Real Numbers Important Formulas

S No.	Type of Numbers	Description
1	Natural Numbers	N = {1,2,3,4,5 …….} It is the counting numbers
2	Whole Numbers	W= {0,1,2,3,4,5…….} It is the counting numbers + zero
3	Integers	All whole numbers, including negative numbers + Positive numbers like -4,-3,-2,-1,0,1,2,3,4,5… so on. Like whole numbers, integers don't include fractions or decimals.
4	Positive Integers	Z+ = 1,2,3,4,5, ……
5	Negative Integers	Z– = -1,-2,-3,-4,-5, ……

6	Rational Numbers	A number is called rational if it can be expressed in the form of p/q where p and q are integers (q> 0). For example, P/q, ⅘.
7	Irrational Number	A number is called irrational if it cannot be expressed in the form of p/q where p and q are integers (q> 0). For example, √3.
8	Real Numbers	A real number is a number that can be found on the number line. Real Numbers are the numbers that we normally use and apply in real-world applications. Real numbers include Natural Numbers, Integers, Whole Numbers, Rational Numbers, Fractions, and Irrational Numbers.

ALGEBRAIC FORMULAS

- $(a+b)^2 = a^2 + b^2 + 2ab$
- $(a-b)^2 = a^2 + b^2 - 2ab$
- $(a+b)\,(a-b) = a^2 - b^2$
- $(x + a)(x + b) = x^2 + (a + b)x + ab$
- $(x + a)(x - b) = x^2 + (a - b)x - ab$
- $(x - a)(x + b) = x^2 + (b - a)x - ab$
- $(x - a)(x - b) = x^2 - (a + b)x + ab$
- $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$
- $(a - b)^3 = a^3 - b^3 - 3ab(a - b)$
- $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$
- $(x + y - z)^2 = x^2 + y^2 + z^2 + 2xy - 2yz - 2xz$
- $(x - y + z)^2 = x^2 + y^2 + z^2 - 2xy - 2yz + 2xz$
- $(x - y - z)^2 = x^2 + y^2 + z^2 - 2xy + 2yz - 2xz$
- $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - xz)$
- $x^2 + y^2 = ½\,[(x + y)^2 + (x - y)^2]$
- $(x + a)\,(x + b)\,(x + c) = x^3 + (a + b + c)x^2 + (ab + bc + ca)x + abc$
- $x^3 + y^3 = (x + y)\,(x^2 - xy + y^2)$
- $x^3 - y^3 = (x - y)\,(x^2 + xy + y^2)$
- $x^2 + y^2 + z^2 - xy - yz - zx = ½\,[(x-y)^2 + (y-z)^2 + (z-x)^2]$

OTHER TRIGONOMETRIC FORMULAS

- $\sin(90° - \theta) = \cos\theta$
- $\cos(90° - \theta) = \sin\theta$
- $\tan(90° - \theta) = \cot\theta$
- $\cot(90° - \theta) = \tan\theta$
- $\sec(90° - \theta) = \operatorname{cosec}\theta$
- $\operatorname{cosec}(90° - \theta) = \sec\theta$
- $\sin^2\theta + \cos^2\theta = 1$
- $\sec^2\theta = 1 + \tan^2\theta$ for $0° \le \theta < 90°$
- $\operatorname{Cosec}^2\theta = 1 + \cot^2\theta$ for $0° \le \theta \le 90°$

$$sin\,\theta = \frac{Side\ opposite\ to\ angle\ \theta}{Hypotenuse} = \frac{Perpendicular}{Hypotenuse} = \frac{P}{H}$$
$$Cos\,\theta = \frac{Adjacent\ side\ to\ angle\ \theta}{Hypotenuse} = \frac{Base}{Hypotenuse} = \frac{B}{H}$$
$$Tan\,\theta = \frac{Side\ opposite\ to\ angle\ \theta}{Adjacent\ side\ to\ angle\ \theta} = \frac{P}{B}$$
$$Sec\,\theta = \frac{1}{cos\,\theta}$$
$$Cot\,\theta = \frac{1}{tan\,\theta}$$
$$Cosec\,\theta = \frac{1}{sin\,\theta}$$
$$Tan\,\theta = \frac{Sin\,\theta}{Cos\,\theta}$$

Angle	**0°**	**30°**	**45°**	**60°**	**90°**
Sinθ	0	1/2	1/√2	√3/2	1
Cosθ	1	√3/2	1/√2	½	0
Tanθ	0	1/√3	1	√3	Undefined
Cotθ	Undefined	√3	1	1/√3	0
Secθ	1	2/√3	√2	2	Undefined
Cosecθ	Undefined	2	√2	2/√3	1

CIRCLES FORMULAS

- Circumference of the circle = $2 \pi r$
- Area of the circle = πr^2
- Area of the sector of angle $\theta = (\theta/360) \times \pi r^2$
- Length of an arc of a sector of angle $\theta = (\theta/360) \times 2 \pi r$

(r = radius of the circle)

SPHERE FORMULAS

Diameter of sphere	2r
Surface area of sphere	$4 \pi r^2$
Volume of Sphere	$4/3 \pi r^3$

CYLINDER FORMULAS

Curved surface area of Cylinder	$2 \pi rh$
Area of two circular bases	$2 \pi r^2$
Total surface area of Cylinder	Curved surface area of Cylinder + Area of Circular bases = $2 \pi rh + 2 \pi r^2$

Volume of Cylinder	$\pi r^2 h$

CONE FORMULAS

Slant height of cone	$l = \sqrt{(r^2 + h^2)}$
Curved surface area of cone	πrl
Total surface area of cone	$\pi r (l + r)$
Volume of cone	$\frac{1}{3} \pi r^2 h$

- **Cuboid Formulas**

Perimeter of cuboid	4(l + b +h)
Length of the longest diagonal of a cuboid	$\sqrt{(l^2 + b^2 + h^2)}$
Total surface area of cuboid	2(l×b + b×h + l×h)
Volume of Cuboid	l × b × h

Here, l = length, b = breadth and h = height. In case of Cube, put l = b = h = a, as cube all its sides of equal length, to find the surface area and volumes.

- **Sphere Formulas**

Diameter of sphere	2r
Surface area of sphere	$4 \pi r^2$
Volume of Sphere	$4/3 \pi r^3$

- **Cylinder Formulas**

Curved surface area of Cylinder	$2 \pi rh$
Area of two circular bases	$2 \pi r^2$
Total surface area of Cylinder	Curved surface area of Cylinder + Area of Circular bases = $2 \pi rh + 2 \pi r^2$
Volume of Cylinder	$\pi r^2 h$

- **Cone Formulas**

Slant height of cone	$l = \sqrt{(r^2 + h^2)}$
Curved surface area of cone	πrl
Total surface area of cone	$\pi r (l + r)$
Volume of cone	$⅓ \pi r^2 h$

- **Cuboid Formulas**

Perimeter of cuboid	$4(l + b + h)$
Length of the longest diagonal of a cuboid	$\sqrt{(l^2 + b^2 + h^2)}$
Total surface area of cuboid	$2(l \times b + b \times h + l \times h)$
Volume of Cuboid	$l \times b \times h$