GOVT HR SEC SCHOOL

THAZHUTHALI

VILLUPURAM DISTRICT

10TH STANDARD

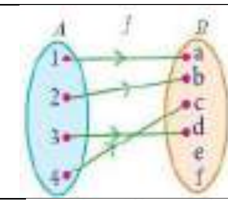
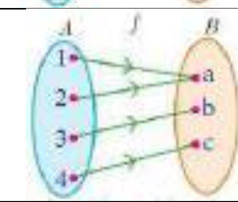
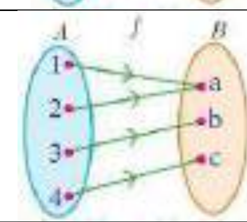
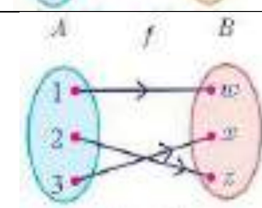
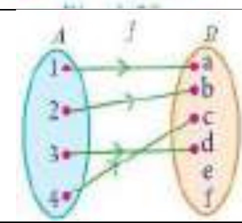
DEFINITIONS AND FORMULAE

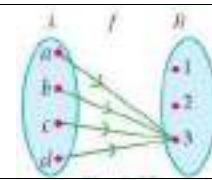
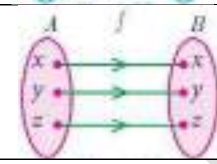
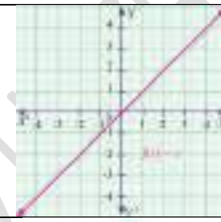
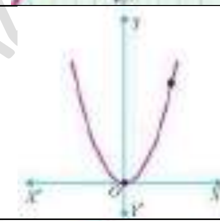
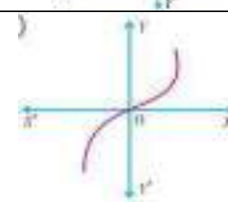
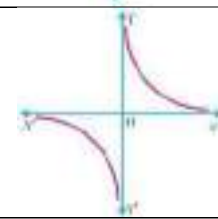
PREPARED BY :
M.MOHAMED RAFFICK.,M.Sc.,B.Ed.,
B.T.ASSISTANT.,
GOVT HR SEC SCHOOL.,
THAZHUTHALI.,
VILLUPURAM DISTRICT – 604 304
CELL : 9360202013

1.RELATIONS AND FUNCTIONS

SL.NO	DEFINITIONS	
1	Cartesian Product	If A and B are two non-empty sets, then the set of all ordered pairs (a , b) such that $a \in A$, $b \in B$ is called the Cartesian Product of A and B and is denoted by $A \times B$. Thus $A \times B = \{ (a, b) \vert\, a \in A , b \in B \}$
2	Relations	Let A and B be any two non empty sets. A relation R from A to B is a subset of $A \times B$ satisfying some specified conditions. That is $R \subseteq A \times B$.
3	Null Relation	A relation which contains no elements is called a ‘ Null relation’
4	Functions	A relation f between two non empty sets X and Y is called a function from X to Y , if for every $x \in X$ there exists only one $y \in Y$ such that (x, y) ∈ f .
5	Composition of function	Let $f: A \to B$ and $g: B \to C$ be two function .Then the composition of f and g denoted by $g \circ f$ is defined as the function $g \circ f(x) = g(f(x))$ for all $x \in A$
6	Vertical Line Test	A curve drawn in a graph represents a function , if every vertical line intersects the curve in at most one point
7	Horizontal Line Test	A function represented in a graph is one-one , if every horizontal line intersects the curve in at most one point.
8	Representation of Function	1. Set of ordered pairs diagram; 2.Table form; 3. Arrow; 4. Graph
9	If $n(A) = p$ and $n(B) = q$, then $\boldsymbol{n(A \times B) = pq}$	
10	If $n(A) = p$, $n(B) = q$, then the **total number of relation** that exist between A and B is $\boldsymbol{2^{pq}}$	
11	If $n(A) = p$, $n(B) = q$, then the **total number of functions** that exist between A and B is $\boldsymbol{q^p}$	

TYPES OF FUNCTIONS

	TYPES	DEFINITION	EXAMPLES
1	One – One Function (injection)	A function $f: A \to B$ is called one-one function if distinct elements of A have distinct images in B.	
2	Many – one Function	A function $f: A \to B$ is called many - one function if two or more elements of A have same image in B.	
3	Onto Function (surjection)	A function $f: A \to B$ is said to be an onto function if every element in B has a pre-image in A. (**Range of f = co-domain**)	
4	One-one and Onto Function (Bijection)	If a function $f: A \to B$ is both one-one and onto , then f is called a bijection from A to B.	
5	Into Function	A function $f: A \to B$ is called an into function if there exists at least one element in B which is not the image of any element of A. (**Range of f is a proper subset of co-domain**)	

6	**Constant Function**	A function $f: A \to B$ is called a constant function if every element of A has the same image in B. That is $f(x) = c$, $\forall\, x \in A$ **(Range of f is a singleton set)**	
7	**Identity Function**	Let A be a non-empty set. Then the function $f: A \to A$ is called an identity function of A if maps each element of A into itself. That is $f(x) = x$, $\forall\, x \in A$.	
8	**Real valued Function**	A function $f: A \to B$ is called a real valued function if the range of f is a subset of the set of all real numbers R. That is $f(A) \subseteq R$	
9	**Linear Function**	A function $f : R \to R$ defined by $f(x) = mx + c$ is called a linear function.	
10	**Quadratic Function**	A function $f: R \to R$ defined by $f(x) = ax^2 + bx + c$ is called a quadratic function.	
11	**Cubic Function**	A function $f : R \to R$ defined by $f(x) = ax^3 + bx^2 + cx + d$ is called a cubic function.	
12	**Reciprocal Function**	A function $f: R - \{0\} \to R$ defined by $f(x) = \frac{1}{x}$ is called a reciprocal function.	

2 . NUMBERS AND SEQUENCES

1	**Euclid's Divisions Lemma**	Let a and b ($a > b$) be any two positive integers. Then there exist unique integers q and r such that $a = bq + r$, $0 \le r < b$
2	**Fundamental theorem of Arithmetic**	Every composite number can be written uniquely as the product of power of primes is called Fundamental Theorem of Arithmetic.
3	**Congruence Modulo**	If $b - a = kn$ for some integer k . Then it can be written as $a \equiv b \,(mod\, n\,)$. Here n is a called modulus. In other words $a \equiv b\,(mod\, n\,)$ means $a - b$ divisible by n.
4	**Sequences**	A real valued sequence is a function defined on the set of natural numbers and taking real values.
5	**Arithmetic Progression**	Let a and d be real numbers. Then the numbers of the form a, a+d, a+2d, a+3d, a+4d,……. is said to be Arithmetic Progression denoted by A.P. The number 'a' is called the first term and 'd' is called the common difference.
6	**Geometric Progression**	A Geometric Progression is a sequence in which each term is obtained by multiplying a fixed non-zero number to be preceding term except the first term. The fixed term is called common ratio. The common ratio is usually denoted by r.

7	**Series**	The sum of the terms of a sequence is called series.
8	**Arithmetic series**	A series whose terms are in Arithmetic Progression is called Arithmetic series.
9	**Geometric Series**	A series whose terms are in Geometric Progression is called Geometric series.

FORMULAE

1	Euclid's Division Lemma	$a = bq + r \quad , \ 0 \leq r < b$

ARITHMETIC PROGRESSION (A.P)

2	General Form an A.P	a , a +d , a +2d , a+3d , ...
3	Common Difference	$d = t_2 - t_1$
4	General term or n[th] term of an A.P	$t_n = a + (n-1)d$
5	Number of terms of an A.P	$n = \left(\frac{l-a}{d}\right) + 1$
6.	Three consecutive terms of an A.P	$a - d\ ,\ a\ ,\ a + d$
7	Four consecutive terms of an A.P	$a - 3d\ ,\ a - d\ ,\ a + d\ ,\ a + 3d$
8	Condition for three numbers (a , b , c) to be in A.P	2b = a + c
9	Sum of n terms of an A.P	$S_n = \frac{n}{2}\ [\ 2a + (n-1)d\ ]$ $S_n = \frac{n}{2}\ [\ a + l\ ]$

GEOMETRIC PROGRESSION (G . P)

10	General Form of G.P	$a\ , ar\ , ar^2\ , ar^3$,...................
11	Common Ratio	$r = \frac{t_2}{t_1}$
12	General term or n[th] term of a G.P	$t_n = ar^{n-1}$
13	Three consecutive terms of a G.P	$\frac{a}{r}\ ,\ a\ ,\ ar$
14	Four consecutive term of a G.P	$\frac{a}{r^3}\ ,\ \frac{a}{r}\ , ar\ ,\ ar^3$
15	Condition for three numbers (a , b , c) to be in G.P	$b^2 = ac$
16	Sum of n terms of a G.P	$t_n = \frac{a(r^n-1)}{r-1} \quad , \ r > 1$ $t_n = \frac{a(1-r^n)}{1-r} \quad , \ r < 1$ $t_n = na \quad , \quad n = 1$
17	Sum to infinite terms of a G.P	$S_\infty = \frac{a}{1-r}\ , \quad -1 < r < 1$

SPECIAL SERIES

18	Sum of first n natural numbers	$\sum n = \frac{n\,(n+1)}{2}$
19	Sum of squares of first n natural numbers	$\sum n^2 = \frac{n\,(n+1)\,(2n+1)}{6}$
20	Sum of cubes of first n natural numbers	$\sum n^3 = \left[\frac{n\,(n+1)}{2}\right]^2$
21	Sum of first n odd natural numbers	$\sum(2n-1) = n^2$
22	Sum of first n odd natural numbers (last term l is given)	$1 + 2 + 3 + \cdots + l = \left(\frac{l+1}{2}\right)^2$
23	Sum of first n even natural numbers	$\sum 2n = n\,(\,n + 1\,)$
24	Sum of natural numbers from p to q	$\sum_{k=p}^{q} k = \frac{(\,q + p\,)\,(\,q - p + 1\,)}{2}$

3.ALGEBRA

1	Simultaneous linear equation in three variables	General form of a linear equation in three variable is $ax+by+cz+d=0$
		A linear equation in three variables represents a plane.
		A system of equation can have unique solution (or) infinitely many solution (or) no solution
		The system of equation has **no solution** if any step comes as **0=1** while solving.
		The system of equation has infinitely **many solution** if any step comes as **0=0** while solving.
2	Excluded Value	A value that makes a rational expression undefined is called an Excluded value.

FORMULAE

3	Relationship between LCM and GCD		$f(x)\times g(x)= LCM \times GCD$
4	General Form of Quadratic Equation		$\boldsymbol{x^2-(Sum\ of\ roots)\,x+\ Product\ of\ roots=0}$
			$x^2-(\alpha+\beta)\,x+\alpha\beta=0$
5	Formula for finding Roots (Solution) of a Quadratic Equation		$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$
6	If α and β are the roots of a quadratic equation $ax^2+bx+c=0$, then	Sum of roots	$\alpha+\beta=\frac{-b}{a}=\frac{-\,co\,efficient\ of\ x}{co\,efficient\ of\ x^2}$
		Product of roots	$\alpha\beta=\frac{c}{a}=\frac{constant\ term}{co\,efficient\ of\ x^2}$
7	$Time=\frac{Distance}{Speed}$	$Speed=\frac{Distance}{Time}$	Distance = Speed X Time

NATURE OF ROOTS OF A QUADRATIC EQUATION

	Values of Discriminant $\Delta=b^2-4ac$	Nature of roots
8	$\Delta>0$	Real and unequal roots
9	$\Delta=0$	Real and Equal roots
10	$\Delta<0$	No real roots

	SOME RESULTS INVOLVING α and β		ALGEBRAIC IDENTITES
11	$\alpha-\beta=\sqrt{(\alpha+\beta)^2-4\alpha\beta}$	19	$(a+b)^2=a^2+b^2+2ab$
12	$\alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta$	20	$(a-b)^2=a^2+b^2-2ab$
13	$\alpha^2-\beta^2=(\alpha+\beta)(\sqrt{(\alpha+\beta)^2-4\alpha\beta}\,)$	21	$(a+b)(a-b)=a^2-b^2$
14	$\alpha^3+\beta^3=(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$	22	$(a+b+c)^2=a^2+b^2+c^2+2ab+2bc+2ca$
15	$\alpha^3-\beta^3=(\alpha-\beta)^3+3\alpha\beta(\alpha-\beta)$	23	$(a+b)^3=a^3+3a^2b+3ab^2+b^3$
16	$\alpha^4+\beta^4=(\alpha^2+\beta^2)^2-2(\alpha\beta)^2$	24	$(a-b)^3=a^3-3a^2b+3ab^2-b^3$
17	$\alpha^4-\beta^4=(\alpha+\beta)(\alpha-\beta)(\alpha^2+\beta^2\,)$	25	$a^3+b^3=(a+b)(a^2-ab+b^2)$
18	$(\alpha+\beta)^2-(\alpha-\beta)^2=4\alpha\beta$	26	$a^3-b^3=(a-b)(a^2+ab+b^2)$

MATRICES

1	Matrices	A matrix is a rectangular array of elements arranged in row and columns.	
2	If a matrix A has m rows and n columns	Order of matrix	$\boldsymbol{m\times n}$
3		Total number of elements	$\boldsymbol{mn}$

TYPES OF MATRICES

	TYPES	DESCRIPTION	EXAMPLE
4	Row Matrix (Row vector)	A matrix is said to be row matrix if it has **only one row** and any number of columns	$A=\begin{pmatrix}1 & 3 & 5\end{pmatrix}$
5	Column Matrix (Column vector)	A matrix is said to be column matrix if it has **only one column** and any number of rows	$B=\begin{pmatrix}2\\4\\6\end{pmatrix}$
6	Square Matrix	A matrix in which the **number of rows and number of columns are equal** is said to be a square matrix.	$C=\begin{pmatrix}1&2&3\\4&5&6\\7&8&9\end{pmatrix}$

7	Diagonal Matrix	A square matrix in which **all the elements above and below the leading diagonal are zero** is called diagonal matrix	$D = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 9 \end{pmatrix}$
8	Scalar Matrix	A diagonal matrix in which **all the leading diagonal elements are equal** is called a scalar matrix	$E = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix}$
9	Identity Matrix (I_n) (Unit Matrix)	A square matrix in which elements in the **leading diagonal are all '1' and rest are all zero** is called an identity matrix.	$F = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
10	Zero Matrix (O_n) (Null Matrix)	A matrix is said to be zero matrix or null matrix if **all its elements are zero**.	$G = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$
11	Lower Triangular Matrix	A square matrix in which **all the entries above the leading diagonal are zero** is called a lower triangular matrix	$H = \begin{pmatrix} 8 & 0 & 0 \\ 4 & 5 & 0 \\ -11 & 3 & 1 \end{pmatrix}$
12	Upper diagonal Matrix	A square matrix in which **all the entries below the leading diagonal are zero** is called an upper triangular matrix	$M = \begin{pmatrix} 1 & 7 & -3 \\ 0 & 2 & 4 \\ 0 & 0 & 7 \end{pmatrix}$
13	Transpose of a Matrix	The matrix which is obtained by **interchanging the elements in rows and columns** of the given matrix A is called transpose of A.	$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}, \; A^T = \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$
14	Equal Matrix	Two matrices A and B are said to be equal if and only if they **have the same order** and **corresponding elements are equal.**	$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, B = \begin{pmatrix} \sqrt{1} & \sqrt{4} \\ \sqrt{9} & \sqrt{16} \end{pmatrix}$ A = B
15	Negative of a Matrix	The negative of a matrix A denoted by –A is the matrix formed by **replacing each element** in the matrix A with **its additive inverse.**	$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}, -A = \begin{pmatrix} -1 & -2 \\ -3 & -4 \end{pmatrix}$

OPERATION ON MATRICES

	OPERATION	CONDITION
16	Two matrices can be added or subtracted if	They have same order
17	Two matrices A and B can be multiplied if	Number of column of A = Number of row of B

PROPERTIES OF ADDITION

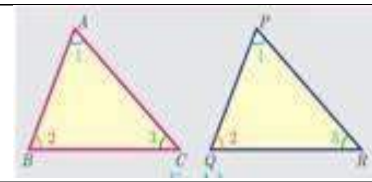
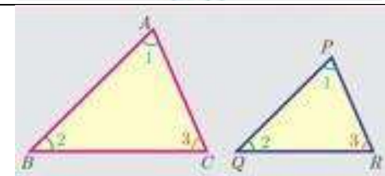
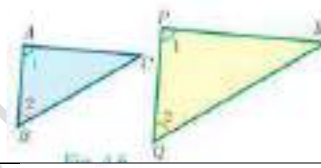
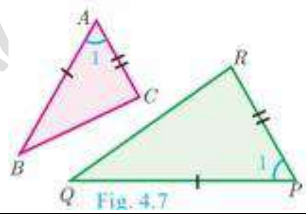
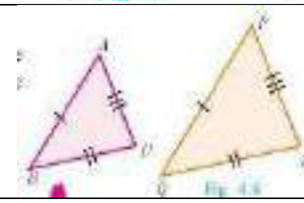
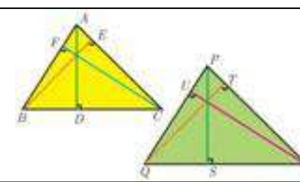
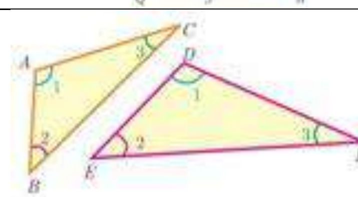
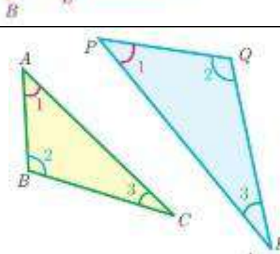
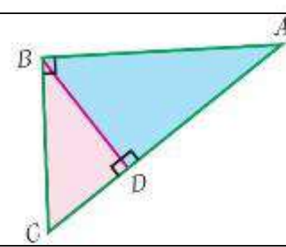
18	Commutative Property of Matrix Addition	$A + B = B + A$
19	Associative Property of Matrix Addition	$A + (B + C) = (A + B) + C$
20	Associative Property of Scalar Multiplication	$(pq)A = p(qA)$
21	Scalar Identity Property	$IA = A$
22	Distributive Property of scalar and two matrices	$p\,(A + B) = pA + pB$
23	Distributive Property of two scalars with a matrix	$(p + q)A = pA + qA$
24	Existence of Additive Identity	$A + O = O + A = A$
25	Existence of Additive Inverse	$A + (-A) = (-A) + A = O$

PROPERTIES OF MULTIPLICATION OF MATRIX

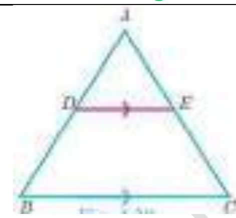
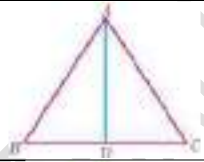
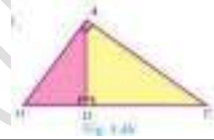
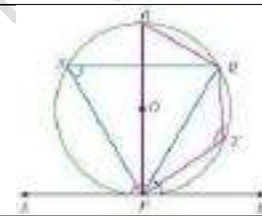
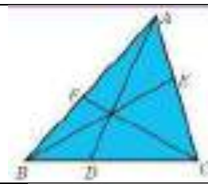
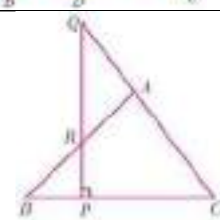
26	Matrix Multiplication is not commutative in general	$AB \neq BA$
27	Matrix Multiplication is always associative	$(AB)C = A(BC)$
28	Matrix Multiplication is distributive over addition	$A(B + C) = AB + AC$ $(A + B)C = AC + BC$
29	Multiplication of a Matrix by a unit Matrix	$AI = IA = A$
30	Reversal law for Transpose of matrices	$(AB)^T = B^T A^T$

4.GEOMETRY

CONGRUENCE AND SIMILAR TRIANGLES

1	**Congruency of Triangles**	Two triangles are said to be congruent if their corresponding angles are equal and corresponding sides are equal. $\angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$ $AB = PQ$, $BC = QR$, $CA = RP$	
2	**Similar Triangles**	Two triangles are said to be similar if their corresponding angles are equal and their corresponding sides are proportional. $\angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$ $AB \neq PQ$, $BC \neq QR$, $CA \neq RP$	
3	**AA Criterion of Similarity (AAA Similarity)**	If two angles of one triangle are respectively equal to two angles of another triangle , then the two triangle are similar. $\angle A = \angle P = 1$, $\angle B = \angle Q = 2$	
4	**SAS Criterion of Similarity**	If one angle of a triangle is equal to one angle of another triangle and if the sides including them are proportional , then the two triangles are similar. $\angle A = \angle P = 1$, $\frac{AB}{PQ} = \frac{AC}{PR}$	
5	**SSS Criterion of Similarity**	If three sides of a triangle are proportional to the three corresponding sides of another triangle , then the two triangles are similar. $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$	
SOME USEFUL RESULTS ON SIMILAR TRIANGLES			
6	If two triangles are similar , then the ratio of the corresponding sides are equal to the ratio of their corresponding altitudes $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP} = \frac{AD}{PS} = \frac{BE}{QT} = \frac{CF}{RU}$		
7	If two triangles are similar, then the ratio of the corresponding sides are equal to the ratio of the corresponding perimeters. $\frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{FD} = \frac{AB+BC+CA}{DE+EF+FD}$		
8	The ratio of the area of two similar triangles are equal to the ratio of the squares of their corresponding sides . $\frac{area\ (\Delta\ ABC)}{area\ (\Delta\ PQR)} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$		
9	If two triangles have common vertex and their bases are on the same straight line , the ratio between their areas is equal to the ratio between the length of their bases. $\frac{area\ (\Delta\ ABD\ )}{area\ (\Delta\ BDC\ )} = \frac{AD}{DC}$		

THEOREMS

	Theorem	Statement	Diagram
10	Thales Theorem Basic Proportionality Theorem (BPT)	A straight line drawn parallel to a side of triangle intersecting the other sides, divides the sides in the same ratio. $\frac{AD}{DB} = \frac{AE}{EC}$ Corollary: $(i).\frac{AB}{AD} = \frac{AC}{AE}$ $(ii).\frac{AB}{DB} = \frac{AC}{EC}$	
11	Angle Bisector Theorem	The internal bisector of an angle of a triangle divides the opposite internally in the ratio of the corresponding sides containing the angle. $\frac{AB}{AC} = \frac{BD}{DC}$	
12	Pythagoras Theorem	In a right angle triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. $BC^2 = AB^2 + AC^2$	
13	Alternate Segment Theorem	If a line touches a circle and from the point of contact a chord is drawn, the angles between the tangent and the chord are respectively equal to the angle in the corresponding alternate segments $(i).\angle QPB = \angle PSQ$ $(ii).\angle QPA = \angle PTQ$	
14	Cevian	A cevian is a line segment that extends from one vertex of a triangle to the opposite side.	Examples: Median, Altitude, Angle bisector are cevians
15	Ceva's Theorem	Let ABC be a triangle and let D, E, F be points on lines BC, CA, AB respectively. Then the cevians AD,BE,CF are concurrent if and only if $\frac{BD}{DC} \times \frac{CE}{EA} \times \frac{AF}{FB} = 1$ where the lengths are directed.	
16	Menelaus Theorem	A necessary and sufficient condition for points P,Q,R on the respective sides BC,CA,AB (or their extension) of a triangle ABC to be collinear is that $\frac{BP}{PC} \times \frac{CQ}{QA} \times \frac{AR}{RB} = -1$ where all segments in the formula are directed segments.	
17	Secant	If a straight line intersects the circle at two points, then the line is called Secant of the circle.	
18	Tangent	If a line touches the circle at only one point, then it is called tangent of the circle	
		A tangent to a circle will be perpendicular to the radius at the point of contact.	
		Two tangents can be drawn from any exterior point of a circle.	
		The lengths of the two tangents drawn from an exterior point to a circle are equal.	
		Two direct common tangents drawn to two circles are equal in length.	

5 . COORDINATE GEOMETRY

1	Distance between two points	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
2	Mid point	$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
3	Centroid	$\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$
4	Section Formula (Internal Division)	$\left(\frac{lx_2 + mx_1}{l+m}, \frac{ly_2 + my_1}{l+m}\right)$

5	Section Formula (External Division)	$\left(\frac{lx_2 - mx_1}{l-m}, \frac{ly_2 - my_1}{l-m}\right)$
6	Area of Triangle	$\frac{1}{2}bh$ $\sqrt{s(s-a)(s-b)(s-c)}$, $s = \frac{a+b+c}{2}$ $\frac{1}{2}\begin{pmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{pmatrix}$
7	Area of quadrilateral	$\frac{1}{2}\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{pmatrix}$ $\frac{1}{2}\begin{pmatrix} x_1 - x_3 & y_1 - y_3 \\ x_2 - x_4 & y_2 - y_4 \end{pmatrix}$

FORMULA FOR SLOPE

8	If angle is given	$m = \tan\theta$
9	If two points are given	$m = \frac{y_2 - y_1}{x_2 - x_1}$
10	Slope of the straight line $ax + by + c = 0$	$m = \frac{-a}{b} = \frac{-\,coefficient\ of\ x}{coefficient\ of\ y}$

COLLINEARITY OF THREE POINTS

11	If Three points A , B , C are collinear	$\begin{pmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{pmatrix} = 0$ Slope of AB = Slope of BC (or) Slope or AC

CONDITION FOR PARALLELISM AND PERPENDICULARITY

12	If two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are	parallel	$m_1 = m_2$ (OR) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$
		perpendicular	$m_1 \times m_2 = -1$ (OR) $a_1a_2 + b_1b_2 = 0$

EQUATION OF STRAIGHT LINES

13	Equation of X axis	$y = 0$
14	Equation of Y axis	$x = 0$
15	Equation of a straight line parallel to X axis	$y = \pm b$
16	Equation of a straight line parallel to Y axis	$x = \pm c$
17	Equation of straight line parallel to $ax + by + c = 0$	$ax + by + k = 0$
18	Equation of a straight line perpendicular to $ax + by + c = 0$	$bx - ay + k = 0$
19	Equation of straight line passing through origin	$y = mx$
20	Equation of straight line (Slope – Intercept form)	$y = mx + c$
21	Equation of straight line (Point – Slope form)	$y - y_1 = m(x - x_1)$
22	Equation of straight line (Two point form)	$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$
23	Equation of straight line (Intercept form)	$\frac{x}{a} + \frac{y}{b} = 1$

6.TRIGONOMETRY

TRIGONOMETRY RATIOS

1	$\sin\theta = \frac{Opposite\ side}{Hypotenuse}$	$\cos\theta = \frac{Adjacent\ side}{Hypotenuse}$	$\tan\theta = \frac{Opposite\ side}{Adjacent\ side}$	$\tan\theta = \frac{\sin\theta}{\cos\theta}$
2	$\operatorname{cosec}\theta = \frac{Hypotenuse}{Opposite\ side}$	$\sec\theta = \frac{Hypotenuse}{Adjacent\ side}$	$\cot\theta = \frac{Adjacent\ side}{Opposite\ side}$	$\cot\theta = \frac{\cos\theta}{\sin\theta}$

COMPLEMENTRY ANGLES

3	$\sin(90 - \theta) = \cos\theta$	$\cos(90 - \theta) = \sin\theta$	$\tan(90 - \theta) = \cot\theta$
4	$\operatorname{cosec}(90 - \theta) = \sec\theta$	$\sec(90 - \theta) = \operatorname{cosec}\theta$	$\cot(90 - \theta) = \tan\theta$

RECIPROCAL RATIOS

5	$\sin\theta = \frac{1}{\operatorname{cosec}\theta}$	$\cos\theta = \frac{1}{\sec\theta}$	$\tan\theta = \frac{1}{\cot\theta}$
6	$\operatorname{cosec}\theta = \frac{1}{\sin\theta}$	$\sec\theta = \frac{1}{\cos\theta}$	$\cot\theta = \frac{1}{\tan\theta}$

TRIGONOMETRIC IDENTITIES

	Identity	Equal forms	
7	$\sin^2\theta + \cos^2\theta = 1$	$\sin^2\theta = 1 - \cos^2\theta$	$\cos^2\theta = 1 - \sin^2\theta$
8	$1 + \tan^2\theta = \sec^2\theta$	$\tan^2\theta = \sec^2\theta - 1$	$\sec^2\theta - \tan^2\theta = 1$
9	$1 + \cot^2\theta = \text{cosec}^2\theta$	$\cot^2\theta = \text{cosec}^2\theta - 1$	$\text{cosec}^2\theta - \cot^2\theta = 1$

TRIGONOMETRIC TABLE

	0°	30°	45°	60°	90°
$\sin\theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Undefined
$\text{cosec}\,\theta$	Undefined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec\theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Undefined
$\cot\theta$	Undefined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

HEIGHT AND DISTANCE

10	Distance between two objects are in opposite direction	$d = h\,[\cot\alpha + \cot\beta\,]$
11	Distance between two objects are in same direction	$d = h\,[\cot\alpha - \cot\beta\,]$
12	Distance of two objects	$x = \frac{y\,[\,\tan\beta - \tan\alpha\,]}{\tan\alpha}$ $y = \frac{x\,\tan\alpha}{\tan\beta - \tan\alpha}$
13	Height of two different objects	$H = \frac{h\,\tan\beta}{\tan\beta - \tan\alpha}$ $h = \frac{H\,[\,\tan\beta - \tan\alpha\,]}{\tan\beta}$
14	Height of two objects are in angle of elevation and depression	$H = h\,[\,1 + \tan\alpha\cot\beta\,]$ $h = \frac{H}{1 + \tan\alpha\cot\beta}$

7. MENSURATION

	SHAPES	CSA / LSA	TSA	VOLUME
1	Cube	$4a^2$	$6a^2$	a^3
2	Cuboid	$2(l+b)h$	$2(\,lb + bh + lh\,)$	$l \times b \times h$
3	Solid Cylinder	$2\pi rh$	$2\pi r(h+r)$	$\pi r^2 h$
4	Hollow Cylinder	$2\pi(\,R + r\,)h$	$2\pi(\,R+r\,)(\,R - r + h\,)$	$\pi(\,R^2 - r^2\,)h$
5	Solid Sphere	$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$
6	Hollow Sphere	$4\pi R^2$	$4\pi(\,R^2 + r^2\,)$	$\frac{4}{3}\pi(\,R^3 - r^3\,)$
7	Hemisphere	$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$
8	Hollow Hemisphere	$2\pi(\,R^2 + r^2\,)$	$\pi(\,3R^2 + r^2\,)$	$\frac{2}{3}\pi(\,R^3 - r^3\,)$
9	Solid Cone	πrl	$\pi r(l+r)$	$\frac{1}{3}\pi r^2 h$
10	Frustum	$\pi(\,R + r\,)l$	$\pi(\,R+r\,)l + \pi R^2 + \pi r^2$	$\frac{1}{3}\pi h\,[\,R^2 + r^2 + Rr\,]$

11	Slant height of cone $l = \sqrt{r^2 + h^2}$	Slant height of frustum $l = \sqrt{h^2 + (R-r)^2}$
12	Radius of cone $r = \sqrt{l^2 - h^2}$	Volume of water flows out through a pipe = Cross section area X Speed X Time
13	Height of cone $h = \sqrt{l^2 - r^2}$	
14	Area of Circle = πr^2	Circumference of Circle = $2\pi r$
15	Weight = Volume X Density	

SECTOR AND CONE

16	Area of sector ($\frac{\theta}{360°} \times \pi R^2$) = CSA of Cone ($\pi r l$)
17	Length of arc a of sector ($\frac{\theta}{360°} \times 2\pi R$) = Circumference of base of the Cone (($2\pi r$)
18	Radius of sector (R) = Slant height of cone (l)

CONVERSIONS

19	1 m^3 = 1000 litres	1 d.m^3 = 1 litre	1000 cm^3 = 1 litre	1 kl = 1000 litres
20	1 cm = 10 mm	1 m = 100 cm	1 km = 1000 m	
21	When **converting one solid to another solid** , the **volumes are equal** but they differ in surface area			

8. STATITICS AND PROBABILITY

1	**Measures of Central Tendency**	1.Arithmetic Mean	2. Median	3. Mode
2	**Measures of Dispersion**	1.Range	2.Mean deviation	3.Quartile deviation
		4.Standard Deviation	5. Variance	6. Coefficient of variation

3	Mean	$\bar{x} = \frac{\sum x}{n}$
4	Range	$R = L - S$
5	Co efficient of range	$\frac{L-S}{L+S}$
6	Standard deviation of first n natural numbers	$\sigma = \sqrt{\frac{n^2-1}{12}}$
7	Variance of first n natural numbers	$\sigma^2 = \frac{n^2-1}{12}$
8	Standard deviation	$\sqrt{Variance}$
9	Variance	$(Standard\ Deviation)^2$

STANDARD DEVIATION

		UNGROUPED DATA	GROUPED DATA
10	**Direct Method**	$\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$	-----
11	**Actual Mean Method**	$\sigma = \sqrt{\frac{\sum d^2}{n}}$, $d = x - \bar{x}$	$\sigma = \sqrt{\frac{\sum fd^2}{\sum f}}$, $d = x - \bar{x}$
12	**Assumed Mean Method**	$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$, $d = x - A$	$\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$, $d = x - A$
13	**Step Deviation Method**	$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2} \times c$, $d = \frac{x-A}{C}$	$\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2} \times c$, $d = \frac{x-A}{c}$

14	**Co efficient of Variation**	CV = $\frac{\sigma}{\bar{x}} \times 100$
15	If co efficient of variation value is less, then the observations of corresponding data are **Consistent**	
16	If co efficient of variation value is more , then the observations of corresponding data are **Inconsistent**	

PROBABILITY

1	Probability of an Event	$P(A) = \frac{Number\ of\ outcomes\ favourable\ to\ A}{Total\ number\ of\ outcomes}$ $P(A) = \frac{n(A)}{n(S)}$
2	Probability of sure event	$P(S) = 1$
3	Probability of impossible event	$P(\emptyset) = 0$
4	Probability value always lies from	0 to 1 (OR) $0 \leq P(A) \leq 1$
5	Probability of complement event	$P(\bar{A}) = 1 - P(A)$ $[\because P(A) + P(\bar{A}) = 1]$

ADDITION THEOREM OF PROBABILITY

6	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	
7	$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$	
8	A and B are mutually exclusive events	$P(A \cap B) = 0$ $P(A \cup B) = P(A) + P(B)$
9	A , B and C are mutually exclusive events	$P(A \cup B \cup C) = P(A) + P(B) + P(C)$
10	$P(A \cap \bar{B}) = P(only\ A) = P(A) - P(A \cap B)$	
11	$P(\bar{A} \cap B) = P(only\ B) = P(B) - P(A \cap B)$	

COIN

12	**Random Experiment**	**Sample Space (S)**	**Total number of outcomes n(S)**
13	Tossing one unbiased coin	{ H , T }	2
14	Tossing two unbiased coin	{ HH , HT , TH , TT }	4
15	Tossing three unbiased coin	{ HHH , HHT , HTH , THH , TTT , TTH , THT , HTT }	8

DICE

16	Rolling one unbiased die	{ 1 , 2 , 3 , 4 , 5 , 6 }	6
17	Rolling two unbiased die	{ (1,1) , (1,2) , (1,3) , (1,4) , (1,5) , (1,6) (2,1) , (2,2) , (2,3) , (2,4) , (2,5) , (2,6) (3,1) , (3,2) , (3,3) , (3,4) , (3,5) , (3,6) (4,1) , (4,2) , (4,3) , (4,4) , (4,5) , (4,6) (5,1) , (5,2) , (5,3) , (5,4) , (5,5) , (5,6) (6,1) , (6,2) , (6,3) , (6,4) , (6,5) , (6,6) }	36
18	Rolling three unbiased die	{(1,1,1) , (1,1,2),………………..(6,6,6) }	216

PLAYING CARDS

19	Total number of cards		52	
	Card	**No.of cards**	**Card**	**No.of cards**
20	Spade card	13	Jack card	4
21	Clavor card	13	Ace card	4
22	Heart card	13	Face card	12
23	Diamond card	13	Number card	36
24	Red card	26	Red King card	2
25	Block card	26	Block king card	2
26	King card	4	Red Queen card	2
27	Queen card	4	Block Queen card	2
28	Leap Year	366 days (OR) 52 weeks 2 days		
29	Ordinary year	365 days (OR) 52 weeks 1 day		

ALL THE BEST