MATHEMATICS
POINTS TO REMEMBER

COMPOUND INTEREST

1. Compound Interest = Amount – Principal
2. Difference between CI for 2 consecutive years $= \frac{\textbf{Interest of Consective Year X Rate \% X Time}}{\textbf{100}}$
3. Difference between Amounts for 2 consecutive years is the interest of one year on the amount of the preceding year.
4. SI for 1st year = CI for 1st year
5. CI of any year be Rs *x*. The CI for the next year on the same sum and same rate = Rs. *x* + Interest of Rs *x* for one year
6. Amount of any year be Rs *x*. The Amount for the next year on the same sum and same rate = Rs. *x* + Interest of Rs *x* for one year
7. Amount $= P\left(1 + \frac{r}{100}\right)^n$ where P is the principal, r is the rate of interest and n is the number of years (Interest compounded yearly)
8. Amount = $P\left(1 + \frac{r}{2\,X100}\right)^{n\,X\,2}$ Interest compounded Half Yearly
9. TABLE SHOWING THE RATE OF INTEREST COMPOUNDED YEARLY AND HALF YEARLY:-

No. of years	Compounded Annually	Compounded half yearly
n = 1 year	A = $P\left(1 + \frac{r}{100}\right)^1$	A = $P\left(1 + \frac{r}{2\,X100}\right)^{1\,X\,2}$
n = 1½ years	A = $P\left(1 + \frac{r}{100}\right)^1 X \left(1 + \frac{r}{2\,X100}\right)^{\frac{1}{2}X\,2}$	A = $P\left(1 + \frac{r}{2\,X100}\right)^{\frac{3}{2}X\,2}$
n = 2 years	A = $P\left(1 + \frac{r}{100}\right)^2$	A = $P\left(1 + \frac{r}{2\,X100}\right)^{2\,X\,2}$
n = 2½ years	A = $P\left(1 + \frac{r}{100}\right)^2 X \left(1 + \frac{r}{2\,X100}\right)^{\frac{1}{2}X\,2}$	A = $P\left(1 + \frac{r}{2\,X100}\right)^{\frac{5}{2}X\,2}$

10. Value after n years = $Present\ value\left(1 \pm \frac{r}{100}\right)^n$
11. Present value = $Value\ n\ years\ ago\left(1 \pm \frac{r}{100}\right)^n$

in 11 and 12, + is used if it is appreciation and – is used if it is depreciation.

SALES TAX AND VALUE ADDED TAX

1. List Price / Marked Price / Printed Price / Quoted Price – The price at which an Article is marked.
2. Sales Tax is calculated after deducting the discount.

3. Sales Tax = $\frac{Rate\ of\ Sales\ Tax\ X\ Sale\ Price}{100}$
4. VAT paid by a person= $\frac{Price\ Added\ by\ the\ person\ X\ VAT\%}{100}$

BANKING

1. SB Account
   a. Withdrawal = Debit
   b. Deposit = Credit
   c. Steps for calculation of interest:
      (i) Find the minimum monthly balance on the 10th day up to the last of each month.
      (ii) Add them. This is the Equivalent Monthly Principal for 1 month.
      (iii) Calculate the SI on the Equivalent Monthly Principal with **T = $^{1}/_{12}$ years.**
      (iv) If the Amount Received on closing is asked, Add the interest to the **LAST BALANCE and not to the Equivalent Monthly Principal**.
2. R D Account
   a. Interest = $\frac{P\ X\ n(n+1) X\ Rate\ \%}{2\ X\ 12\ X\ 100}$
   b. Maturity Value = P X n + I.

SHARES AND DIVIDEND

1. Nominal Value is also called Register Value, Printed Value, Face Value.
2. If the *MV of the share is same as its NV*, the share is said to be *at par*.
3. If the *MV of the share is greater than NV,* the share is said to be *at premium.*
4. If the *MV of the share is less than NV,* the share is said to be *at discount*.
5. No. of shares = $\frac{Investment}{Market\ Value\ of\ each\ share}$
6. Dividend = $\frac{Dividend\ \%}{100}$ X Nominal Value of each share X No. of shares
7. Return% = $\frac{Dividend}{Investment}$ X 100 %
8. Rate of dividend X NV = Return% X MV
9. Percentage increase in return on original investment = $\frac{New\ Dividend}{Original\ \ Investment}$ X 100%
10. Percentage increase in return = $\frac{New\ Dividend\ -Old\ dividend}{Old\ dividend}$ X 100%

LINEAR INEQUATIONS

1. Solid circle● for ≥ and ≤.
2. Hollow Circle○ for < and >.

3. "and" means 'INTERSECTION'
4. "or" means 'UNION'.

QUADRATIC EQUATIONS

1. Steps for solving by factorization:
   a. Clear all fractions and brackets if necessary.
   b. Bring it to the form $ax^2 + bx + c = 0$ by transposing terms.
   c. Factorize the expression by splitting the middle term as a sum of the product of *a* & *c*.
2. $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

COORDINATE GEOMETRY

1. $M_x (x , y) = (x , – y)$
2. $M_y(x , y) = (– x , y)$
3. $M_O(x , y) = (– x , – y)$
4. X axis – y = 0;
5. Y axis – x = 0;

RATIO AND PROPORTION

1. In the ratio, a : b, a is called antecedent and b is called consequent.
2. $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{a+c+e}{b+d+f}$
3. Compound ratio of a : b and c : d is (a X b) : (c X d)
4. Duplicate ratio of a : b is $a^2 : b^2$
5. Triplicate ratio of a : b is $a^3 : b^3$
6. Sub – duplicate ratio of a : b is $\sqrt{a} : \sqrt{b}$
7. Sub – triplicate ratio of a : b is $\sqrt[3]{a} : \sqrt[3]{b}$
8. Reciprocal ratio of a : b is b : a
9. Proportion – a : b : : c : d or a : b = c : d
10. Continued Proportion – a : b : : b : c or a : b = b : c
11. Invertendo – If a : b = c : d, then b : a = d : c
12. Alternendo – If a : b = c : d, then a : c = b : d
13. Componendo – If a : b = c : d, then a + b : b = c + d : d
14. Dividendo – If a : b = c : d, then a – b : b = c – d : d
15. Componendo and dividendo – If a : b = c : d, a + b : a – b = c + d : c – d

REMAINDER AND FACTOR THEOREM

1. REMAINDER THEOREM: If f (x) is a polynomial, which is divided by (x – a), then the remainder is f (a).

2. FACTOR THEOREM: If the remainder on dividing a polynomial f (x) by (x – a), f (a) = 0, then (x – a) is a factor of f (x).

MATRICES

1. The order of a matrix is calculated using the letter L.
2. Row matrix – Only 1 row $[\ a \quad b\ ]$
3. Column matrix – Only 1 column $\begin{bmatrix} a \\ b \end{bmatrix}$
4. Square matrix – Number of rows = number of columns $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$
5. Rectangular matrix – The number of rows ≠ The number of columns $\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix}$
6. Zero matrix – All elements are zero $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
7. Diagonal Matrix – A square matrix with all the elements zero except the elements on the leading diagonal. $\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$
8. Unit Matrix (I) – A diagonal matrix with all the elements on the leading diagonal = 1. $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
9. Transpose of a matrix – If $A = \begin{bmatrix} 2 & 3 & 5 \\ 2 & 8 & 1 \end{bmatrix}$ $A^t = \begin{bmatrix} 2 & 2 \\ 3 & 8 \\ 5 & 1 \end{bmatrix}$
10. Addition of 2 matrices - $\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} p & q \\ r & s \end{bmatrix} = \begin{bmatrix} a+p & b+q \\ c+r & d+s \end{bmatrix}$
11. Multiplication of matrix by a real number – $i\ X \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} a\ X\ i & b\ X\ i \\ c\ X\ i & d\ X\ i \end{bmatrix}$
12. Multiplication of 2 matrices - $[\qquad]_{x\ X\ y}\ X\ \begin{bmatrix} \ \end{bmatrix}_{b\ X\ a}$ Here, y = b and the order of the product matrix = (x X a)

    Multiplication process:

    $\begin{bmatrix} a & b \\ c & d \end{bmatrix} X \begin{bmatrix} p & q \\ r & s \end{bmatrix} = \begin{bmatrix} a\ X\ p + b\ X\ r & a\ X\ q + b\ X\ s \\ c\ X\ p + d\ X\ r & c\ X\ q + d\ X\ s \end{bmatrix}$

MORE ABOUT COORDINATE GEOMETRY

1. Distance formula – To find the distance between two coordinates

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

2. Section formula – To find the coordinates of a point which divides the line segment with two given coordinates in a given ratio $m_1 : m_2$

   Coordinates of the point (x , y) = $\left(\frac{m_1x_2+m_2x_1}{m_1+m_2} , \frac{m_1y_2+m_2y_1}{m_1+m_2}\right)$

3. Midpoint formula – To find the coordinates of the midpoint of a line segment

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

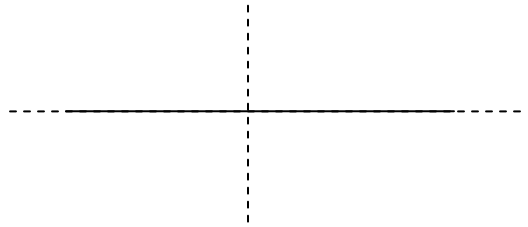
4. Centroid of a triangle – The point of intersection of the medians or the point which divides the median of a triangle in the ratio 2 : 1 from the vertex of the triangle

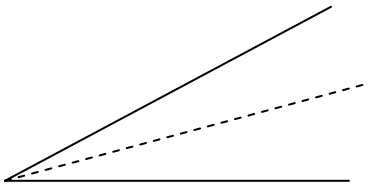
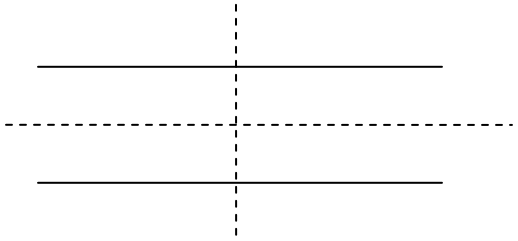
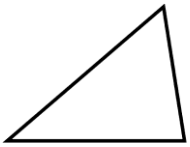
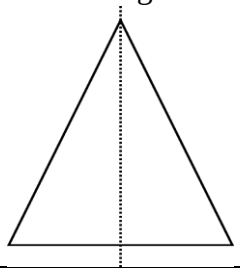
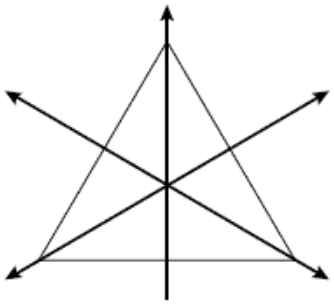
   Centroid of a triangle (x , y) = $\left(\frac{x_1+x_2+x_3}{3} , \frac{y_1+y_2+y_3}{3}\right)$

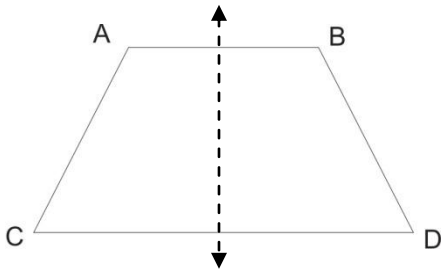
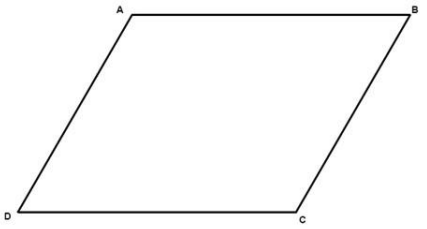
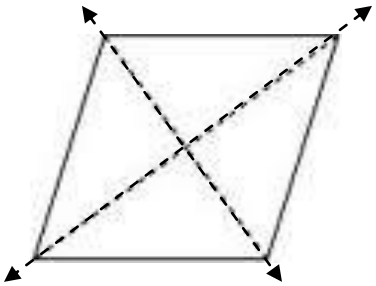
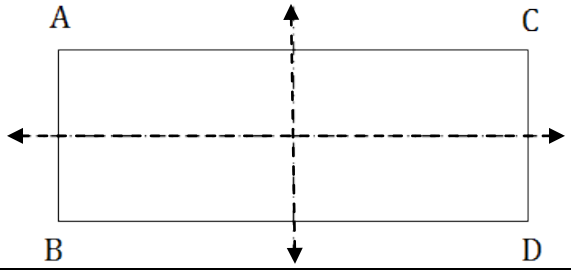
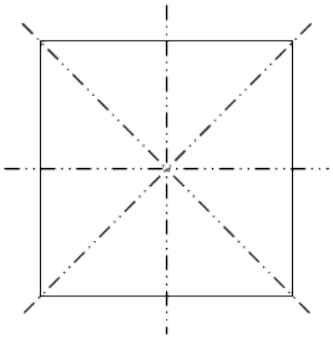
EQUATION OF A LINE

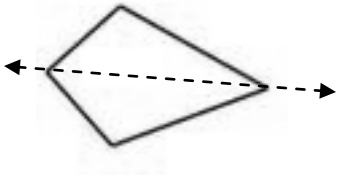
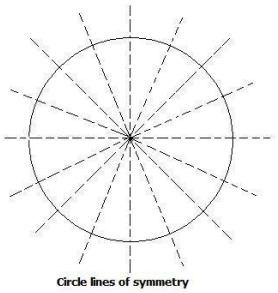
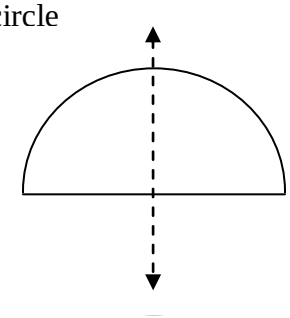
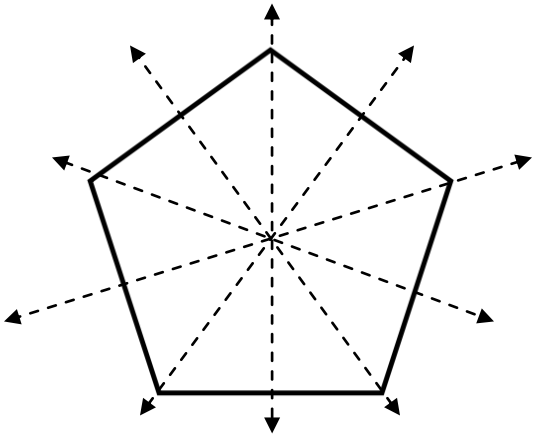
1. Slope of a line = tan θ where θ is the angle of inclination or the angle the line makes with the x axis in the positive direction.
2. Inclination θ of x axis and every line || to it = 0^o.
3. Inclination θ of y axis and every line || to it = 90^o.
4. Slope of a line which passes through (x_1 , y_1) and (x_2 , y_2) = $\left(\frac{y_2-y_1}{x_2-x_1}\right)$
5. Slope of two parallel lines are equal.
6. Product of the slopes of two perpendicular line = – 1.
7. Equation of a line :
   a. $y = mx + c$ – Slope intercept form – where y is m is the slope and c is the y-intercept.
   b. $(y – y_1) = m(x – x_1)$ – Slope point form – where (x_1, y_1) are the coordinates of the point through which the line passes and m is the slope.
   c. $(y – y_1) = m(x – x_1)$ *where* $m = \left(\frac{y_2-y_1}{x_2-x_1}\right)$ – Two point form – where (x_1, y_1) and (x_2, y_2) are the coordinates of the point through which the line passes.

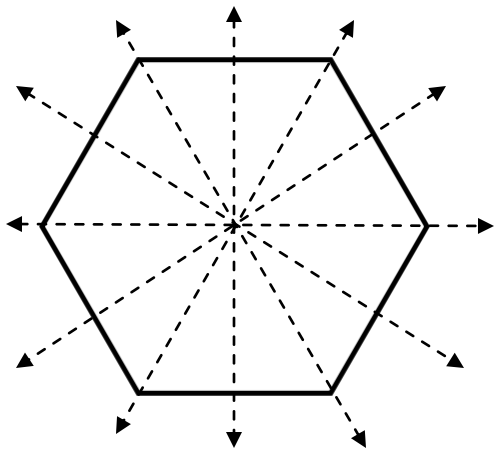
SYMMETRY

GEOMETRICAL NAME	LINE(S) OF SYMMETRY
1. Line segment 	<u>2 lines of symmetry</u> 1. The line itself 2. The perpendicular bisector of the line segment
2. Angle with equal arms	

	<u>1 line of symmetry</u> The angular bisector
3. A pair of equal parallel line segments 	<u>2 lines of symmetry</u> A line midway of the two lines The perpendicular bisector of the two lines
4. A scalene triangle 	*Nil*
5. An isosceles triangle 	<u>1 line of symmetry</u> The bisector of the vertical angle which is also the perpendicular bisector of the base
6. An equilateral triangle 	<u>3 lines of symmetry</u> The angular bisectors which is also the perpendicular bisectors of the sides
7. An isosceles trapezium	

	<u>1 line of symmetry</u> The line joining the midpoint of the two parallel sides
8. A parallelogram 	*Nil*
9. A rhombus 	<u>2 lines of symmetry</u> The diagonals
10. A rectangle 	<u>2 lines of symmetry</u> The lines joining the midpoints of the opposite sides
11. Square 	<u>4 lines of symmetry</u> The diagonals - 2 The lines joining the midpoints of the opposite sides – 2
12. Kite	

	<u>1 line of symmetry</u> The diagonal that bisects the pair of angles contained by equal sides
13. Circle  	<u>Infinite lines of symmetry</u> All the diameters
14. Semicircle 	<u>One line of symmetry</u> The perpendicular bisector of the diameter
15. A requlr pentagon 	<u>Five lines of symmetry</u> The angular bisectors of the angles or the perpendicular bisector of the sides
16. A requlr hexagon	

	<u>6 lines of symmetry</u> The angular bisectors – 3 The perpendicular bisectors of the sides – 3

SIMILARITY

1. Criteria for similarity – 1. AA or AAA criteria 2. SAS criteria 3. SSS criteria
2. A perpendicular drawn for the vertex of a right-angled triangle divides the triangle into two triangles similar to each other and also to the original triangle.
3. *Basic Proportionality Theorem* – A line drawn parallel to any side of a triangle divides the other two sides proportionally.
4. *The areas of two similar triangles are proportional to the square on their corresponding sides.*
5. *Median divides a triangle into two triangles of equal area.*
6. *If many triangles have a common vertex and their bases are along the same straight line, the ratio between their areas is equal to the ratio between the lengths of their bases.*
7. Scale factor is given by the letter *k.*
8. $k = \frac{Length\ of\ the\ model}{Length\ of\ the\ object}$
9. $k^2 = \frac{Area\ of\ the\ model}{Area\ of\ the\ object}$
10. $k^3 = \frac{Volume\ of\ the\ model}{Volume\ of\ the\ object}$

LOCUS

1. *The locus of a point which is equidistant from two fixed points is the perpendicular bisector of the line segment joining the two fixed points.*
2. *Any point lying on the perpendicular bisector of a line segment joining two fixed points is equidistant from the points.*
3. *The locus of a point which is equidistant from the two intersecting straight lines consists of a pair of straight lines which bisect the angles between the two given lines.*
4. *Any point lying on the bisector of an angle is equidistant from the arms of that angle.*

CIRCLE

1. A line drawn from the centre of a circle to bisect the chord is perpendicular to the chord.
2. A perpendicular line drawn to a chord from the centre of the circle bisects the chord.
3. The perpendicular bisector of a chord passes through the centre of the circle.
4. One and only one circle can be drawn passing through three non-collinear points.
5. Equal chords are equidistant from the centre.
6. Chords which are equidistant from the centre are equal in length.
7. If the parallel chords are drawn in a circle, then the line through the midpoints of the chords passes through the centre.
8. Greater the size of the chord, lesser is its distance from the centre.
9. Angle at the centre = 2 X Angle on the circumference
10. Angles in the same segment are equal.
11. Angle in a semicircle is a right angle.
12. The opposite angles of a cyclic quadrilateral are supplementary.
13. If the opposite angles of a quadrilateral are supplementary, then the quadrilateral is cyclic.
14. Angle in the major segment in acute and in the minor segment is obtuse.
15. Exterior angle of a cyclic quadrilateral = Interior opposite angle.
16. In equal circles or in the same circle, if two arcs subtend equal angels at the centre, then they are equal.
17. In equal circle, if two arcs are equal, then they subtend equal angles at the centre.
18. In equal circles, if two chords are equal, they cut off equal arcs.
19. In equal circle, if two arcs are equal, the chords of the arcs are also equal.
20. The tangent at any point of a circle and the radius through this point are perpendicular to each other.
21. If two tangents are drawn to a circle from an exterior point,
    a. The tangents are equal
    b. They subtend equal angles at the centre of the circle
    c. They are equally inclined to the line joining the point and the centre of the circle.
22. If two circles touch each other (externally or internally) the line joining the centers of the circle passes through the point of contact.
23. Direct common tangent = $\sqrt{d^2 - (r_1 - r_2)^2}$
24. Transverse common tangent = $\sqrt{d^2 - (r_1 + r_2)^2}$
25. If two chords of a circle intersect each other internally or externally, then the product of the lengths of their segments is equal.
26. Angles in the alternate segment are equal.
27. Tangent^2 = Product of the lengths of the segments of the chord
28. Incentre – Point of intersection of the angular bisectors
29. Circumcentre – Point of intersection of the perpendicular bisectors of the sides

30. Orthocentre – Point of intersection of the altitudes

AREA AND VOLUME

1. CIRCLE
    a. Circumference = $2\pi r$
    b. Area = πr^2
2. CIRCULAR RING
    a. Area = $\pi(R^2 - r^2)$
3. Distance travelled by a wheel in one revolution = Its circumference
4. No. of Revolutions = $\frac{Total\ \ distance\ \ travelled}{Circumference\ \ \ of\ the\ wheel}$
5. ARCS
    a. Length of arc = $\frac{\theta}{360^o}$ X $2\pi r$
    b. Perimeter = $\frac{\theta}{360^o}$ X $2\pi r + 2r$
    c. Area = $\frac{\theta}{360^o}$ X πr^2
6. TRIANGLE
    a. Area = ½ X Base X Height
    b. Area(Equilateral triangle) = $\frac{\sqrt{3}}{4}$ a^2
7. CUBOID
    a. Volume = l X b X h
    b. TSA = 2(lb + bh + hl)
    c. Diagonal = $\sqrt{l^2 + b^2 + h^2}$
8. CUBE
    a. Volume = a^3
    b. TSA = $6a^2$
    c. Diagonal = $a\sqrt{3}$
9. SOLID CYLINDER
    a. Volume = $\pi r^2 h$
    b. CSA = $2\pi rh$
    c. TSA = $2\pi rh + 2\pi r^2$
10. HOLLOW CYLINDER
    a. Volume = $\pi(R^2 - r^2)h$
    b. TSA = $2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$
11. RIGHT CIRCULAR CONE
    a. Slant height l = $\sqrt{h^2 + r^2}$

b. Volume = $\frac{1}{3}\pi r^2 h$

c. CSA = πrl

d. TSA = $\pi rl + \pi r^2$

12. SPHERE

a. Volume = $\frac{4}{3}\pi r^3$

b. Surface area = $4\pi r^2$

13. HEMISPHERE

a. Volume = $\frac{2}{3}\pi r^3$

b. Curved Surface area = $2\pi r^2$

c. Total Surface Area = $3\pi r^2$

14. HOLLOW SPHERE

a. Volume = $\frac{4}{3}\pi(R^3 - r^3)$

TRIGONOMETRY

1. $sin\ \theta = \frac{1}{cosec\ \theta}$
2. $cos\ \theta = \frac{1}{sec\ \theta}$
3. $tan\ \theta = \frac{1}{cot\ \theta}$
4. $tan\ \theta = \frac{\sin\ \theta}{cos\ \theta}$
5. $cot\ \theta = \frac{\cos\ \theta}{sin\ \theta}$
6. $sin^2\theta + cos^2\theta = 1$
7. $1 + tan^2\theta = sec^2\theta$
8. $1 + cot^2\theta = cosec^2\theta$
9. $\sin(90^O - \theta) = \cos\theta$
10. $\tan(90^O - \theta) = \cot\theta$
11. $\sec(90^O - \theta) = \text{cosec}\,\theta$

STATISTICS

1. Arithmetic mean on non tabulated data → $\bar{x} = \frac{\sum x}{n}$
2. Arithmetic mean of tabulated data (Direct Method) :

Class Interval	**Frequency (f)**	x	fx
$A - B$	i	$\frac{A+B}{2}$	i X x
B - C	j	$\frac{B+C}{2}$	j X x
	$\sum f = i + j$		$\sum fx = ix + jx$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

3. Short-Cut method

		$A(Assumed\ mean) = \frac{B+C}{2}$		
Class Interval	**Frequency (f)**	x	$d = x - A$	fd
A – B	i	$\frac{A+B}{2}$	$\frac{A+B}{2} - \frac{B+C}{2}$	$i\ X\ d$
B – C	j	$\frac{B+C}{2}$	$\frac{B+C}{2} - \frac{B+C}{2}$	$j\ X\ d$
C - D	k	$\frac{D+C}{2}$	$\frac{D+C}{2} - \frac{B+C}{2}$	$k\ X\ d$
	$\sum f = i + j + k$			$\sum fd = id + jd + kd$

$$\bar{x} = \frac{\sum fd}{\sum f} + A$$

4. Step – Deviation Method

		$A(Assumed\ mean) = \frac{B+C}{2}$		$i = B - A$	
Class Interval	**Frequency (f)**	x	$d = x - A$	$t = \frac{d}{i}$	ft
A – B	p	$\frac{A+B}{2}$	$\frac{A+B}{2} - \frac{B+C}{2}$	l	$p\ l$
B – C	q	$\frac{B+C}{2}$	$\frac{B+C}{2} - \frac{B+C}{2}$	m	$q\ m$
C - D	r	$\frac{D+C}{2}$	$\frac{D+C}{2} - \frac{B+C}{2}$	n	$r\ n$

	$\sum f = p + q + r$				$\sum ft = pl + qm + rn$

$$\bar{x} = \left(\frac{\sum ft}{\sum f} X\, i\right) + A$$

5. Median

   (i) If n is odd, Median = $\left(\frac{n+1}{2}\right)^{th}$ term

   (ii) If n is even, Median = $\frac{1}{2}\left(\left(\frac{n}{2}\right)^{th} term + \left(\frac{n}{2} + 1\right)^{th} term\right)$

   (iii) For tabulated data, Median = $\left(\frac{n}{2}\right)^{th}$ term if *n* is *even* and $\left(\frac{n+1}{2}\right)^{th}$ term if *n* is *odd.*

6. Quartile

   (i) LOWER QUARTILE (Q_1)

   (a) If n is odd, $Q_1 = \left(\frac{n+1}{4}\right)^{th}$ term

   (b) If n is even, $Q_1 = \left(\frac{n}{4}\right)^{th}$ term

   (ii) UPPER QUARTILE (Q_3)

   (a) If n is odd, $Q_3 = \left(\frac{3(n+1)}{4}\right)^{th}$ term

   (b) If n is even, $Q_3 = \left(\frac{3n}{4}\right)^{th}$ term

   (iii) Inter Quartile range = $Q_3 - Q_1$

PROBABILITY

1. P (Event) = $\frac{Number\ \ of\ favourable\ \ outcomes}{Number\ \ of\ possible\ \ outcomes}$
2. $0 \leq P(E) \leq 1$