{\sum(f_i x_i)}{\sum f_i}$$

where:

- f_i = frequency
- x_i = class mark = $\frac{\text{upper limit} + \text{lower limit}}{2}$

(ii) Assumed Mean Method

$$\bar{x} = a + \frac{\sum(f_i d_i)}{\sum f_i}$$

where:

- a = assumed mean
- $d_i = x_i - a$

(iii) Step Deviation Method

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

where:

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

✓ **Exam Tip:** Use **step deviation** when numbers are big → saves time in calculation.

3. Mode of Grouped Data

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 of class before modal class
- f_2 = frequency of class after modal class
- h = class size

✓ **Quick Concept:** Modal class = class with  highest frequency.

4. Median of Grouped Data

Formula:

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

where:

- $n = \sum f_i$ = total frequency
- l = lower boundary of median class
- C = cumulative frequency before median class
- f = frequency of median class
- h = class size

✓ **Quick Concept:** Median class = the class where cumulative frequency $\geq n/2$.

5. Graphical Representation

- **Histogram** → rectangles with frequency as height.
- **Frequency Polygon** → join midpoints of histogram tops or directly using class marks.
- **Ogive (Cumulative Frequency Curve)** → used to find **median** graphically.

6. Tips & Tricks for Exams

- ✓ Always check **class interval size (h)** before applying formulas.
- ✓ If class intervals are not continuous, make them **continuous** first.
- ✓ For **mean**: choose a smart assumed mean to make calculations easy
- ✓ For **mode**: don't forget which is **modal class** (highest frequency).
- ✓ Graph questions → label axes carefully.
- ✓ **Time saving trick**: For big frequency tables, use **step deviation**.

7. Commonly Asked Questions in CBSE

- Find **mean, median, mode** from given grouped data.
- Draw histogram and frequency polygon.
- Use **graphical method** to find **median**.
- Word problems: marks, wages, heights, daily income etc.

CBSE Class 10 – Chapter 15: Probability

1. Basic Definition

 Probability of an event (E):

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

-  Always: $0 \leq P(E) \leq 1$
-  If event is **certain**, $P(E) = 1$
-  If event is **impossible**, $P(E) = 0$

2. Complementary Events

- $P(E) + P(\text{not } E) = 1$
- Example: Probability of getting head = 0.5 → Probability of not getting head = 0.5

3. Important Formulas & Results

- **Coin Toss:**
 - 1 coin → outcomes = {H, T}
 - 2 coins → outcomes = {HH, HT, TH, TT} (4 outcomes)
 - 3 coins → 8 outcomes
- **Die Throw:** outcomes = {1, 2, 3, 4, 5, 6}
 - $P(\text{even number}) = \frac{3}{6} = \frac{1}{2}$
 - $P(\text{multiple of 3}) = \frac{2}{6} = \frac{1}{3}$
- **Deck of 52 Cards:**
 - Total cards = 52 (4 suits: ♥ ♦ ♣ ♠)
 - Each suit has 13 cards (A, 2–10, J, Q, K)
 - Red cards = 26 (♥ ♦), Black cards = 26 (♣ ♠)
 - Face cards (J, Q, K) = 12 (3 × 4) 

🟡 4. Tricks for Word Problems

- ✓ **At least one** = Use complement:

$$P(\text{at least one}) = 1 - P(\text{none})$$

- ✓ **Drawing without replacement** → total outcomes reduce.
- ✓ **Drawing with replacement** → total outcomes remain same.
- ✓ **For dice questions**, total outcomes = 6^n (if n dice rolled).

🔺 5. Common CBSE Question Types

- Toss of 1/2/3 coins → head-tail probability.
- Throwing dice → even, odd, prime, multiples, etc.
- Cards → red/black, face cards, king/queen/ace/joker type problems.
- Word problems: defective items, bulbs, balls in a bag.
- Complementary event problems.

🌟 6. Quick Exam Tips

- ✓ Write **sample space** clearly in probability questions.
- ✓ Always check if question says **with replacement** or **without replacement**.
- ✓ Simplify fractions in the end (CBSE step marks).
- ✓ Use $P(\text{not } E) = 1 - P(E)$ for faster calculation.
- ✓ Practice **cards & dice** thoroughly → most repeated in exams.

👉 Examples:

- $P(\text{drawing red card}) = 26/52 = 1/2$
- $P(\text{face card}) = 12/52 = 3/13$
- $P(\text{ace}) = 4/52 = 1/13$
- **Complement Example:**
 $P(\text{not ace}) = 1 - 1/13 = 12/13$

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