JKBOSE WALLAH

# JKBOSE EXPRESS

## 10th CLASS

SUBJECTS

PHYSICS, CHEMISTRY, BIOLOGY, MATHS, SST

**CHEAT SHEET & LONG, SHORT, OBJECTIVE TYPE QUESTIONS.**

# Kohinoor 2025

# Mathematics

## CHAPTER-1
## REAL NUMBERS

## Cheat Sheet

**Real Numbers**

**The Fundamental Theorem of Arithmetic:**

- Every composite number can be expressed (factorized) as a product of primes, and this factorisation is unique, apart from the order in which the prime factors occur.

  **Note:** Fundamental theorem of arithmetic is called a Unique Factorisation Theorem.

  Composite number = Product of prime numbers.

  e.g. $\therefore$ $24 = 2 \times 2 \times 2 \times 3$

  $= 2^3 \times 3$, where 2 and 3 are prime numbers

**Theorems:**

- **Theorem 1:** Let $p$ be a prime number. If $p$ divides $a^2$, then $p$ divides $a$, where $a$ is a positive integer.
- **Theorem 2:** $\sqrt{2}$ is an irrational number.

  **Note:** Square root of any prime number is always an irrational number

**Irrational Numbers:**

It cannot be expressed as $x = \dfrac{p}{q}$, $q \neq 0$. where $p$ and $q$ are integers.

e.g.: $\sqrt{2}, \sqrt{3}, \pi, \ldots$

**Prime Factorisation Method:**

Prime Factorisation is a way of representing a number as a product of its prime factors. It is also used to find out the H.C.F and L.C.M.

For any two positive integers $a$ and $b$ we have,

H.C.F $(a, b) \times$ L.C.M $(a, b) = a \times b$

e.g.: Find H.C.F of 24 and 36.

Prime factors of 24 : $2^3 \times 3^1$

Prime factors of 36 : $2^2 \times 3^2$

H.C.F $= 2^2 \times 3^1 = 12$

e.g.: Find L.C.M of 12 and 18.

Prime factors of 12 : $2^2 \times 3^1$

Prime factors of 18 : $2^1 \times 3^2$

L.C.M $= 2^2 \times 3^2 = 36$

**Rational Numbers:**

It can be expressed as $x = \dfrac{p}{q}$, $q \neq 0$. where $p$ and $q$ are integers.

e.g.: $\dfrac{1}{4}, \dfrac{2}{3}, 2, \ldots$

**Integers '*Z*' or '*I*':**

Integers include all whole numbers and negative numbers.

e.g.: … –3, –2, –1, 0,2,3,.......

**Negative Integer:**

e.g.: –1, –2, –3, …

**Whole Number '*W*':**

The whole number which includes all the non-negative integers.

$W$: 0, 1, 2, 3, …

**Zero**

**Natural Number '*N*':**

Natural numbers are all positive integers

$N$: 1, 2, 3, …

**Prime Number:**

Prime numbers are natural numbers that are divisible by only 1 and the number itself.

e.g. 2, 3, 5, 7, 11, 13.....

**Composite Number:**

Composite numbers are numbers that have more than two factors.

e.g. 4, 6, 8, 9, 10, 12....

**Co-prime Number:**

Co-prime numbers are two pairs of numbers which have a common factor of 1.

e.g. (14,15), (1,99), (8,15)

# CHAPTER-2
## POLYNOMIALS

## Cheat Sheet

**Polynomial:** A polynomial is defined as an expression that includes variables, constants and exponents.

**Types of Polynomial**

**Linear Polynomial:**
$p(x) = ax + b, a \neq 0$

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

**Cubic Polynomial:**
$p(x) = ax^3 + bx^2 + cx + d, a \neq 0$

**Degree of Polynomial:**
Highest power of the variable is known as the degree of the polynomial.

**Formation of Quadratic and Cubic Polynomial:**

1. Quadratic polynomial having $\alpha$ and $\beta$ as its zeroes is given by $p(x) = k\{x^2 - (\alpha + \beta)x + \alpha\beta\}$, where $k$ is any non-zero real number.
2. Cubic polynomial having $\alpha$, $\beta$, and $\gamma$ as its zeroes is given by $p(x) = k\{x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma\}$, where $k$ is any non-zero real number.

**General Form:**
$p(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + a_3x^{n-3} + ... + a_{n-1}x^1 + a_n$,
where all the powers are non-negative integers and
$a_0, a_1, ......... a_n, \in R$

**Zeroes of Polynomials:**
The value of $x$ where the graph intersect $x$-axis

**Zeroes of Linear Polynomial:**
If $k$ is zero of $p(x) = ax + b, a \neq 0$
i.e. $p(k) = ak + b = 0$

$$\therefore\ k = \frac{-b}{a} = \frac{-\text{ Constant term}}{\text{Coefficient of } x}$$

**Zeroes of Quadratic Polynomial:**
If $\alpha$ and $\beta$ are zeroes of quadratic polynomial $p(x) = ax^2 + bx + c, a \neq 0$

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

$$\text{and } \alpha \cdot \beta = \frac{c}{a} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$$

**Zeroes of Cubic Polynomial:**
If $\alpha$, $\beta$, and $\gamma$ are the zeroes of the cubic polynomial $p(x) = ax^3 + bx^2 + cx + d$, then,

$$\alpha + \beta + \gamma = \frac{-b}{a} = -\frac{\text{Coefficient of } x^2}{\text{Coefficient of } x^3}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} = \frac{\text{Coefficient of } x}{\text{Coefficient of } x^3}$$

$$\alpha\,\beta\,\gamma = \frac{-d}{a} = -\frac{\text{Constant term}}{\text{Coefficient of } x^3}.$$

# CHAPTER-3
## PAIR OF LINEAR EQUATION IN TWO VARIABLES

## Cheat Sheet

### Pair of Linear Equations in Two Variables

**Definition:** A collection of two linear equations in the same two variables.

**General From:**
$a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$
Where, $a_1, a_2, a_3, b_1, b_2$ & $b_3$ are real numbers such that
$a_1$ & $b_1$ and $a_2$ & $b_2$ can not be equal to zero simultaneously.

### Algebraic Method

**Solution:**
The value of the two variables which satisfy both the linear equations in the two variables

**Substitution Method:**
To find the solution using this method we substitute value of one variable (in terms of another variable) from one equation to another equation.

**Example:** $7x - 15y = 2$ ...(*i*)
$x + 2y = 3$ ...(*ii*)

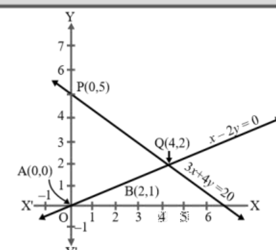
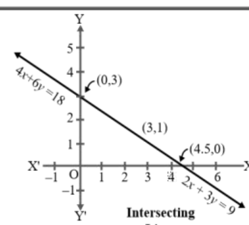
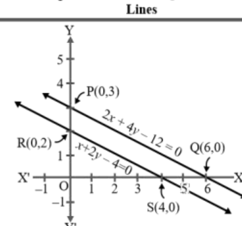
**Sol.** From equation (*ii*), $x = 3 - 2y$ ...(*iii*)
Substitute value of $x$ in eq. (*i*)
$7(3 - 2y) - 15y = 2$
$-29y = -19 \Rightarrow y = \frac{19}{29}$
$\therefore$ In eq. (*iii*) $x = 3 - 2\left(\frac{19}{29}\right) = \left(\frac{49}{29}\right)$

**Elimination Method:**
To find the solution using this method we eliminate one of the variables by adding/subtracting both equation after, if necessary, multiplying the equation by appropriate numbers.

**Example:** $2x + 3y = 8$ ... (*i*)
$4x + 6y = 7$ ... (*ii*)

**Sol.** From equation (*i*) × 2 – eq. (*ii*) × 1, we have
$(4x - 4x) + (6y - 6y) = 16 - 7$
$0 = 9$, which is a false statement
The pair of equation has no solution

### Graphical Representation and Nature of equations/solutions

| S. No. | Pair of Lines | $\frac{a_1}{a_2}$ | $\frac{b_1}{b_2}$ | $\frac{c_1}{c_2}$ | Compare the Ratios | Graphical Representation | Algebraic Interpretation |
|---|---|---|---|---|---|---|---|
| 1. | $x - 2y = 0$<br>$3x + 4y - 20 = 0$ | $\frac{1}{3}$ | $\frac{-2}{4}$ | $\frac{0}{-20}$ | $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ |  Intersecting Lines | Exactly one solution-consistent (Unique) |
| 2. | $2x + 3y - 9 = 0$<br>$4x + 6y - 18 = 0$ | $\frac{2}{4}$ | $\frac{3}{6}$ | $\frac{-9}{-18}$ | $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ |  Coincident Lines | Infinitely many solutions-consistent (Dependent) |
| 3. | $x + 2y - 4 = 0$<br>$2x + 4y - 12 = 0$ | $\frac{1}{2}$ | $\frac{2}{4}$ | $\frac{-4}{-12}$ | $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ |  Parallel Lines | No solutions-Inconsistent |

# CHAPTER-4
## QUADRATIC EQUATIONS

Cheat Sheet

**Factorisation Method:**
In this method ($ax^2 + bx + c = 0$) can be expressible as the product of two linear expressions, say $(px + q)$ and $(rx + s)$, where $p, q, r$ are real numbers such that $p \neq 0, r \neq 0$.
Then $ax^2 + bx + c = 0 \Rightarrow (px + q)(rx + s) = 0$
$(px + q) = 0$ or $(rx + s) = 0 \Rightarrow x = \frac{-q}{p}$ or $x = \frac{-s}{r}$

**Quadratic Formula:**
For $ax^2 + bx + c = 0$, $D = b^2 - 4ac$,
$$x = \frac{-b \pm \sqrt{D}}{2a}$$

**Method of Finding Solution**

An equation of the form $ax^2 + bx + c = 0$ where $a, b, c$ are real numbers and $a \neq 0$. is called a quadratic equation in $x$.

**Solution of Roots of Quadratic Equation:**
A real number $\alpha$ is called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$.

**Quadratic Equation**

**Application:**
- Speed $= \frac{\text{Distance}}{\text{Time}}$
- Area of figures
- Volume of water = flow rate × time
- Number of ages

**Nature of roots:**
$ax^2 + bx + c = 0$, $a \neq 0$, where $D = (b^2 - 4ac)$ and the roots are given by $\alpha = \frac{-b + \sqrt{D}}{2a}$ and $\beta = \frac{-b - \sqrt{D}}{2a}$

**Case I:**
When $D > 0$, roots are real, distinct and given by
$\alpha = \frac{-b + \sqrt{D}}{2a}$ and $\beta = \frac{-b - \sqrt{D}}{2a}$

**Case II:**
When $D = 0$, roots are real and equal and roots are given by $\alpha = \frac{-b}{2a}$ and $\beta = \frac{-b}{2a}$

**Case III:**
When $D < 0$, roots are imaginary.

# CHAPTER-5
## ARITHMETIC PROGRESSIONS

Cheat Sheet

## Arithmetic Progressions

### Sum of $n^{th}$ term:

- When first term ($a$) and common difference ($d$) is given, then,

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

- When first term ($a$) and last term ($l$) is given, then

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

### General form of an A.P.

$a, a+d, a+2d, ..., a+(n-1)d$

### Common difference ($d$)

- The fixed number added in an arithmetic progression is the common difference i.e., difference between the two consecutive terms of an A.P. is called common difference.

$$d = a_n - a_{n-1}$$

- It can be positive, negative or zero.

### Types of an A.P.:

**Finite A.P.:** An arithmetic progression (A.P) in which number of terms are finite is known as finite A.P.

$a_1, a_2, \ldots\ldots\ldots\ldots\ldots a_n$

**Infinite A.P.:** An arithmetic progression (A.P) in which number of terms are infinite is known as infinite A.P.

$a_1, a_2, a_3\ldots\ldots\ldots\ldots\ldots$

### $n^{th}$ term from end

$a_n = l - (n-1)\,d$

Here, $l$ is last term and $d$ is common difference

### Definition:

A sequence of numbers in which each term is obtained by adding/subtracting a fixed number to the preceding term, except the first term is called an Arithmetic Progression.

### $n^{th}$ term of an A.P.

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

Here, $a$ is first term and $d$ is common difference

### Term:

Each number in the sequence of an A.P.

# CHAPTER-6
## TRIANGLES

## Cheat Sheet

# Triangles

### Similarity of Triangles
- Corresponding angles are congruent
- Corresponding sides are in same ratio

### Congruent of Triangles
- Corresponding angles are congruent
- Corresponding sides are also congruent

### Criteria for Similarity of Triangles

***AA* (Angle-Angle) Criteria:** If two angles of one triangle are respectively equal to two angles of another triangle, then the two triangles are similar.

***AAA* (Angle-Angle-Angle):** If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio and hence the two triangles are similar.

***SSS* (Side-Side-Side):** If in two triangles, sides of one triangle are proportional to (i.e., in the same ratio of ) the sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar.

***SAS* (Side–Angle–Side):** If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar.

### Theorem
- If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
- If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.
- If in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio (or proportional) and hence the two triangles are similar.
- If in two triangles, sides of one triangle are proportional to (i.e., in the same ratio of) the sides of the other triangle, then their corresponding angles are equal and hence the two triangles are similar.
- If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then the two triangles are similar.

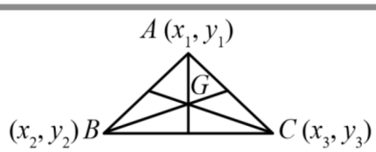
### Important Terms
- **Scale Factor:** The scale factor is the ratio of any two corresponding lengths in similar figures. It determines the relationship between the corresponding sides of the figures.
- **Corresponding Angles:** Corresponding angles are angles that occupy the same relative positions in two or more similar figures
- **Corresponding Sides:** Corresponding sides are sides that are in the same relative position in two or more similar figures.
- **Proportional:** Two quantities are proportional if they have a constant ratio. In the context of similar figures, corresponding sides are proportional, meaning their lengths are in the same ratio.
- **Congruent:** Two figures are said to be congruent if all the corresponding sides and all the corresponding angles are equal in measure.
- **Similar:** Two figures having the same shape but not necessarily the same size is known as similar.

# CHAPTER-7
## COORDINATE GEOMETRY

## Cheat Sheet

### Coordinate Geometry

### Centroid




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

**Example:** Determine the centroid of a triangle whose vertices are (5, 3), (6, 1) and (7, 8)

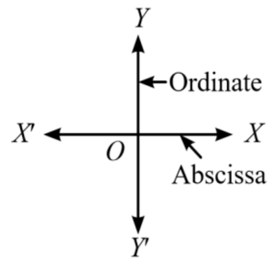
**Sol.** Given parameters are,
$(x_1, y_1) = (5, 3)$, $(x_2, y_2) = (6,1)$
and $(x_3, y_3) = (7, 8)$

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

$$G=\left(\frac{5+6+7}{3},\frac{3+1+8}{3}\right)$$

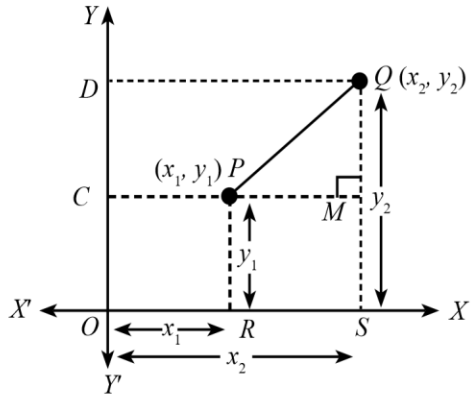
$$G=\left(\frac{18}{3},\frac{12}{3}\right)=(6,4)$$

### Coordinate Axis




Horizontal = $x$-axis (Abscissa)
Vertical = $y$-axis (Ordinate)

### Distance Formula




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

**Example:** Find the distance between the point $P(-5,7)$ and $Q(-1,3)$.

**Sol.** We have,

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

Given, $x_1=-5, x_2=-1, y_1=7, y_2=3$

So, $d=\sqrt{(-1-(-5))^2+(3-7)^2}=\sqrt{(4)^2+(-4)^2}$

$=\sqrt{16+16}=\sqrt{32}=4\sqrt{2}$ units

### Mid-point Line Segment

The mid-point of the line segment joining the points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is $\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$.

**Example:** Find the coordinates of mid-point of the line segment joining (4, –1) and (–2, –3).

**Sol.** Let the given points be $P(4, -1)$ and $Q(-2, -3)$

Since, the mid-point of the line segment joining the points $P(4, -1)$ and $Q(-2, -3)$

$$=\left(\frac{4-2}{2},\frac{-1-3}{2}\right)=\left(\frac{2}{2},\frac{-4}{2}\right)=(1,-2)$$

### Section Formula

The coordinates of the point $P(x, y)$ which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2},\frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$.

**Example:** Find the coordinates of the point which divides the line joining of (–1, 7) and (4, –3) in the ratio 2 : 3.

**Sol.** Let $P(x, y)$ be the required point. Thus, we have

$$x=\frac{m_1x_2+m_2x_1}{m_1+m_2} \text{ and } y=\frac{m_1y_2+m_2y_1}{m_1+m_2}$$

Therefore,

$$x=\frac{2\times4+3\times(-1)}{2+3}=\frac{8-3}{5}=\frac{5}{5}=1$$

$$y=\frac{2\times(-3)+3\times7}{2+3}=\frac{-6+21}{5}=\frac{15}{5}=3$$

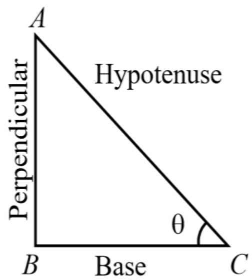
So, the coordinates of $P$ are (1, 3).

# CHAPTER-8
## INTRODUCTION TO TRIGONOMETRY

## Cheat Sheet

### Introduction to Trigonometry

**Right Angled Triangle**




$$\sin\theta = \frac{AB}{AC}$$

$$\cos\theta = \frac{BC}{AC}$$

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

$$\text{cosec }\theta = \frac{AC}{AB}$$

$$\sec\theta = \frac{AC}{BC}$$

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

**Trigonometric Ratios and Angles**

$$\sin\theta = \frac{1}{\text{cosec}\,\theta} \Rightarrow \text{cosec}\,\theta = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{1}{\sec\theta} \Rightarrow \sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{1}{\cot\theta} \Rightarrow \cot\theta = \frac{1}{\tan\theta}$$

**Trigonometric Identities**

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

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

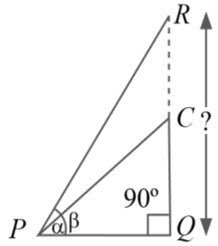
$$\text{cosec}^2\theta - \cot^2\theta = 1$$

**Trigonometric Ratios of some Specific Angles.**

| θ | 0° | 30° | 45° | 60° | 90° |
|---|---|---|---|---|---|
| **sin** | 0 | $\frac{1}{2}$ | $\frac{1}{\sqrt{2}}$ | $\frac{\sqrt{3}}{2}$ | 1 |
| **cos** | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{1}{\sqrt{2}}$ | $\frac{1}{2}$ | 0 |
| **tan** | 0 | $\frac{1}{\sqrt{3}}$ | 1 | $\sqrt{3}$ | Not Defined |
| **cosec** | Not Defined | 2 | $\sqrt{2}$ | $\frac{2}{\sqrt{3}}$ | 1 |
| **sec** | 1 | $\frac{2}{\sqrt{3}}$ | $\sqrt{2}$ | 2 | Not Defined |
| **cot** | Not Defined | $\sqrt{3}$ | 1 | $\frac{1}{\sqrt{3}}$ | 0 |

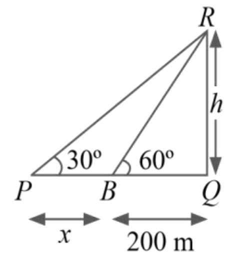
# CHAPTER-9
## SOME APPLICATIONS OF TRIGONOMETRY

## Cheat Sheet




Find length $QR$

**Distance between Two Points**



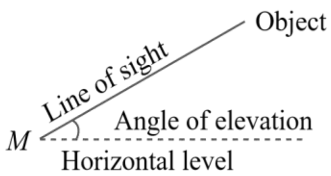

Find $x$ and $h$

Trigonometric ratios can be used to find the distances and heights of those objects for which direct measurement of lengths are not possible.

**Some Application of Trigonometry**

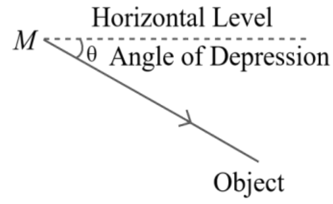
**Angle of Elevation:**

The angle of elevation of the point viewed is the angle formed by the line of sight with the horizontal when the point being viewed is above the horizontal level.




**Angle of Depression:**

The angle of depression of a point on the object being viewed is the angle formed by the line of sight with the horizontal when the point is below the horizontal level.




**Line of Sight:**

Line of sight is the line drawn from the eye of an observer to the point in the object viewed by the observer.

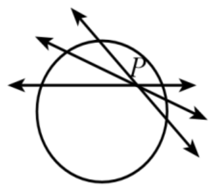
# CHAPTER-10
## CIRCLES

## Cheat Sheet

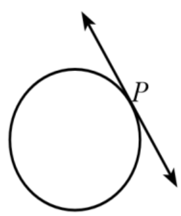
# Circles

### Number of Tangents

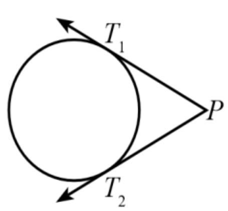
- ❑ There are no tangent to a circle passing through a point lying inside the circle.




- ❑ There is one and only one tangent to a circle passing through a point lying on the circle.

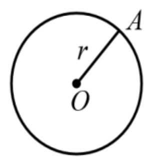



- ❑ There are exactly two tangents to a circle through a point lying outside the circle.



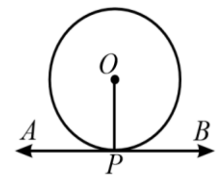

### Definition

The locus of a point that is equidistant from a fixed point is known as a circle. The fixed point is called centre and the distance between the fixed point and the point on the circle is called radius.



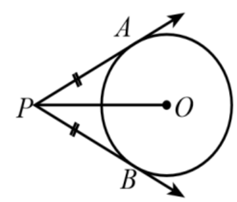

### Theorem 1

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



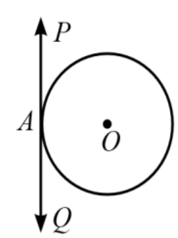

### Theorem 2

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



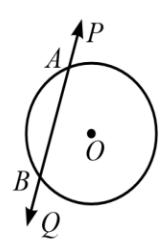

### Tangent

A line intersecting a circle at only one point is known as tangent and the intersecting point is known as point of contact.




### Secant

A line intersecting a circle at two different points is known as secant.




### Terms Related to Circle:

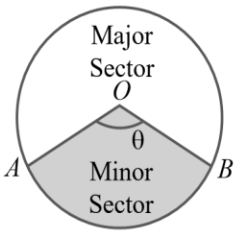
1. Chord
2. Arc
3. Sector
4. Segment
   (a) Minor segment
   (b) Major segment

# CHAPTER-11
## AREAS RELATED TO CIRCLES

## Cheat Sheet

### Areas Related to Circles

#### Sector of circle

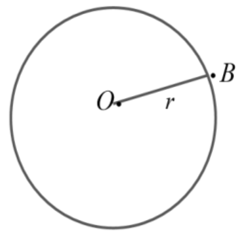



Length of arc $(AB) = \dfrac{\theta}{360^\circ} \times 2\pi r$

Perimeter of sector $(OAB) = 2r +$ length of arc

Area of sector $= \dfrac{\theta}{360^\circ} \times \pi r^2$

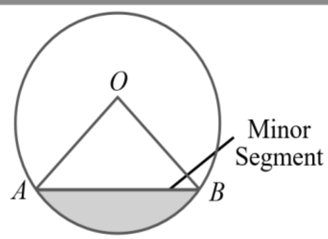
#### Circle




Circumference of the circle $= 2\pi r$

Area of the circle $= \pi r^2$

#### Segment of circle

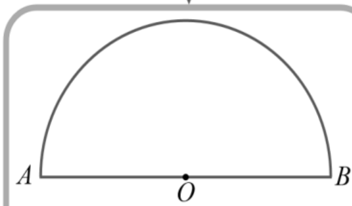



Length of chord $(AB) = 2r\sin\left(\dfrac{\theta}{2}\right)$

Area of segment = Area of sector $(OAB)$ – Area of $\Delta\, OAB$

$$= \frac{\theta}{360^\circ} \times \pi r^2 - \frac{1}{2} r^2 \sin\theta$$

#### Semi-Circle




Perimeter of the semi-circle $= \pi r + 2r$

Area of the semi-circle $= \dfrac{1}{2}\pi r^2$

# CHAPTER-12
## SURFACE AREAS AND VOLUMES

### Cheat Sheet

**Surface Areas and Volumes**

**Volume**

The capacity occupied by a 3-D solid shape

**Surface Area**

Surface area is the space which is occupied by a solid

**Combination of Solids**

T.S.A = $(\text{C.S.A})_{\text{Cylinder}}$ + $(\text{C.S.A})_{\text{Cone}}$ + $(\text{Base Area})_{\text{Cylinder}}$

Volume = $(\text{Volume})_{\text{Cone}}$ + $(\text{Volume})_{\text{Cylinder}}$

T.S.A = $(\text{C.S.A})_{\text{Cone}}$ + $(\text{C.S.A})_{\text{Hemisphere}}$

Volume = $(\text{Volume})_{\text{Cone}}$ + $(\text{Volume})_{\text{Hemisphere}}$

T.S.A = $(\text{T.S.A})_{\text{Cube}}$ + $(\text{C.S.A})_{\text{Hemisphere}}$ – $(\text{Base Area})_{\text{Hemisphere}}$

Volume = $(\text{Volume})_{\text{Cube}}$ + $(\text{Volume})_{\text{Hemisphere}}$

T.S.A = $(\text{T.S.A})_{\text{Cube}}$ + $(\text{T.S.A})_{\text{Cylinder}}$ – $(\text{Base Area})_{\text{Cylinder}}$

Volume = $(\text{Volume})_{\text{Cube}}$ + $(\text{Volume})_{\text{Cylinder}}$

T.S.A = $(\text{T.S.A})_{\text{Cube}}$ + $(\text{C.S.A})_{\text{Cone}}$ – $(\text{Base Area})_{\text{Cone}}$

Volume = $(\text{Volume})_{\text{Cone}}$ + $(\text{Volume})_{\text{Cube}}$

**Formula**

| Name of Solid | Volume (V) | Curved Surface Area (C.S.A) | Total Surface Area (T.S.A) |
|---|---|---|---|
| Cube | $a^3$ | $4a^2$ | $6a^2$ |
| Cuboid | $l\times b\times h$ | $2h\,(l+b)$ | $2\,(lb+bh+hl)$ |
| Sphere | $\frac{4}{3}\pi r^3$ | $4\pi r^2$ | $4\pi r^2$ |
| Hemisphere | $\frac{2}{3}\pi r^3$ | $2\pi r^2$ | $3\pi r^2$ |
| Right Circular Cylinder | $\pi r^2 h$ | $2\pi rh$ | $2\pi r\,(h+r)$ |
| Right Circular Hollow Cylinder ($R > r$) | $\pi(R^2-r^2)h$ | $2\pi(R+r)h$ | $2\pi(R+r)(h+R-r)$ |
| Cone | $\frac{1}{3}\pi r^2 h$ | $\pi rl$ | $\pi r\,(l+r)$ |

# CHAPTER-13
## STATISTICS

**Cheat Sheet**

**Statistics**

**Data:**
Facts, observations and information that come from investigations are known as data.

**Grouped Data:**
Grouped data is a data given in the form of class intervals 0–5, 5–10, 10–15,...etc.

$$\text{Class width} = \frac{\text{Lower limit} + \text{Upper limit}}{2}$$

**Mode:**
Mode is the value of the observation having the maximum frequency.

**Modal Class:**
Class having maximum frequency called modal class.

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

$f_1$ = frequency of the modal class
$f_0$ = frequency of the class preceding the modal class
$f_2$ = frequency of the class succeeding the modal class
$h$ = size of class internal
$l$ = lower limit of the modal class

**Mean:**
The arithmetic mean is the sum of the values of all the observations divided by total number of observations.

$$\bar{x} = \frac{x_1 + x_2 + x_3 + ... + x_n}{n}$$

- **Direct Method**

$$\text{Mean } \bar{x} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}$$

- **Assumed Mean Method**

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

- **Step-deviation Method**

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

**Median:**
The middle most value of the given data set when it is arranged in either ascending or descending order of magnitude is called median.

**Median:**
- If total number of observations is odd, say $n$. Then,

Median = value of $\left(\frac{n+1}{2}\right)^{th}$ observation.

- If total number of observations is even, say $n$. Then,

$$\text{Median} = \frac{\text{Value of } \left(\frac{n}{2}\right)^{\text{th}} \text{ term} + \text{Value of } \left(\frac{n}{2}+1\right)^{\text{th}} \text{ term}}{2}$$

**Median Class:**
Median class is just greater than $\frac{N}{2}$ is called median class where $N$ is sum of frequencies i.e. $N = \Sigma f_i$

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

$l$ = lower limit of median class interval
$Cf$ = Cumulative frequency preceding to the median
$f$ = frequency of the class interval to which median belongs.
$h$ = size of class internal

# CHAPTER-14
## PROBABILITY

## Cheat Sheet

**Probability**

**Definition:** Probability is the branch of mathematics that deals with the study of random events or outcomes. It is the measure of the likelihood or chance that an event will occur.

**Experiment:** An experiment refers to a specific action or process that produces an outcome. For example, tossing a coin, rolling a die, or selecting a card from a deck.

### Event
A desired outcome of the random experiment is known as an event of the random experiment e.g., Getting a tail on tossing a coin, getting a red card when a card is drawn from a pack of 52 cards.

### Complementary Event
When there are two events such that one event can occur if and only if the other does not take place then such events are known as complementary events in probability. The sum of the probability of complementary events will always be equal to 1. The complement of $A$ is denoted by $\overline{A}$.

### Compound Event
An event which has more than one elementary event is called a compound event.

For example, the probability of rolling an even number on a die, then tossing a head on a coin.

### Impossible Event
The events whose probability is zero are called impossible events.

For example, the event of drawing a black ball from a bag containing three red and four white balls is an impossible event.

### Elementary Event
An event having only one outcome or any single outcome of an experiment is called an elementary event.

For example, the probability of getting a 3 when a die is tossed.

- Sum of probability of all elementary events is 1.

### Sure or Certain Event
The events whose probability is one are called sure/certain events.

For example, the event of drawing a black ball from a bag containing ninety red balls is a sure event.

### Theoretical Probability
The theoretical (or classical) probability of an event $E$ is given by

$$P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes of the experiment}}$$

### Experimental Probability
The experimental (or empirical) probability of an event $E$ is given by

$$P(E) = \frac{\text{Number of trials in which the event happened}}{\text{Total number of trials}}$$

## Long Answer Type Questions

1. Prove that $(\text{cosec}\theta - \cot\theta)^2 = \frac{1-\cos\theta}{1+\cos\theta}$.
2. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree.
3. A kite is flying at a height of 60 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string, assuming that there is no slack in the string.
4. Prove that $\frac{1+\tan^2\theta}{1+\cot^2\theta} = \left(\frac{1-\tan A}{1-\cot A}\right)^2 = \tan^2\theta$
5. A cubical block of side 7 cm is surmounted by a hemisphere. What is the greatest diameter the hemisphere can have? Find the surface area of the solid.

## Short Type Questions

1. If A and B are $(-2,2)$ and $(2,-4)$ respectively, find the coordinates of P such that $\text{AP} = \frac{3}{7}\text{AB}$ and P lies on the segment AB.
2. Find the area of the sector of a circle with radius 4 cm and angle $30°$. Also find the area of the corresponding major sector.
3. Prove that $4 + 2\sqrt{3}$ is an irrational number.
4. The 17th term of an AP exceeds it 10th term by 7. Find the common difference.
5. Find the sum of the first 22 terms of an A.P in which $d = 7$ and 22th term is$149$.

## Very Short Type Questions

1. Find the discriminant of the quadratic equation $4x^2 + 4x + 1 = 0$ and nature of roots.
2. Given that $2\sin\theta = \sqrt{3}$, then find the value of $\theta$?
3. Calculate the volume of the Cylinder of radius 1 cm and height 1 cm.
4. Find the Point on the x-axis which is equidistant from $(2,-5)$ and $(-2,9)$.
5. The sum and the product of zeroes of the Polynomial $x^2 + 8x + 16$.

## Multiple Choice Questions

**1.** The number $\pi$ is:
a) An even number.
b) Rational number.
c) Irrational number.
d) None of these.

**2.** The number of real zeroes of a Cubic Polynomial is almost
a) 2
b) 3
c) 1
d) 4

**3.** The Pair of linear equations $2x + 3y = 10$ and $4x + 6y = 20$ are:
a) Parallel
b) Intersecting
c) Coincident
d) None.

**4.** The HCF$(18,45)$ is:
a) 9
b) 5
c) 18
d) None.

**5.** The Sum of first 100 natural numbers is:
a) 5000
b) 5050
c) 5600
d) 3200

**6.** The value of $\tan 1^\circ \times \tan 2^\circ \times \tan 3^\circ \times \ldots . \tan 89^\circ$
a) 1
b) 2
c) -1
d) 0

**7.** The coordinates of a point on x-axis which is at a distance of 5 units from the origin.
a) $(3,0)$
b) $(0,5)$
c) $(5,0)$
d) Both (a) and (b)

**8.** Which of the following is a quadratic equation:
a) $x^2 + 1 = x^2 + 2x + 3$
b) $x^2 = x + 1$
c) $x^2 + 2x + 1 = x^2$
d) None

**9.** The units digit of $6^n$ , for any natural number n , is always:
a) 1
b) 3
c) 6
d) 4

**10.** The probability of an event A cannot be:
a) Greater than 1
b) Less than 1
c) Less than 0
d) Both (a) and (c)