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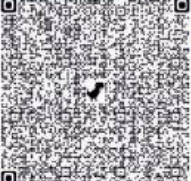
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According to latest ICSE syllabus 2024-2027 exams

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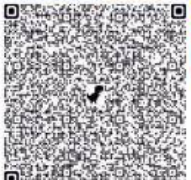
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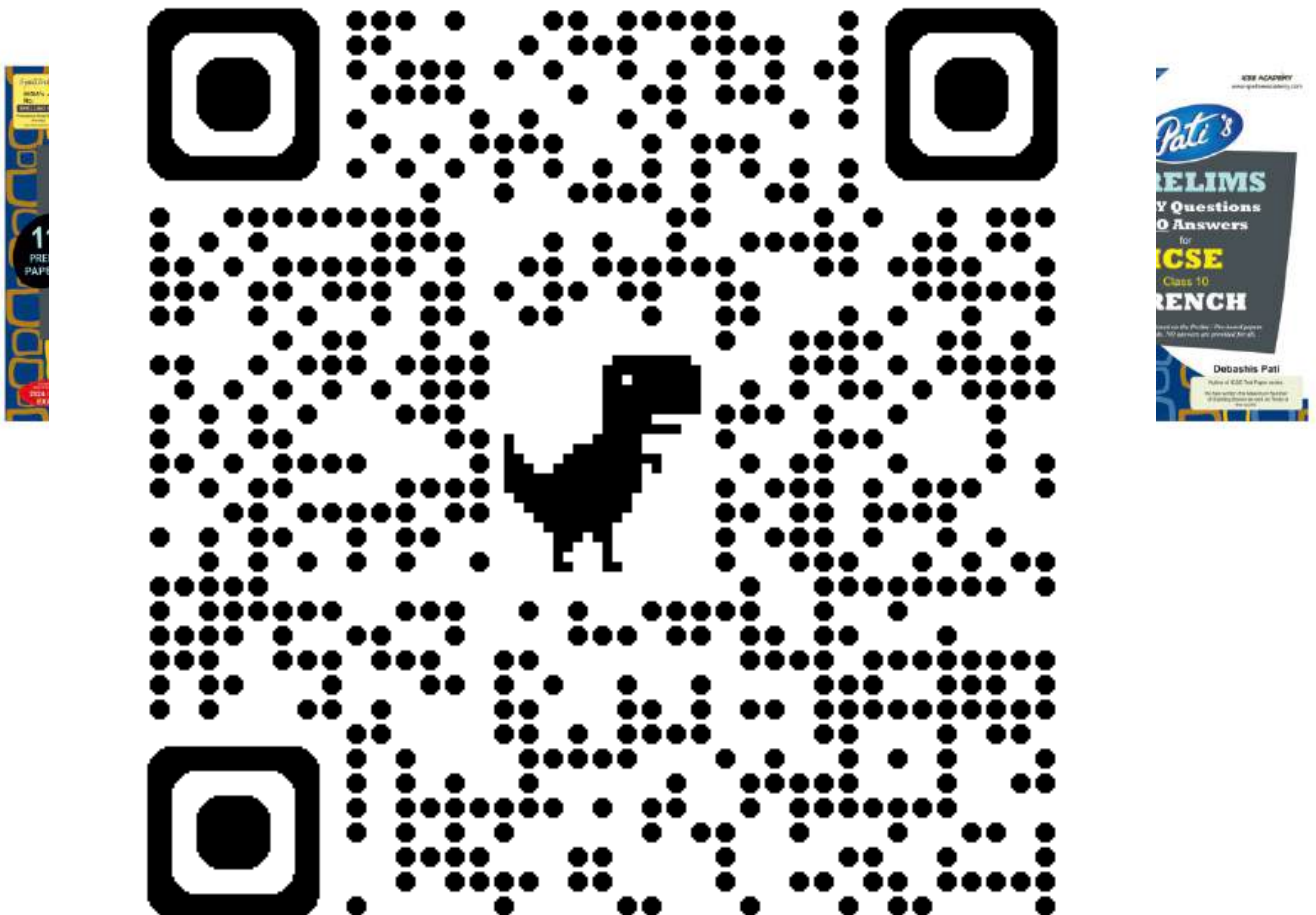
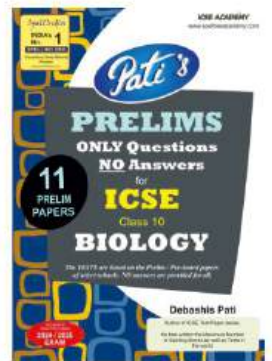
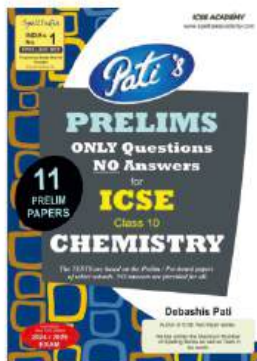
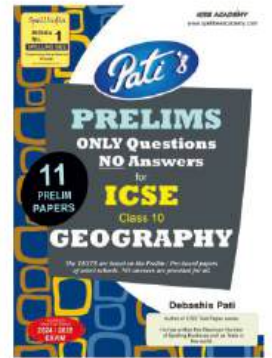
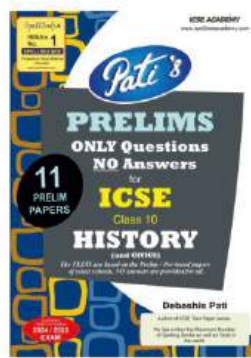
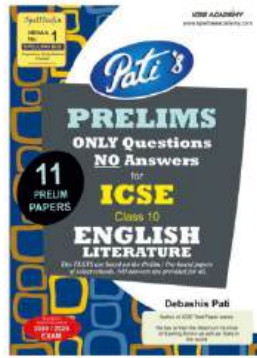
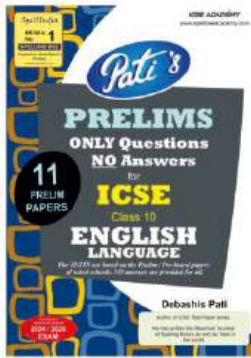
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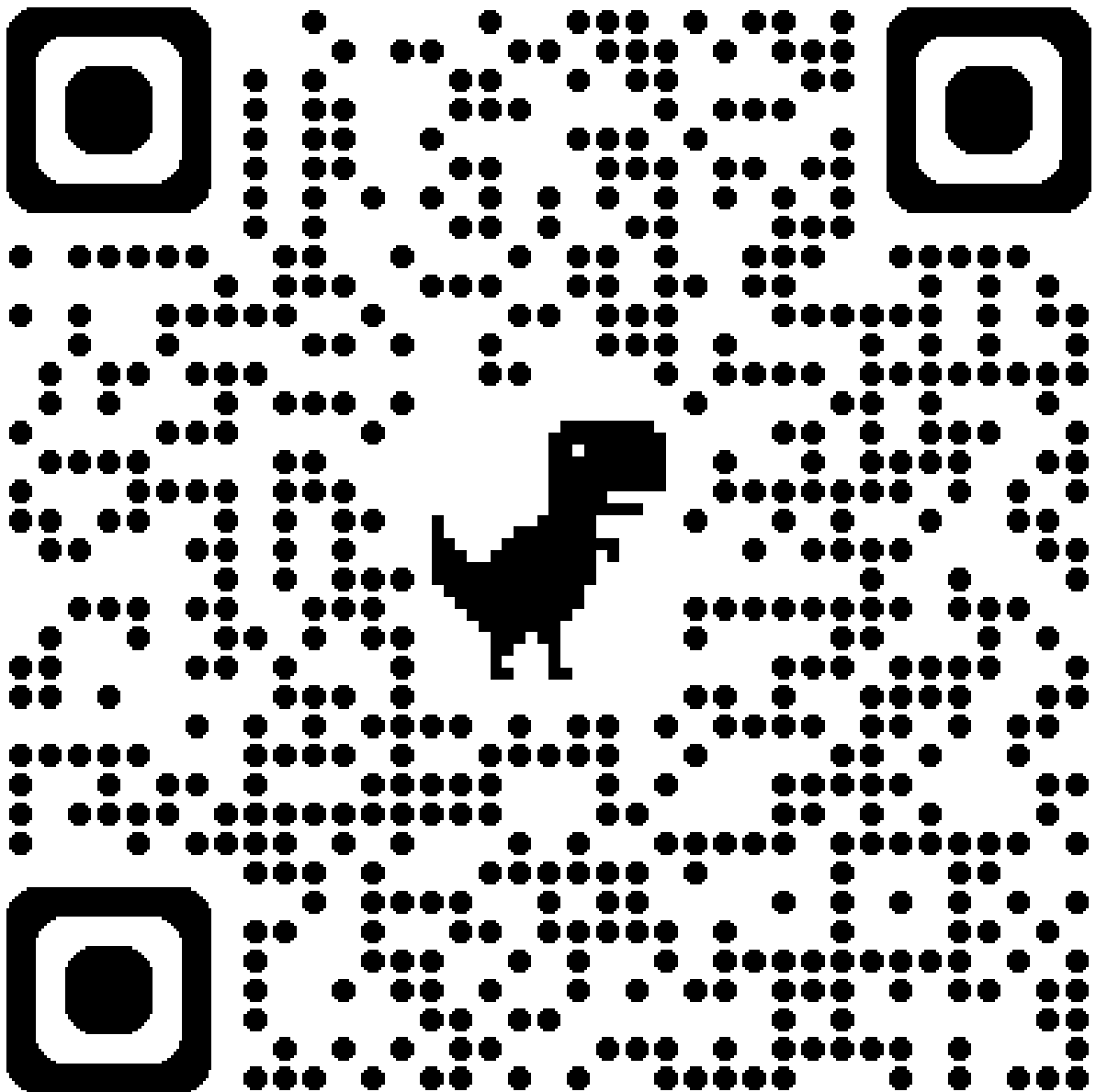
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GOODS AND SERVICE TAX (G.S.T)

GST is a consumption based tax levied on sale, manufacture and consumption on goods and services at a national level. This tax will be substitute for all indirect tax levied by state and central government.

Type of differences	CGST	SGST	IGST
Applicable transactions (Goods and services)	Intrastate (Within one state)	Intrastate (Within one state)	Interstate (between two states or one state and one UT) and imports
Collected by	Central Govt.	State Govt.	Central Govt.
Benefitting Authority	Central Govt.	State Govt.	Central Govt. and State Govt.

SHARES AND DIVIDEND

1. Investment = Market value \times No. of shares.
2. Annual Income/Dividend = $\frac{\% D}{100} \times F. V. \times n$
where, %D = dividend percent
F. V. = Face value [also known as Nominal value]
n = No. of shares
3. %R \times M. V. = %D \times F. V. where %R = Return percent / yield percent
4. Rate of interest on the investment (yield) % R = $\frac{\text{Total Dividend}}{\text{Total Investment}} \times 100$

BANKING

For Recurring deposit account:

$$1. \quad \text{Interest} = p \times n \times \left(\frac{n+1}{2} \right) \times \frac{1}{12} \times \frac{\% R}{100}$$

Money deposited = $p \times n$

Interest = Maturity value – Money deposited

$$2. \quad \text{Maturity Value} = p \times n + p \times n \times \left(\frac{n+1}{2} \right) \times \frac{1}{12} \times \frac{\% R}{100}$$

Where p = Instalment per month.

n = No. of months.

R = Rate of interest.

COMPOUND INTEREST

1. S. I. for 1st year = C. I. for 1st year.
2. Amount for 1st year = Principal for 2nd year.

3. $A = P \left(1 + \frac{R}{100} \right)^n$, C. I. = $A - P = P \left(1 + \frac{R}{100} \right)^n - P$

where A = Amount,
P = Principal,
R = Rate of Interest,
n = number of years.

4. When interest is calculated yearly or annually.

$$A = P \left(1 + \frac{R}{200} \right)^{2n}, \text{ C. I.} = A - P = P \left(1 + \frac{R}{200} \right)^{2n} - P$$

when interest is compounded semi-annually or half-yearly.

5. $A = P \left(1 + \frac{R}{100} \right)^x \left(1 + \frac{R \times \frac{y}{12}}{100} \right)$ when interest is compounded for x years

and y months. [Interest is compounded annually or yearly]

6. When successive years rate of interest $R_1\%$ and $R_2\%$ for two years is given.

$$A = P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right)$$

7. When successive years rate of interest $R_1\%$, $R_2\%$ and $R_3\%$ for three years is given.

$$A = P \left(1 + \frac{R_1}{100} \right) \left(1 + \frac{R_2}{100} \right) \left(1 + \frac{R_3}{100} \right)$$

8. When Amounts A_1 and A_2 for consecutive years are given,

$$\% R = \left(\frac{A_2 - A_1}{A_1} \right) \times 100$$

9. When Compound Interest C. I.₁ and C. I.₂ for consecutive years are given,

$$\% R = \left(\frac{C. I._2 - C. I._1}{C. I._1} \right) \times 100$$

10. Growth :

$$\text{Population/Value after } n \text{ yrs.} = \text{Original/Present Population/Value} \times \left(1 + \frac{R}{100} \right)^n$$

$$\text{Population/Value } n \text{ yrs ago} \times \left(1 + \frac{R}{100} \right)^n = \text{Original/Present Population/Value.}$$

11. Depreciation :

$$\text{Population/Value after } n \text{ yrs.} = \text{Original/Present Population/Value} \times \left(1 - \frac{R}{100} \right)^n$$

$$\text{Population/Value } n \text{ yrs ago} \times \left(1 - \frac{R}{100} \right)^n = \text{Original/Present Population/Value.}$$

ALGEBRA

QUADRATIC EQUATIONS

1. For $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2. **Nature of roots**

Discriminant (Δ) = $b^2 - 4ac$

If $\Delta = 0$, then roots are real and equal.

If $\Delta < 0$, then roots are imaginary.

If $\Delta > 0$, then

- (i) If $\Delta =$ perfect square then roots are rational and unequal.
- (ii) If $\Delta \neq$ perfect square then roots are irrational and unequal.

PROPORTION

Proportion

An equality of two ratios is called a proportion.

1. If four numbers a, b, c, d are in proportion then $\frac{a}{b} = \frac{c}{d} \Rightarrow a \times d = b \times c$
 \Rightarrow product of extreme = product of mean
2. If a, b, c are in continued proportion, then $\frac{a}{b} = \frac{b}{c}$ or $b^2 = ac$
3. If a, b, c, d are in continued proportion, then $\frac{a}{b} = \frac{b}{c} = \frac{c}{d}$
4. a, b, c, d, e are in continued proportion then $\frac{a}{b} = \frac{b}{c} = \frac{c}{d} = \frac{d}{e}$ or $bd = c^2 = ae$

K method

1. If a, b, c and d are in proportion then $\frac{a}{b} = \frac{c}{d} = k$ (say) $\Rightarrow \frac{a}{b} = k$ and $\frac{c}{d} = k$
 $\Rightarrow a = bk$ and $c = dk$
2. If b is the mean proportional between a and c or a, b and c are in continued proportion then $\frac{a}{b} = \frac{b}{c} = k$ (say) $\Rightarrow \frac{a}{b} = k$ and $\frac{b}{c} = k \Rightarrow a = bk$ and $b = ck$
 $\Rightarrow a = bk = (ck)k = ck^2$
3. If a, b, c and d are in continued proportion then $\frac{a}{b} = \frac{b}{c} = \frac{c}{d} = k$ (say)
 $\Rightarrow a = bk, b = ck, c = dk$
 $\Rightarrow b = ck = (dk)k = dk^2$
 $\Rightarrow a = bk = (dk^2)k = dk^3$

Properties of proportion

1. If $\frac{a}{b} = \frac{c}{d}$ then $\frac{a+b}{b} = \frac{c+d}{d}$ (Componendo)
2. If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a-b}{b} = \frac{c-d}{d}$ (Dividendo)
3. If $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \frac{d}{c}$ (Invertendo)
4. If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{c} = \frac{b}{d}$ (Alternendo)
5. If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$ (Componendo-Dividendo)

Law of equal ratio

If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$, then each ratio = $\frac{a + c + e}{b + d + f} = \frac{\text{sum of antecedent's}}{\text{sum of consequent's}}$

FACTOR THEOREM

If $f(x)$ is a polynomial in x and $f(a) = 0$, then $x - a$ is the factor of $f(x)$.

REMAINDER THEOREM

If $f(x)$ is a polynomial in x which is divided by $x - a$, then remainder = $f(a)$.

MATRICES

If a matrix has m rows and n columns then its order is $m \times n$

Unit Matrix or Identity matrix = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Equality of Matrix : If $\begin{bmatrix} p & q \\ r & s \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ then $p = 1$, $q = 2$, $r = 3$, $s = 4$

Addition of Matrices : $\begin{bmatrix} a \\ b \end{bmatrix} + \begin{bmatrix} c \\ d \end{bmatrix} = \begin{bmatrix} a+c \\ b+d \end{bmatrix}$

Subtraction of Matrices : $\begin{bmatrix} a \\ b \end{bmatrix} - \begin{bmatrix} c \\ d \end{bmatrix} = \begin{bmatrix} a-c \\ b-d \end{bmatrix}$

Multiplication of Matrices : Rule \implies No. of columns in 1st matrix = No. of rows in 2nd matrix.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} p & q \\ r & s \end{bmatrix} = \begin{bmatrix} ap+br & aq+bs \\ cp+dr & cq+ds \end{bmatrix}$$

In Matrix algebra, If $(A + B)^2 = A^2 + 2AB + B^2$

$$\implies (A + B)(A + B) = A^2 + 2AB + B^2$$

$$\implies A^2 + BA + AB + B^2 = A^2 + 2AB + B^2$$

$$\implies BA = AB$$

Note : Matrix multiplication is non-commutative i. e. in general $AB \neq BA$

ARITHMETIC PROGRESSION

- $T_n = a + (n - 1) d$, $d = T_n - T_{n-1}$
Where, a = First term
 d = Common difference
 n = No. of terms
 T_n = Last term
 T_{n-1} = Second last term
- $S_n = \frac{n}{2} [2a + (n-1)d]$ Or $S_n = \frac{n}{2} (a + T_n) \dots [T_n = a + (n - 1)d]$
Where S_n = Sum of n terms
- $T_n = S_n - S_{n-1}$
where, S_n = Sum of n terms and S_{n-1} = Sum of $n - 1$ terms
- If a, b, c are in A.P. then $2b = a + c \Rightarrow b = \frac{a+c}{2}$.
- A.M. (A) between two numbers a and b is $\frac{a+b}{2}$.
- Three numbers in A.P. can be taken as $a - d, a, a + d$.
Four numbers in A.P. can be taken as $a - 3d, a - d, a + d, a + 3d$.
Five numbers in A.P. can be taken as $a - 2d, a - d, a, a + d, a + 2d$.

GEOMETRIC PROGRESSION

1. $T_n = ar^{n-1}$,
where, a = First term
 r = Common ratio
 n = No. of terms
 T_n = Last term
2. $S_n = \frac{a(1-r^n)}{1-r}$, if $r < 1$ and $S_n = \frac{a(r^n-1)}{r-1}$ if $r > 1$ where, S_n = Sum of n terms
3. $S_\infty = \frac{a}{1-r}$, $|r| < 1$ where, S_∞ = Sum of infinite terms
4. Geometric mean (G) between two positive numbers a and b is $G = \sqrt{ab}$.
5. i) Three numbers in G.P. are taken as $\frac{a}{r}, a, ar$.
ii) Four numbers in G.P. are taken as $\frac{a}{r^3}, \frac{a}{r}, ar, ar^3$.
iii) Five numbers in G.P. are taken as $\frac{a}{r^2}, \frac{a}{r}, a, ar, ar^2$.

REFLECTION

1. $P(x, y) \xrightarrow{R_x} P'(x, -y)$ $R_x = \text{Reflection in X-axis.}$

2. $P(x, y) \xrightarrow{R_y} P'(-x, y)$ $R_y = \text{Reflection in Y-axis.}$

3. $P(x, y) \xrightarrow{R_o} P'(-x, -y)$ $R_o = \text{Reflection in Origin.}$

4. $P(x, y) \xrightarrow{x=a} P'(x', y)$ where $\frac{x + x'}{2} = a$

5. $P(x, y) \xrightarrow{y=a} P'(x, y')$ where $\frac{y + y'}{2} = a$

6. An invariant point is a point which remains fixed when a figure is transformed (moved, rotated, reflected, etc.).

For example, when the point $P(7, 0)$ is reflected in the X-axis, the co-ordinates of its image is also $(7, 0)$ - so, the coordinates remain unchanged.

Point $P(7, 0)$ is said to be invariant under reflection in the X-axis.

MID-POINT AND SECTION FORMULA

1. The distance between two points A (x_1, y_1) and B (x_2, y_2) is given by

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

2. Section formula : If P(x, y) divides the join of A (x_1, y_1) and B (x_2, y_2) in the ratio $m : n$ then the co-ordinates of P are given by the formula.

$$x = \frac{mx_2 + nx_1}{m + n}, y = \frac{my_2 + ny_1}{m + n}$$

3. Mid-point Formula : The co-ordinates of the mid-point P (x, y) joining the points A (x_1, y_1) and B (x_2, y_2) is given by the formula : $x = \frac{x_2 + x_1}{2}, y = \frac{y_2 + y_1}{2}$

4. Centroid Formula : If A (x_1, y_1), B (x_2, y_2) and C (x_3, y_3) are the vertices of a triangle then the co-ordinates of the Centroid P (x, y) is given by

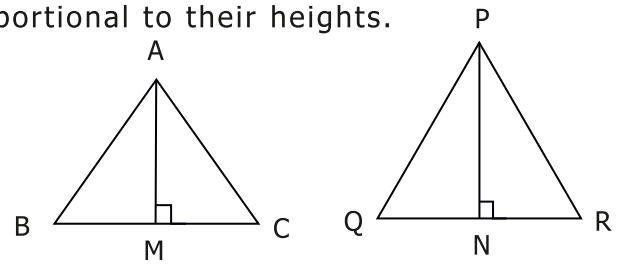
$$x = \frac{x_1 + x_2 + x_3}{3}, y = \frac{y_1 + y_2 + y_3}{3}$$

Centroid divides the median in the ratio 2 : 1.

GEOMETRY

SIMILARITY

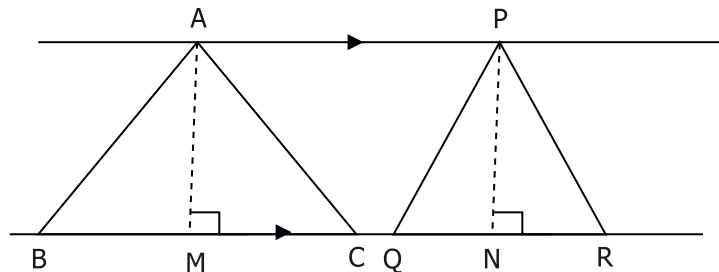
1. If $\angle A = \angle P$, $\angle B = \angle Q$ then $\Delta ABC \sim \Delta PQR$ by A. A test
2. If $\angle A = \angle P$, $\frac{AB}{PQ} = \frac{AC}{PR}$ then $\Delta ABC \sim \Delta PQR$ by S. A. S. test
3. If $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$ then $\Delta ABC \sim \Delta PQR$ by S. S. S. test
4. If $\Delta ABC \sim \Delta PQR$ then $\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{AB^2}{PQ^2} = \frac{AC^2}{PR^2} = \frac{BC^2}{QR^2}$ (Area theorem)
5. Triangles having equal bases have areas proportional to their heights.
If $BC = QR$ then $\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{AM}{PN}$



6. Triangles having equal heights have areas proportional to their bases.
If $AM = PN$ then $\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{BC}{QR}$
7. Triangles having equal bases and equal heights have equal areas.
If $AM = PN$ and $BC = QR$ then $A(\Delta ABC) = A(\Delta PQR)$

Case 1 : When heights are equal,

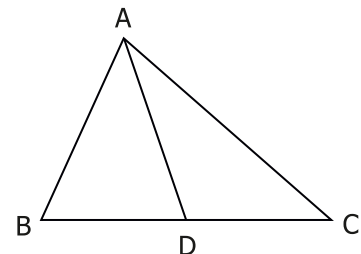
When two triangles lie between two parallel lines then heights are equal



ΔABC and ΔPQR lie between two parallel lines. \therefore Their heights are equal.
i.e. $AM = PN$.

Case 2 : When heights are equal,

When two triangles have a common vertex and their bases lie on the same line then their heights are equal. ΔABD and ΔADC have a common vertex A and their bases BD and CD lie on the same line. \therefore Their heights are equal.



8. Triangles having equal bases and equal heights have equal areas. If $AM = PN$ and $BC = QR$ then $A(\Delta ABC) = A(\Delta PQR)$

SIZE TRANSFORMATION

MAPS

The map of the plane figure and the actual figure are similar to one another.

1 : k = scale factor.

- (i) $\frac{\text{Map length}}{\text{Actual length}} = \frac{1}{k}$
- (ii) $\frac{\text{Map breadth}}{\text{Actual breadth}} = \frac{1}{k}$
- (iii) $\frac{\text{Map Area}}{\text{Actual Area}} = \left(\frac{1}{k}\right)^2$

MODELS

- (i) $\frac{\text{Model side}}{\text{Actual side}} = \frac{1}{k}$
- (ii) $\frac{\text{Model Area}}{\text{Actual Area}} = \left(\frac{1}{k}\right)^2$
- (iii) $\frac{\text{Model Volume}}{\text{Actual Volume}} = \left(\frac{1}{k}\right)^3$

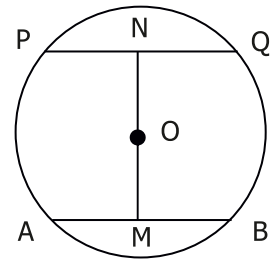
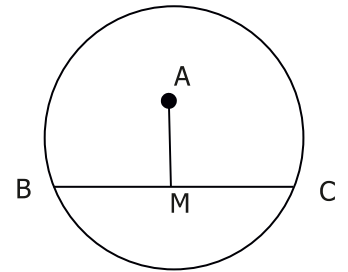
LOCUS

- (i) Locus of points equidistant from a point is circle.
- (ii) Locus of points equidistant from two points is the perpendicular bisector.
- (iii) Locus of points equidistant from two intersecting lines is the angle bisector.
- (iv) Locus of points equidistant from a given line is the line parallel to the given line.

CIRCLES

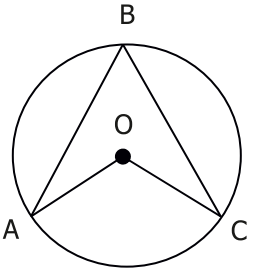
CHORD PROPERTIES

1. Perpendicular drawn from the centre bisects the chord
(Chord bisector theorem)
If $AM \perp BC$ then $BM = CM$
2. Line joining the centre and the mid-point of the chord is perpendicular. (Converse of chord bisector theorem)
If $BM = CM$ then $AM \perp BC$
3. Equal chords are equidistant from the centre.
If $AB = PQ$ then $ON = OM$.
4. Chords equidistant from the centre are equal.
If $ON = OM$ then $AB = PQ$.

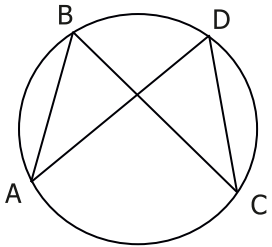


ANGLE PROPERTIES

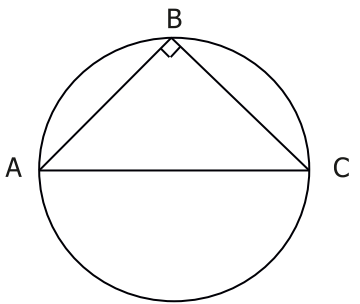
1. Angle at the centre is twice the angle at the circumference.
 $\angle AOC = 2 \angle ABC$



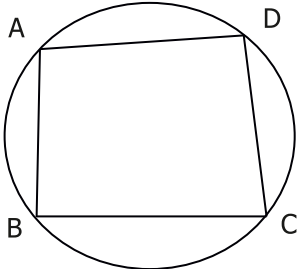
2. Angles inscribed in the same arc are equal.
 $\angle DAB = \angle DCB$
 $\angle ABC = \angle ADC$



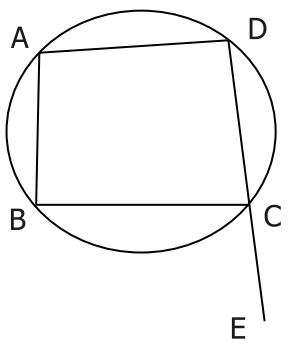
3. Angle inscribed in the semi-circle is a right angle. (Diameter property)
 If AC is the diameter, then $\angle ABC = 90^\circ$



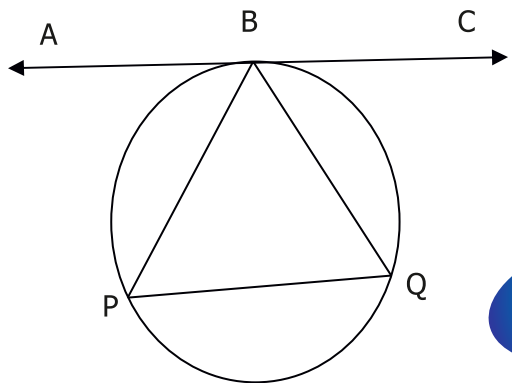
4. Opposite angles of a cyclic quadrilateral are supplementary.
 $m\angle A + m\angle C = 180^\circ$
 $m\angle B + m\angle D = 180^\circ$



5. Exterior angle of a cyclic quadrilateral is equal to the remote interior opposite angle.
 $m\angle BCE = m\angle BAD$

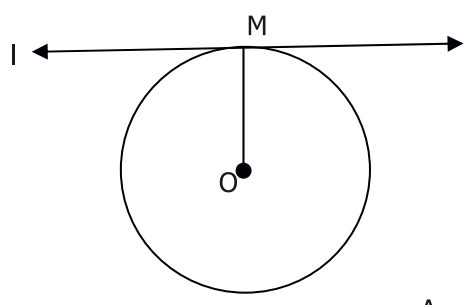


6. Alternate segment theorem.
 $m\angle ABP = m\angle BQP$
 $m\angle CBQ = m\angle BPQ$

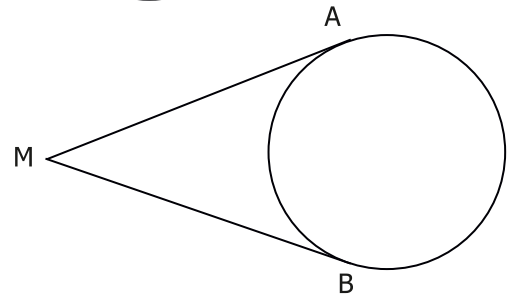


TANGENT PROPERTIES

1. Tangent perpendicularity theorem :
 $OM \perp \text{line } l$

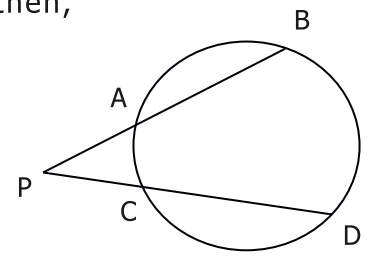
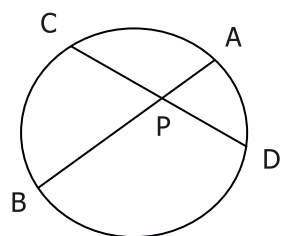


2. Tangents drawn from an external point to the circle are equal in length.
 $AM = BM$

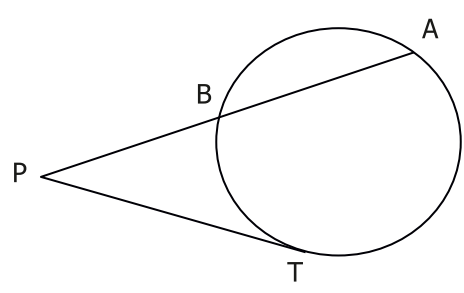


Rectangular property of a circle.

3. If two chords AB and CD intersect at point P then,
 $AP \times BP = DP \times CP$

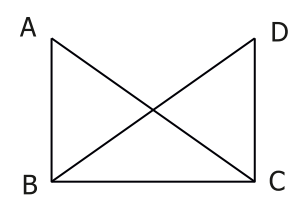


4. If tangent PT and secant ABP intersect each other then, $PA \times PB = PT^2$



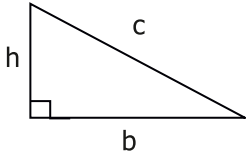
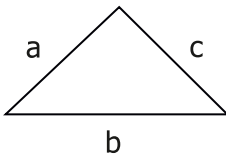
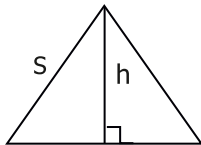
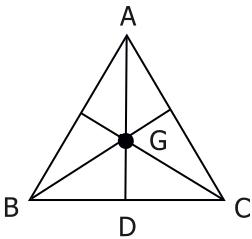
Concyclic Points

Vertices of cyclic Quadrilateral are called as concyclic points.
 If $\angle BAC = \angle BDC$ and have BC as their common interior segment then A, B, C and D are called as concyclic points.

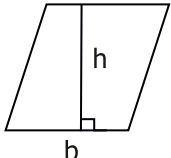
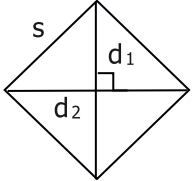
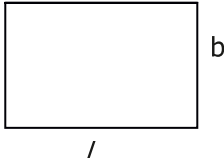

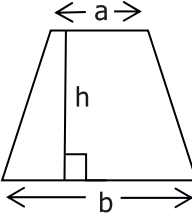
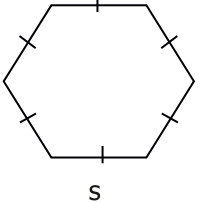


MENSURATION

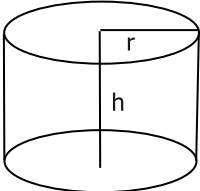
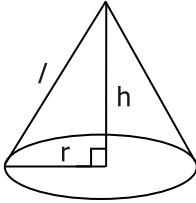
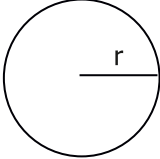
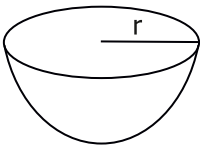
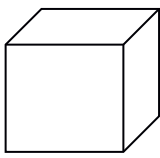
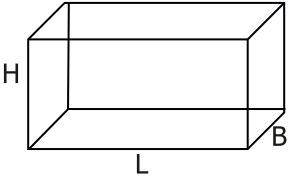
TRIANGLES

Sr. no.	Name of the figure	Diagram	
1.	Right angled triangle		Perimeter = $c + h + b$ Area = $\frac{1}{2} \times \text{base} \times \text{height}$ = $\frac{1}{2} \times b \times h$ $c^2 = h^2 + b^2$ by Pythagoras theorem
2.	Triangle when all three sides are given (a, b, and c)		Area = $\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$ Perimeter = $a + b + c$
3.	An Equilateral triangle		Area = $\frac{\sqrt{3}}{4} \times (\text{side})^2$ Perimeter = $3 \times \text{side} = 3s$ $h = \frac{\sqrt{3}}{2} \times \text{side} = \frac{\sqrt{3}}{2} \times s$
4.	Centroid property		If G is the Centroid of the ΔABC then, $GA = \frac{2}{3} \times AD$ $GD = \frac{1}{3} \times AD$

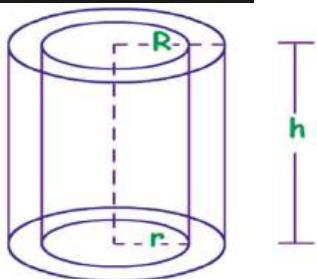
QUADRILATERALS

Sr. no.	Name of the figure	Diagram	Area	Perimeter
1.	Parallelogram		base \times height	Sum of all sides
2.	Rhombus		$\frac{1}{2} \times d_1 \times d_2$	4 s
3.	Rectangle		$l \times b$	$2 (l + b)$
4.	Square		(side) ²	4 s
5.	Trapezium		$\frac{1}{2} \times (a + b) \times h$	Sum of all sides
6.	Regular Hexagon		$\frac{3\sqrt{3}}{2} \times (\text{side})^2$	6 s

SOLIDS

Solids	Diagram	Volume	Curved surface Area	Total surface Area
Cylinder		$\pi r^2 h$	$2 \pi r h$	$2 \pi r (h + r)$
Cone	$l^2 = r^2 + h^2$ 	$\frac{1}{3} \pi r^2 h$	$\pi r l$	$\pi r (l + r)$
Sphere		$\frac{4}{3} \pi r^3$	--	$4 \pi r^2$
Hemisphere		$\frac{2}{3} \pi r^3$	$2 \pi r^2$	$3 \pi r^2$
Cube		(side) ³	$4 (\text{side})^2$	$6 (\text{side})^2$
Cuboid		$L \times B \times H$	$2 (L + B) \times H$	$2 (L \times B + B \times H + H \times L)$

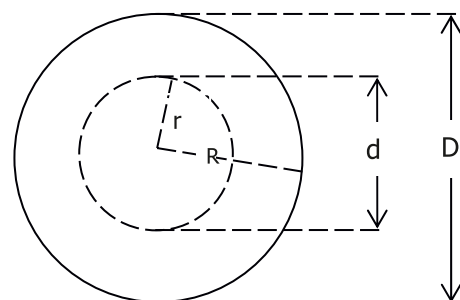
Hollow cylinder



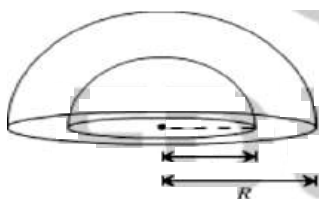
- (i) Thickness = $R - r$
- (ii) Area of cross-section = $\pi(R^2 - r^2)$
- (iii) External curved surface area = $2\pi Rh$
- (iv) Internal curved surface area = $2\pi rh$
- (v) Total surface area = external curved surface area + internal surface area + area of the two ends.
 $= 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2) = 2\pi(Rh + rh + R^2 - r^2)$
- (vi) Volume of material = $\pi R^2 h - \pi r^2 h = \pi h(R^2 - r^2)$

Spherical shell (Hollow sphere)

- (i) Thickness = $R - r$
- (ii) Volume of the material = $\frac{4}{3}\pi(R^3 - r^3)$



Hemispherical shell (Hollow hemisphere)



- (i) Thickness of shell = $R - r$
- (ii) Area of base = $\pi(R^2 - r^2)$
- (iii) External curved surface area = $2\pi R^2$
- (iv) Internal curved surface area = $2\pi r^2$
- (iii) Total surface area = $2\pi R^2 + 2\pi r^2 + \pi(R^2 - r^2) = \pi(3R^2 + r^2)$
- (vi) Volume of the material = $\frac{2}{3}\pi(R^3 - r^3)$

CIRCLES

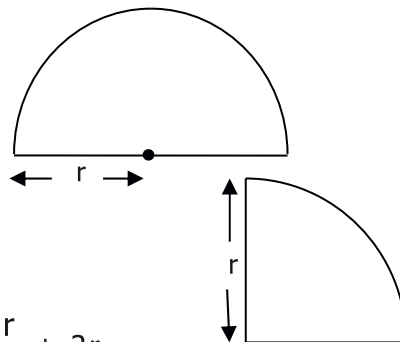
1. Diameter = $2 \times$ radius
2. $C = \pi d$ or $C = 2\pi r$ where C = circumference, d = diameter, r = radius.
3. Area of Circle = πr^2

4. Area of semi-circle = $\frac{1}{2} \pi r^2$

5. Perimeter of semi-circle = $\pi r + 2r$

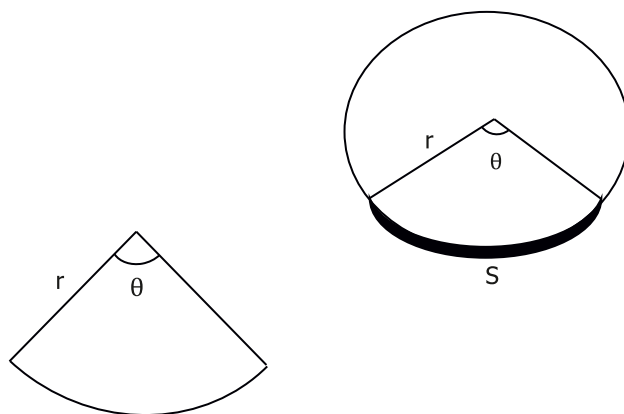
6. Area of quadrant (quarter circle) = $\frac{1}{4} \pi r^2$

7. Perimeter of a quadrant (quarter circle) = $\frac{\pi r}{2} + 2r$

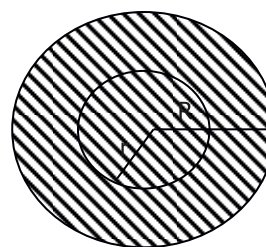


8. Length of the arc $S = \frac{\theta}{360} \times 2\pi r$

9. Area of the sector = $\frac{\theta}{360} \times \pi r^2$



10. Area of a circular ring = $\pi (R^2 - r^2)$



11. Distance covered by a wheel in one revolution = Circumference.

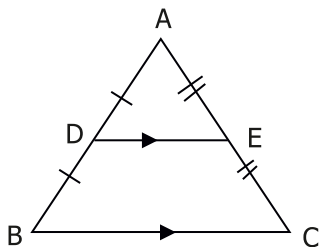
12. Distance = No. of rotations \times Circumference.

13. Each Interior angle of a regular polygon = $\frac{(n - 2) \times 180}{n}$

14. Central angle = $\frac{360}{n}$

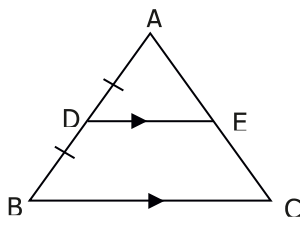
MID-POINT THEOREM

If in ΔABC , D and E are the midpoints of AB and AC respectively then
 $DE \parallel BC$ and $DE = \frac{1}{2} BC$



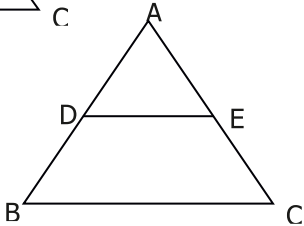
CONVERSE OF MID-POINT THEOREM

If in ΔABC , D is the midpoint of AB and E lies on AC such that $DE \parallel BC$ then
 E is the mid-point of AC and $DE = \frac{1}{2} BC$



BASIC PROPORTIONALITY THEOREM

If in ΔABC , D and E are the points on AB and AC respectively such that $DE \parallel BC$ then
 $\frac{AD}{DB} = \frac{AE}{EC}$



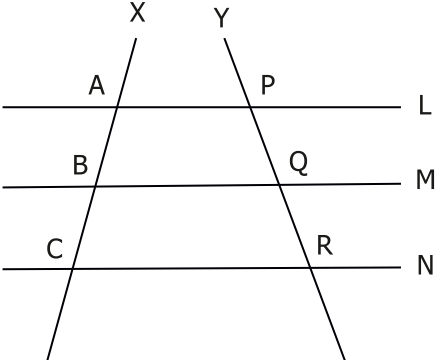
CONVERSE OF BASIC PROPORTIONALITY THEOREM

If in ΔABC , D and E are the points on AB and AC respectively such that $\frac{AD}{DB} = \frac{AE}{EC}$

then $DE \parallel BC$

INTERCEPT THEOREM :

If line L \parallel line M \parallel line N and line X and line Y are the two transversals making equal intercepts $AB = BC$ then $PQ = QR$



TRIGONOMETRY

$$\sin \theta = \frac{\text{Opp. side}}{\text{Hypotenuse}}$$

$$\cos \theta = \frac{\text{Adj. side}}{\text{Hypotenuse}}$$

$$\tan \theta = \frac{\text{Opp. side}}{\text{Adj. side}}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\sin \theta \times \operatorname{cosec} \theta = 1$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sin^2 \theta = 1 - \cos^2 \theta$$

$$\cos^2 \theta = 1 - \sin^2 \theta$$

$$\operatorname{Cosec} \theta = \frac{\text{Hypotenuse}}{\text{Opp. side}}$$

$$\operatorname{Sec} \theta = \frac{\text{Hypotenuse}}{\text{Adj. side}}$$

$$\operatorname{Cot} \theta = \frac{\text{Adj. side}}{\text{Opp. side}}$$

$$\operatorname{Cot} \theta = \frac{\cos \theta}{\sin \theta}$$

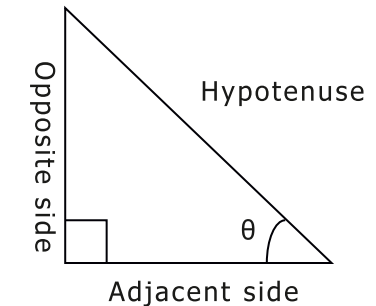
$$\cos \theta \times \sec \theta = 1$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\sec^2 \theta = 1 + \tan^2 \theta$$

$$\tan^2 \theta = \sec^2 \theta - 1$$



$$\tan \theta \times \cot \theta = 1$$

$$\cot \theta = \frac{1}{\tan \theta}$$

$$\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$$

$$\operatorname{cosec}^2 \theta = 1 + \cot^2 \theta$$

$$\cot^2 \theta = \operatorname{cosec}^2 \theta - 1$$

Complementary angles:

$$\sin (90 - \theta) = \cos \theta$$

$$\operatorname{Cosec} (90 - \theta) = \sec \theta$$

$$\tan (90 - \theta) = \cot \theta$$

$$\cos (90 - \theta) = \sin \theta$$

$$\sec (90 - \theta) = \operatorname{cosec} \theta$$

$$\cot (90 - \theta) = \tan \theta$$

Trigonometric Values :

	0°	30°	45°	60°	90°
Sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
Cosec θ	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
Sec θ	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
Cot θ	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

STATISTICS

MEAN

1. Mean by Direct method: $\frac{\sum fx}{\sum f}$ where f = frequency, x = class mark.
2. Mean by Short – cut method or deviation method or Assumed mean method:
 $A + \frac{\sum fd}{\sum f}$ where A = Assumed mean, f = frequency, $d = x - A$.
3. Mean by Step deviation method : $A + \frac{\sum fu}{\sum f} \times c$

where A = Assumed mean, f = frequency, $u = \frac{x - A}{c}$,
 c = class interval (True upper limit – True lower limit).

Quartiles

Quartiles	N is odd	N is even
Median	$\left(\frac{N+1}{2}\right)^{\text{th}}$ observation	$\frac{1}{2} \left[\left(\frac{N}{2}\right)^{\text{th}} \text{ observation} + \left(\frac{N}{2} + 1\right)^{\text{th}} \text{ observation} \right]$
Lower Quartile	$\left(\frac{N+1}{4}\right)^{\text{th}}$ observation	$\left(\frac{N}{4}\right)^{\text{th}}$ observation
Upper Quartile	$\left(\frac{3(N+1)}{4}\right)^{\text{th}}$ observation	$\left(\frac{3N}{4}\right)^{\text{th}}$ observation

Cumulative Frequency curve or an Ogive:

Steps:

1. Construct a cumulative frequency table.
2. Mark the actual class limits along x-axis.
3. Mark the cumulative frequencies of respective classes along y-axis.
4. Plot the points corresponding to cumulative frequency at each upper limit point.
5. Join the points plotted by a free hand curve.

Estimation of Median from ogive:

If there be n terms in the given distribution; then use the ogive to find the value of $\left(\frac{n}{2}\right)^{\text{th}}$ or $\left(\frac{n+1}{2}\right)^{\text{th}}$ term which is the median of given distribution.

Let, $\left(\frac{n}{2}\right)^{\text{th}} = A^{\text{th}}$ term

Through mark A on y-axis, draw a horizontal line which meets the curve at point B. Through point B, on the curve, draw a vertical line which meets x-axis at point C. The value of point C on x-axis is median.

Class Mark = (upper limit + lower limit) \div 2

Range = Highest observation – Lowest Observation.

Interquartile range = Upper quartile – Lower quartile

Semi-Interquartile range = Interquartile range \div 2

Ogive

Quartiles	N is odd	N is even
Median	$\left(\frac{N+1}{2}\right)^{\text{th}}$ observation	$\left(\frac{N}{2}\right)^{\text{th}}$ observation
Lower Quartile	$\left(\frac{N+1}{4}\right)^{\text{th}}$ observation	$\left(\frac{N}{4}\right)^{\text{th}}$ observation
Upper Quartile	$\left(\frac{3(N+1)}{4}\right)^{\text{th}}$ observation	$\left(\frac{3N}{4}\right)^{\text{th}}$ observation

MODE

Class mark of the highest occurring frequency.

The class with the maximum frequency is called the modal class.

Estimation of mode from Histogram

Inside the highest rectangle, draw two straight lines from the corners of the rectangles on either side of the highest rectangle to the opposite corners of the highest rectangle. Through the point of intersection of the two straight lines, a vertical line which meets the x-axis variate is the required mode.

Empirical relation between mean, median and mode.

Mode = 3 Median – 2 Mean.

Probability

If E is an event, then the empirical probability, written as P (E), is defined as

$$P (E) = \frac{\text{Number of outcomes in which E has occurred}}{\text{Total number of outcomes}}.$$

No. of Cards 52	26 Black Cards	13 Clubs
		13 Spades
	26 Red Cards	13 Hearts
		13 Diamonds

No. of Court Cards / Face Cards / Picture Cards = 12

- **Sample space of coins:**

1. When one coin is tossed,
Sample space = {H, T}
Total outcomes = 2

2. When two coins are tossed simultaneously or one coin is tossed two times,
Sample space = {HH, HT, TH, TT}
Total outcomes = 4

3. When three coins are tossed simultaneously or one coin is tossed three times,
Sample space = {HHH, HHT, HTH, HTT, THH, THT, TTH, TTT}
Total outcomes = 8

- **Sample space of dice:**

1. When one die is thrown,
Sample space = {1, 2, 3, 4, 5, 6}
Total outcomes = 6

2. When two dice are thrown simultaneously or one die is thrown twice,
Sample space = $\left\{ \begin{array}{l} (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), \\ (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), \\ (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), \\ (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), \\ (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), \\ (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6) \end{array} \right\}$

Total outcomes = 36

Important Formulas

Identities Formula:

$$(a + b)^2 = a^2 + b^2 + 2ab$$

$$(a - b)^2 = a^2 + b^2 - 2ab$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$(a + b)^3 = a^3 + b^3 + 3ab(a + b)$$

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

Key Formula :

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\text{Profit \%} = \frac{\text{P}}{\text{CP}} \times 100$$

$$\text{Loss \%} = \frac{\text{L}}{\text{CP}} \times 100$$

Conversions

$$1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ m} = 100 \text{ cm}$$

$$1 \text{ km} = 100000 \text{ cm}$$

$$1 \text{ cm} = 10 \text{ mm}$$

$$1 \text{ km} = 1000000 \text{ mm}$$

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$1 \text{ m}^3 = 1000 \text{ litre}$$

Law of logarithms :

$$\log a^m = m \log a$$

$$\log (a \times b) = \log a + \log b$$

$$\log (a \div b) = \log a - \log b$$

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

Formulas of Polygons :

$$\text{Sum of interior angles} = (n - 2) \times 180$$

$$\text{Each interior angle} = \frac{(n - 2) \times 180}{n}$$

$$\text{Sum of exterior angles} = 360$$

$$\text{Each exterior angle} = \frac{360}{n}$$

$$\text{Interior angle} + \text{Exterior angle} = 180$$

$$1 \text{ km}^2 = 1000 \times 1000 \text{ m}^2$$

$$1 \text{ m}^2 = 100 \times 100 \text{ cm}^2$$

$$1 \text{ km}^2 = 100000 \times 100000 \text{ cm}^2$$

$$1 \text{ cm}^2 = 10 \times 10 \text{ mm}^2$$

$$1 \text{ km}^2 = 1000000 \times 1000000 \text{ mm}^2$$

Law of Exponents :

$$a^m \times a^n = a^{m + n}$$

$$a^m \div a^n = a^{m - n}$$

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

$$(a \times b)^m = a^m \times b^m$$

$$a^0 = 1$$

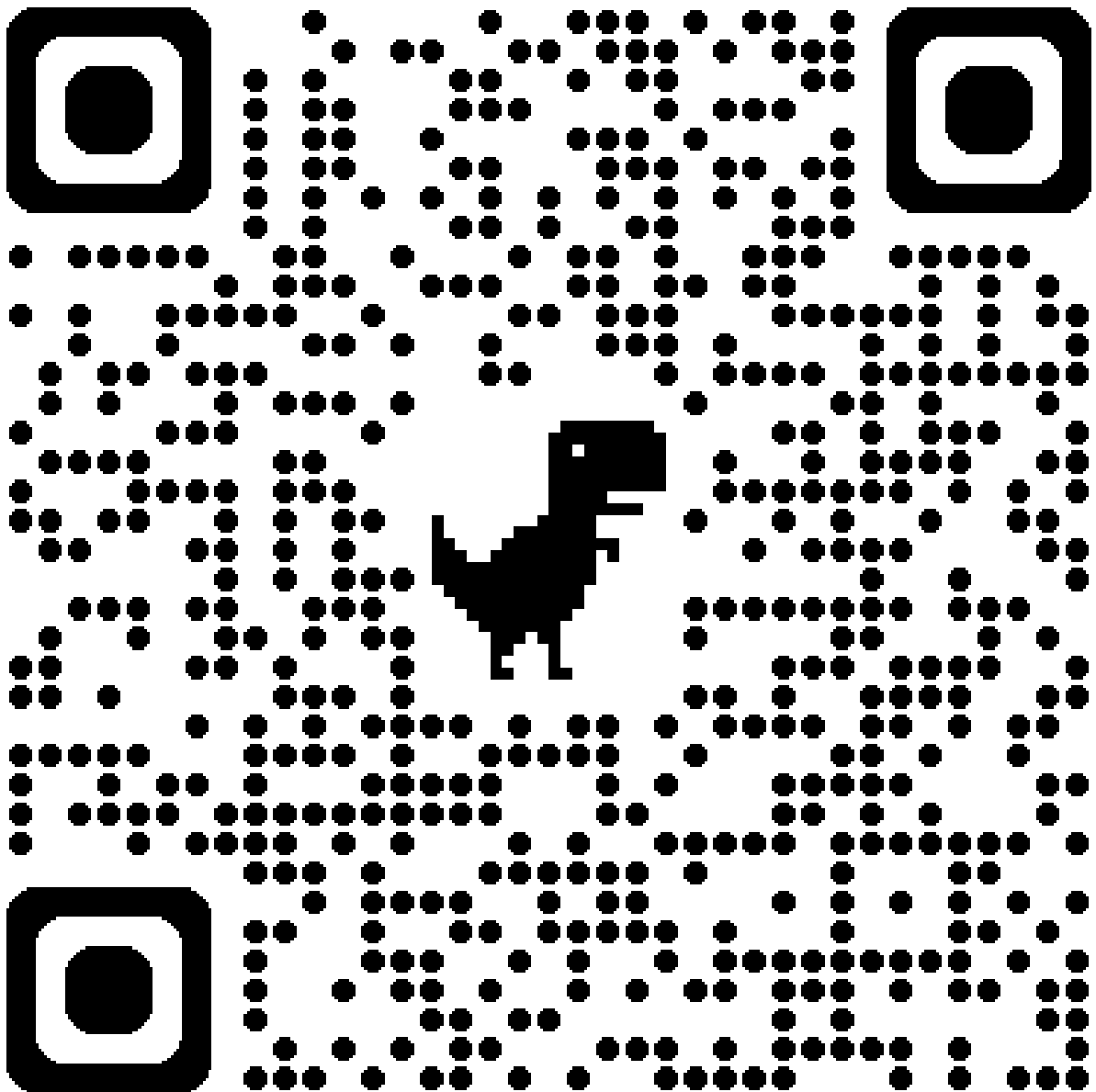
$$a^{-m} = \frac{1}{a^m}$$

$$(a^m)^n = a^{m \times n}$$

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