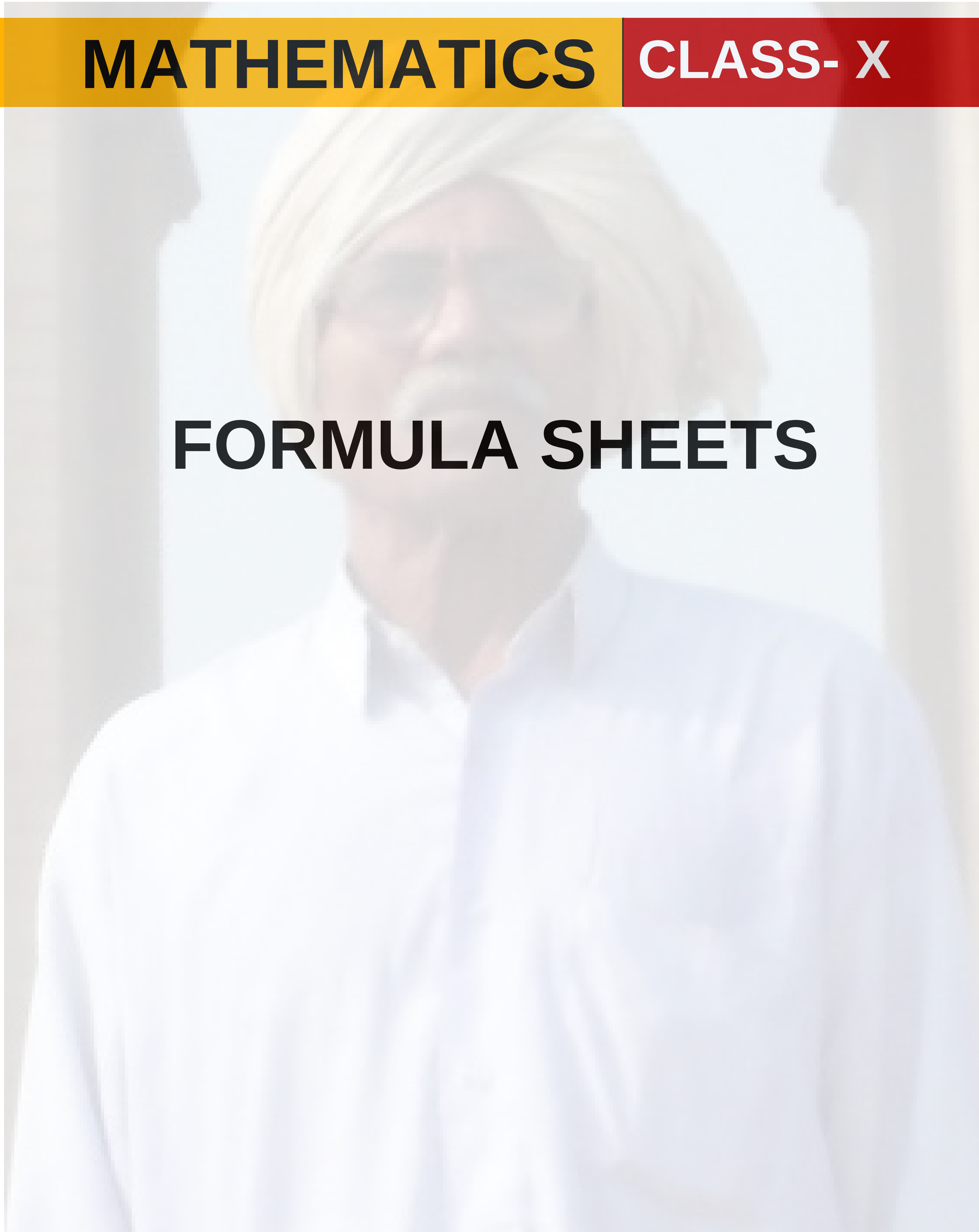


MATHEMATICS CLASS- X

FORMULA SHEETS

PAIR OF LINEAR EQUATION IN TWO VARIABLES

1

IMPORTANT FORMULA SHEET

An equation of the form $ax + by + c = 0$, where a, b and c are real numbers, such that a and b are not both zero, is called a linear equation in two variables.

Important points to Note

S. No.	Points
1.	A linear equation in two variable has infinite solutions.
2.	The graph of every linear equation in two variable is a straight line.
3.	$x = 0$ is the equation of the y-axis and $y = 0$ is the equation of the x-axis.
4.	The graph $x = a$ is a line parallel to y-axis.
5.	The graph $y = b$ is a line parallel to x-axis.
6.	An equation of the type $y = mx$ represents a line passing through the origin.
7.	Every point on the graph of a linear equation in two variables is a solution of the linear equation. Moreover, every solution of the linear equation is a point on the graph.

S. No.	Types of Equation	Mathematical Representation	Solutions
1.	Linear equation in one Variable	$ax + b = 0, a \neq 0$ a and b are real number	One solution
2.	Linear equation in two Variable	$ax + by + c = 0,\ a \neq 0$ and $b \neq 0$ a, b and c are real number	Infinite solution possible
3.	Linear equation in three Variable	$ax + by + cz + d = 0, a \neq 0, b \neq 0$ and $c \neq 0$. a, b, c, d are real number	Infinite solution possible

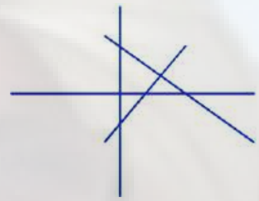
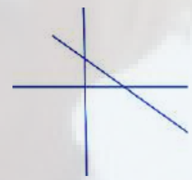
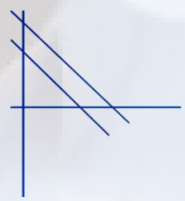
Simultaneous pair of Linear equation:

A pair of Linear equation in two variables

$a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

Graphically it is represented by two straight lines on Cartesian plane.

Simultaneous pair of Linear equation	Condition	Graphical representation	Algebraic interpretation
$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ **Example:** $x – 4y + 14 = 0$ $3x + 2y – 14 = 0$	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Intersecting lines. The intersecting point coordinate is the only solution 	One unique solution.
$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ **Example:** $2x + 4y = 16$ $3x + 6y = 24$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Coincident lines. Then any coordinate on the line is the solution. 	Infinite solution.
$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ **Example:** $2x + 4y = 6$ $4x + 8y = 18$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	Parallel Lines 	No solution.

The graphical solution can be obtained by drawing the lines on the Cartesian plane.

<u>Algebraic Solution of system of Linear equation</u>

S. No.	Type of method	Working of method
1.	Method of elimination by substitution	(1) Suppose the equation are $a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ (2) Find the value of variable of either x or y in other variable term in first equation. (3) Substitute the value of that variable in second equation. (4) Now this is a linear equation in one variable. Find the value of the variable (5) Substitute this value in first equation and get the second variable

2.	Method of elimination by equating the coefficients	(1) Suppose the equation are $a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ (2) Find the LCM of a_1 and a_2. Let it k. (3) Multiple the first equation by the value k/a_1 (4) Multiple the first equation by the value k/a_2 (5) Subtract the equation obtained. This way one variable will be eliminated and we can solve to get the value of variable y (6) Substitute this value in first equation and get the second variable
3.	Cross Multiplication method	(1) Suppose the equation are $a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$ (2) This can be written as $\frac{x}{\begin{matrix} b_1 & c_1 \\ b_2 & c_2 \end{matrix}} = \frac{-y}{\begin{matrix} a_1 & c_1 \\ a_2 & c_2 \end{matrix}} = \frac{1}{\begin{matrix} a_1 & b_1 \\ a_2 & b_2 \end{matrix}}$ (3) This can be written as $\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{a_1c_2 - a_2c_1} = \frac{1}{a_1b_2 - a_2b_1}$ (4) Value of x and y can be find using the $x \Rightarrow$ first and last expression $y \Rightarrow$ second and last expression

POLYNOMIAL

2

IMPORTANT FORMULA SHEET

A polynomial expression S(x) in one variable x is an algebraic expression in x term as

$$S(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \dots \dots \dots \dots + ax + a_0$$

Where $a_n, a_{n-1}, \dots, a_1, a_0$ are constant and real numbers and a_n is not equal to zero

Some Important points to Note

S. No.	Description
1.	$a_n, a_{n-1}, a_{n-2}, \dots a_1, a_0$ are called the coefficients for $x^n, x^{n-1}, \dots, x^1, x^0$
2.	n is called the degree of the polynomial
3.	when $a_n, a_{n-1}, a_{n-2}, \dots a_1, a_0$ all are zero, it is called zero polynomial
4.	A constant polynomial is the polynomial with zero degree, it is a constant value polynomial
5.	A polynomial of one term is called monomial, two terms binomial and three terms as trinomial
6.	A polynomial of one degree is called linear polynomial, two degree as quadratic polynomial and degree three as cubic polynomial

Important concepts on Polynomial

Concept	Description
Zero's or roots of the polynomial	It is a solution to the polynomial equation $S(x) = 0$ i.e. a number "a" is said to be a zero of a polynomial if $S(a) = 0$. If we draw the graph of $S(x) = 0$, the values where the curve cuts the X-axis are called Zeroes of the polynomial
Remainder Theorem's	If $p(x)$ is an polynomial of degree greater than or equal to 1 and $p(x)$ is divided by the expression $(x - a)$, then the remainder will be $p(a)$
Factor's Theorem's	If $x - a$ is a factor of polynomial $p(x)$ then $p(a) = 0$ or if $p(a) = 0$, $x - a$ is the factor the polynomial $p(x)$

Geometric Meaning of the Zeroes of the polynomial

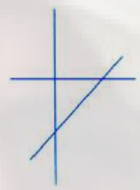
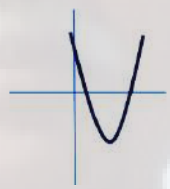
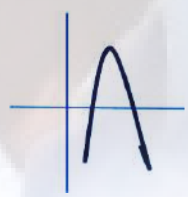
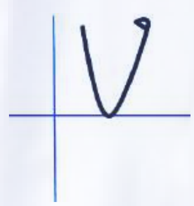
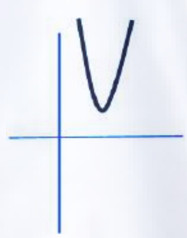
Let's us assume

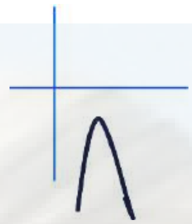
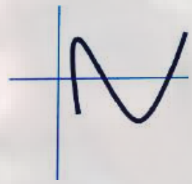
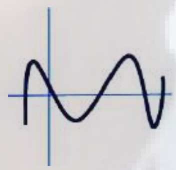
$y = p(x)$ where $p(x)$ is the polynomial of any form.

Now we can plot the equation $y = p(x)$ on the Cartesian plane by taking various values of x and y obtained by putting the values. The plot or graph obtained can be of any shapes.

The zeroes of the polynomial are the points where the graph meet x axis in the Cartesian plane. If the graph does not meet x axis, then the polynomial does not have any zero's.

Let us take some useful polynomial and shapes obtained on the Cartesian plane

S. No.	$y = p(x)$	**Graph Obtained**	**Name of the graph**	**Name of the equation**
1.	$y = ax + b$ where a and b can be any values ($a \neq 0$) **Example:** $y = 2x + 3$		Straight line. It intersect the x-axis at $(-b/a, 0)$. **Example:** $(-3/2, 0)$	Linear polynomial
2.	$y = ax^2 + bx + c$ where $b^2 - 4ac > 0$ and $a \neq 0$ and $a > 0$ **Example:** $y = x^2 - 7x + 12$		Parabola It intersect the x-axis at two points. **Example:** (3,0) and (4,0)	Quadratic polynomial
3.	$y = ax^2 + bx + c$ where $b^2 - 4ac > 0$ and $a \neq 0$ and $a < 0$ **Example:** $y = -x^2 + 2x + 8$		Parabola It intersect the xaxis at two points: **Example:** (-2,0) and (4,0)	Quadratic polynomial
4.	$y = ax^2 + bx + c$ where $b^2 - 4ac = 0$ and $a \neq 0$ $a > 0$ **Example:** $y = (x - 2)^2$		Parabola It intersect the x-axis at one points.	Quadratic polynomial
5.	$y = ax^2 + bx + c$ where $b^2 - 4ac < 0$ and $a \neq 0$ $a > 0$ **Example:** $y = x^2 - 2x + 6$		Parabola It does not intersect the x-axis It has no zero's	Quadratic Polynomial

6.	$y = ax^2 + bx + c$ where $b^2 - 4ac < 0$ and $a \neq 0$ $a < 0$ **Example:** $y = x^2 - 2x - 6$		Parabola It does not intersect the x-axis It has no zero's	Quadratic Polynomial
7.	$y = ax^3 + bx^2 + cx + d$ where $a \neq 0$	It can be of any shape 	It will cut the x-axis at the most 3 times	Cubic Polynomial
8.	$a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots \dots \dots \dots + ax + a_0$	It can be of any shape 	It will cut the x-axis at the most n times	Polynomial of n degree

Relation between coefficient and zeroes of the Polynomial

S. No.	Type of Polynomial	General form	Zero's	Relationship between Zero's and coefficients
1.	Linear	$ax + b, a \neq 0$	1	$k = \frac{-\text{constant term}}{\text{coefficient of } x}$
2.	Quadratic	$ax^2 + bx + c, a \neq 0$	2	$k_1 + k_2 = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$ $k_1 k_2 = \frac{\text{contant term}}{\text{coefficient of } x^2}$
3.	Cubic	$ax^3 + bx^2 + cx + d, a \neq 0$	3	$k_1 + k_2 + k_3 = -\frac{\text{coefficient of } x^2}{\text{coefficient of } x^3}$ $k_1 k_2 k_3 = -\frac{\text{contant term}}{\text{coefficient of } x^{32}}$ $k_1 k_2 + k_2 k_3 + k_1 k_3 = \frac{\text{coefficient of } x}{\text{coefficient of } x^2}$

Formation of polynomial when the zeroes are given

Type of Polynomial	Zero's	Polynomial Formed
Linear	$k = a$	$ax + b, a \neq 0$
Quadratic	$k_1 = a$ and $k_2 = b$	$(x - a)(x - b)$ Or $x^2 - (a + b)x + ab$ Or x^2 – (Sum of the zero's)x + product of the zero's
Cubic	$k_1 = a$, $k_2 = b$ and $k_3 = c$	$(x - a)(x - b)(x - c)$

Division algorithm for Polynomial

Let's $p(x)$ and $q(x)$ are any two polynomial with $q(x) \neq 0$, then we can find polynomial $s(x)$ and $r(x)$ such that

$P(x) = s(x)\, q(x) + r(x)$

Where $r(x)$ can be zero or degree of $r(x)$ < degree of $g(x)$

Dividend = Quotient × Divisor + Remainder

REAL NUMBER

3

IMPORTANT FORMULA SHEET

S. No.	Types of Number	Description
1.	Natural Numbers	N = {1, 2, 3, 4, 5……….} It is the counting numbers
2.	Whole number	W = {0, 1, 2, 3, 4, 5……..} It is the counting numbers + zero
3.	Integers	Z = {…–7, –6, –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, 6…}
4.	Positive integers	Z_+ = {1, 2, 3, 4, 5……..}
5.	Negative integers	Z_- ={…–7, –6, –5, –4, –3, –2, –1……….}
6.	Rational Number	A number is called rational if it can be expressed in the form p/q where p and q are integers ($q \neq 0$). **Example:** 1/2, 4/3 , 5/7, 1 etc.
7.	Irrational Number	A number is called rational if it cannot be expressed in the form p/q where p and q are integers ($q \neq 0$). **Example:** $\sqrt{3}, \sqrt{2}, \sqrt{5}, \pi$ etc.
8.	Real Numbers	All rational and all irrational number makes the collection of real number. It is denoted by the letter R

S. No.	Terms	Descriptions
1.	Euclid's Division Lemma	For a and b any two positive integer, we can always find unique integer q and r such that $a = bq + r,\ 0 \leq r \leq b$ If $r = 0$, then b is divisor of a.

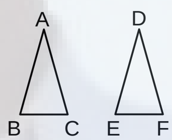
2.	HCF (Highest common factor)	HCF of two positive integers can be find using the Euclid's Division Lemma algorithm.
		We know that for any two integers a, b. we can write following expression
		$a = bq + r,\ 0 \leq r \leq b$
		If $r = 0$, then
		HCF(a, b) = b
		If $r \neq 0$, then
		HCF (a, b) = HCF (b, r)
		Again expressing the integer b, r in Euclid's Division Lemma, we get
		$b = pr + r_1$
		HCF(b, r) = HCF (r, r_1)
		Similarly successive Euclid 's division can be written

		until we get the remainder zero, the divisor at that point is called the HCF of the *a* and *b*
3.	HCF (*a*, *b*) = 1	Then a and b are co primes.
4.	Fundamental Theorem of Arithmetic	Composite number = Product of primes
5.	HCF and LCM by prime factorization method	HCF = Product of the smallest power of each common factor in the numbers. LCM = Product of the greatest power of each prime factor involved in the number/
6.	Important Formula	HCF (*a*, *b*) × LCM (*a*, *b*) = *a* × *b*
7.	Important concept for rational Number	Terminating decimal expression can be written in the form $p/2^n5^m$

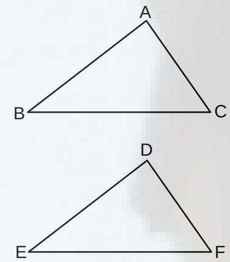
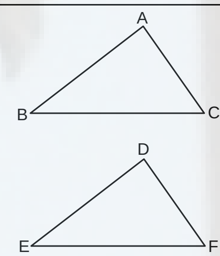
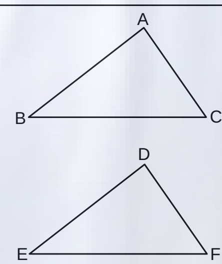
SIMILAR TRIANGLES

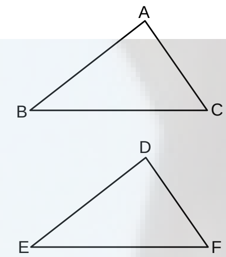
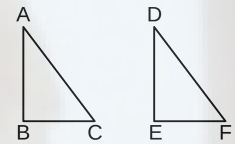
4

IMPORTANT FORMULA SHEET

S. No.	Terms	Descriptions
1.	Congruence	• Two Geometric figure are said to be congruent if they are exactly same size and shape Symbol used is ≅ • Two angles are congruent if they are equal • Two circle are congruent if they have equal radii • Two squares are congruent if the sides are equal
2.	Triangle Congruence	• Two triangles are congruent if three sides and three angles of one triangle is congruent to the corresponding sides and angles of the other  • Corresponding sides are equal AB = DE, BC = EF, AC = DF • Corresponding angles are equal $\angle A = \angle D$, $\angle B = \angle E$, $\angle C = \angle F$ • We write this as ABC ≅ DEF • The above six equalities are between the corresponding parts of the two congruent triangles. In short form this is called **C.P.C.T.** • We should keep the letters in correct order on both sides
3.	Inequalities in Triangles	• In a triangle angle opposite to longer side is larger • In a triangle side opposite to larger angle is larger • The sum of any two sides of the triangle is greater than the third side In triangle ABC AB + BC > AC

Different Criterion for Congruence of the triangles

S. No.	Criterion	Descriptions	Figures and expression
1.	Side angle Side (SAS) congruence	• Two triangles are congruent if the two sides and included angles of one triangle is equal to the two sides and included angle • It is an axiom as it cannot be proved so it is an accepted truth • ASS and SSA type two triangles may not be congruent always	 If following condition AB = DE, BC = EF ∠B = ∠E Then ABC ≅ DEF
2.	Angle side angle (ASA) congruence	• Two triangles are congruent if the two angles and included side of one triangle is equal to the corresponding angles and side • It is a theorem and can be proved	 If following condition BC = EF ∠B = ∠E, ∠C = ∠F Then ABC ≅ DEF
3.	Angle angle side(AAS) congruence	• Two triangles are congruent if the any two pair of angles and any side of one triangle is equal to the corresponding angles and side • It is a theorem and can be proved	 If following condition BC = EF ∠A = ∠D, ∠C = ∠F Then ABC ≅ DEF

4.	Side-Side-Side (SSS) Congruence	• Two triangles are congruent if the three sides of one triangle is equal to the three sides of the another	 If following condition BC=EF, AB=DE, DF=AC Then .ABC ≅ DEF
5.	Right angle – Hypotenuse side (RHS)	• Two right triangles are congruent if the hypotenuse and a side of the one triangle are equal to corresponding hypotenuse and side of the another	 If following condition AC = DF, BC = EF Then ABC ≅ DEF

<u>Some Important points on Triangles</u>

Terms	**Description**
Side angle Side (SAS) congruence	Point of intersection of the three altitude of the triangle
Equilateral	Triangle whose all sides are equal and all angles are equal to 60°
Median	A line Segment joining the vertex of the triangle to the midpoint of the opposite side of the triangle
Altitude	A line Segment from the vertex of the triangle and perpendicular to the opposite side of the triangle
Isosceles	A triangle whose two sides are equal
Centroid	Point of intersection of the three median of the triangle is called the centroid of the triangle
In center	All the angle bisector of the triangle passes through same point
Circumcenter	The perpendicular bisector of the sides of the triangles passes through same point
Scalene triangle	Triangle having no equal angles and no equal sides
Right Triangle	Right triangle has one angle equal to 90°
Obtuse Triangle	One angle is obtuse angle while other two are acute angles
Acute Triangle	All the angles are acute

Similarity of Triangles

S. No.	Points
1.	Two figures having the same shape but not necessarily the same size are called similar figures.
2.	All the congruent figures are similar but the converse is not true.
3.	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then the other two sides are divided in the same ratio.
4.	If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

Different Criterion for Similarity of the triangles

S. No.	Criterion	Descriptions	Expression
1.	Angle Angle Angle (AAA) similarity	Two triangles are similar if corresponding angle are equal	If following condition ∠A = ∠D ∠B = ∠E ∠C = ∠F Then $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ Then $ABC \sim DEF$
2.	Angle angle (AA) similarity	• Two triangles are similar if the two corresponding angles are equal as by angle property third angle will be also equal	If following condition ∠A = ∠D ∠B = ∠E Then ∠C = ∠F Then $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ Then $ABC \sim DEF$
3.	Side side side(SSS) Similarity	• Two triangles are similar if the sides of one triangle is proportional to the sides of other triangle	If following condition $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ Then ∠A = ∠D ∠B = ∠E ∠C = ∠F Then $ABC \cong DEF$
4.	Side-Angle-Side (SAS) Similarity	• Two triangles are similar if the one angle of a triangle is equal to one angle of other triangles and sides including that angle is proportional	If following condition $\frac{AB}{DE} = \frac{AC}{DF}$ And ∠A = ∠D Then $ABC \cong DEF$

Area of Similar triangles

If the two triangle ABC and DEF are similar

ABC ≅ DEF

Then

$$\frac{Area\ of\ Triangle\ ABC}{Area\ of\ Triangle\ DEF} = \left(\frac{AB}{DE}\right)^2 = \left(\frac{BC}{EF}\right)^2 = \left(\frac{AC}{DF}\right)^2$$

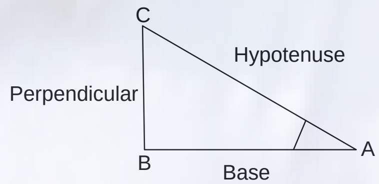
Pythagoras Theorem

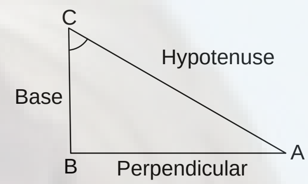
S. No.	Points
1.	If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, then the triangles on both sides of the perpendicular are similar to the whole triangle and also to each other.
2.	In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides (Pythagoras Theorem). $(hyp)^2 = (base)^2 + (perp)^2$
3.	If in a triangle, square of one side is equal to the sum of the squares of the other two sides, then the angle opposite the first side is a right angle

TRIGONOMETRY

5

IMPORTANT FORMULA SHEET

S. No.	Terms	Description
1.	What is Trigonometry?	Trigonometry from Greek trigõnon, "triangle" and metron, "measure") is a branch of mathematics that studies relationships involving lengths and angles of triangles. The field emerged during the 3^{rd} century BC from applications of geometry to astronomical studies. Trigonometry is most simply associated with planar right angle triangles (each of which is a two-dimensional triangle with one angle equal to 90 degrees). The applicability to non-right-angle triangles exists, but, since any non-right-angle triangle (on a flat plane) can be bisected to create two right-angle triangles, most problems can be reduced to calculations on right-angle triangles. Thus the majority of applications relate to right-angle triangles.
2.	Trigonometric Ratio’s	In a right angle triangle ABC where B = 90°  We can define following term for angle A **Base:** Side adjacent to angle **Perpendicular:** Side Opposite of angle **Hypotenuse:** Side opposite to right angle We can define the trigonometric ratios for angle A as: sin A = Perpendicular/Hypotenuse = BC/AC cosec A= Hypotenuse/Perpendicular = AC/BC cos A= Base/Hypotenuse = AB/AC sec A= Hypotenuse/Base = AC/AB tan A= Perpendicular/Base = BC/AB cot A= Base/Perpendicular = AB/BC Notice that each ratio in the right-hand column is the inverse, or the reciprocal, of the ratio in the left-hand column.
3.	Reciprocal of functions	The reciprocal of sin A is cosec A; and viceversa.

		The reciprocal of cos A is sec A And the reciprocal of tan A is cot A These are valid for acute angles. We can define tan A = sin A/cos A And cot A = cos A/sin A
4.	Value of of sin and cos	Is always less 1
5.	Trigonometric ration from another angle	We can define the trigonometric ratios for angle C as  sin C = Perpendicular/Hypotenuse = AB/AC cosec C = Hypotenuse/Perpendicular = AC/ABB cos C = Base/Hypotenuse = BC/AC sec C = Hypotenuse/Base = AC/BC tan A = Perpendicular/Base = AB/BC cot A = Base/Perpendicular = BC/AB
6.	Trigonometric ratios of complimentary angles	sin(90 – A) = cosA cos(90 – A) = sinA tan(90 – A) = cotA sec(90 – A) = cosecA cosec(90 – A) = secA cot(90 – A) = tanA
7.	Trigonometric identities	$\sin^2 A + \cos^2 A = 0$ $1 + \tan^2 A = \sec^2 A$ $1 + \cot^2 A = \text{cosec}^2 A$

Trigonometric Ratios of Common angles

We can find the values of trigonometric ratio’s various angle.

Angles(A)	**SinA**	**CosA**	**TanA**	**CosecA**	**SecA**	**CotA**
0°	0	1	0	Not defined	1	Not defined
30°	1/2	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	2	$\frac{2}{\sqrt{3}}$	$\sqrt{3}$
45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1	$\sqrt{2}$	$\sqrt{2}$	1
60°	$\frac{\sqrt{3}}{2}$	1/2	$\sqrt{3}$	$\frac{2}{\sqrt{3}}$	2	$\frac{1}{\sqrt{3}}$
90°	1	0	Not defined	1	Not defined	0

QUADRATIC EQUATION

6

IMPORTANT FORMULA SHEET

S. No.	Terms	Description
1.	Quadratic Polynomial	$P(x) = ax^2 + bx + c$ where $a \neq 0$
2.	Quadratic equation	$ax^2 + bx + c = 0$ where $a \neq 0$
3.	Solution or root of the Quadratic equation	A real number α is called the root or solution of the quadratic equation if $a\alpha^2 + b\alpha + c = 0$
4.	zeroes of the polynomial p(x).	The root of the quadratic equation are called zeroes
5.	Maximum roots of quadratic equations	We know from chapter two that a polynomial of degree can have max two zeroes. So a quadratic equation can have maximum two roots
6.	Condition for real roots	A quadratic equation has real roots if $b^2 - 4ac > 0$

How to Solve Quadratic equation

S. No.	Method	Working
1.	Factorization	This method we factorize the equation by splitting the middle term b In $ax^2 + bx + c = 0$ **Example:** $6x^2 - x - 2 = 0$ (1) First we need to multiple the coefficient a and c. In this case = $6x - 2 = -12$ (2) Splitting the middle term so that multiplication is 12 and difference is the coefficient b. $6x^2 + 3x - 4x - 2 = 0$ $3x(2x + 1) -2(2x + 1) = 0$ $(3x - 2)(2x + 1) = 0$ (3) Roots of the equation can be find equating the factors to zero $3x - 2 = 0 \Rightarrow x = 3/2$ $2x + 1 = 0 \Rightarrow x = -1/2$

2.	Square method	In this method we create square on LHS and RHS and then find the value. $ax^2 + bx + c = 0$ (1) $x^2 + (b/a)\,x + (c/a) = 0$ (2) $(x + b/2a)^2 - (b/2a)^2 + (c/a) = 0$ (3) $(x + b/2a)^2 = (b^2 - 4ac)/4a^2$ (4) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ **Example:** $x^2 + 4x - 5 = 0$ (1) $(x + 2)^2 - 4 - 5 = 0$ (2) $(x + 2)^2 = 9$ (3) Roots of the equation can be find using square root on both the sides $x + 2 = -3 \Rightarrow x = -5$ $x + 2 = 3 \Rightarrow x = 1$
3.	Quadratic method	For quadratic equation $ax^2 + bx + c = 0$, roots are given by $x = \dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$, $x = \dfrac{-b - \sqrt{b^2 - 4ac}}{2a}$ For $b^2 - 4ac > 0$, Quadratic equation has two real roots of different value For $b^2 - 4ac = 0$, quadratic equation has one real root For $b^2 - 4ac < 0$, no real roots for quadratic equation

Nature of roots of Quadratic equation

S. No.	Condition	Nature of roots
1.	$b^2 - 4ac > 0$	Two distinct real roots
2.	$b^2 - 4ac = 0$	One real root
3.	$b^2 - 4ac < 0$	No real roots

ARITHMETIC PROGRESSION

7

IMPORTANT FORMULA SHEET

S. No.	Terms	Description
1.	Arithmetic Progression	An arithmetic progression is a sequence of numbers such that the difference of any two successive members is a constant **Examples:** (1) 1, 5, 9, 13, 17…. (2) 1, 2, 3, 4, 5, …
2.	common difference of the AP	The difference between any successive members is a constant and it is called the common difference of AP (1) If a_1, a_2, a_3, a_4, a_5 are the terms in AP then $D = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = a_5 - a_4$ (2) We can represent the general form of AP in the form $a, a + d, a + 2d, a + 3d, a + 4d$ …. Where a is first term and d is the common difference
3.	n^{th} term of Arithmetic Progression	n^{th} term $= a + (n - 1)d$
4.	Sum of nth item in Arithmetic Progression	$S_n = (n/2)[2a + (n - 1)d]$ Or $S_n = (n/2)[t_1 + t_n]$

COORDINATE GEOMETRY

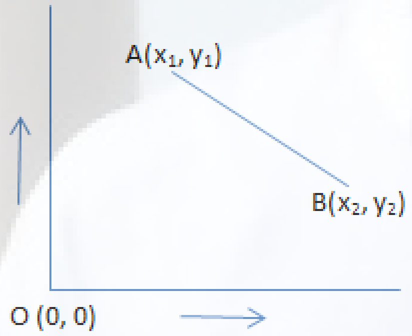
8

IMPORTANT FORMULA SHEET

Introduction

- We require two perpendicular axes to locate a point in the plane. One of them is horizontal and other is Vertical.The plane is called Cartesian plane and axis are called the coordinates axis
- The horizontal axis is called x-axis and Vertical axis is called Y-axis
- The point of intersection of axis is called origin.
- The distance of a point from y axis is called x –coordinate or abscissa and the distance of the point from x –axis is called y – coordinate or Ordinate
- The x-coordinate and y –coordinate of the point in the plane is written as (x, y) for point and is called the coordinates of the point

Distance formula



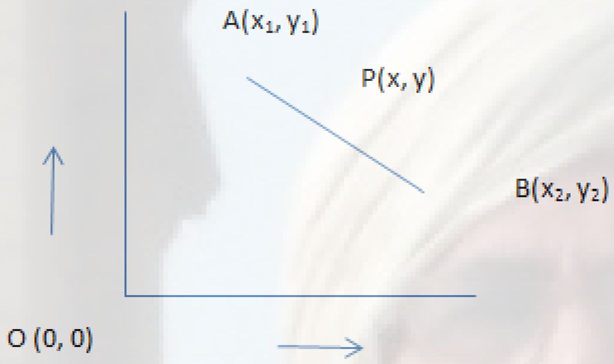
Distance between the points AB is given by

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

Distance of Point A from Origin

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

Section Formula



A point P(x,y) which divide the line segment AB in the ratio m_1 and m_1 is given by

$$x = \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$$

$$y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$$

The mid point P is given by

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

Area of Triangle ABC

Area of triangle ABC of coordinates $A(x_1,y_1)$, $B(x_2,y_2)$ and $C(x_3,y_3)$ is given by

$$A = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

For point A,B and C to be collinear, The value of A should be zero

NOTE:

(1) Area cannot be negative so, we shall ignore negative sign if it occurs in a problem.

(2) To find the area of quadrilateral we shall divide it into two triangles by joining two opposite vertices, find their areas and add them.

(3) If the area of triangle is zero sq. units then the vertices of triangle are collinear.

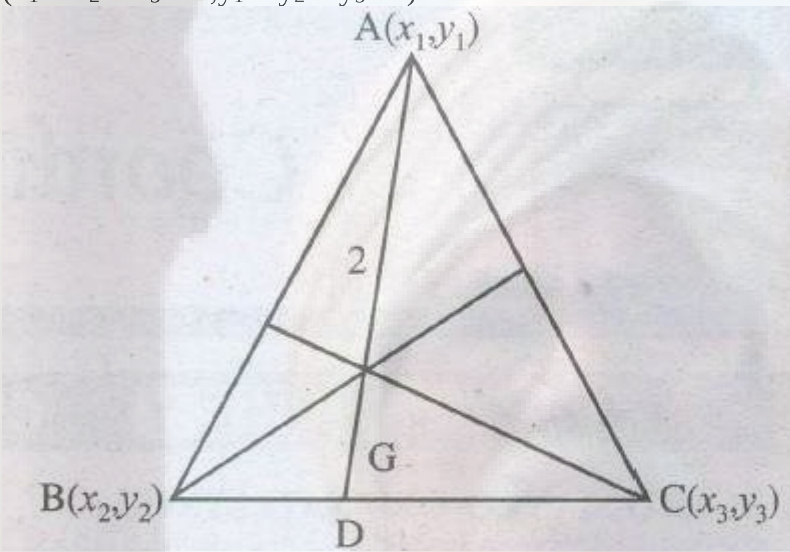
CENIROID OF A TRIANGLE

The point where the medians of a triangle meet is called the centroid of the triangle.

“If AD is a mediam of the triangle ABC and G is its centroid, then AG/GD = 2/1.”

The coordinates of the point G are

($x_1 + x_2 + x_3 / 3$,$y_1 + y_2 + y_3 / 3$)



Note:

(I) Four points will form :
(a) a **parallelogram** if its opposite sides are equal, but diagonals are unequal.

(b) a **rectangle** if opposite sides are equal and two diagonals are also equal.

(c) a **rhombus** if all the four sides are equal, but diagonals unequal,

(d) a **square** if all sides are equal and diagonals are also equal.

(II) Three points will form:
(a) an equilateral triangle if all the three sides are equal.

(b) an isosceles triangle if any two sides are equal.

(c) a right angled triangle if sum of square of any two sides is equal to square of the third side.

(d) a triangle if sum of any two sides (distances) is greater than the third side (distance).

(III) Three points A, B and C are collinear or lie on a line if one of the following holds
(i) AB + BC — AC

(ii) AC + CB AB

(iii) CA + AB CB.

To prove that given three points are collinear using formula

We need to assume that if they are not collinear,they should be able to form triangle.
We will calculate the area of the triangle,if it comes zero, that no triangle can be found and they are collinear.

$$A = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

AREA RELATED CIRCLE

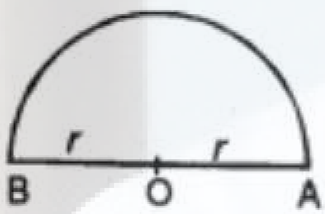
9

IMPORTANT FORMULA SHEET

Circumference of a Circle or Perimeter of a Circle

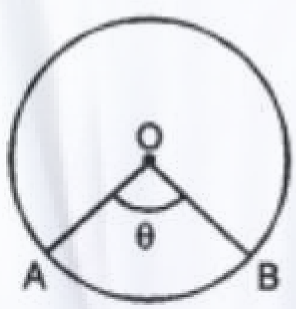
- The distance around the circle or the length of a circle is called its circumference or perimeter.
- Circumference (perimeter) of a circle = πd or $2\pi r$,
  where d is a diameter and r is a radius of the circle and $\pi = 22/7$
- Area of a circle = πr^2
- Area of a semicircle = $1/2\ \pi r^2$
- Area of quadrant = $1/4\ \pi r^2$

Perimeter of a semicircle:
Perimeter of a semicircle or protractor = $\pi r + 2r$



Area of the ring Formulas :
Area of the ring or an annulus = $\pi R^2 - \pi r^2$
$= \pi(R^2 - r^2)$
$= \pi (R + r) (R - r)$

Length of the arc AB = $\frac{2\pi r\theta}{360} = \frac{\pi r\theta}{180}$

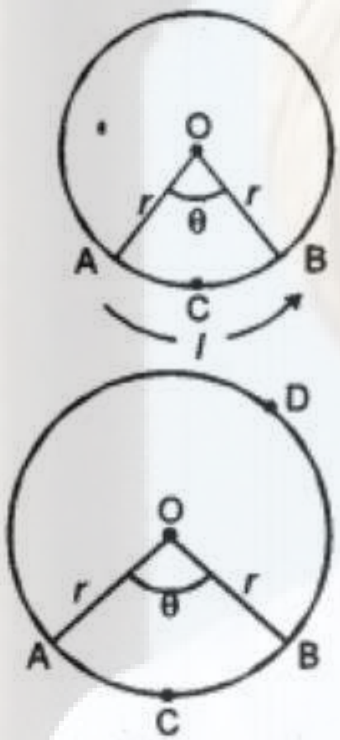


Area of sector formula:

- Area of sector OACBO = $\frac{\pi r^2 \theta}{360}$
- Area of sector OACBO = 1/2 (r × l).

Perimeter of a sector Formula:

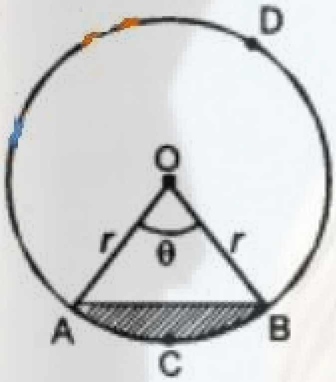
Perimeter of sector OACBO = Length of arc AB + 2r
= $\frac{\pi r \theta}{180}$ + 2r



Other important formulae:

- Distance moved by a wheel in 1 revolution = Circumference of the wheel.
- Number of revolutions in one minute = $\frac{\text{Distance moved in 1 minute}}{\text{Circumference}}$
- Angle described by minute hand in 60 minutes = 360°
- Angle described by hour hand in 12 hours = 360°
- The mid-point of the hypotenuse of a right triangle is equidistant from the vertices of the triangle.
- The angle subtended at the circumference by a diameter is always a right angle.

Area of a segment Formula Class 10 :



- Area of minor segment ACBA = Area of sector OACBO – Area of ΔOAB
  $= \frac{\pi r^2 \theta}{360} - \frac{1}{2} r^2 \sin\theta$
- Area of major segment BDAB = Area of the circle – Area of minor segment ACBA
  $= \pi r^2$ – Area of minor segment ACBA.
- If a chord subtends a right angle at the centre, then
  Area of the corresponding segment = $\left(\frac{\pi}{4} - \frac{1}{2}\right) r^2$
- If a chord subtends an angle of 60° at the centre, then
  Area of the corresponding segment = $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{2}\right) r^2$
- If a chord subtends an angle of 120° at the centre, then
  Area of the corresponding segment = $\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right) r^2$

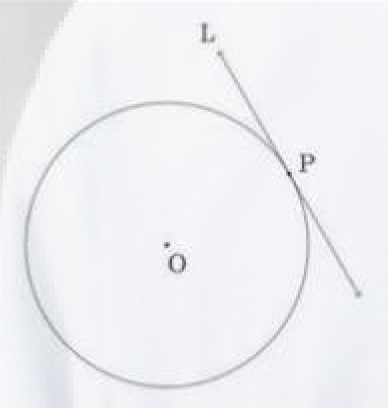
CIRCLE

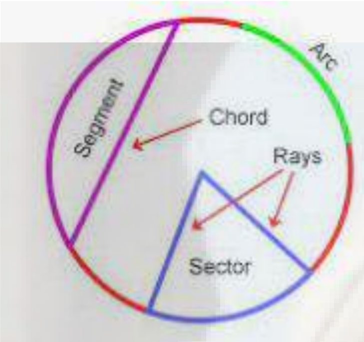
10

IMPORTANT FORMULA SHEET

- onstant distance from a fixed point.
- **Centre**: The fixed point is called a centre.
- **Radius**: The constant distance is called the radius.
- **Diameter**: Twice of radius is called the diameter.
- **Chord**: The line joining two points on the circumference of the circle is called a chord. The longest chord is the diameter of the circle.
- **Sector of a circle**: The region enclosed by two radii and the corresponding arc is called a sector of the circle.
- **Segment of the circle**: The region bounded by an arc and the corresponding chord is called the segment of the circle.

Tangent





1. **Tangent to a Circle** : It is a line that intersects the circle at only one point.
2. **Point of contact**: The common point between the circle and the tangent is called the point of contact.
3. **Secant**: A line which has only two points common to a circle is called the secant.
4. There is only one tangent at a point of the circle.
5. No tangent can be drawn from a point inside the circle.
6. The tangent at any point of a circle is perpendicular to the radius through the point of contact.
7. The lengths of tangents drawn from an external point to a circle are equal.

SURFACE AREA AND VOLUME

11

IMPORTANT FORMULA SHEET

LSA = Lateral Surface Area,

TSA = Total Surface Area.

Sphere	**Diameter:** 2r **Circumference:** $2 \pi r$ **TSA:** $4\pi r^2$ **Volume:** $\frac{4}{3}\pi r2$ r = radius
Cylinder	**Circumference:** $2\pi r$ **LSA:** $2\pi rh$ **TSA:** $2\pi r (r + h)$ **Volume:** $\pi r^2 h$ r = radius, h = height
Cone	**Slant height:** $l = \sqrt{h^2 + r^2}$ **LSA:** πrl **TSA:** $\pi r(r + l)$ **Volume:** $\frac{1}{3}\pi r2h$ r = radius, l = slant height, h = height
Cuboid	**LSA:** $2h(l + b)$ **TSA:** $2(lb + bh + hl)$ **Volume:** lbh

	l = length, b = breadth, h = height
Cube	**LSA:** $4a^2$ **TSA:** $6a^2$ **Volume:** a^3 a = sides of a cube
Frustum	CSA of the frustum of a cone = $\pi l(r_1 + r_2)$. $l = \sqrt{h^2 + (r_1 - r_2)^2}$ TSA of a frustum of a cone = $\pi l(r_1 + r_2) + \pi r_1^2 + \pi r_2^2$ Volume of the frustum of a cone = $(1/3)\,\pi h\,(r_1^2 + r_2^2 + r_1 r_2)$

12 STATISTICS

IMPORTANT FORMULA SHEET

1. **Mean** : The mean for grouped data can be found by :

(i) The direct method =

$$\bar{X} = \frac{\sum fixi}{\sum fi}$$

(ii) The assumed mean method

$$X = a + \frac{\sum fidi}{\sum fi}$$

Where di=xi−a.

a = Provisional mean

(iii) The step deviation method

$$X = a + \frac{\sum fiui}{\sum fi} \times h,$$

Where,

$$U_1 = \frac{X_i - a}{h}$$

2. **Mode** : The mode for the grouped data can be found by using the formula :

$$\text{mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

l= lower limit of the modal class.

$f1$ = frequency of the modal class.

fo = frequency of the preceding class of the modal class.

$f2$= frequency of the succeeding class of the modal class.

h = size of the class interval.

Modal class - class interval with highest frequency.

3. **Median** : Median of continuous series is:

(i) $(\frac{N}{2})$th term (if number of terms are odd)

(ii) $\frac{1}{2}[(\frac{N}{2})^{th}$ term$+(\frac{N}{2}+1)^{th}$term] (if number of terms are even]

(iii) The median for the grouped data can be found by using the formula :

$$\text{median} = l + \left[\frac{n/2 - Cf}{f}\right] \times h$$

l= lower limit of the median class.

n = number of observations.

Cf = cumulative frequency of class interval preceding the median class.

f = frequency of median class.

h = class size.

4.**Empirical Formula** : Mode = 3 median - 2 mean.

5.**Cumulative frequency curve or an Ogive** :

(i) Ogive is the graphical representation of the cumulative frequency distribution.

(ii) Less than type Ogive :

• Construct a cumulative frequency table.

• Mark the upper class limit on the x-axis.

(iii) More than type Ogive :

• Construct a frequency table.

• Mark the lower class limit on the x-axis.

(iv) To obtain the median of frequency distribution from the graph :

• Locate point of intersection of less than type Ogive and more than type Ogive :

Draw a perpendicular from this point on x-axis.

• The point at which it cuts the x-axis gives us the median.

13 PROBABILITY

IMPORTANT FORMULA SHEET

1. The Theoretical probability of the occurence of an event E written as P(E) is
   $$P(E)=\frac{\text{Number of outcomes favourable of E}}{\text{Number of all possible outcomes of the experiment}}$$
2. **Experiment**: An activity which ends in some well defined outcomes is called an experiment.
3. **Trial**: Performing an experiment once is called a trial.
4. **Event**: The possible outcomes of a trial is called an event.
5. **Sure event**: An event whose occurence is certain is called a sure event.
6. The sum of the probability of all the elementary events of an experiment is 1.
7. The probability of a sure event is 1 and probability of an impossible event is 0.
8. If E is an event, in general, it is true that $P(E) + P(\bar{E}) = 1$. $[P(\bar{E})=P(\text{not}E)]$
9. From the definition of the probability, the numerator is always less than or equal to the denominator therefore $0\leq P(E)\leq 1 0\leq P(E)\leq 1$