



Trigonometry

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$$\Rightarrow \text{Angle } \theta^\circ \text{ to Radian multiply it by } \frac{\pi}{180^\circ}.$$

$$\Rightarrow \text{Angle Radian to } \theta^\circ \text{ multiplying it by } \frac{180^\circ}{\pi}.$$

Trigonometrical Ratios :

$$\sin \theta = \frac{P}{H} = \frac{MP}{OP}$$

$$\cos \theta = \frac{B}{H} = \frac{OM}{OP}$$

$$\tan \theta = \frac{P}{B} = \frac{MP}{OM}$$

$$\cot \theta = \frac{B}{P} = \frac{OM}{MP}$$

$$\sec \theta = \frac{H}{B} = \frac{OP}{OM}$$

$$\cosec \theta = \frac{H}{P} = \frac{OP}{MP}$$

$$\Rightarrow \sin^2 \theta + \cos^2 \theta = 1; 1 + \tan^2 \theta = \sec^2; 1 + \cot^2 \theta = \cosec^2 \theta$$

Table : Trigonometry Standard angles from 0° to 180°

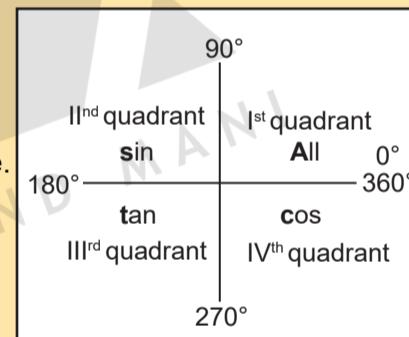
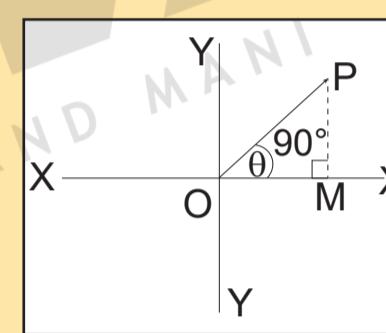
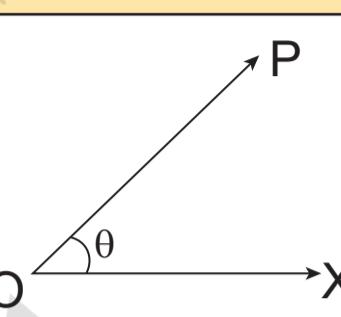
Four Quadrants and ASTC Rule :

\Rightarrow In Ist quadrant, all trigonometric ratios are positive.

\Rightarrow In IInd quadrant, only $\sin \theta$ and $\cosec \theta$ are positive.

\Rightarrow In IIIrd quadrant, only $\tan \theta$ and $\cot \theta$ are positive.

\Rightarrow In IVth quadrant, only $\cos \theta$ and $\sec \theta$ are positive.



Important trigonometric formula :

Range of trigonometric functions :

$$\Rightarrow \sin \theta = \frac{P}{H} \text{ and } P \leq H$$

$$\text{So, } -1 \leq \sin \theta \leq 1$$

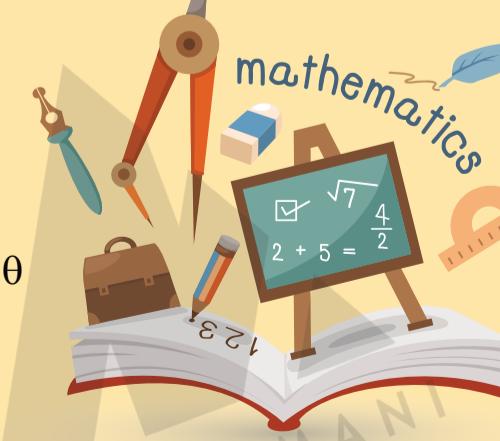
$$\Rightarrow \cos \theta = \frac{B}{H} \text{ and } B \leq H, \text{ So } -1 \leq \cos \theta \leq 1$$

$$\Rightarrow \tan \theta = \frac{P}{B} \text{ So, } -\infty < \tan \theta < \infty$$

Small Angle Approximation :

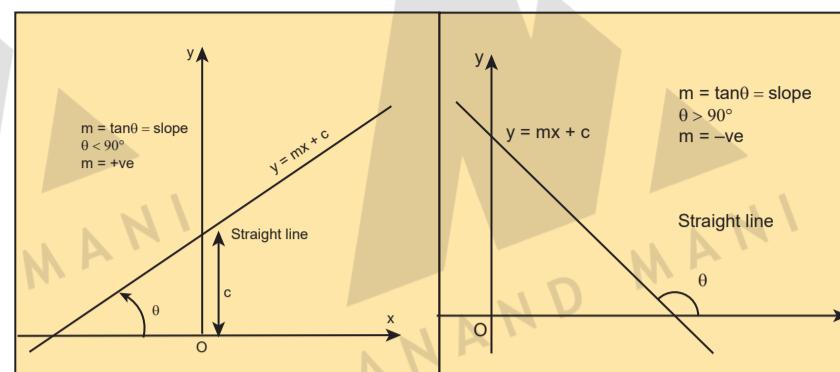
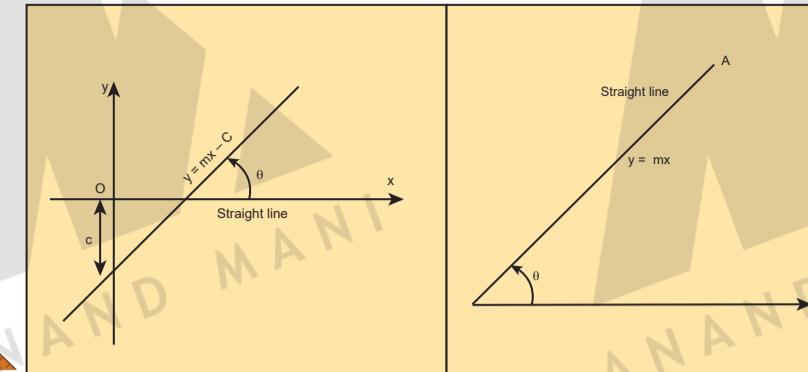
If θ is small ($\theta < 45^\circ$)

$$\sin \theta \approx \theta; \cos \approx 1 \text{ and } \tan \theta \approx \theta$$



BASIC MATHEMATICS

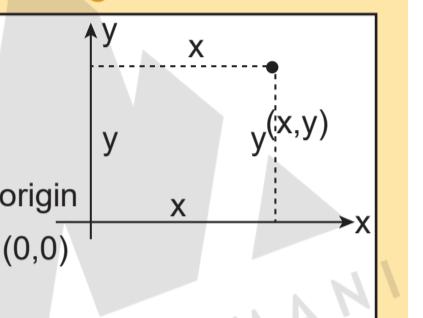
Standard Graphs and their Equations



Coordinate Geometry

- Origin : ANY fixed point from which all measurements are taken from this.

- Axis : ANY fixed direction passing through origin.



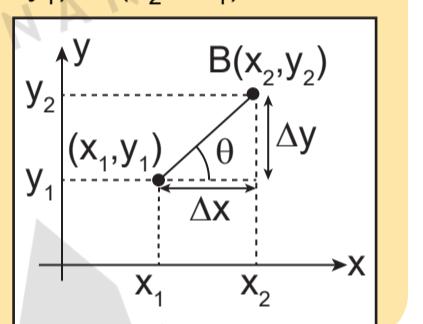
Distance Formula :

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

$$\text{In 3-d (space)} - d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

Slope of a line :

$$m = \tan \theta = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

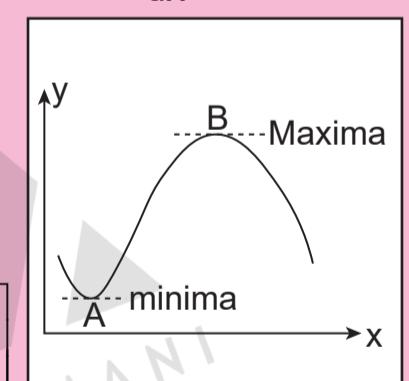


Important Formulae of Differentiation :

$$\Rightarrow \frac{d}{dx}(\sin x) = \cos x \Rightarrow \frac{d}{dx}(\cos x) = -\sin x \quad (\#) \frac{d}{dx}(\log_e x) = \frac{1}{x}$$

$$\Rightarrow \frac{d}{dx}(\tan x) = \sec^2 x \Rightarrow \frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x \quad (\#) \frac{d}{dx}(e^x) = e^x$$

$$\Rightarrow \frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \operatorname{cat} x \quad (\#) \frac{d}{dx}(e^{ax}) = ae^x$$



Concept of Maxima and Minima

$$\Rightarrow \text{Condition for minima : } \left[\frac{dy}{dx} = 0 \text{ and } \frac{d^2y}{dx^2} > 0 \right]$$

$$\Rightarrow \text{Condition for maxima : } \left[\frac{dy}{dx} = 0 \text{ and } \frac{d^2y}{dx^2} < 0 \right]$$

Algebra

Quadratic Equation and its Solutions :

AN algebraic equation of 2nd order is called a quadratic equation. Equation = $ax^2 + bx + c = 0$

$$\text{General Solution} \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Differentiation

Physical Meaning of $\frac{dy}{dx} = 1$

- (i) The ratio of small change in the function y and the variable x is called the average rate of change y w.r.t. x .

- (ii) When $\Delta x \rightarrow 0$. The limiting value of $\frac{\Delta y}{\Delta x}$ is $\lim_{\Delta x \rightarrow 0} \frac{\Delta y}{\Delta x} = \frac{dy}{dx}$

Main Formulas of Differentiation

$$1. \frac{d}{dx}(K) = 0 \quad K = \text{constant}$$

$$2. \frac{d}{dx}(KU) = K \frac{dU}{dx} \quad [U \text{ is a function of } x]$$

$$3. \frac{d}{dx}(U \pm V \pm W) = \frac{dU}{dx} \pm \frac{dV}{dx} \pm \frac{dW}{dx}$$

where U, V and W are functions of x.

$$4. \frac{d}{dx}(UV) = U \frac{dV}{dx} + V \frac{dU}{dx}$$

$$5. \frac{d}{dx}\left(\frac{U}{V}\right) = \frac{V \frac{dU}{dx} - U \frac{dV}{dx}}{V^2}$$

$$6. \frac{d}{dx}(x^n) = nx^{n-1}$$



Integration

If I is the integration of $f(x)$ with respect to x then $I = \int f(x)dx$

Main Formulae of Integration :

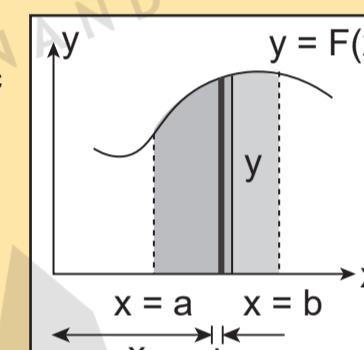
$$1. \int x^n dx = \frac{x^{n+1}}{n+1} + C, n \neq -1$$

$$2. \int \sin x dx = -\cos x + C, C = \text{constant}$$

$$3. \int \cos x dx = \sin x + C$$

$$4. \int \frac{1}{x} dx = \log_e x + C$$

$$5. \int e^x dx = e^x + C$$



If $\frac{d}{dx}(f(x)) = f'(x)$ then $\int f'(x)dx = f(x)|_a^b$

is called definite integral.

Area Under Curve :

$$\int_a^b f(x)dx = \text{Shaded area between curve and x-axis.}$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)x^2}{2 \times 1} + \dots$$

Logarithm Main Formulae :

$$\log mn = \log m + \log n$$

$$\log m^n = n \log m$$

$$\log \frac{m}{n} = \log m - \log n$$

$$\log_e m = 2.303 \log_{10} m$$

Arithmetic Progression (AP) :

$$(AP) = a + a + d + a + 2d + \dots + a + (N-1)d$$

where a = first term d = common difference

$$\Rightarrow \text{Sum of } n \text{ term's } S_n = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}[a + a + (n-1)d]$$

$$(i) \text{ Sum of first } n \text{ natural number's } S_n = \frac{n(n+1)}{2};$$

$$(ii) \text{ Sum of squares of first } n \text{ numbers } S_{n^2} = \frac{n(n+1)(2n+1)}{6}$$

Geometric Progression (GP) :

$$(GP) = a, ar, ar^2, ar^3, \dots, ar^{n-1}; a = \text{first term}, r = \text{common ratio}$$

$$\text{Sum of } n \text{ terms } \rightarrow S_n = \frac{a(1-r^n)}{1-r}, \text{ For } 0 \leq |r| < 1$$

$$\text{Sum of } \infty \text{ terms } S_\infty = \frac{a}{1-r}$$



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