YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

Physics | Lecture - 10

By- Manish Raj (MR Sir)

Topics to be covered

1
2
3
4

(1) * Variation of slope in curved

(2) Basic Differentiation

Recap of previous lecture

1. Revision of last 2 lecture
2.
3.
4.

Revision

(1) Straight line:-

$$y = mx + c$$

→ Slope and Intercept fixed ho harmul

Slope $= \tan\theta =$ → θ = Angle b/w line & +ve x axis in Anti-clock.

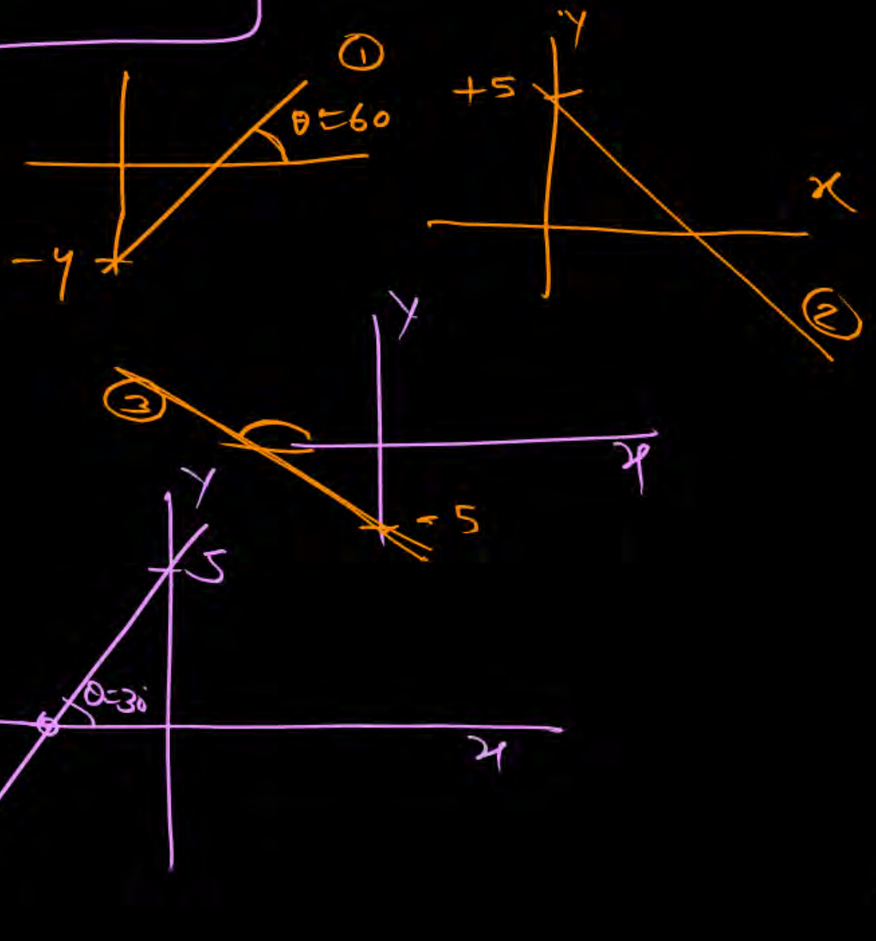
c = y intcent (value of y when $x = 0$)

(1) $y = \sqrt{3}x - 4$

(2) $y = -\sqrt{3}x + 5$

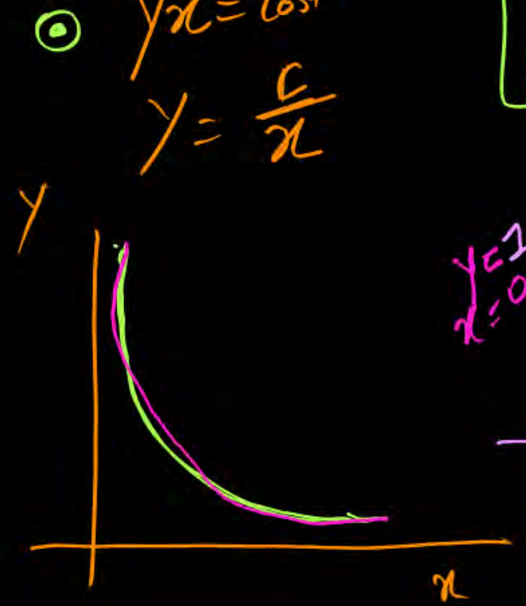
(3) $y = -\frac{1}{\sqrt{3}}x - 5$

(4) $y = +\frac{1}{\sqrt{3}}x + 5$

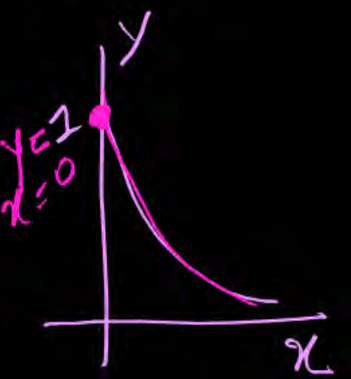


⊙ $yx = \text{Cost}^n$

$y = \frac{c}{x}$



$y = e^{-x}$ ⊓/w



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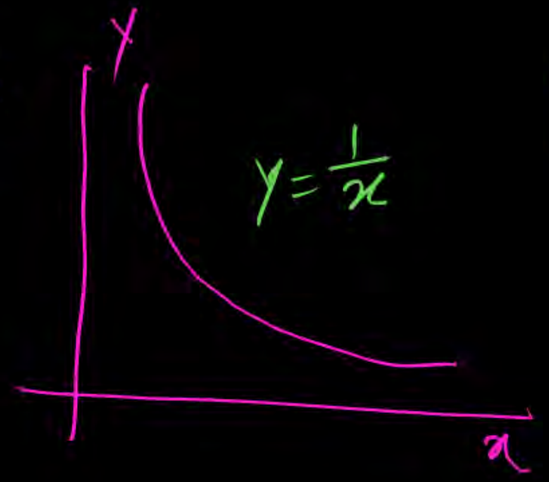
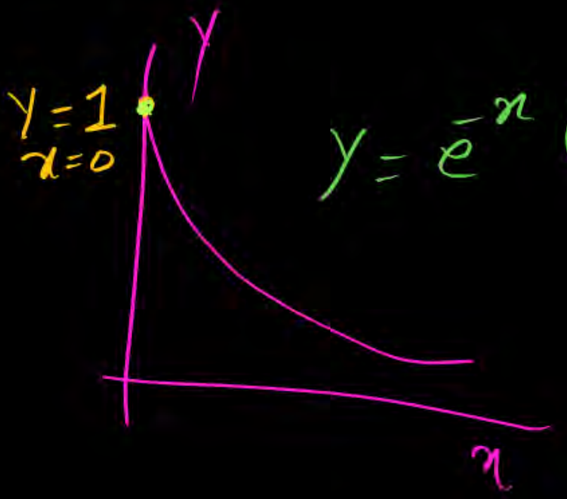
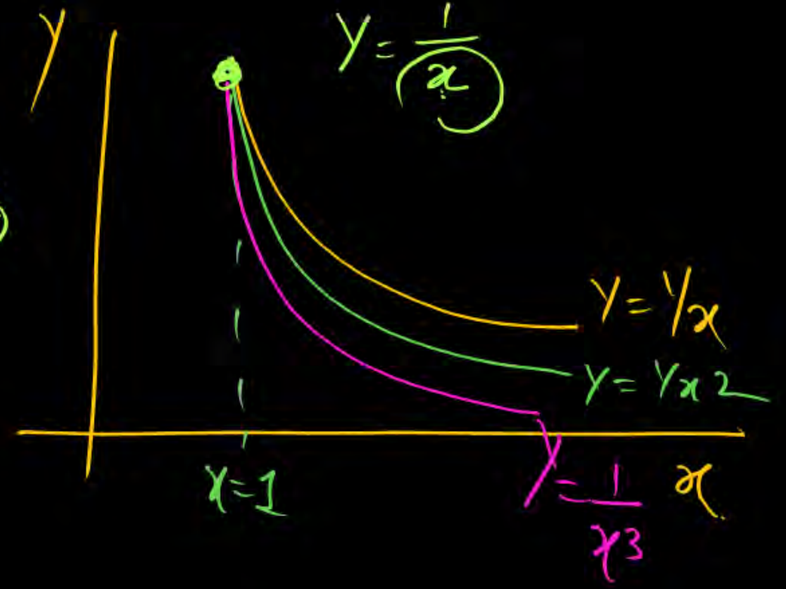

y
$y = \frac{1}{x}$
x

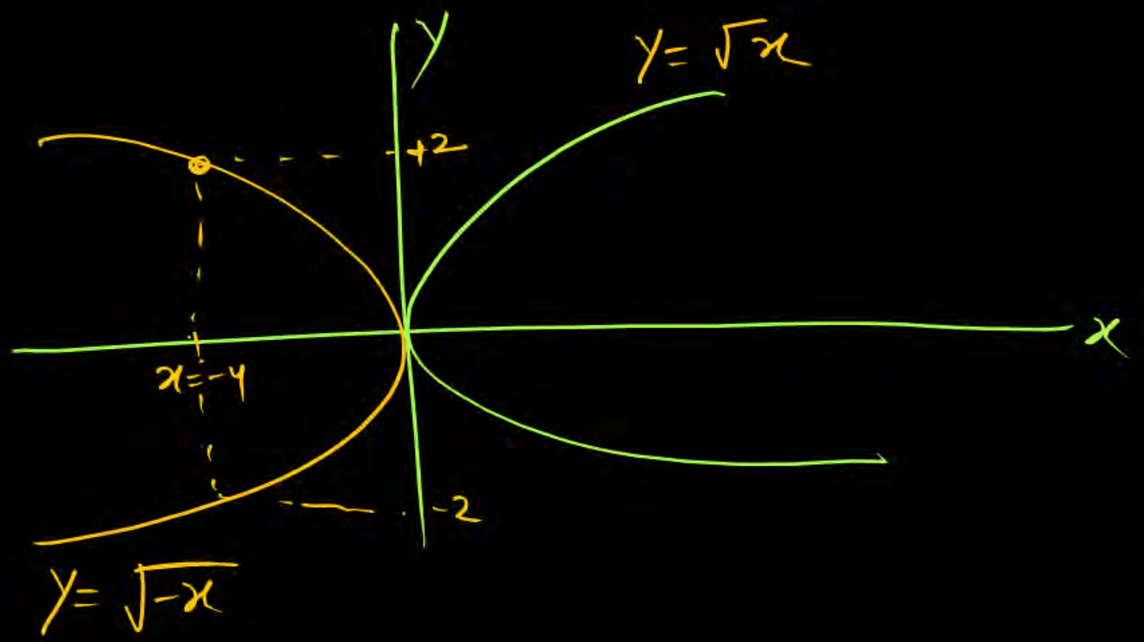

y
$y = 1$
$x = 0$
$y = e^{-x}$ (M/O solucão)
x

(#)

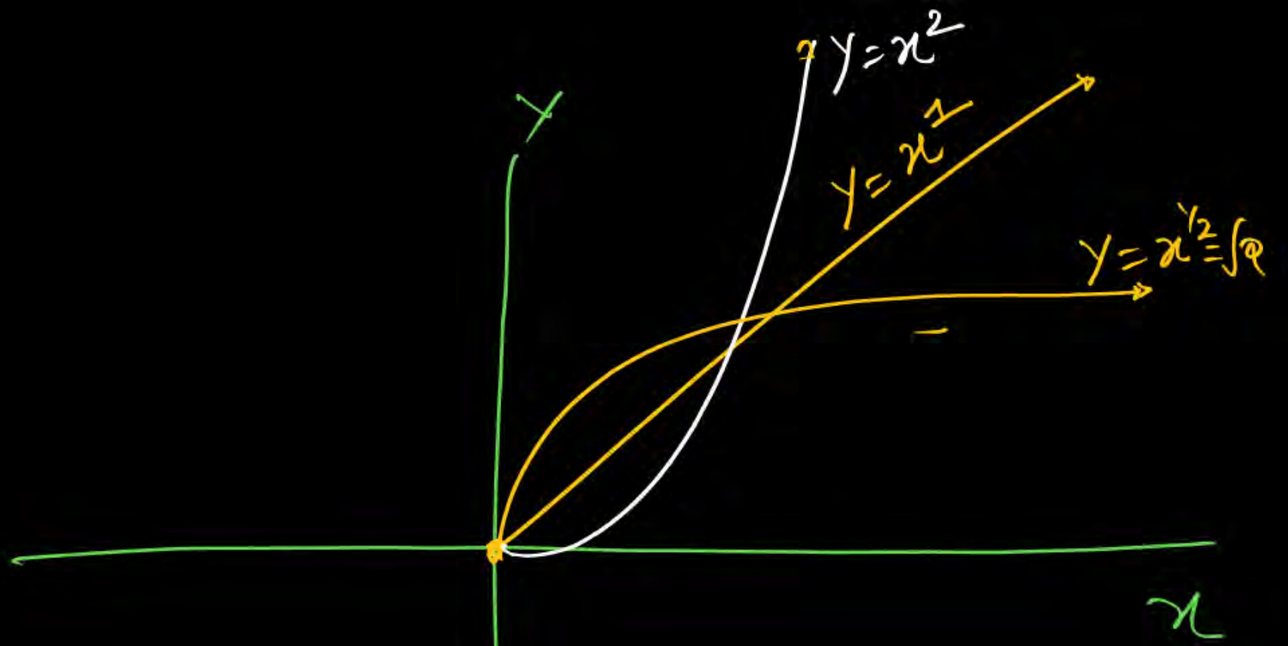

y
$y = \frac{1}{x}$
$y = 1/x$
$y = 1/x^2$
$y = \frac{1}{x^3}$
x
x=1


y
$y_1 = \frac{1}{x}$
$y_3 = \frac{3}{x}$
$y_2 = \frac{2}{x}$
$y_1 = \frac{1}{x}$
x
x

$y = \sqrt{x}$



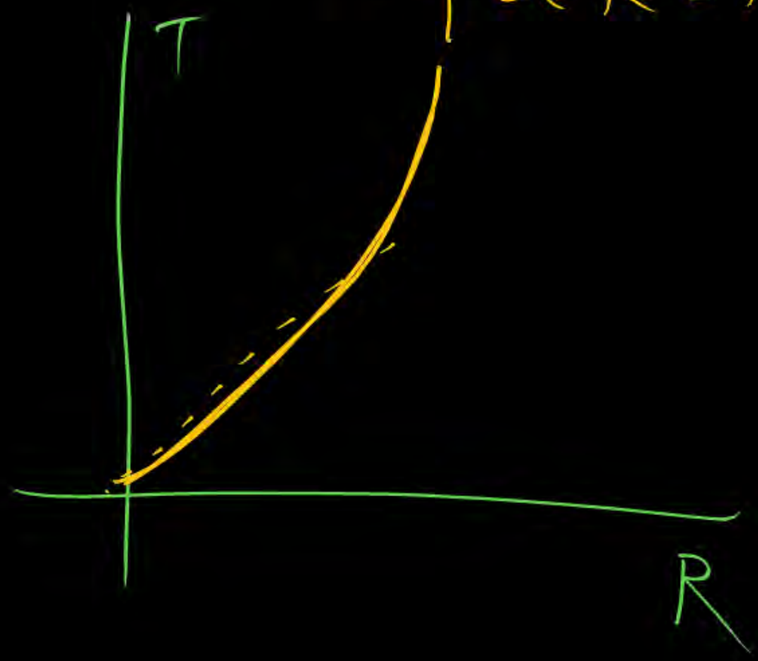
$$y = \sqrt{-(-4)} = \sqrt{4} = \pm 2$$



MR* y ke formula me x ka Power 1 to strum.
Power Jayda → graph upar
Power Kam → graph niche

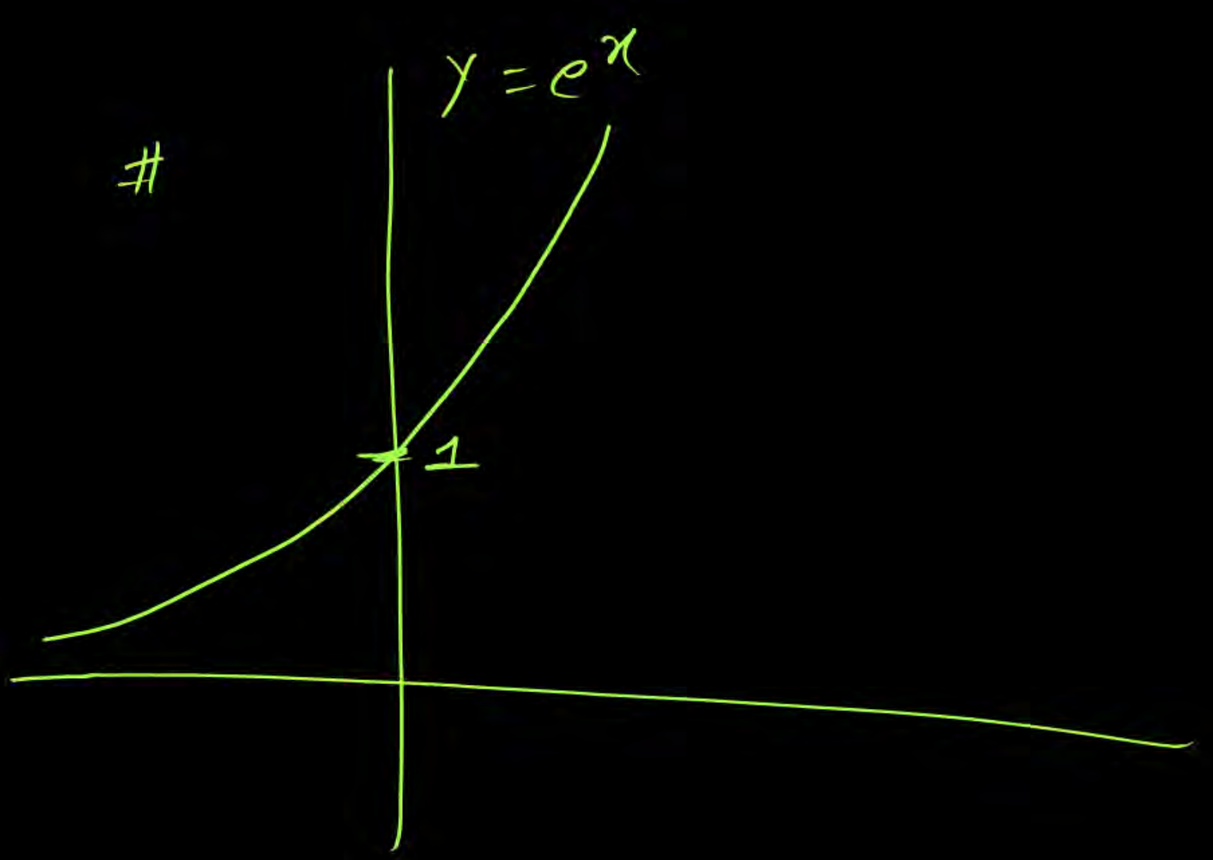
$T^2 \propto R^3$

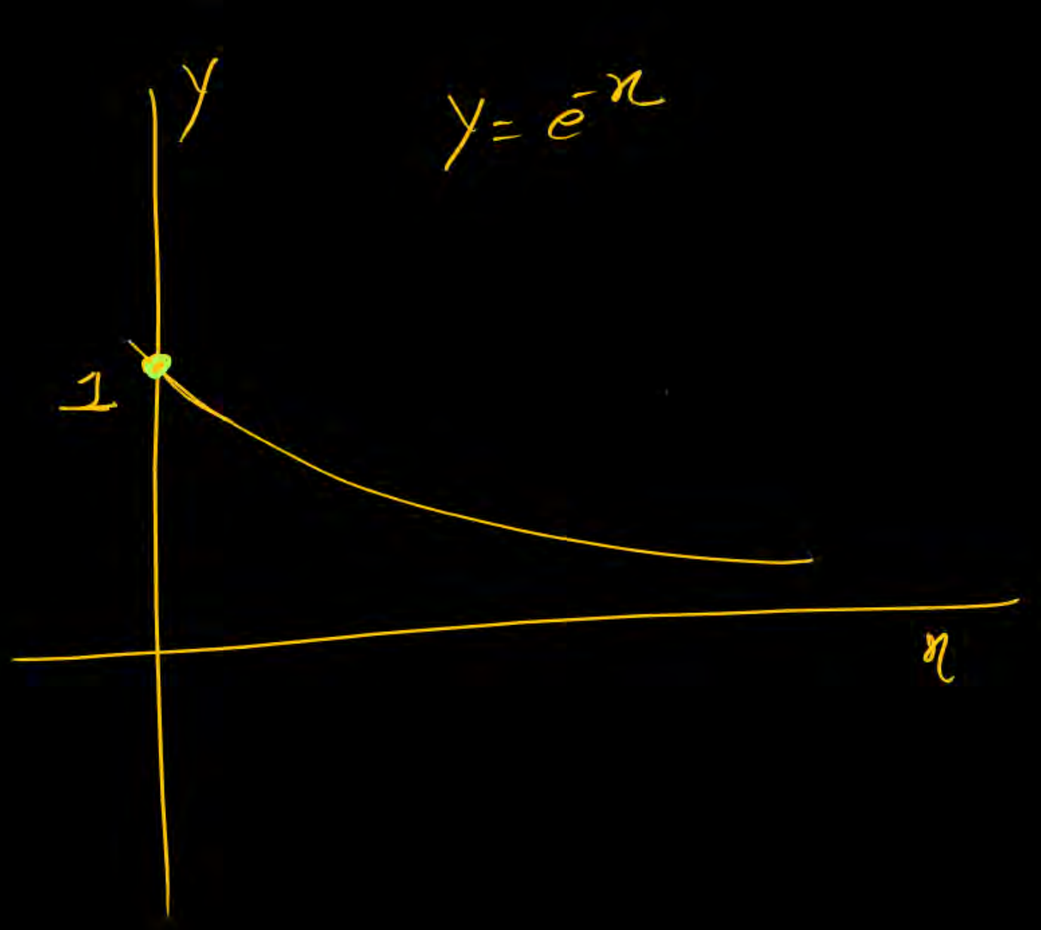
$T \propto R^{3/2} = R^{1.5}$



$T^2 \propto R3$

#


$y = e^x$
1


y
$y = e^{-x}$
1
x

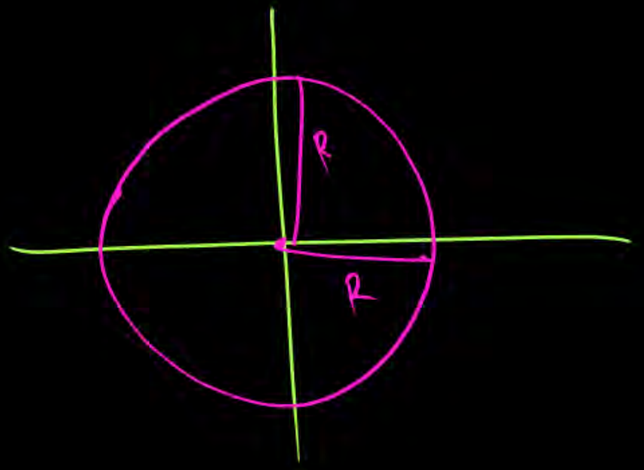
$$(x-x_0)^2 + (y-y_0)^2 = R^2$$

distance formula = eqⁿ of circle

centre (x_0, y_0) Radu = R

\# $(x_0, y_0) = (0,0)$

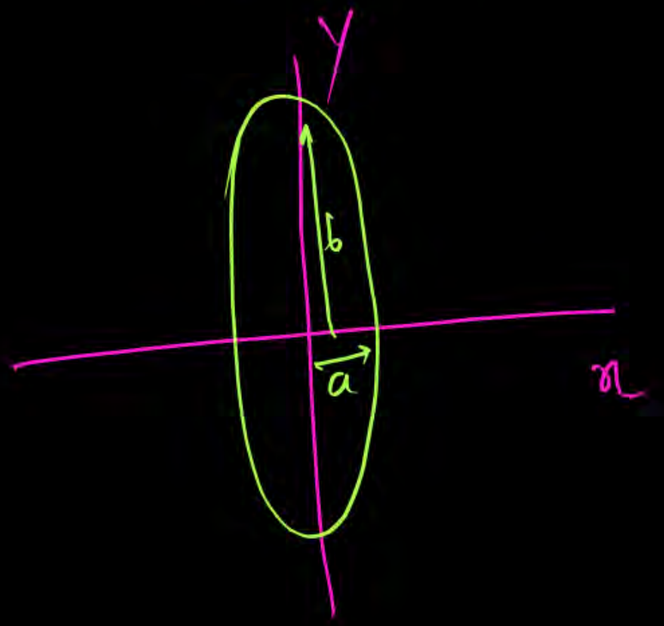
$$x^2 + y^2 = R^2$$



$$\boxed{\frac{x^2}{R^2} + \frac{y^2}{R^2} = 1}$$

eqn of ckt.

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

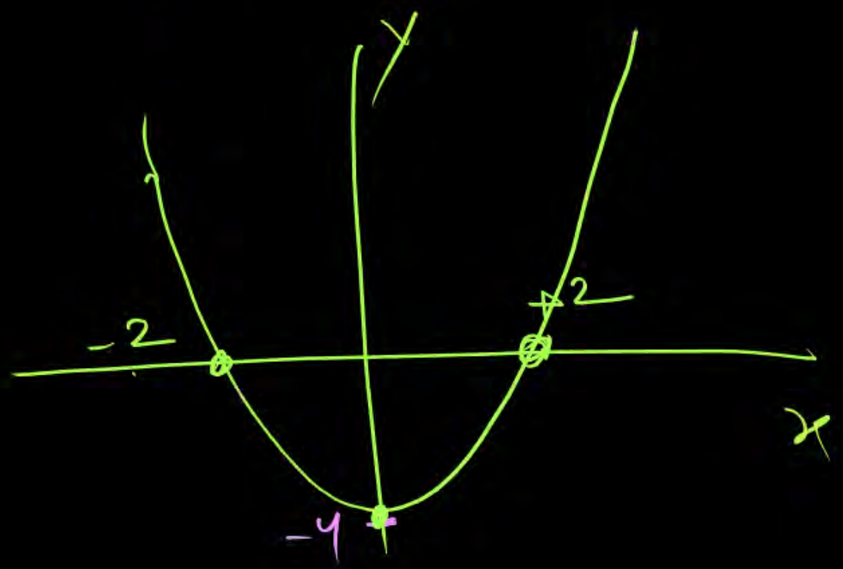


$y = x^2 - 4$ → for x-Incept

$y = x^2 - 4 = 0$

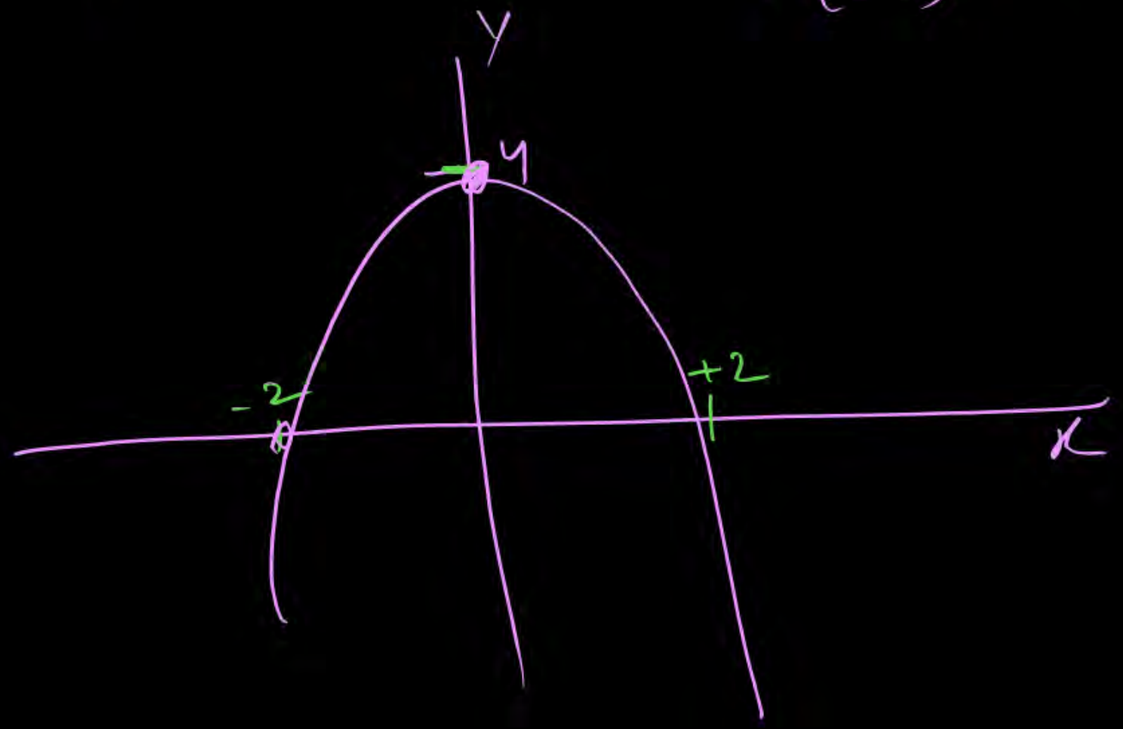
$x = \sqrt{4}$

$x = \pm 2$



$$y = -x^2 + 4$$

y intercept ($x=0$) $= 4$



#

$$Y = x^2 - 5x + 6$$

Y (Intercept) $x = 0$ $= 6$

x intercept $(Y = 0)$

$$0 = x^2 - 5x + 6$$

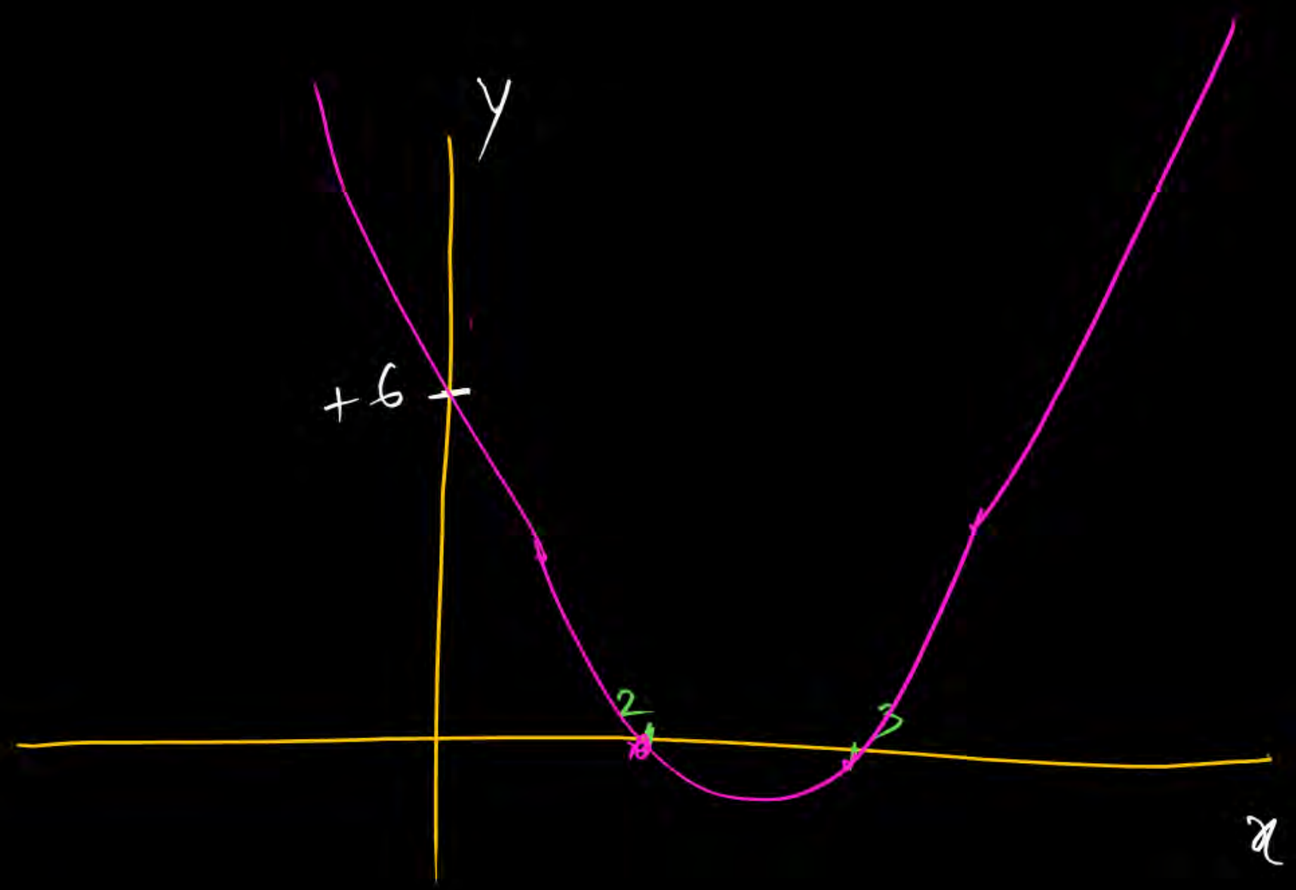
$$x^2 - 3x - 2x + 6 = 0$$

$$x(x-3) - 2(x-3) = 0$$

$$(x-3)(x-2) = 0$$

$x - 3 = 0$, $x_1 = 3$

$x_2 = 2$



$X^2+7x+12=0$

If $x=0$, $y=12$

I^st method

$a=1$, $b=7$, $c=12$

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

$$=\frac{-7\pm\sqrt{7^2-4\times1\times12}}{2\times1}$$

$$=\frac{-7\pm\sqrt{1}}{2}$$

$$x=\frac{-7\pm1}{2}$$

$x_1=\frac{-7-1}{2}=\frac{-8}{2}=-4$

$x_2=\frac{-7+1}{2}=-3$

II^nd method

$x^2+(4+3)x+12=0$

$x^2+4x+3x+12=0$

$x(x+4)+3(x+4)=0$

$(x+3)(x+4)$

- $x+3=0$, $x=-3$
- $x+4=0$, $x=-4$

Sir please draw graph of this equation Both X value is -ve

$y=x^2+7x+12$ Positive

Draw graph b/w $y \le x$

y Intercept ($x=0$) $y_0=12$

x (Intercept) $y=0$

$x^2+7x+12=0$

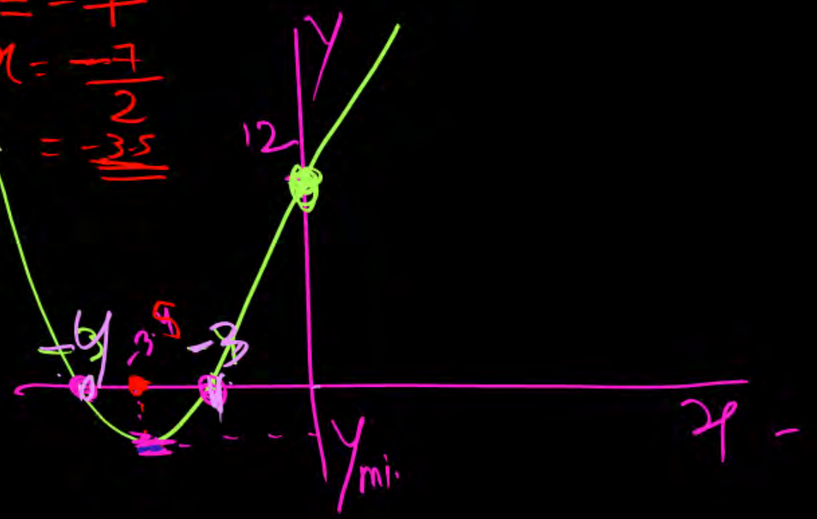
↳ Quadratic eqn.

$x_1=-3$, $x_2=-4$

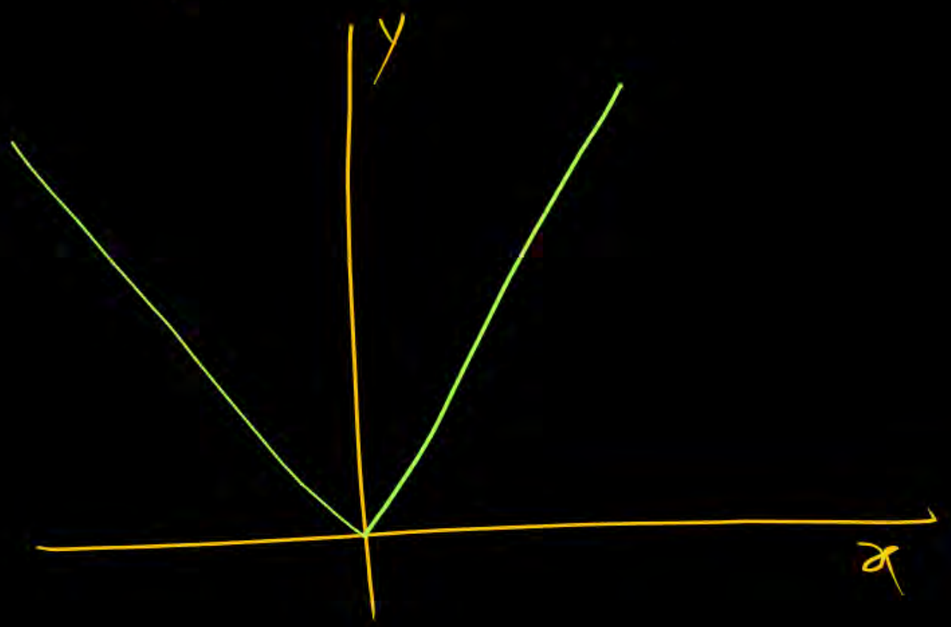
$\left(\frac{dy}{dx}\right)=2x+7=0$

$2x=-7$

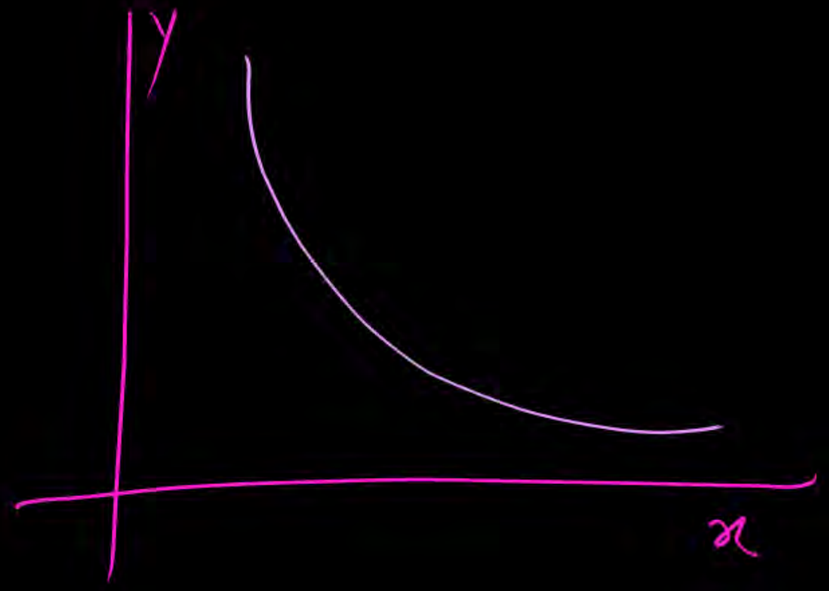
$x=\frac{-7}{2}=-3.5$



$y = |x|$



$y = \frac{1}{\sqrt{x}} = \frac{1}{x^{1/2}}$

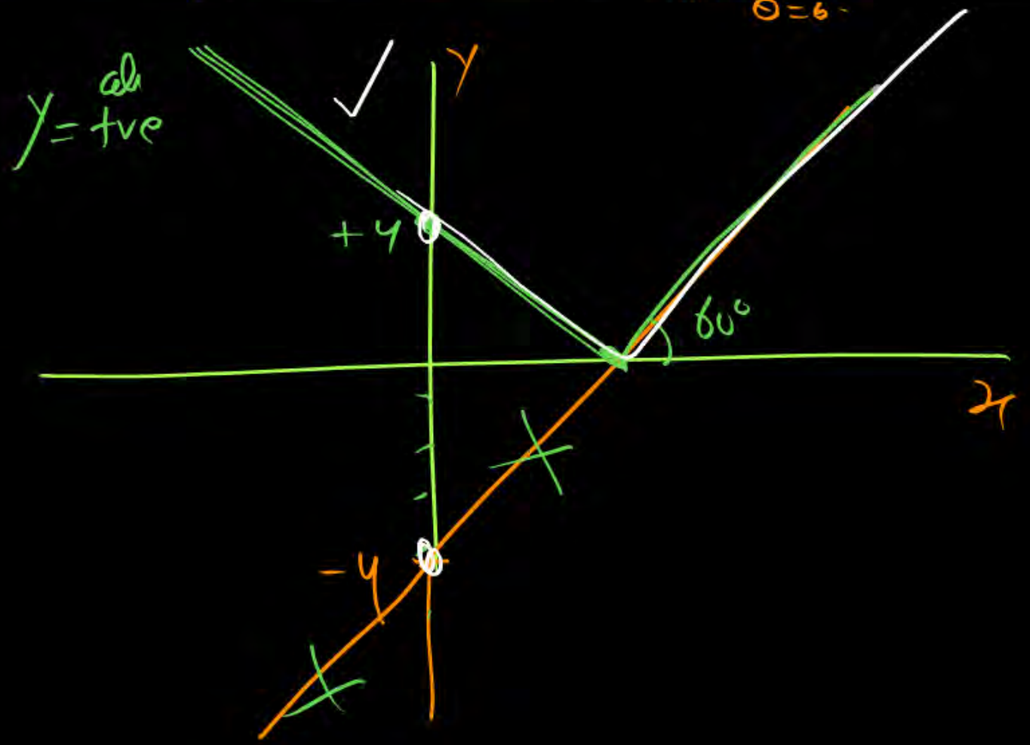


$$y = |\sqrt{3}x - 4| \quad *$$

$$y = \sqrt{3}x - 4$$

$\tan\theta = \sqrt{3}$

$\theta = 60^\circ$



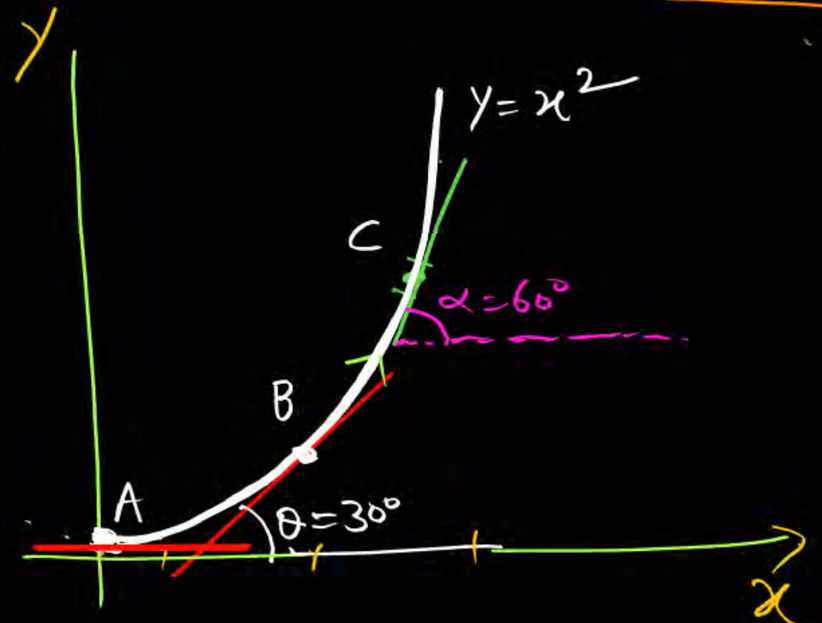
Two staight line is ⊥r to each oths then Product of thur slo — 1

Note Karlye

Slope of curve

method-1 → Draw tangent at that Point → slope of tangent is slope of curve at that Point.

method-2 → $\text{Slope} = \frac{dy}{dx}$ = slope at that Point.



method-1

$m_A = \tan 0 = 0$

$m_B = +ve$

$m_B = \tan 30 = \frac{1}{\sqrt{3}}$

$m_C = \tan 60 = \sqrt{3}$

$m_A < m_B < m_C$

Magnitude of slope ↑

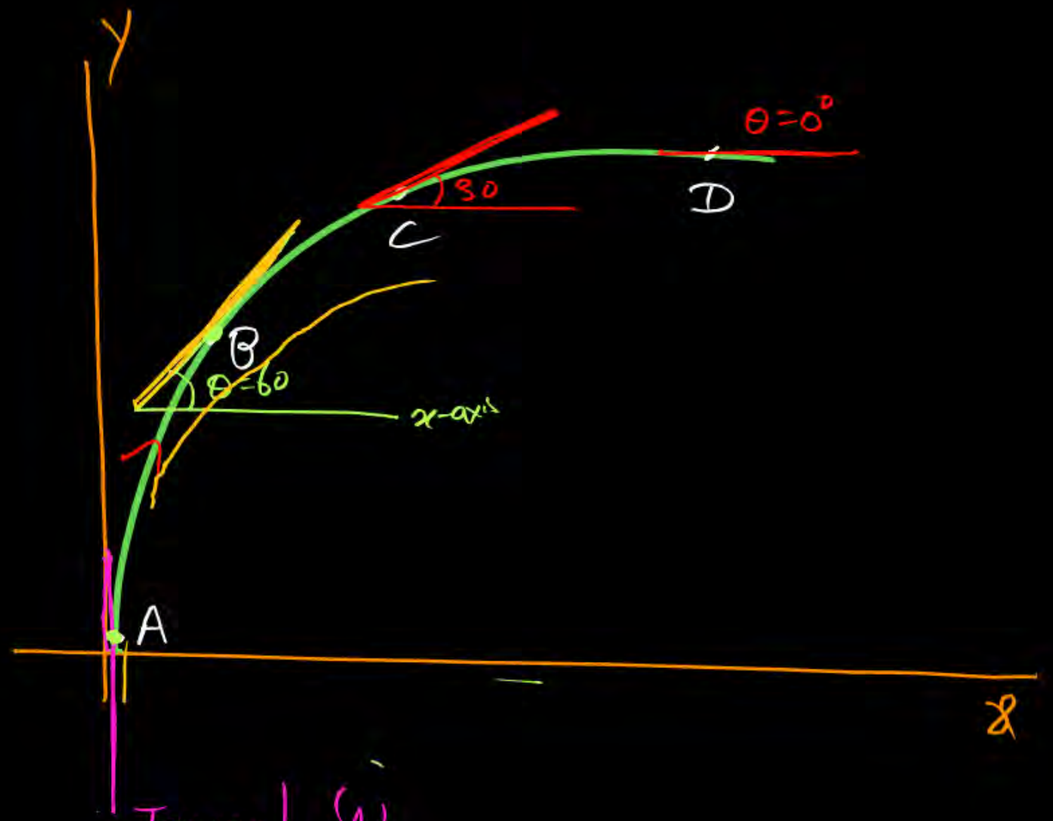
Slope → Increase

method-2

$\text{Slope} = \frac{dy}{dx} = \frac{d x^2}{dx}$

$\text{Slope} = 2x$

$(m_A)_{x=0} = 0$



Tangent 'A'

$$(\text{Slope})_A = \tan 90 = \infty$$

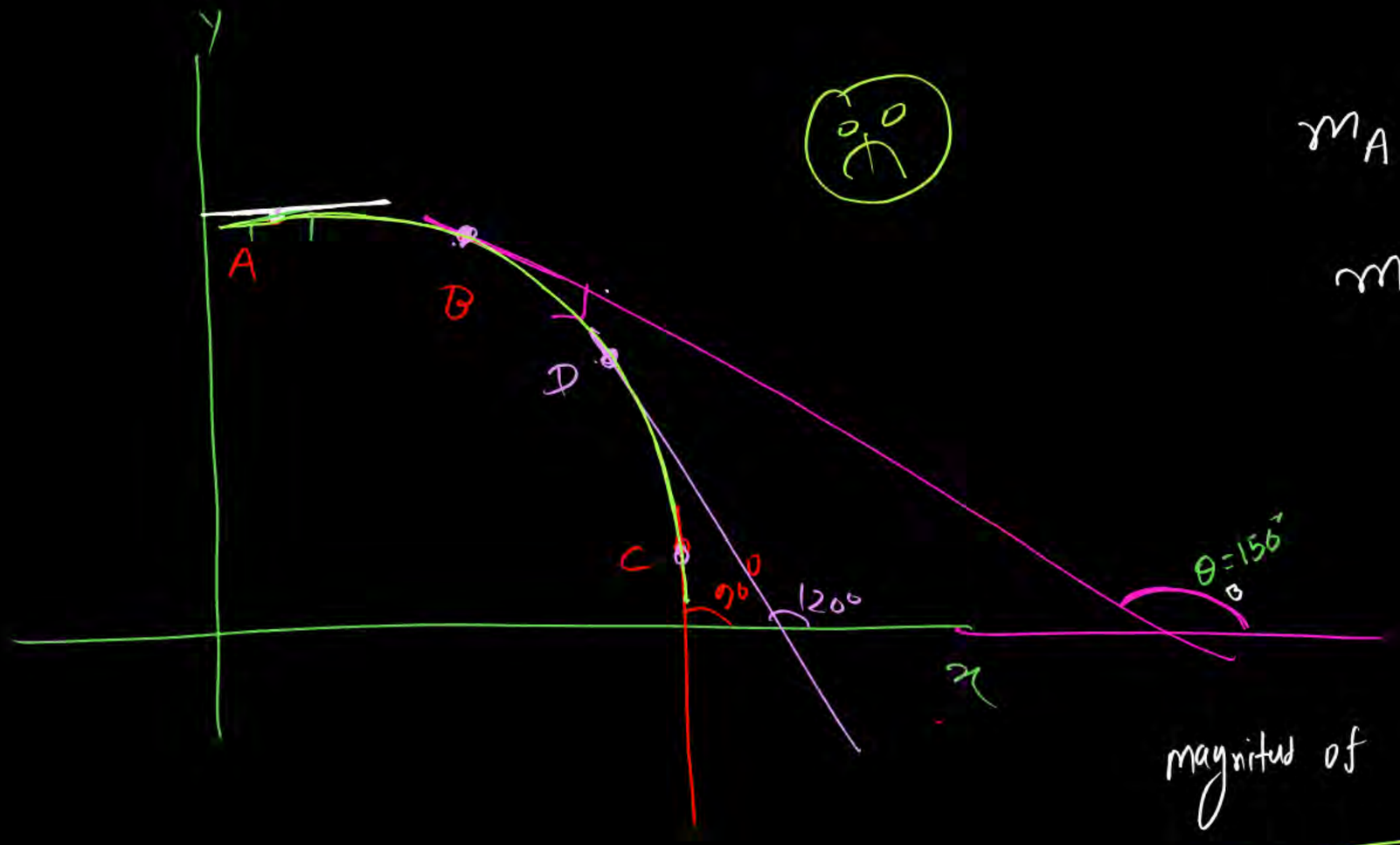
$$m_B = \tan 60^\circ = +\sqrt{3}$$

$$m_C = \tan 30^\circ = +\frac{1}{\sqrt{3}}$$

$$m_D = 0$$

Slope → density

Magnitude of slope → density



m_A = zero

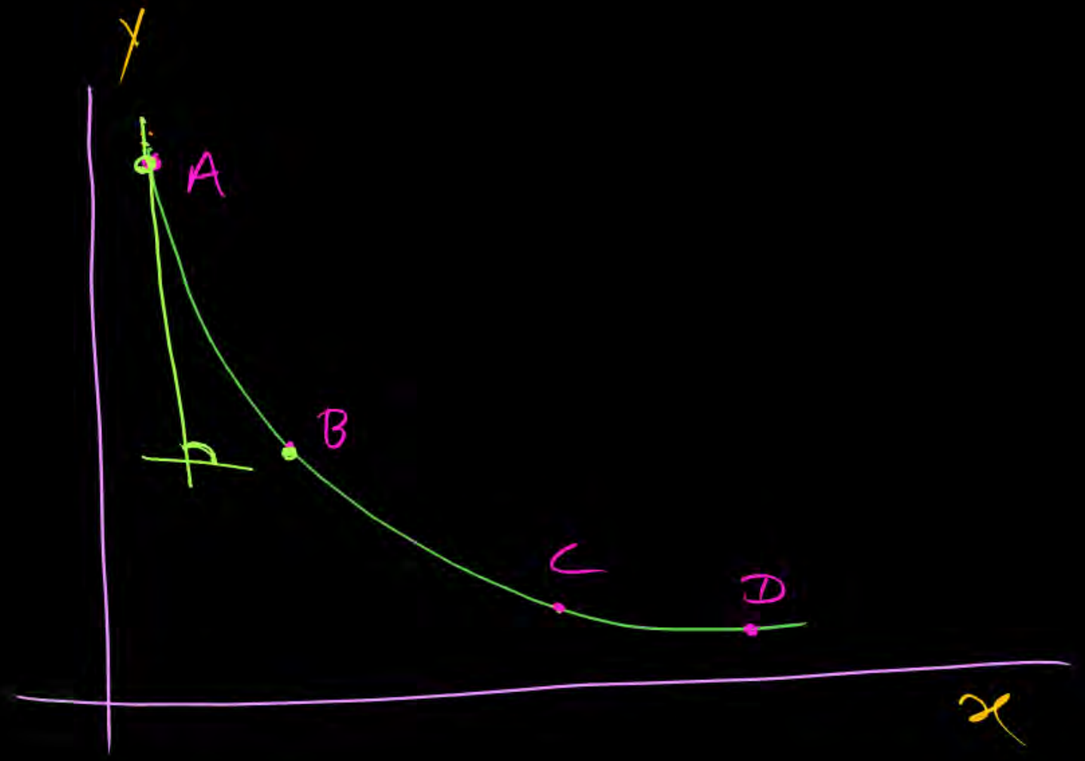
$m_B = \tan 150^\circ = -\frac{1}{\sqrt{3}}$

m_C = infinite

$m_D = \tan 120^\circ = -\sqrt{3}$

magnitud of Slope → Increas.

Slope → decreas

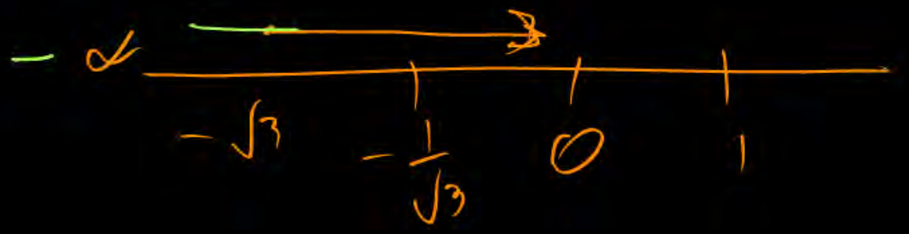


m_A = infinite

m_B = −ve

m_C = −ve

m_D = 0



Slope → Increasing ✓

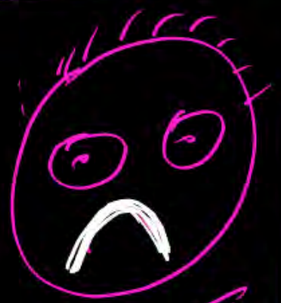
Magnitude → decreasing

MR*

for slope →

हसता हुआ Ramu

Slope ↑

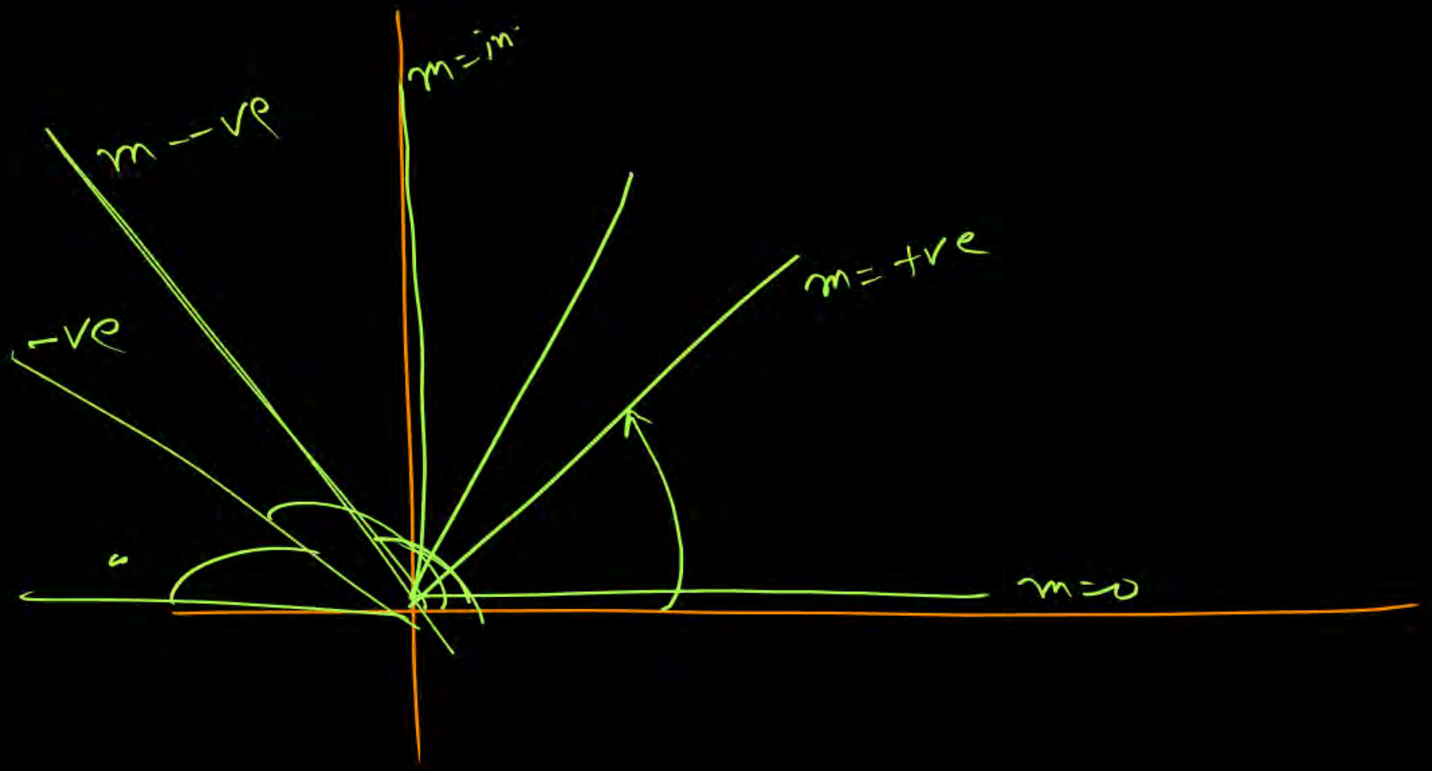


रोता हुआ Ramu

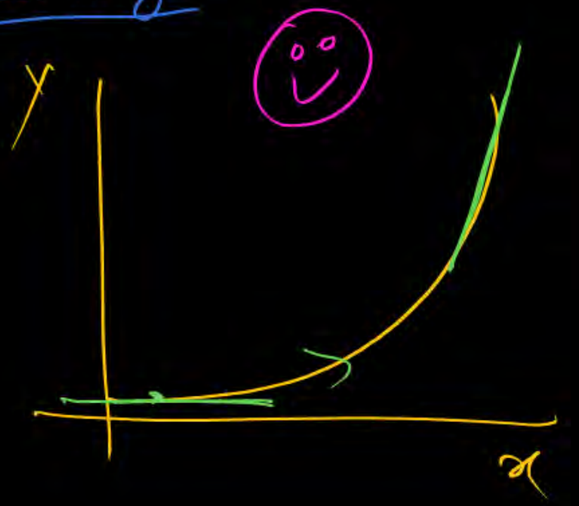
Slope ↓

for magnitude of slope →

Rekha jitni vertical hogi uska magnitude of slope of jayda.


m = ∞
m = -ve
-ve
m = +ve
m = 0

No writing

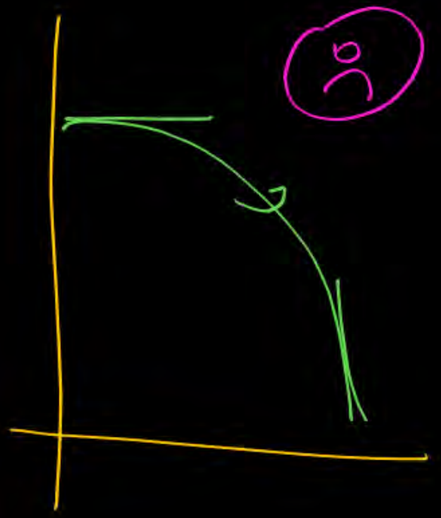


Slope = ↑

Magnitude of slope = ↑

Slope = ↓

Magnitude of slope = ↓



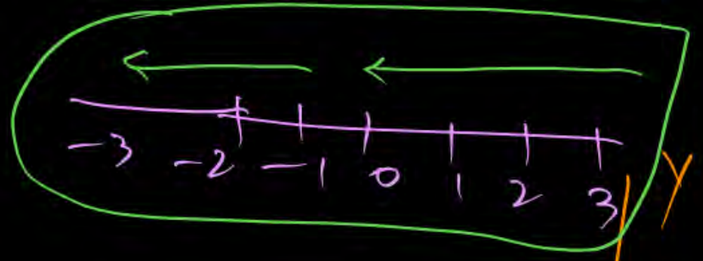
Slope = ↓

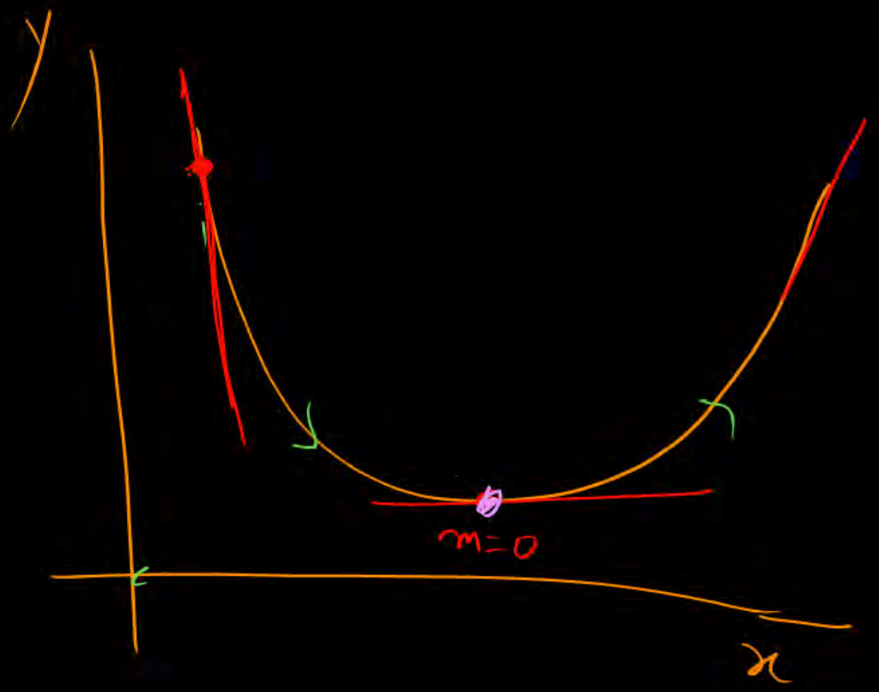
Magnitude of slope = ↑

Slope = ↑

Magnitude of slope = ↓

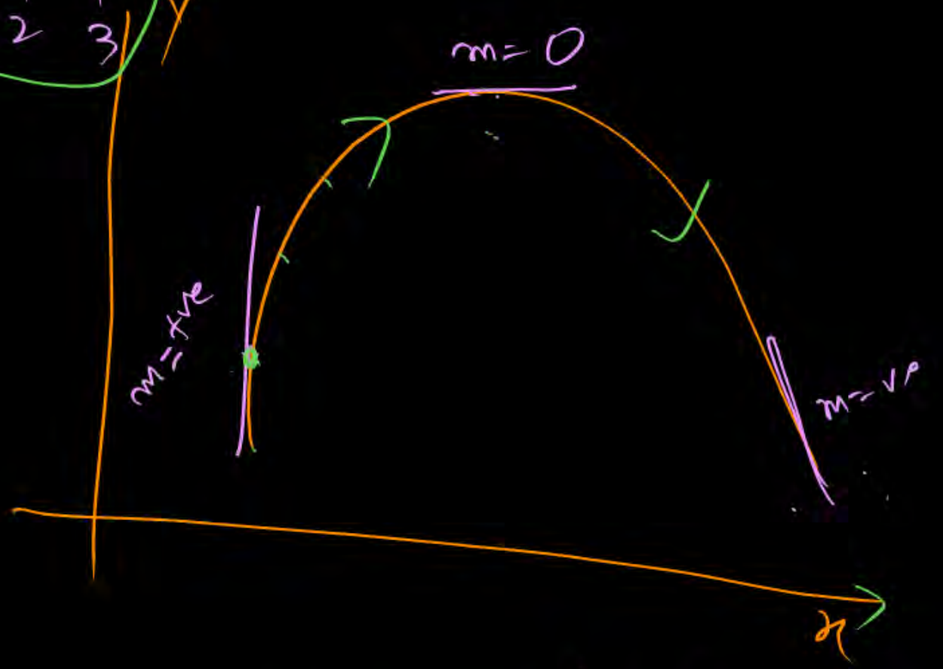
likhna hu





Slope → always Increse

- Magnitude of slope = 1st decresig then Incresig



Slope → always decresig

magnitude of slope →
1st decreasig then
Incresing

gf $y = 2x + 4$

(i) find change in y when x changes from $x_1 = 1$ to $x_2 = 3$.
(initial) (final)

(ii) find change in y with respect to change in x, when $x_1 = 1$ to $x_2 = 3$

(iii) find change in y w.r.t change in x when x changes from $x_1 = 1$ to $x_2 = 1.00001$

Soln

(i) $\Delta y = y_2 - y_1$

$= 10 - 6 = 4$

given in question

$y = 2x + 4$

$y_1(x_1 = 1) = 2 \times 1 + 4$

$= 6$

$y_2(x_2 = 3) = 2 \times 3 + 4 = 10$

(ii) $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-6}{3-1} = \frac{4}{2} = 2$

(iii) $\Delta x \rightarrow$ very small

$\Delta y \rightarrow$ very-very small.

↳ Bat Newton Baba Tak gai.

$$\left(\frac{\Delta y}{\Delta x}\right)_{\substack{\Delta x \to 0 \\ \text{small change}}} = \frac{dy}{dx} = \frac{d(y)}{dx}$$

Diffrentiation

$\frac{d}{dx}$ = differential operation.

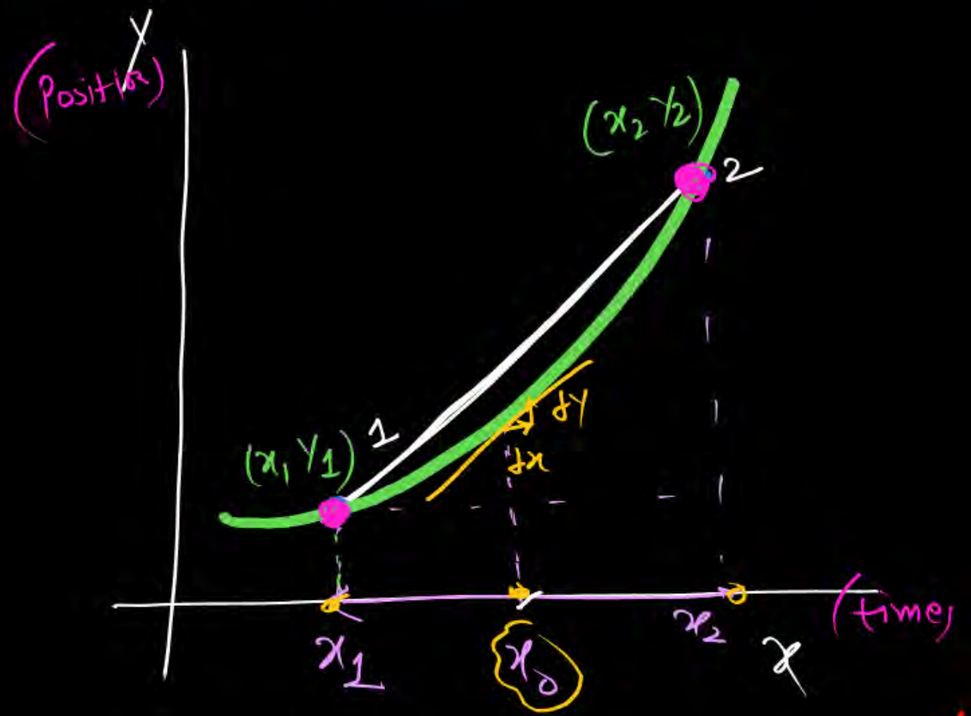
$\frac{d\square}{dx}$ = The Rate of change in $\square$ w.r.t x

$\frac{d\square}{dt}$ = The Rate of change in $\square$ w.r.t 't'

(#) $\frac{d[Y]}{dx}$ = The Rate of change in $[Y]$ w.r.t. x.
= Slope

(#) $\frac{d(M \cdot R)}{dx}$ = The Rate of change in $[M \cdot R]$ w.r.t x.

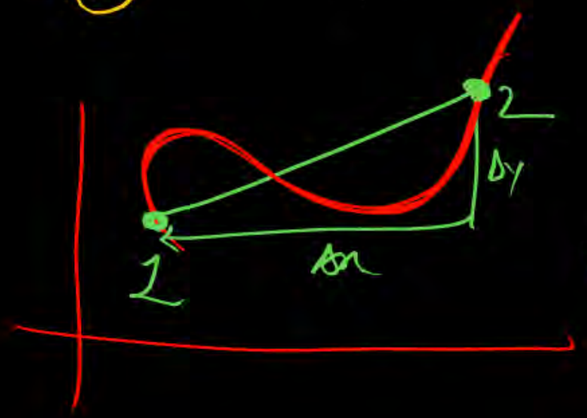
Graphical meaning of differentiation



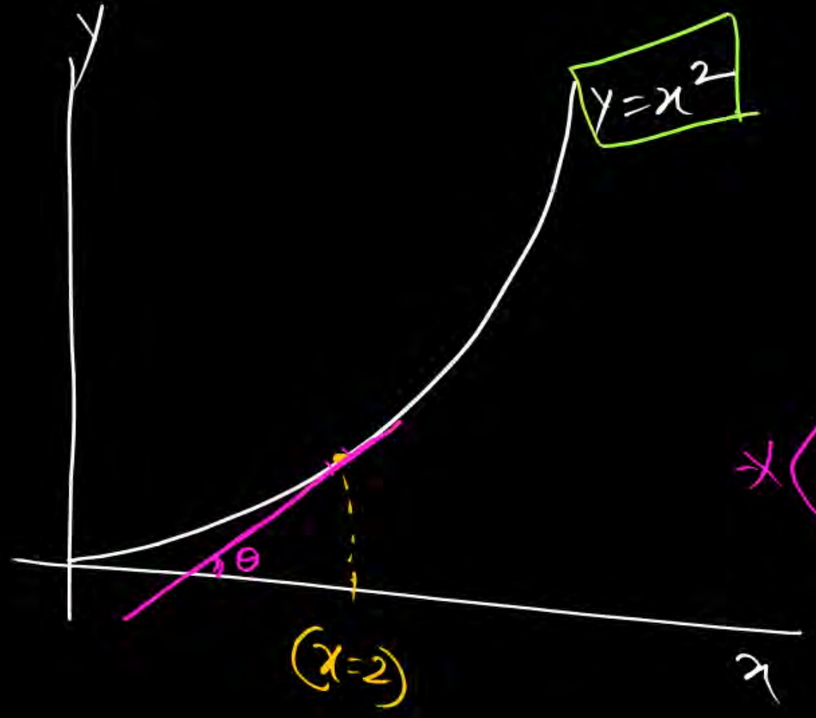
$$\left[\text{Avg slope}_{\text{B/w 1 \& 2}}\right] = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\left|\text{Instantaneous slope}\right| = \text{Slope at a point} = \left\{\frac{dy}{dx}\right\}$$

$$(\text{Slope})_{\text{at point}} = \left|\frac{dy}{dx}\right|_{\text{at } x_0}$$



$$\text{Avg slg} = \frac{\Delta y}{\Delta x}$$



Find slope of this cure at $x=2$

* $\text{Slope} = \frac{dy}{dx}$

Putting value of Y

$$\text{slope} = \frac{d(x^2)}{dx} = 2x$$

$$|\text{slope}|_{\text{at } x=2} = 2x = 2\times 2 = 4$$

Ans

Rule of diffrentiation

Rule (1) Diffrentiation of Constant value is zero.

Constant → fixed

$\frac{dy}{dx}$ = The Rate of change in y w.r.t x

Ex- $y = 5$

$$\frac{dy}{dx} = \frac{d5}{dx} = 0$$

$\frac{d(\pi)}{dt} = 0$ = The Rate of chaye in π w.r.t time.

$\frac{dG}{dt} = 0$

G = gravitation Cons

Rule - 2

Diff^n of algebric functio.

$$y = x^n$$

$$\# \quad \frac{dy}{dx} = \frac{d(x)^n}{dx} = n x^{n-1}$$

Ex $y = x^3$

$$\# \quad \frac{dy}{dx} = \frac{dx^3}{dx} = 3x^{3-1} = 3x^2$$

Ex $y = x^4$

$$\frac{dx^4}{dx} = 4x^{4-1} = 4x^3$$

Ex $y = x^{3/2}$

$$\frac{dx^{3/2}}{dx} = \frac{3}{2} x^{\frac{3}{2}-1}$$

$$= \frac{3}{2} x^{\frac{3-2}{2}}$$

$$= \frac{3}{2} x^{1/2} = \frac{3}{2}\sqrt{x}$$

$y = \sqrt{x}$

$$\frac{d\sqrt{x}}{dx} = \frac{d x^{1/2}}{dx} = \frac{1}{2} x^{\frac{1}{2}-1}$$

$$= \frac{1}{2} x^{\frac{1-2}{2}}$$

$$= \frac{1}{2} x^{-1/2}$$

$$= \frac{1}{2 x^{1/2}}$$

$$= \frac{1}{2\sqrt{x}}$$

MP*

$$x^n = \frac{1}{x^{-n}}$$

$$y = \frac{1}{x^2} = x^{-2}$$

$$\frac{dx^{-2}}{dx} = -2\,x^{-2-1}$$

$$= -2\,x^{-3}$$

$$\boxed{\frac{dy}{dx} = \frac{-2}{x^3}}$$

H/w

Revise all Graph

Solve assignment
Sanghesh array → 2
Solution upload

THANK YOU