B - Bracket [{ ( ) }]
O - Of
D - Division ÷
M - Multiplication ×
A - Addition +
S - Subtraction –

- $(a+b)^2 = a^2 + b^2 + 2ab$
- $(a-b)^2 = a^2 + b^2 - 2ab$
- $(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$
- $(a+b)^2 - (a-b)^2 = 4ab$
- $a^2 - b^2 = (a+b)(a-b)$

- $a^3 + b^3 = (a^2 - ab + b^2)(a+b)$
- $a^3 - b^3 = (a^2 + ab + b^2)(a-b)$
- $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
- $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$
- $ax + ay = a(x+y)$

Product of Two numbers = L.C.M × H.C.F

L.C.M of Fractions = $\frac{\text{LCM of Numerator}}{\text{HCF of Denominator}}$

H.C.F of Fractions = $\frac{\text{HCF of Numerator}}{\text{LCM of Denominator}}$

Sum of the Natural Numbers = $\frac{n(n+1)}{2}$

Sum of Squares of Natural No. = $\frac{n(n+1)(2n+1)}{6}$

Sum of Cubes of Natural No. = $\frac{n^2(n+1)^2}{4}$ or $\left(\frac{n(n+1)}{2}\right)^2$

Sum of the Even Numbers = $n(n+1)$

Sum of the Odd Numbers = n^2

Average of the Natural Numbers = $\frac{n+1}{2}$

Average of the Even Numbers = $n+1$

Average of the Odd Numbers = n

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $(a/b)^m = a^m/b^m$
- $a^{-m} = 1/a^m$
- $a^0 = 1$
- $a^1 = a$
- $\sqrt[m]{a} = a^{1/m}$
- $\sqrt[m]{a^n} = a^{n/m}$

$x + 1/x = a$, then
$x^2 + 1/x^2 = a^2 - 2$
$x^3 + 1/x^3 = a^3 - 3a$
$x^4 + 1/x^4 = (a^2-2)^2 - 2$

$x - 1/x = a$, then
$x^2 + 1/x^2 = a^2 + 2$
$x^3 - 1/x^3 = a^3 + 3a$
$x^4 + 1/x^4 = (a^2+2)^2 - 2$

Dividend = Divisor x Quotient + Remainder

- $(I+I) + \frac{(I \times I)}{100}$
- $(D+D) - \frac{(D \times D)}{100}$
- $(I-D) - \frac{(I \times D)}{100}$

Average = $\frac{\text{Sum of the Observations}}{\text{Number of Observations}}$

100% = 1	50% = ½	$33\frac{1}{3}\% = \frac{1}{3}$	25% = ¼	20% = $\frac{1}{5}$	$16\frac{2}{3}\% = \frac{1}{6}$	$14\frac{2}{7}\% = \frac{1}{7}$	$12\frac{1}{2}\% = \frac{1}{8}$
$11\frac{1}{9}\% = \frac{1}{9}$	10% = $\frac{1}{10}$	$9\frac{1}{11}\% = \frac{1}{11}$	$8\frac{1}{3}\% = \frac{1}{12}$	$7\frac{9}{13}\% = \frac{1}{13}$	$7\frac{1}{7}\% = \frac{1}{14}$	$6\frac{2}{3}\% = \frac{1}{15}$	$6\frac{1}{4}\% = \frac{1}{16}$

Profit & Loss

Price

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

$L\% = \frac{\text{Loss} \times 100}{\text{C.P}}$

$\text{C.P} = \text{S.P} \times \frac{100}{100 + P\% \text{ or}) - L\%}$

$\text{S.P} = \text{C.P} \times \frac{100 + P\%(\text{or}) - L\%}{100}$

Quantity

$P\% = \frac{\text{Profit} \times 100}{\text{S.Q}}$

$L\% = \frac{\text{Loss} \times 100}{\text{S.Q}}$

$\text{S.Q} = \text{C.Q} \times \frac{100}{100 + P\%(\text{or}) - L\%}$

$\text{C.Q} = \text{S.Q} \times \frac{100 + P\%(\text{or}) - L\%}{100}$

M.P – Discount = S.P

$D\% = \frac{\text{Discount}}{\text{M.P}} \times 100$

Ratio & Proportion

- Product of Extremes = Product of Means
- III Proportion = b^2/a
- Mean Proportion = $\sqrt{ab}$

Time & Distance

- m/sec to km/h = to multiply $\frac{18}{5}$
- km/h to m/sec = to multiply $\frac{5}{18}$
- Distance = Speed × Time
- Average Speed = $\frac{2xy}{x+y}$

$P = \frac{100}{I} = \frac{TR}{}$

Simple Interest

$S.I = \frac{PTR}{100}$

Amount = P + I

Compound Interest

$C.I = P\left[1 + \frac{R}{100}\right]^T - P$

$\text{Amount} = P\left[1 + \frac{R}{100}\right]^T$

Difference between C.I & S.I

2 yrs $D = \frac{P \times R^2}{100^2}$

3 yrs $D = \frac{P \times R^2(300+R)}{100^3}$

Boats & Streams

Boat speed in

Still Water = $\frac{D+U}{2}$

Stream = $\frac{D-U}{2}$

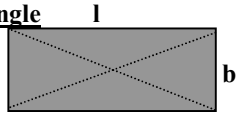
Down Stream = Still + Stream

Up Stream = Still - Stream

$1^2 = 1$	$11^2 = 121$	$21^2 = 441$
$2^2 = 4$	$12^2 = 144$	$22^2 = 484$
$3^2 = 9$	$13^2 = 169$	$23^2 = 529$
$4^2 = 16$	$14^2 = 196$	$24^2 = 576$
$5^2 = 25$	$15^2 = 225$	$25^2 = 625$
$6^2 = 36$	$16^2 = 256$	$26^2 = 676$
$7^2 = 49$	$17^2 = 289$	$27^2 = 729$
$8^2 = 64$	$18^2 = 324$	$28^2 = 784$
$9^2 = 81$	$19^2 = 361$	$29^2 = 841$
$10^2 = 100$	$20^2 = 400$	$30^2 = 900$

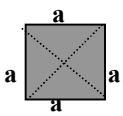
$1^3 = 1$
$2^3 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$
$6^3 = 216$
$7^3 = 343$
$8^3 = 512$
$9^3 = 729$
$10^3 = 1000$

Rectangle



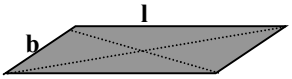
- Perimeter = $2(l + b)$
- Area = $l \times b$
- Diagonal = $\sqrt{l^2 + b^2}$
- Area of 4 walls = $2(l + b)\,h$

Square



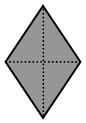
- Perimeter = $4a$
- Area = a^2 (or) $\frac{1}{2} d^2$ (or) $p^2/16$
- Diagonal = $a\sqrt{2}$

Parallelogram



- Perimeter = $2(l + b)$
- Area = $b \times h$
- Diagonal = $\sqrt{l^2 + b^2}$

Rhombus

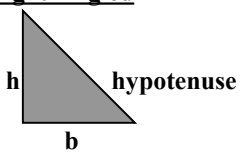


Perimeter = $4a$

Area = $\frac{1}{2} d_1 \times d_2$

Triangle

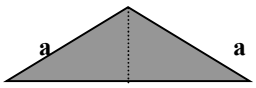
Right Angled



- Perimeter = $h + b +$ hypo
- Area = $\frac{1}{2} \times b \times h$

$S = (a + b + c) / 2$

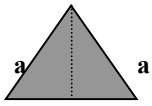
Isosceles



Perimeter = $2a + b$

Area = $\frac{1}{2} \times b \times h$ (or) $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

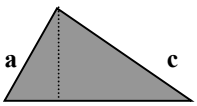
Equilateral



Perimeter = $3a$

Area = $\sqrt{3}/4\, a^2$

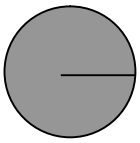
Scalene



Perimeter = $a + b + c$

Area = $\frac{1}{2} \times b \times h$ (or) $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

Circle

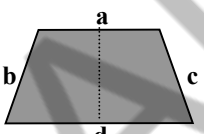


Semi Circle

- Circumference = $2\pi r$ (or) πd = $\pi r + 2r$
- Area = πr^2 (or) $\frac{1}{4}\pi d^2$ = $\frac{\pi r^2}{2}$

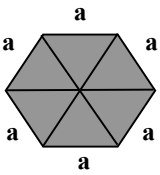
- Arc length = $\frac{2\pi r \times \theta}{360}$
- Area of Sector = $\frac{\pi r^2 \times \theta}{360}$

Trapezium



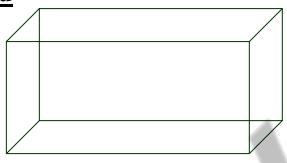
- Perimeter = $a + b + c + d$
- Area = $\frac{1}{2}(a+d)\,h$

Hexagon



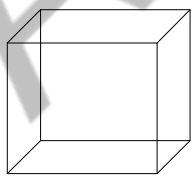
- Perimeter = $6a$
- Area = $6\sqrt{3}/4\, a^2$

Cuboid



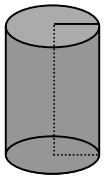
- Curved Surface Area = $2(l+b)\,h$
- Total Surface Area = $2(lb + lh + bh)$
- Volume = $l\,b\,h$
- Diagonal = $\sqrt{l^2 + b^2 + h^2}$

Cube



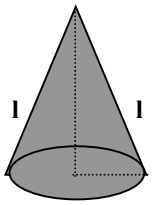
- Curved Surface Area = $4\,a^2$
- Total Surface Area = $6\,a^2$
- Volume = a^3
- Diagonal = $a\sqrt{3}$

Cylender



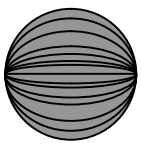
- Curved Surface Area = $2\pi r\,h$
- Total Surface Area = $2\pi rh + 2\pi r^2$ (or) $2\pi(rh + r^2)$
- Volume = $\pi r^2 h$

Cone



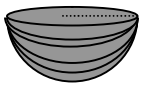
- Curved Surface Area = $\pi r l$
- Total Surface Area = $\pi r l + \pi r^2$
- Volume = $\frac{\pi r^2 h}{3}$
- Slant Hieght l = $\sqrt{h^2 + r^2}$

Sphere



- Total Surface Area = $4\pi r^2$
- Volume = $4/3\,\pi r^3$

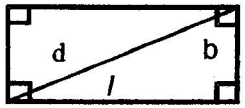
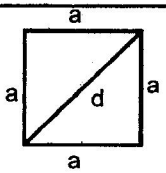
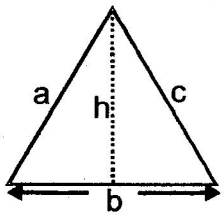
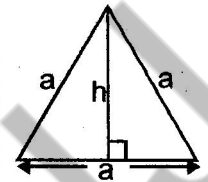
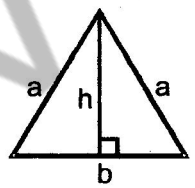
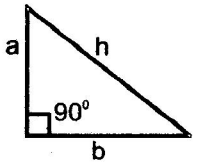
Heme Sphere

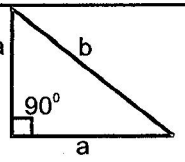
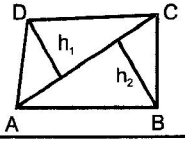
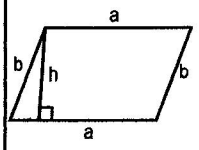
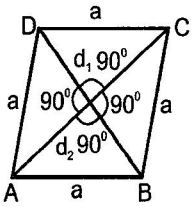
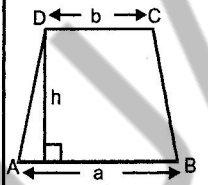
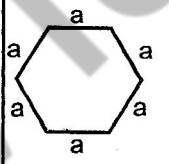
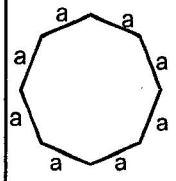
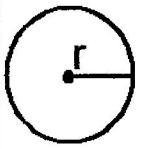


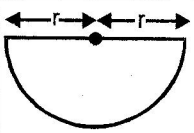
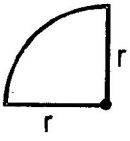
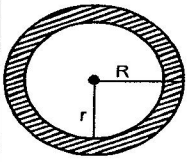
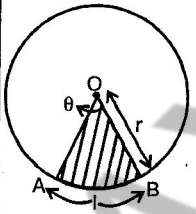
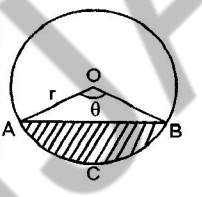
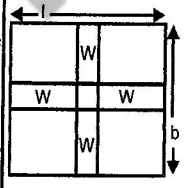
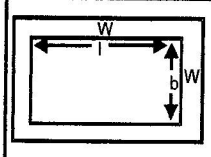
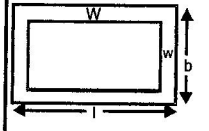
Curved Surface Area = $2\pi r^2$

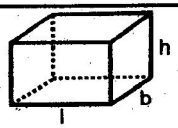
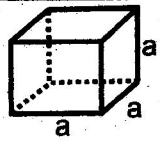
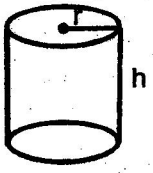
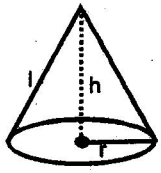
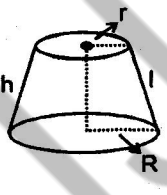
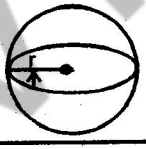
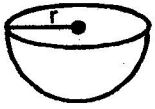
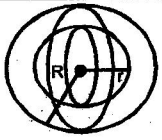
Total Surface Area = $3\pi r^2$

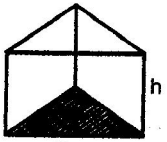
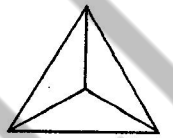
Volume = $2/3\,\pi r^3$

S. NO.	Name	Figure	Nomenclature	Area	Perimeter
1.	Rectangle		$l \rightarrow$ length $b \rightarrow$ breadth $d \rightarrow$ diagonal $d = \sqrt{l^2 + b^2}$	$l \times b = lb$	$2l+2b = 2(l+b)$
2.	Square		$a \rightarrow$ side $d \rightarrow$ diagonal $d = a\sqrt{2}$	(i) $a \times a = a^2$ (ii) $\frac{d^2}{2}$	$a+a+a+a = 4a$
3.	Triangle (Scalene)		a, b and c are three sides of triangle and s is semiperimeter, where $s = \left(\frac{a+b+c}{2}\right)$ b is the base and h is the altitutde of triangle h = height or altitude	(i) $\frac{1}{2} \times b \times h$ (ii) $\sqrt{s(s-a)(s-b)(s-c)}$ (Heron's formula)	$a+b+c = 2s$
4.	Equilateral triangle		$a \rightarrow$ equal sides $h \rightarrow$ height or altitude $h = \frac{\sqrt{3}}{2}a$	(i) $\frac{1}{2} \times a \times h$ (ii) $\frac{\sqrt{3}}{4}a^2$	3a
5.	Isosceles triangle		$a \rightarrow$ equal sides $b \rightarrow$ base $h \rightarrow$ height or altitude $h = \frac{\sqrt{4a^2 - b^2}}{2}$	(i) $\frac{1}{2} \times b \times h$ (ii) $\frac{1}{4} \times b \times \sqrt{4a^2 - b^2}$	$2a+b$
6.	Right angled triangle		$b \rightarrow$ base $a \rightarrow$ altitude/height $h =$ hypotenuse $h = \sqrt{a^2 + b^2}$	$\frac{1}{2} \times b \times a$	$b+h+a$

S. NO.	Name	Figure	Nomenclature	Area	Perimeter
7.	Isosceles right angled triangle		a → equal sides b → other side $b = a\sqrt{2}$	$\frac{1}{2}a^2 = \frac{b^2}{4}$	2a + b
8.	Quadrilateral		AC is the diagonal and h_1, h_2 are the altitudes on AC from the vertices D and B respectively.	$\frac{1}{2} \times AC \times (h_1 + h_2)$	AB+BC+CD+AD
9.	Parallelogram		a and b are side adjacent to each other. h→ distance between the parallel sides.	a×h	2(a+b)
10.	Rhombus		a- length of each side of rhombus d_1 and d_2 are the diagonals $d_1 \rightarrow BD$ $d_2 \rightarrow AC$ $a = \frac{1}{2}\sqrt{{d_1}^2 + {d_2}^2}$	$\frac{1}{2} \times d_1 \times d_2$	4a or $2\sqrt{d_1^2 + d_2^2}$
11.	Trapezium		a and b are parallel sides to each other and h is the perpendicular distance between parallel sides.	$\left(\frac{a+b}{2}\right) \times h$	AB+BC+CD+AD
12.	Regular hexagon		a → length of each side	$\frac{3\sqrt{3}}{2}a^2$	6a
13.	Regular octagon		a → length of each side	$2a^2(1+\sqrt{2})$	8a
14.	Circle		r → radius of the circle	πr^2	$2\pi r$ (called as circumference)

S. NO.	Name	Figure	Nomenclature	Area	Perimeter
15.	Semicircle		r → radius of the circle	$\frac{1}{2}\pi r^2$	$r(\pi+2)=\frac{36}{7}r$
16.	Quadrant		r → radius	$1/4\ \pi r^2$	$\frac{1}{2}\pi r+2r=\frac{25}{7}r$
17.	Ring or circlular path (shaded region)		R→ outer radius r →inner radius	$\pi(R^2-r^2)$	(outer) →$2\pi R$ (inner) →$2\pi r$
18.	Sector of a circle		O→ centre of the circle r → radius l→ length of the arc θ→ angle of the sector $l \rightarrow 2\pi r\left(\frac{\theta}{360^\circ}\right)$	$\pi r^2\left(\frac{\theta}{360^\circ}\right)$	l+2r
19.	Segment of a circle		θ → angle of the sector r → radius AB → chord ACB → arc of the circle	Area of segment ACB (minor segment) $=r^2\left(\frac{\pi\theta}{360^\circ}-\frac{\sin\theta}{2}\right)$	$2r\left[\frac{\pi\theta}{360^\circ}+\sin\left(\frac{\theta}{2}\right)\right]$
20.	Pathways running parallel inside to sides of a rectanlge		l → length b → breadth w → width of the path (road)	(l+b – w)w	2(l+b) - 4w
21.	Outer path		l → length b → breadth w → width of the path	(l+b+2w) 2w	(inner) →2 (l+b) (outer)→2 (l+b+4w)
22.	Inner path		l → length b → breadth w → width of the path	(l+b–2w) 2w	(Other)→2(l+b) (inner)→2(l+b-4w)

S. NO.	Name	Figure	Nomenclature	Volume	Curved/ Lateral surface area	Total surface area
1.	Cuboid		l → length b → breadth h → height	lbh	2(l+b)h	2(lb+bh+hl)
2.	Cube		a→ edge/side	a^3	$4a^2$	$6a^2$
3.	Right circular cylinder		r→ radius of base h→ height of the cylinder	πr^2h	$2\pi rh$	$2\pi r(h+r)$
4.	Right circular cone		r→ radius h→ height l→slant height $l=\sqrt{r^2+h^2}$	$\frac{1}{3}\pi r^2h$	πrl	$\pi r(l+r)$
5.	Frustum of a cone		r → smaller radius R→ layer radius l→ slant height h→height $l=\sqrt{(R-r)^2+h^2}$	$\frac{\pi}{3}(r^2+Rr+R^2)$	$\pi(r+R)l$	lateral surface area + $\pi[R^2+r^2]$
6.	Sphere		r→ radius	$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
7.	Hemisphere		r→ radius	$\frac{2}{3}\pi r^3$	$2\pi r^2$	$3\pi r^2$
8.	Spherical shell		r→inner radius R→outer radius	$\frac{4}{3}\pi[R^3-r^3]$	inner = $4\pi r^2$ outer= $4\pi R^2$	$4\pi[R^2+r^2]$

9.	Right triangular prism		h—height	area of base × height	perimeter of base × height	lateral surface area + 2(area of base)
10.	Right pyramid			$\frac{1}{3}$ ×area of base × height	$\frac{1}{2}$ ×perimeter of base × slant height	lateral surface area + area of base
11.	Tetrahedron		$(h)=\frac{1}{3}\times\sqrt{6}\times side$ $r=\frac{1}{12}\times\sqrt{6}\times side$ $R=\frac{1}{4}\times\sqrt{6}\times side$ (Where h height, r inradius R circum-radius)	$\frac{1}{12}\times\sqrt{2}\times(side)^3$	$\frac{3\sqrt{3}}{4}(side)^2$	$\sqrt{3}(side)^2$