Class 10 Math's Formula

CBSE Class 10 Math's Summary

This pdf list all the Class 10 CBSE math's formula in a concise manner to help the students in revision and examination as per NCERT syllabus

Real Numbers

S.no	Type of Numbers	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> 0). Example : ½ , 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> 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

		$a=bq + r$, $0 \le r \le b$ 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 $a=bq + r$, $0 \le r \le b$ If r=0 ,then HCF(a, b) =b If $r \ne 0$, 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) X LCM (a,b) =a X b
7	Important concept for rational Number	Terminating decimal expression can be written in the form $p/2^n5^m$

Polynomial expressions

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

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

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

Some Important point to Note

S.no	Points
1	a_n ,a_{n-1} ,a_{n-2} ,…..a_1,a_0 are called the coefficients for x^n,x^{n-1} ,…..x^1,x^0

2	n is called the degree of the polynomial
3	when a_n ,a_{n-1} ,a_{n-2} ,.....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 item is called monomial, two items binomial and three items 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

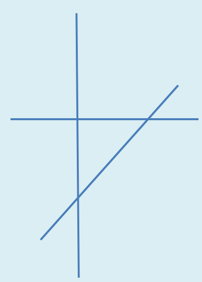
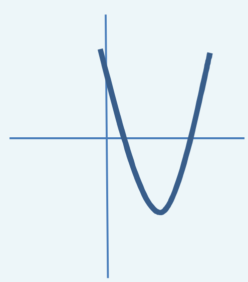
Let's us assume

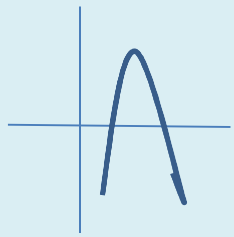
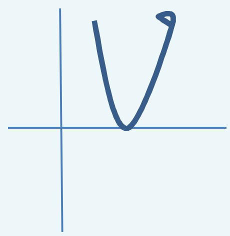
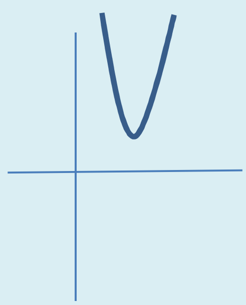
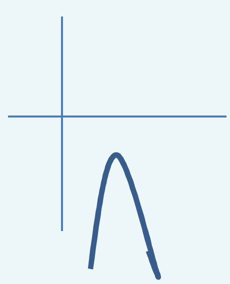
y= p(x) where p(x) is the polynomial of any form.

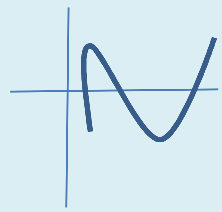
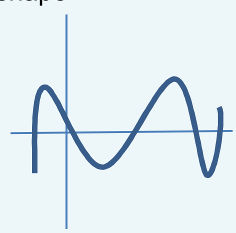
Now we can plot the equation y=p(x) on the Cartesian plane by taking various values of x and y obtained by putting the values. The plot or graph obtained can be of any shapes

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 $a\neq0$ and $a < 0$ Example $y=-x^2+2x+8$		Parabola It intersect the x-axis at two points Example (-2,0) and (4,0)	Quadratic polynomial
4	$y=ax^2+bx+c$ where $b^2-4ac = 0$ and $a\neq0$ $a > 0$ 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 $a\neq0$ $a > 0$ 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 $a\neq0$ $a < 0$ Example $y=-x^2-2x-6$		Parabola It does not intersect the x-axis It has no zero's	Quadratic polynomial

7	y=ax³ +bx²+cx+d where a≠0	It can be of any shape 	It will cut the x-axis at the most 3 times	Cubic Polynomial
8	$a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots \dots \dots \dots + ax + a_0$ Where a_n ≠0	It can be of any shape 	It will cut the x-axis at the most n times	Polynomial of n degree

<u>Relation between coefficient and zeroes of the Polynomial:</u>

S.no	Type of Polynomial	General form	Zero's	Relationship between Zero's and coefficients
1	Linear polynomial	ax+b , a≠0	1	$k = \frac{-constant\ term}{Coefficent\ of\ x}$
2	Quadratic	ax²+bx+c, a≠0	2	$k_1 + k_2 = -\frac{Coefficent\ of\ x}{Coefficent\ of\ x^2}$ $k_1k_2 = \frac{Contant\ term}{Coefficent\ of\ x^2}$
3	Cubic	ax³+bx²+cx+d, a≠0	3	$k_1 + k_2 + k_3 = -\frac{Coefficent\ of\ x^2}{Coefficent\ of\ x^3}$

$$k_1k_2k_3 = -\frac{Contant\ term}{Coefficent\ of\ x^{32}}$$

$$k_1k_2 + k_2k_3 + k_1k_3 = \frac{Coefficent\ of\ x}{Coefficent\ of\ x^2}$$

Formation of polynomial when the zeroes are given

Type of polynomial	Zero's	Polynomial Formed
Linear	k=a	(x-a)
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) ≠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 X Divisor + Remainder

COORDINATE GEOMETRY

S.no	Points
1	We require two perpendicular axes to locate a point in the plane. One of them is horizontal and other is Vertical
2	The plane is called Cartesian plane and axis are called the coordinates axis
3	The horizontal axis is called x-axis and Vertical axis is called Y-axis
4	The point of intersection of axis is called origin.
5	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
6	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
7	The Origin has zero distance from both x-axis and y-axis so that its abscissa and ordinate both are zero. So the coordinate of the origin is (0, 0)
8	A point on the x –axis has zero distance from x-axis so coordinate of any point on the x-axis will be (x, 0)
9	A point on the y –axis has zero distance from y-axis so coordinate of any point on the y-axis will be (0, y)
10	The axes divide the Cartesian plane in to four parts. These Four parts are called the quadrants

The coordinates of the points in the four quadrants will have sign according to the below table

Quadrant	x-coordinate	y-coordinate
Ist Quadrant	+	+
IInd quadrant	-	+
IIIrd quadrant	-	-
IVth quadrant	+	-

S.no	Terms	Descriptions
1	**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 $$D=\sqrt{x^2+y^2}$$
2	**Section Formula**	A point P(x,y) which divide the line segment AB in the ratio m_1 and m_2 is given by

		$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$$ $$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2}$$ The midpoint P is given by $\left(\frac{x_1+x_2}{2}\right), \left(\frac{y_1+y_2}{2}\right)$
3	Area of Triangle	*Area of triangle ABC of coordinates A(x_1,y_1) , B(x_2,y_2) and C(x_3,y_3)* $$A = \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$ For point A,B and C to be collinear, The value of A should be zero

LINEAR EQUATIONS IN TWO VARIABLES

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

A(x_1, y_1)

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	Type of equation	Mathematical representation	Solutions
1	Linear equation in one Variable	$ax+b=0$,$a\neq0$ a and b are real number	One solution
2	Linear equation in two Variable	$ax+by+c=0$, $a\neq0$ and $b\neq0$ a, b and c are real number	Infinite solution possible
3	Linear equation in three Variable	$ax+by+cz+d=0$, $a\neq0$,$b\neq0$ and $c\neq0$	Infinite solution possible

		a, b, c, d are real number	

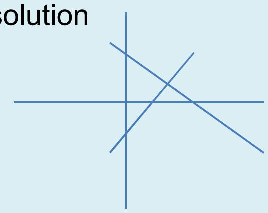
Simultaneous pair of Linear equation:

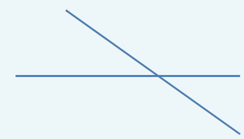
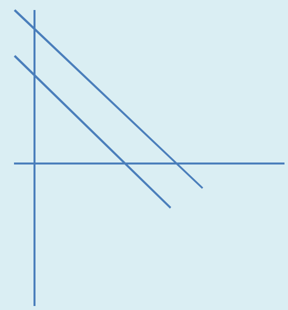
A pair of Linear equation in two variables

$a_1x+b_1y+c_1=0$

$a_2x+b_2y+c_2=0$

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 only.
$a_1x+b_1y+c_1=0$ **$a_2x+b_2y+c_2=0$**	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Coincident lines. The any coordinate on the line is the solution.	Infinite solution.

Example **$2x+4y=16$** **$3x+6y=24$**			
$a_1x+b_1y+c_1=0$ **$a_2x+b_2y+c_2=0$** **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.

Algebraic Solution of system of Linear equation

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 4) Subtract the equation obtained. This way one variable will be eliminated and we can solve to get the value of variable y 5) 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 => first and last expression y=> second and last expression

Quadratic Equations

S.no	Terms	Descriptions
1	*Quadratic Polynomial*	P(x) = ax^2+bx+c where $a\neq0$
2	*Quadratic equation*	$ax^2+bx+c=0$ where $a\neq0$
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 => 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) $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ 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 => x=-5 x+2=3=> x=1
3	Quadratic method	For quadratic equation $ax^2 + bx + c = 0$, roots are given by $x = \frac{-b+\sqrt{b^2-4ac}}{2a}$, $x = \frac{-b-\sqrt{b^2-4ac}}{2a}$

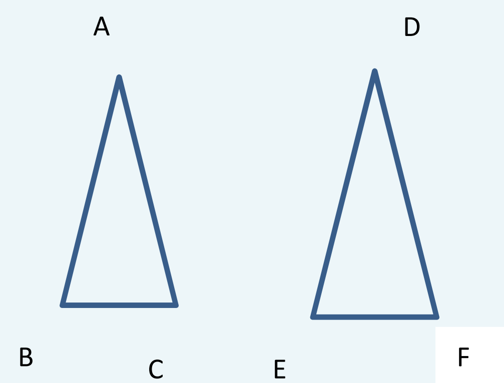
	For b^2 -4ac > 0, Quadratic equation has two real roots of different value For b^2-4ac =0, quadratic equation has one real root For b^2-4ac < 0, no real roots for quadratic equation

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

Triangles

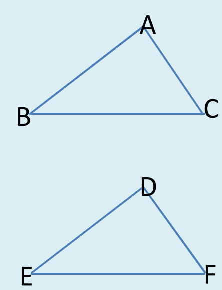
S.no	Terms	Descriptions
1	Congruence	Two Geometric figure are said to be congruence if they are exactly same size and shape Symbol used is $\cong$ Two angles are congruent if they are equal Two circle are congruent if they have equal radii Two squares are congruent if the sides are equal

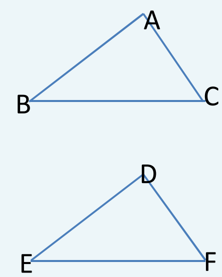
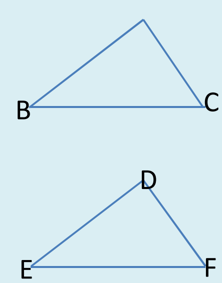
2	Triangle Congruence	• Two triangles are congruent if three sides and three angles of one triangle is congruent to the corresponding sides and angles of the other  • Corresponding sides are equal AB=DE , BC=EF ,AC=DF • Corresponding angles are equal $\angle A=\angle D, \angle B=\angle E, \angle C=\angle F$ • We write this as $ABC \cong DEF$ • 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	1) In a triangle angle opposite to longer side is larger 2) In a triangle side opposite to larger angle is larger 3) The sum of any two sides of the triangle is greater than the third side

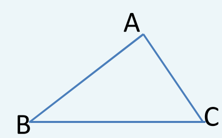
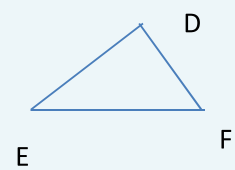
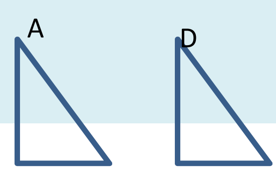
In triangle ABC

AB +BC > AC

Different Criterion for Congruence of the triangles

N	Criterion	Description	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 $\angle \boldsymbol{B} = \angle \boldsymbol{E}$ **Then** $ABC \cong DEF$
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** $\angle \boldsymbol{B} = \angle \boldsymbol{E}, \angle \boldsymbol{C} = \angle \boldsymbol{F}$ **Then** $ABC \cong DEF$
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** $\angle \boldsymbol{A} = \angle \boldsymbol{D}, \angle \boldsymbol{C} = \angle \boldsymbol{F}$ **Then** $ABC \cong DEF$
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** $ABC \cong DEF$
5	Right angle – hypotenuse-side(RHS)	• Two right triangles are congruent if the hypotenuse and a side of the one triangle are equal to	

congruence	corresponding hypotenuse and side of the another	B C E F **If following condition** **AC=DF,BC=EF** **Then** $ABC \cong DEF$

Some Important points on Triangles

Terms	Description
Orthocenter	Point of intersection of the three altitude of the triangle
Equilateral	triangle whose all sides are equal and all angles are equal to 60^0
Median	A line Segment joining the corner of the triangle to the midpoint of the opposite side of the triangle
Altitude	A line Segment from the corner 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 90^0
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

N	Criterion	Description	Expression
1	Angle Angle angle(AAA) similarity	• Two triangles are similar if corresponding angle are equal	***If following condition*** $\angle A = \angle D$ $\angle B = \angle E$ $\angle C = \angle F$ ***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*** $\angle \boldsymbol{A} = \angle \boldsymbol{D}$ $\angle \boldsymbol{B} = \angle \boldsymbol{E}$ ***Then*** $\angle \boldsymbol{C} = \angle \boldsymbol{F}$ ***Then*** $\frac{\boldsymbol{AB}}{\boldsymbol{DE}} = \frac{\boldsymbol{BC}}{\boldsymbol{EF}} = \frac{\boldsymbol{AC}}{\boldsymbol{DF}}$ ***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** $\frac{\boldsymbol{AB}}{\boldsymbol{DE}} = \frac{\boldsymbol{BC}}{\boldsymbol{EF}} = \frac{\boldsymbol{AC}}{\boldsymbol{DF}}$ **Then** $\angle \boldsymbol{A} = \angle \boldsymbol{D}$ $\angle \boldsymbol{B} = \angle \boldsymbol{E}$ $\angle \boldsymbol{C} = \angle \boldsymbol{F}$ **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*** $\angle A = \angle D$ **Then** $ABC \cong DEF$

Area of Similar triangles

If the two triangle ABC and DEF are similar

$$ABC \cong DEF$$

Then

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

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

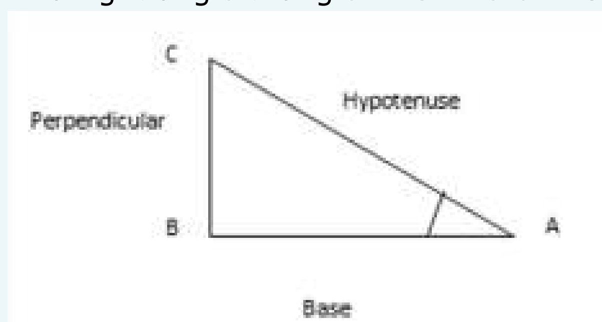
Arithmetic Progression

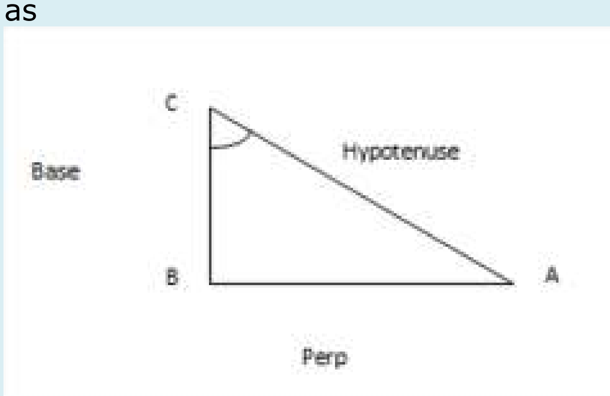
S.no	Terms	Descriptions
1	Arithmetic Progression	An arithmetic progression is a sequence of numbers such that the difference of any two successive members is a constant Examples 1) 1,5,9,13,17…. 2) 1,2,3,4,5,…
2	common difference of the AP	the difference between any successive members is a constant and 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	nth term of Arithmetic Progression	n^{th} term = a + (n - 1)d
4	Sum of nth item in Arithmetic Progression	$S_n = (n/2)[a + (n-1)d]$ Or $S_n = (n/2)[t_1 + t_n]$

Trigonometry

S.no	Terms	Descriptions
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 3rd 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 vice-versa. 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	Sin (90-A) =cos(A) Cos(90-A) = sin A

	angles	Tan(90-A) =cot A Sec(90-A)= cosec A Cosec (90-A) =sec A Cot(90- A) =tan A
7	Trigonometric identities	Sin^2 A + cos^2 A =0 1 + tan^2 A =sec^2 A 1 + cot^2 A =$cosec^2$ A

Trigonometric Ratios of Common angles

We can find the values of trigonometric ratio's various angle

Angles(A)	SinA	Cos A	TanA	Cosec A	Sec A	Cot A
0^0	0	1	0	Not defined	1	Not defined
30^0	1/2	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	2	$\frac{2}{\sqrt{3}}$	$\sqrt{3}$
45^0	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1	$\sqrt{2}$	$\sqrt{2}$	1
60^0	$\frac{\sqrt{3}}{2}$	1/2	$\sqrt{3}$	$\frac{2}{\sqrt{3}}$	2	$\frac{1}{\sqrt{3}}$
90^0	1	0	Not defined	1	Not defined	0

Area of Circles

S.no	Points
1	A circle is a collection of all the points in a plane, which are equidistant from a fixed point in the plane
2	Equal chords of a circle (or of congruent circles) subtend equal angles at the center.
3	If the angles subtended by two chords of a circle (or of congruent circles) at the center (corresponding center) are equal, the chords are equal.
4	The perpendicular from the center of a circle to a chord bisects the chord.
5	The line drawn through the center of a circle to bisect a chord is perpendicular to the chord.
6	There is one and only one circle passing through three non-collinear points
7	Equal chords of a circle (or of congruent circles) are equidistant from the center (or corresponding centers).
8	Chords equidistant from the center (or corresponding centers) of a circle (or of congruent circles) are equal
9	If two arcs of a circle are congruent, then their corresponding chords are equal and conversely, if two chords of a circle are equal, then their corresponding arcs (minor, major) are congruent.
10	Congruent arcs of a circle subtend equal angles at the center.
11	The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle
12	Angles in the same segment of a circle are equal

13	Angle in a semicircle is a right angle.
14	If a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, the four points lie on a circle.
15	The sum of either pair of opposite angles of a cyclic quadrilateral is 180°.
16	If the sum of a pair of opposite angles of a quadrilateral is 180°, then the quadrilateral is cyclic.

S.no	Terms	Descriptions
1	Circumference of a circle	$2 \pi r$.
2	Area of circle	πr^2
3	Length of the arc of the sector of angle	Length of the arc of the sector of angle θ $\frac{\theta}{360} 2\pi r$
4	Area of the sector of angle	Area of the sector of angle θ $\frac{\theta}{360} \pi r^2$
5	Area of segment of a circle	Area of the corresponding sector – Area of the corresponding triangle

Surface Area and Volume

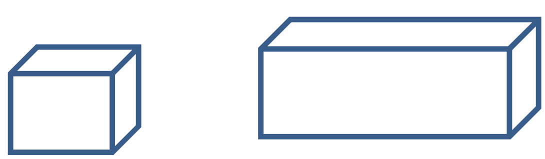
S.no	Term	Description

1	Mensuration	It is branch of mathematics which is concerned about the measurement of length ,area and Volume of plane and Solid figure
2	Perimeter	a)The perimeter of plane figure is defined as the length of the boundary b)It units is same as that of length i.e. m ,cm,km
3	Area	a)The area of the plane figure is the surface enclosed by its boundary b) It unit is square of length unit. i.e. m^2 , km^2
4	Volume	Volume is the measure of the amount of space inside of a solid figure, like a cube, ball, cylinder or pyramid. Its units are always "cubic", that is, the number of little element cubes that fit inside the figure.

Volume Unit conversion

1 cm^3	**1mL**	**1000 mm^3**
1 Litre	1000ml	1000 cm^3
1 m^3	10^6 cm^3	1000 L
1 dm^3	1000 cm^3	1 L

Surface Area and Volume of Cube and Cuboid

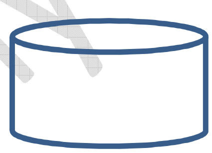


Cube

Cuboid

Type	Measurement
Surface Area of Cuboid of Length L, Breadth B and Height H	2(LB + BH + LH).
Lateral surface area of the cuboids	2(L + B) H
Diagonal of the cuboids	$\sqrt{L^2 + B^2 + H^2}$
Volume of a cuboids	LBH
Length of all 12 edges of the cuboids	4 (L+B+H).
Surface Area of Cube of side L	$6L^2$
Lateral surface area of the cube	$4L^2$
Diagonal of the cube	$L\sqrt{3}$
Volume of a cube	L^3

Surface Area and Volume of Right circular cylinder



Radius	**The radius (r) of the circular base is called the radius of the cylinder**
Height	The length of the axis of the cylinder is called the height (h) of the

	cylinder
Lateral Surface	The curved surface joining the two base of a right circular cylinder is called Lateral Surface.

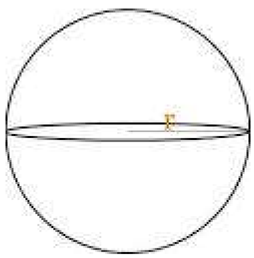
Type	Measurement
Curved or lateral Surface Area of cylinder	$2\pi rh$
Total surface area of cylinder	$2\pi r (h+r)$
Volume of Cylinder	$\pi r^2 h$

Surface Area and Volume of Right circular cone

Radius	**The radius (r) of the circular base is called the radius of the cone**
Height	The length of the line segment joining the vertex to the center of base is called the height (h) of the cone.
Slant Height	The length of the segment joining the vertex to any point on the circular edge of the base is called the slant height (L) of the cone.
Lateral surface Area	The curved surface joining the base and uppermost point of a right circular cone is called Lateral Surface

Type	Measurement
Curved or lateral Surface Area of cone	πrL
Total surface area of cone	$\pi r\,(L+r)$
Volume of Cone	$\frac{1}{3}\pi r^2 h$

Surface Area and Volume of sphere and hemisphere



Sphere

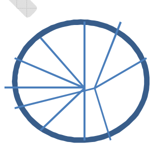
Hemisphere

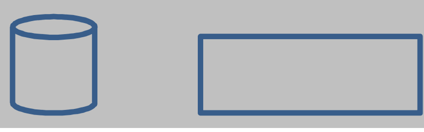
Sphere	**A sphere can also be considered as a solid obtained on rotating a circle About its diameter**
Hemisphere	A plane through the centre of the sphere divides the sphere into two equal parts, each of which is called a hemisphere
radius	The radius of the circle by which it is formed
Spherical Shell	The difference of two solid concentric spheres is called a spherical shell
Lateral Surface Area for	Total surface area of the sphere

Sphere	
Lateral Surface area of Hemisphere	It is the curved surface area leaving the circular base

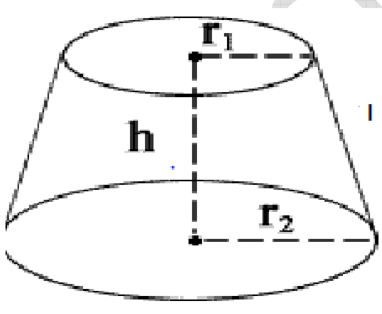
Type	Measurement
Surface area of Sphere	$4\pi r^2$
Volume of Sphere	$\frac{4}{3}\pi r^3$
Curved Surface area of hemisphere	$2\pi r^2$
Total Surface area of hemisphere	$3\pi r^2$
Volume of hemisphere	$\frac{2}{3}\pi r^3$
Volume of the spherical shell whose outer and inner radii and 'R' and 'r' respectively	$\frac{4}{3}\pi(R^3 - r^3)$

How the Surface area and Volume are determined

Area of Circle 	**The circumference of a circle is 2пr. This is the definition of п (pi). Divide the circle into many triangular segments. The area of the triangles is 1/2 times the sum of their bases, 2пr (the circumference), times their**

	height, r. $$A=\frac{1}{2}2\pi rr=\pi r^2$$
Surface Area of cylinder 	This can be imagined as unwrapping the surface into a rectangle.
Surface area of cone	This can be achieved by divide the surface of the cone into its triangles, or the surface of the cone into many thin triangles. The area of the triangles is 1/2 times the sum of their bases, p, times their height, $$A=\frac{1}{2}2\pi rs=\pi rs$$

Surface Area and Volume of frustum of cone



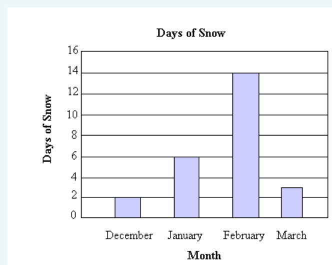
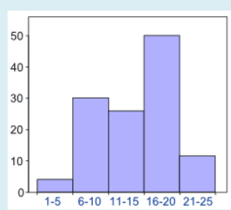
h = vertical height of the frustum
l = slant height of the frustum
r_1 and r_2 are radii of the two bases (ends) of the frustum.

Type	Measurement
Volume of a frustum of a cone	$\frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$
Slant height of frustum of a cone	$\sqrt{h^2 + (r_1 - r_2)^2}$
Curved surface area of a frustum of a cone	$\pi l(r_1 + r_2)$
Total surface area of frustum of a cone	$\pi l(r_1 + r_2) + \pi(r_1^2 + r_2^2)$

Statistics

S.no	Term	Description
1	Statistics	Statistics is a broad mathematical discipline which studies ways to collect, summarize, and draw conclusions from data
2	Data	A systematic record of facts or different values of a quantity is called **data**. Data is of two types - Primary data and Secondary data. **Primary Data**: The data collected by a researcher with a specific purpose in mind is called primary data. **Secondary Data**: The data gathered from a source where it already exists is called secondary

		data
3	Features of data	- Statistics deals with collection, presentation, analysis and interpretation of numerical data. - Arranging data in an order to study their salient features is called presentation of data. - Data arranged in ascending or descending order is called arrayed data or an array **Range** of the data is the difference between the maximum and the minimum values of the observations - Table that shows the frequency of different values in the given data is called a **frequency distribution table** - A frequency distribution table that shows the frequency of each individual value in the given data is called an ungrouped frequency distribution table. - A table that shows the frequency of groups of values in the given data is called a grouped frequency distribution table - The groupings used to group the values in given data are called classes or class-intervals. The number of values that each class contains is called the class size or class width. The lower value in a class is called the lower class limit. The higher value in a class is called the upper class limit. **Class mark** of a class is the mid value of the two limits of that class. - A frequency distribution in which the upper limit of one class differs from the lower limit of the succeeding class is called an **Inclusive or discontinuous Frequency Distribution**. - A frequency distribution in which the upper limit of one class coincides from the lower limit of the succeeding class is called an **exclusive or continuous Frequency**

	Distribution	
	• .	
4	Bar graph	A bar graph is a pictorial representation of data in which rectangular bars of uniform width are drawn with equal spacing between them on one axis, usually the x axis. The value of the variable is shown on the other axis that is the y axis. 
5	Histogram	A histogram is a set of adjacent rectangles whose areas are proportional to the frequencies of a given continuous frequency distribution 
6	Mean	The mean value of a variable is defined as the sum of all the values of the variable divided by the number of values. $$a_m = \frac{a_1 + a_2 + a_3 + a_4}{4} = \frac{\sum_0^n a}{n}$$
7	Median	The **median** of a set of data values is the middle value of the data set when it has been arranged in ascending order. That is, from the smallest value to the highest value Median is calculated as

		$\frac{1}{2}(n+1)$ Where n is the number of values in the data If the number of values in the data set is even, then the **median** is the average of the two middle values.
8	Mode	Mode of a statistical data is the value of that variable which has the maximum frequency

S.no	Term	Description
1	**Mean for Ungroup Frequency table**	Mean is given by $$M = \frac{\sum f_i x_i}{\sum f_i}$$
2	**Mean for group Frequency table**	In these distribution, it is assumed that frequency of each class interval is centered around its mid-point i.e. class marks $$Class\ mark = \frac{Upper\ class\ limit + Lower\ class\ limit}{2}$$ **Mean can be calculated using three method** **a) Direct method** $$M = \frac{\sum f_i x_i}{\sum f_i}$$ **b) Assumed mean method** $$M = a + \frac{\sum f_i d_i}{\sum f_i}$$

		Where a=> Assumed mean d_i => x_i –a **c) Step deviation Method** $$M = a + \frac{\sum f_i u_i}{\sum f_i} h$$ Where a=> Assumed mean u_i => (x_i –a)/h
3	**Mode for grouped frequency table**	*Modal class: The class interval having highest frequency is called the modal class and Mode is obtained using the modal class* $$M_o = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) h$$ Where l = lower limit of the modal class, h = size of the class interval (assuming all class sizes to be equal), 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.
4	**Median of a grouped data frequency table**	For the given data, we need to have class interval, frequency distribution and cumulative frequency distribution Median is calculated as

		$$M_m = l + \left(\frac{\frac{n}{2} - cf}{f}\right)h$$ Where l = lower limit of median class, n = number of observations, cf = cumulative frequency of class preceding the median class, f = frequency of median class, h = class size (assuming class size to be equal)
5	**Empirical Formula between Mode, Mean and Median**	*3 Median=Mode +2 Mean*

Probability

S.no	Term	Description
1	***Empirical probability***	It is a probability of event which is calculated based on experiments $$\textbf{Emprical Probability} = \frac{\textbf{No of trails which expected outcome came}}{\textbf{Total Number of trials}}$$ ***Example:*** A coin is tossed 1000 times; we get 499 times head and

		501 times tail, So empirical or experimental probability of getting head is calculated as $p = \frac{499}{1000} = .499$ ***Empirical probability depends on experiment and different will get different values based on the experiment***
2	Important point about events	If the event A, B, C covers the entire possible outcome in the experiment. Then, **P (A) +P (B) +P(C) =1**
3	**impossible event**	The probability of an event (U) which is impossible to occur is 0. Such an event is called an **impossible event** **P (U)=0**
4	Sure or certain event	The probability of an event (X) which is sure (or certain) to occur is 1. Such an event is called a **sure event or a certain event** **P(X) =1**
5	Probability of any event	Probability of any event can be as $0 \le P(E) \le 1$

S.no	Term	Description

1	**Theoretical Probability**	The theoretical probability or the classical probability of the event is defined as $$P(E) = \frac{Number\ of\ outcome\ favourable\ to\ E}{Number\ of\ all\ possible\ outcome\ of\ the\ experiment}$$
2	Elementary events	An event having only one outcome of the experiment is called an elementary event. **"The sum of the probabilities of all the elementary events of an experiment is 1."** I.e. If we three elementary event A,B,C in the experiment ,then **P(A)+P(B) +P(C)=1**
3	**Complementary events**	The event Ā, representing 'not A', is called the complement of the event A. We also say that Ā and A are complementary events. Also **P(A) +P(Ā)=1**
4	Sure or certain event	The probability of an event (X) which is sure (or certain) to occur is 1. Such an event is called a **sure event or a certain event** **P(X) =1**
5	Probability of any event	Probability of any event can be as $$0 \leq P(E) \leq 1$$