Definition of Unit 1 (Matrices)

Matrix: A rectangular array in which real numbers are arranged within the bracket in the form of rows and columns is called matrix we use capital letter to denote the matrix. e.g. $M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

Row matrix: A matrix having only one row is called a row matrix. e.g. $M = [6 \quad 1]$

Column matrix: A matrix is called a column matrix if it has only one column. e.g. $A = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$

Rectangular matrix: A matrix "M" is called a rectangular matrix if the number of rows of "M" is not equal to the number of columns of M. e.g. $M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

Square matrix: A matrix is called a square matrix if its number of rows is equal to the number of columns.

e.g. $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

Symmetric matrix: A square matrix is symmetric if $A^t = A$ e.g. $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and $A^t = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

Skew symmetric matrix: A square matrix is called skew symmetric if $A^t = -A$.

e.g $A = \begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix}$ and $A^t = \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix} = -A$

Diagonal matrix: A square matrix A is called a diagonal matrix if at least any one of the entries of its diagonal is not zero and non-diagonal entries must all be zero. e.g. $A = \begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}$

Scalar matrix: A diagonal matrix is called a scalar matrix if all the diagonal entries are same and non-zero. e.g. $A = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$

Singular matrix: A square matrix A is called singular if the determinant of A is equal to zero. e.g. $A = \begin{bmatrix} 2 & 3 \\ 2 & 3 \end{bmatrix}$ det A=0

Non-singular matrix: A square matrix A is called non-singular if det $A \neq 0$. e.g. $A = \begin{bmatrix} 2 & 2 \\ 2 & 3 \end{bmatrix}$ det $A = 2 \neq 0$

Order of matrix: If a matrix A has 'm' rows and 'n' columns then A is called is said to be of order 'm' by 'n'.

e.g. $M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ so the order of M= 2 *by* 3

Equal matrix: Two matrices A and B are said to be equal to each other if (i) order of A=order of B

(ii) Corresponding entries are equal.

Negative of matrix: let 'A' be a matrix, then its negative is obtained by changing the signs of all the entries of A. e.g $A=\begin{bmatrix}0 & -2\\ 2 & 0\end{bmatrix}$ and $-A=\begin{bmatrix}0 & 2\\ -2 & 0\end{bmatrix}$

Transpose of a matrix: A matrix is obtained by interchanging the rows into columns OR columns into rows of a matrix, is called a transpose of a matrix. e.g. $A=\begin{bmatrix}1 & 3\\ 2 & 4\end{bmatrix}$ and $A^t=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$

Identity matrix: A diagonal matrix is called identity matrix, if all the diagonal entries are equal to 1 and is denoted by I .e.g $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

Addition of matrices: Two matrices A and B are confirmable for addition if they have the same order.

Subtraction of matrices: Two matrices A and B are confirmable for subtraction if they have the same order.

Additive identity of matrix: For any matrix A and zero matrix 'O' of the same order "O" is called identity matrix of A as A+O=O+A=A.

Additive inverse of matrix: additive inverse of any matrix A is obtained by changing the signs of the entries of each non-zero entry of A. e.g $A=\begin{bmatrix}0 & -2\\ 2 & 0\end{bmatrix}$ and $-A=\begin{bmatrix}0 & 2\\ -2 & 0\end{bmatrix}$

Scalar multiplication: The scalar multiplication of a matrix A with a real number "k" is obtained by multiplying each entry of matrix A with k. e.g. $A=\begin{bmatrix}1 & 3\\ 2 & 4\end{bmatrix}$ and $kA=\begin{bmatrix}1k & 2k\\ 3k & 4k\end{bmatrix}$

Multiplication of matrices: Two matrices A and B are confirmable for multiplication if number of columns of first matrix is equal to the number of rows of second matrix. The product of $\begin{bmatrix}1 & 2\end{bmatrix}\begin{bmatrix}5\\ -4\end{bmatrix}=[-3]$

Associative law under multiplication: if A, B and C are three matrices and confirmable for multiplication then associative law under multiplication is given as A(BC)=(AB)C.

Distributive law of multiplication over addition and subtraction: A,B and C are three matrices then Distributive law of multiplication over addition and subtraction are given below (i)A(B+C)=AB+AC (ii) A(B−C)=AB−AC.

Commutative law of multiplication: Commutative law of multiplication doesn't hold in matrix i.e. AB≠BA.

Determinant of matrix: let $A=\begin{bmatrix}a & b\\ c & d\end{bmatrix}$ be a 2 by 2 square matrix. The determinant of A denoted by ***det*A** and is defined as **detA**=ad−bc e.g. if $A=\begin{bmatrix}2 & 2\\ 2 & 3\end{bmatrix}$ det A= 6-4 =2

Adjoint of matrix : Adjoint of a square matrix $A=\begin{bmatrix}a & b\\ c & d\end{bmatrix}$ is obtained by interchanging diagonal entries and changing the signs of other entries. $AdjA=\begin{bmatrix}d & -b\\ -c & a\end{bmatrix}$

Multiplicative inverse of non-matrix: let A and B are two non-singular matrices of same order then A and B are said to be multiplicative inverses of each other if AB=BA=I so $A^{-1} = \frac{1}{detA} \times AdjA$.

Unit 2(Real & Complex numbers)

Irrational numbers: The numbers that cannot be written in the form $\frac{p}{q}$ where p, q ∈ Z and q≠0 are called irrational numbers and are denoted by Q' .Example: $\sqrt{2}$, $\sqrt{3}$ ... etc.

Natural numbers: The numbers 1,2,3…. which were for counting objects are called natural numbers and denoted by N. i.e. N={1,2,3….}.

Whole numbers: If we include 0 in the set of natural number the resulting set is the set of whole numbers and denoted by W. i.e. W={0,1,2,3….}.

Integers: The set of integers consists of positive integers, 0 and negative integers.

Rational numbers: All numbers of the form $\frac{p}{q}$ where p, q ∈ Z and q≠0 are called rational numbers and are denoted by Q . i.e :$\frac{2}{3}, \frac{3}{4}, \frac{4}{7}$…etc.

Real numbers: The union of the set of rational numbers and irrational numbers is known as real numbers and is denoted by "R". i.e. $R=Q \cup Q'$.

Terminating decimal fraction: The decimal fraction in which there is finite number of digits in decimal parts is called terminating decimal fraction. i.e. 0.4, 0.375 … etc.

Recurring and Non-Terminating decimal fraction: The decimal fraction in which some digits are repeated again and again in the same order in its decimal part is called a recurring decimal fraction. i.e. $\frac{2}{9}$ = 0.22222…

Complex numbers: A number of the form $Z=a + bi$ where *a* and *b* are real numbers and $i=\sqrt{-1}$.

Conjugate of complex number: If we change "*i*" into $-i$ in $Z= a+bi$, we obtain another complex number

$\overline{Z}= a-bi$

Radical and radicand: If in the radical $\sqrt[n]{x}$. "√ " is radical sign, "x" is radicand and "n" is index of the radical.

Unit 3 (Logarithms)

Logarithm of a real number: If $a^x = y$ then "x" is called the logarithm of "y" to the base "a" and is written as $X=\log_a y$ where $a > 0, a \neq 1 \; and \; y > 0$.

Scientific notation: A number written in the form $\boldsymbol{a \times 10^n}$, where $\mathbf{1 < a < 10}$ and n is an integer is called scientific notation.

Common logarithm or Brigg's Logarithm: If the base of the logarithm is taken as "10" then logarithm is called Common logarithm or Brigg's Logarithm.

Natural logarithm or Napier logarithm: logarithm having the base "*e*" is called Natural logarithm or Napier logarithm.

Characteristic: The integral part of logarithm of any number is called characteristic.

e.g in log278.23= 2.4443 "2" is called **characteristic**

Mantissa: The decimal part of logarithm of a number is called mantissa and is always positive.

e.g in log278.23= 2.4443 ".4443" is called **mantissa**

Unit 4 (Algebraic expression & Algebraic Formulas)

Polynomials: A polynomial in the variable 'x' is an algebraic expression of the form

$P(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_1 x + a_0, \quad a_n \neq 0$.Where n is the highest power of "x"

is a non-negative integer i.e. the power of "x" should be "**0"** or **positive. e.g x^2+3x-1**

Surd: An irrational radical with a rational radicand is called a surd. e.g. $\sqrt[3]{7}$ and $\sqrt{3}$ are called surds.

Monomial surd: A surd which contains a single term is called monomial surd e.g. $\sqrt[3]{7}$ and $\sqrt{3}$ are called monomial surds.

Binomial surd: A surd which contains sum of two monomial surds are sum of monomial surd and rational number is called binomial surds e.g. $\sqrt{3} + \sqrt{7}$ and $\sqrt{3} + 5$ etc.

Rational expression: The quotient $\frac{p(x)}{q(x)}$ of two polynomials $p(x) and \; q(x)$ where $q(x)$ is a non-zero polynomial, is called a **rational expression**. $e.g \quad \frac{(x+1)}{(x^2-1)}$

Unit 5 (Factorization)

Factorization: The process of expressing an algebraic expression in terms of its factors is called factorization.

Remainder theorem: If a polynomial $f(x)$ is divided by linear divisor($\boldsymbol{x-a}$), then the remainder is "$\boldsymbol{f(a)}$".

Factor theorem: The polynomial $(x-a)$ is a factor of polynomial $f(x)$if and only if $\boldsymbol{f(a)}$=0.

Zero of the polynomial: (If a specific number x=a is substituted for the variable x in a polynomial P(x) so that the value of P(a) is zero, then x=a is called zero of the polynomial P(x).

Unit 6(Algebraic Manipulation)

H.C.F.: If two or more algebraic expressions are given then their common factors of highest power are called the H.C.F of the expressions.

Q. What is the relation between H.C.F and L.C.M?

Ans: We establish a relation between H.C.F and L.C.M of two polynomials P(x) and q(x) given by the formula

H.C.F × L.C.M = P(x) × q(x).

Square root: As with the numbers we define the square root of given expression P(x) as another expression q(x) such that q(x).q(x)=p(x). As 5 × 5=25, so square root of 25 is 5.

Unit 7 (Linear Equations and Inequalities)

Radical equation: when the variable in the equation occurs under a radical sign, the equation is called a radical equation. e.g. $\sqrt{2x-3}$ -7=0

Linear equation in one variable: Linear equation in one variable "x" is an equation of the form $ax+b=0$ where $a, b \in R \; and \; a \neq 0$.

Identity equation: It is an equation that is satisfied by every number for which both sides are defined.

e.g. $x+3=x+3$.

Conditional equation: It is an equation that is satisfied by at least one number but is not an identity.

e.g. $2x+3=9$.

Inconsistent equation: It is an equation whose solution set is empty set .e.g. $x=x+5$ because no value of "x" satisfies it.

Absolute value of a real number: The absolute value of a real number "a" denoted by $/a/=\begin{cases} -a, if\ a<0 \\ a, if\ a \geq 0 \end{cases}$

Equivalent equation: Two linear equations are said to be equivalent if they have exactly the same solution.

Solution: A solution to a linear equation is any substitution for the variable "x" that makes the statement true.

Extraneous solution: Sometimes it may happen that solutions obtained do not satisfy the original equation. Such solutions are called extraneous solutions.

Extraneous roots: Sometimes it may happen that roots obtained do not satisfy the original equation. Such **roots** are called extraneous **roots**.

Linear inequality: A linear inequality in one variable "x" is an equality in which the variable "x" occurs only to the first power and is of the form.$ax + b < 0 \quad a, b \in R \; and \; a \neq 0$

Unit 8 (Linear Graphs and Their Application)

Cartesian Plane or coordinate plane: The plane formed by two straight lines perpendicular to each other is called Cartesian plane. Cartesian plane is divided into four quadrants.

Coordinate axes: In plane, two mutually perpendicular straight lines are drawn. The lines are called coordinate axes. i.e. X- axis and Y- axis are coordinate axes.

Origin: The point of intersection of two coordinate axes is called origin i.e. O (0 , 0)

Ordered pair: An ordered pair is a pair of elements in which elements are written in specific order.

e.g. (2,3)and (3,2) are two different ordered pairs .

Abscissa: The x-coordinate of a point is called abscissa. e.g. in (2,3) "2" is called abscissa.

Ordinate: The y-coordinate of a point is called ordinate. e.g. in (2,3) "3" is called ordinate.

Scale of graph: To draw a graph of an equation we choose a scale. e.g. 1cm represents 5m or 1small square length represents 10 or 5 meters. It is selected by keeping in mind the size of the paper.

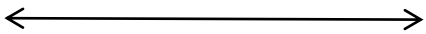
Unit 9(Introduction to Coordinate Geometry)

1. **Distance formula**: The distance between two P(x_1, y_1) and Q (x_2, y_2) in the coordinate plane is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, Where d >0.
2. **Mid-point**: If P(x_1, y_1) and Q (x_2, y_2) are two points in a plane, then the mid-point M (x, y) of the line segment PQ is M $(x, y) = M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right)$

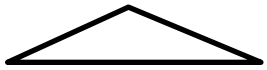
Coordinate Geometry: The study of geometrical shapes in a Cartesian plane is called coordinate geometry.

3. **Plane geometry**: The study of geometrical shapes in a plane is called plane geometry.

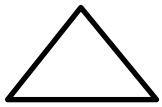
4. **Collinear points**: Two or more than two points which lie on the same straight line are called collinear points with respect to that line.



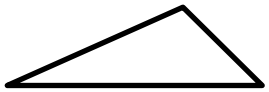
5. **Non-Collinear points**: Two or more than two points which do not lie on the same straight line are called non-collinear points with respect to that line.



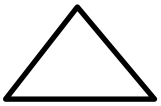
6. **Equilateral triangle**: If the length of all three sides of a triangle is same, then triangle is called an equilateral triangle.



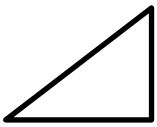
7. **Scalene triangle**: If the length of all three sides of a triangle is not same, then triangle is called a scalene triangle.



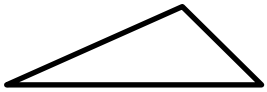
8. **Isosceles triangle**: If the length of two sides of a triangle is same while the third side has a different length, then triangle is called an Isosceles triangle.



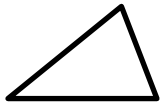
9. **Right-angled triangle**: A triangle in which one of the angles has measure equal to 90^o is called right angled triangle.



10. Obtuse - angled triangle: A triangle in which one of the angles has measure greater than 90^o but less than 180^o.



10. **Acute-angled triangle**: A triangle in which all the angles has measure less than 90^o is called acute angled triangle.



11. Supplementary angles: If sum of two angles is equal to 180° then the angles are called supplementary angles. e.g $60^o+120^o=180^o$

12. Complementary angles: If sum of two angles is equal to 90° then the angles are called complementary angles. e.g $60^o+30^o=90$

13 Square: A four-sided figure in the plane is called a square if

(i) All the four sides are equal
(ii) And measure of each angle is 90^o.

14.**Rectangle**: A four-sided figure in the plane is called a rectangle if

(i) Its opposite sides are equal

(ii) And measure of each angle is 90^o.

15 .**Parallelogram**: A four-sided figure in the plane is called a parallelogram if

(i) Its opposite sides and angles are congruent to each other.
(ii) Its opposite sides are parallel.

Unit 10(Congruent triangles)

Congruency of Triangles: Two triangles are said to be congruent if there exists a correspondence between them such that all the corresponding sides and angles are congruent i.e

S.A.S Postulate: In any correspondence of two triangles if two sides and their included angle of one triangle are congruent to the corresponding two sides and their included angle of the other then the triangles are congruent.

H.S Postulate: If in the correspondence of the two right angles triangles the hypotenuse and one side of one triangle are congruent to the hypotenuse and the corresponding side of the other then the triangles are congruent.

S.S.S postulate: In a correspondence of two triangles, if three sides of one triangle are congruent to the corresponding three sides of the other, then the two triangles are congruent.

Unit 12(Line Bisectors& angle Bisectors)

Right bisector of a line segment: a line 'AB' is called a right bisector of a line segment if "AB" is perpendicular to the line segment and passes through its midpoint**.**

Bisector of an angle: A ray BP called the bisector of <ABC if P is a point in the interior of the angle and <ABP = <PBC.

Unit 14 (Ratio& Proportion)

Proportion: The equality of two ratios is called a proportion i.e a:b = c:d

Similar triangles: Two triangles are said to be Similar if they are equiangular and corresponding sides are proportional**.**

Ratio: A comparison between two alike quantities is called ratio i.e a:b

e.g 4cm : 12cm

Unit 15(Pythagoras Theorem)

Pythagoras Theorem: In a right-angled triangle, the square of the length of the hypotenuse is equal to the sum of the square of the lengths of the other two sides i.e.
$(\text{Hypotenuse})^2=(\text{perpendicular})^2+(\text{base})^2$

Unit 16

Triangle:A three sided figure in a plane is called a triangle.

Area of the figure: The region enclosed by the bounding lines of a closed figure is called the area of the figure and is expressed in square meter i.e m^2.

Triangular region: A triangular region is the union of a triangle and it's interior.

Rectangular region: A rectangular region is the union of a rectangle and it's interior.

Height or altitude of a parallelogram: If one side of a parallelogram is taken as its base, the perpendicular distance between that side and the side parallel to it is called the altitude or a height of a parallelogram.

Altitude of a triangle: A perpendicular from vertex of a triangle to the opposite side is called the altitude or height of a triangle.

Square region: A square region is the union of a square and its interior.

Unit 17

Ortho center: The point of concurrency of the three altitudes of a triangle is called orthocenter.

Centroid: The point of concurrency of the three medians is called the centroid.

Incenter: The point of concurrency of the three angle bisectors is called the incenter.

Circumcenter: The point of concurrency of the three perpendicular bisectors of the sides of a triangle is called the circumcenter.

Concurrent lines: Three or more than three lines are said to be concurrent if they all pass through the same point. The common point is called the point of concurrency of the lines

Median of a triangle: A line segment joining a vertex of a triangle to the mid-point of the opposite side is called the median of a triangle.