YAKEEN NEET 2.0

2026

Basic Maths and Calculus (Mathematical Tools)

Physics | Lecture - 9

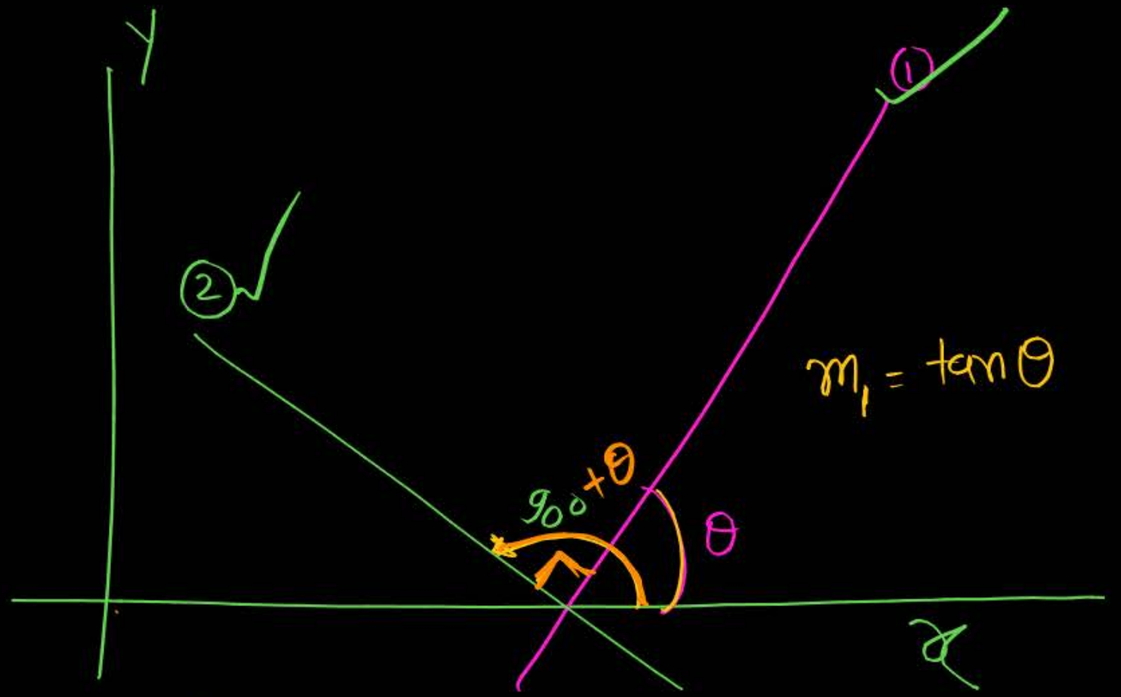
By- Manish Raj (MR Sir)

Topics to be covered

1. H/W
2. Parabola, ellipse, Circle.
3. Variation of slope
4.

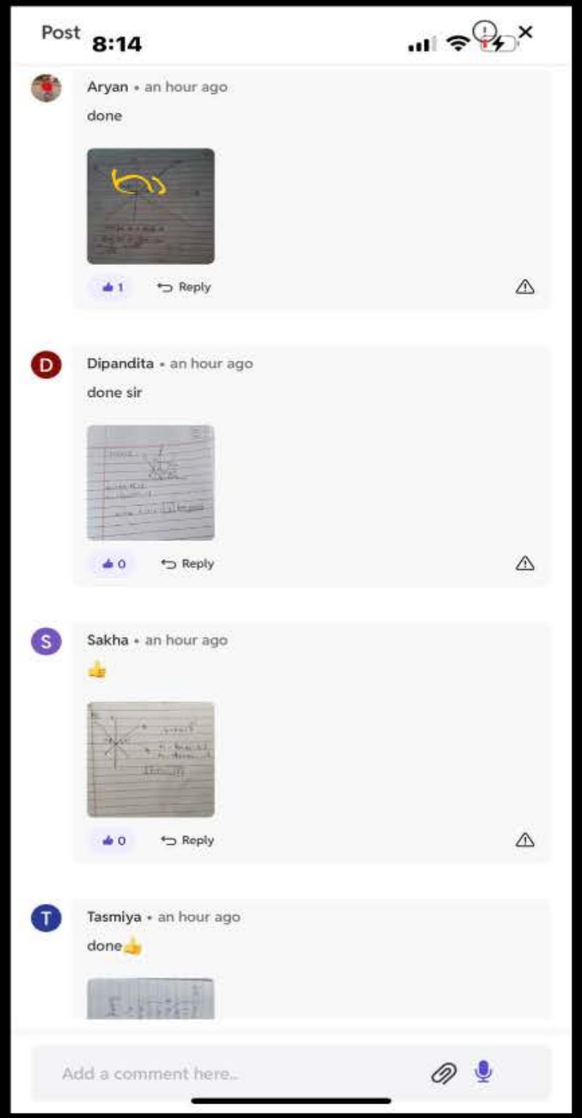
Not for all

(9) Two straight line perpendicular to each other then prove that Product of their slope is -1.



$$m_2 = \tan(90+\theta) = -\cot\theta$$

$$m_1 m_2 = \tan\theta \times (-\cot\theta) = -\frac{\sin\theta}{\cos\theta}\times\frac{\cos\theta}{\sin\theta} = -1$$

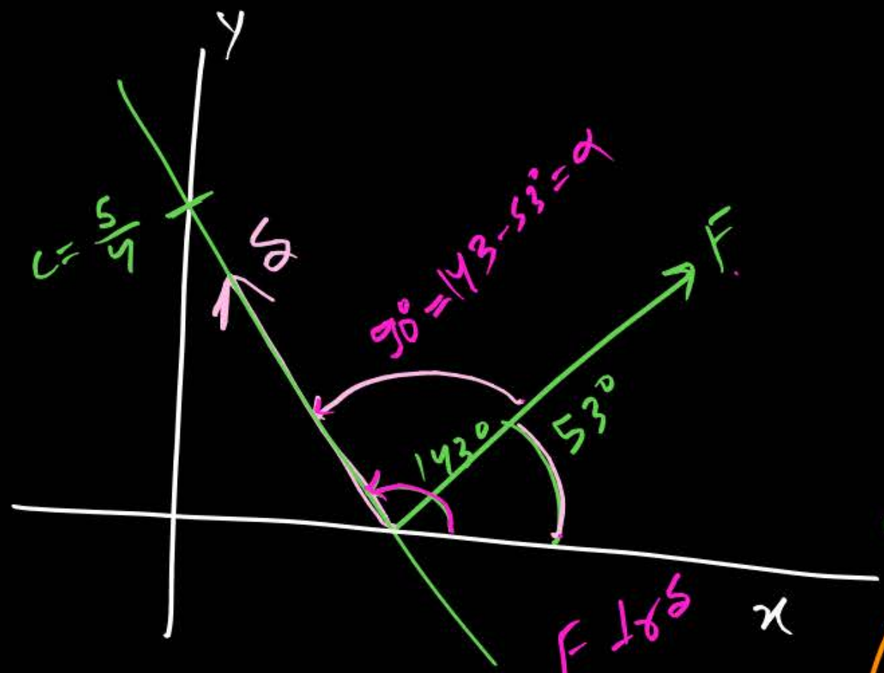


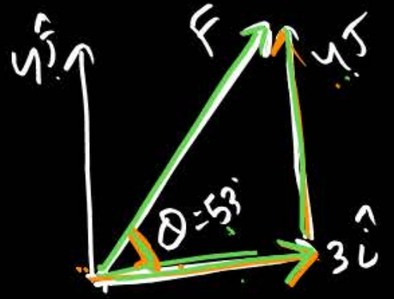

@MRPHYSICSS

(Q) Object is moving on the straight line of equation $4y + 3x = 5$ and force acting on it is $F = 3\hat{i} + 4\hat{j}$ then work done will be ?? (JEE)

hint: $W = \vec{F} \cdot \vec{S} = FS\cos\theta$

$\# \quad F = 3\hat{i} + 4\hat{j}$





$\tan\theta = \frac{4}{3}$

$\tan\theta = \frac{4}{3}$

$\rightarrow \quad 4y + 3x = 5$

$4y = -3x + 5$

$$y = -\frac{3}{4}x + \frac{5}{4} \quad \text{— (1)}$$

$m = -\frac{3}{4} = \tan\theta$

$\theta = 143°$

F ⊥ S

$W = 0$

2nd method

mR^*

$m_1 = -3/4$

$m_2 = 4/3$

$m_1 m_2 = -\frac{3}{4} \times \frac{4}{3} = -1$

→ Both are ⊥ to each other

F ⊥ S

$W = 0$ ✓

vale of $\sqrt{-4}$??

(a) +2

(b) −2

(c) +2 & −2 wrong

(d) None of thes.

Ans (d)

$\sqrt{-4}$ = not real value ✓

$y = (x)^2$

↳ y alway +ve whatever the value of x

$x = \sqrt{y}$ → y is alwa +ve

H/W

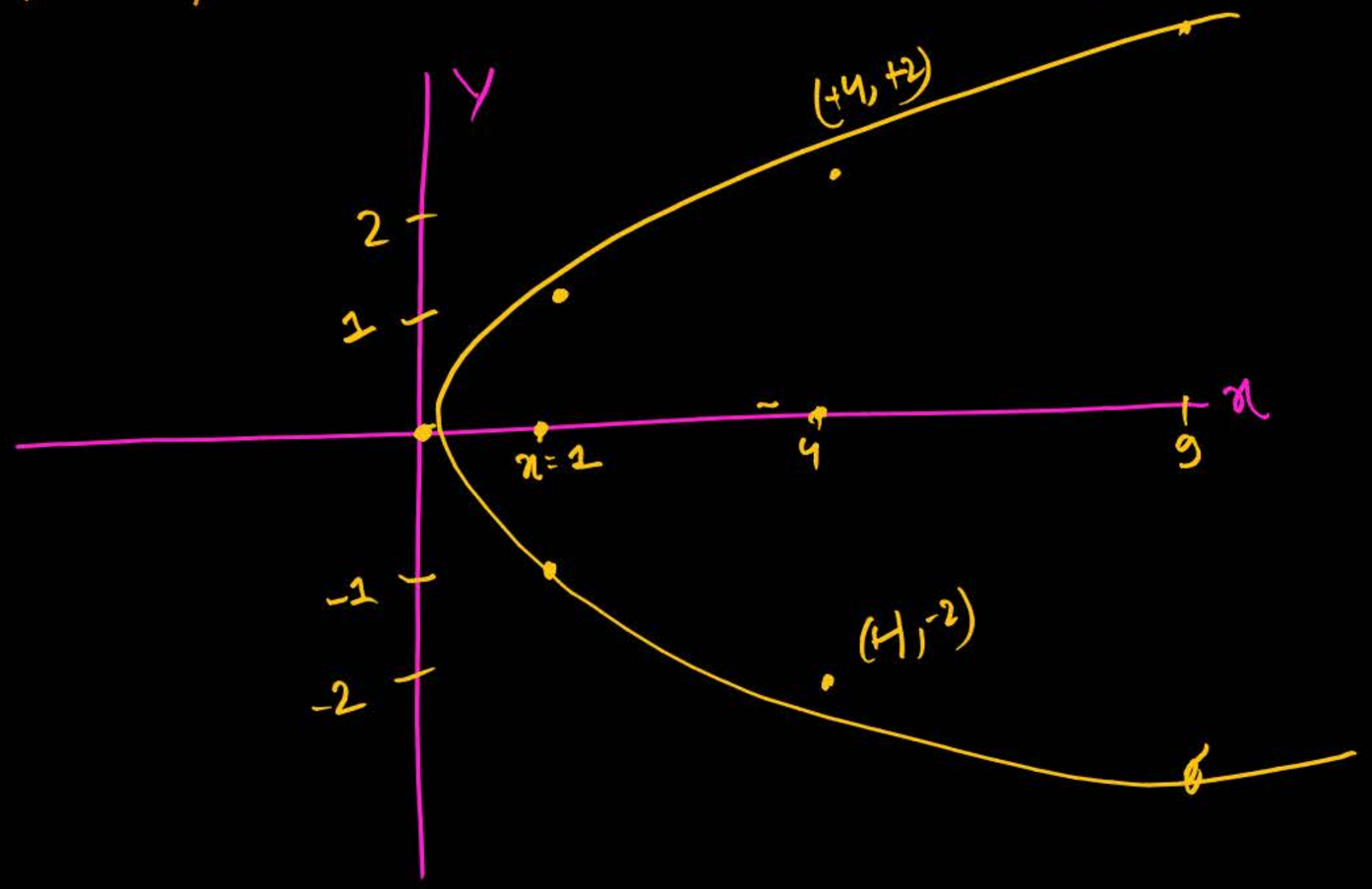
$y = \sqrt{x}$; Draw Graph B/w y & x

lateral Parabola

y	x
0	0
± 1	1
± 2	4
± 3	9
± 4	16
X	-4

$y = \sqrt{x}$

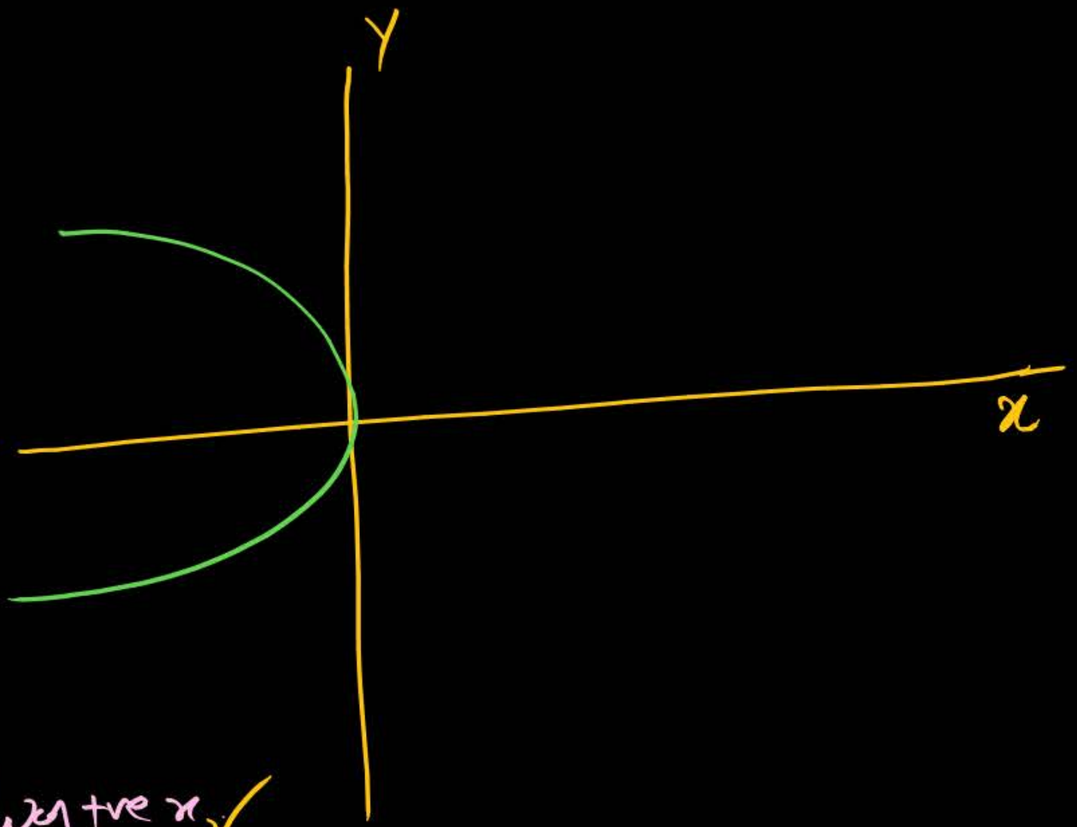
$\sqrt{4} = \pm 2$



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

graph (a) → Possible

(b) → Not Possible



$\sqrt{-4}$ ✗ $\sqrt{x}$ ← always +ve x ✓

$\sqrt{-2}$ ✗ $\sqrt{-x}$ ← always x is -ve

x → can't be +ve

$\sqrt{-(-2)} = \sqrt{2}$

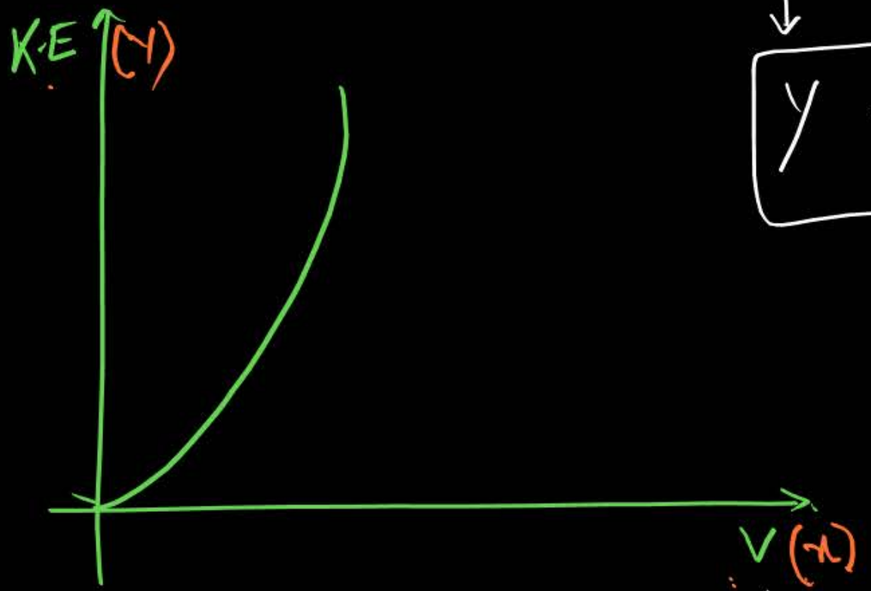
Ex $K.E = \frac{1}{2} m v^2$

$m = Cost^m$

K.E & V ka graph.

$K.E = \frac{1}{2} m v^2$

$y = k x^2$

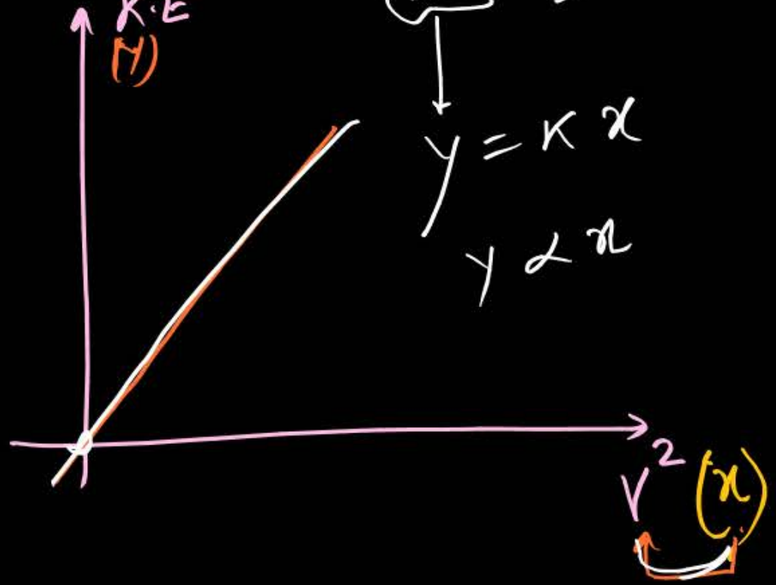


Draw Graph B/w K.E & (V^2)

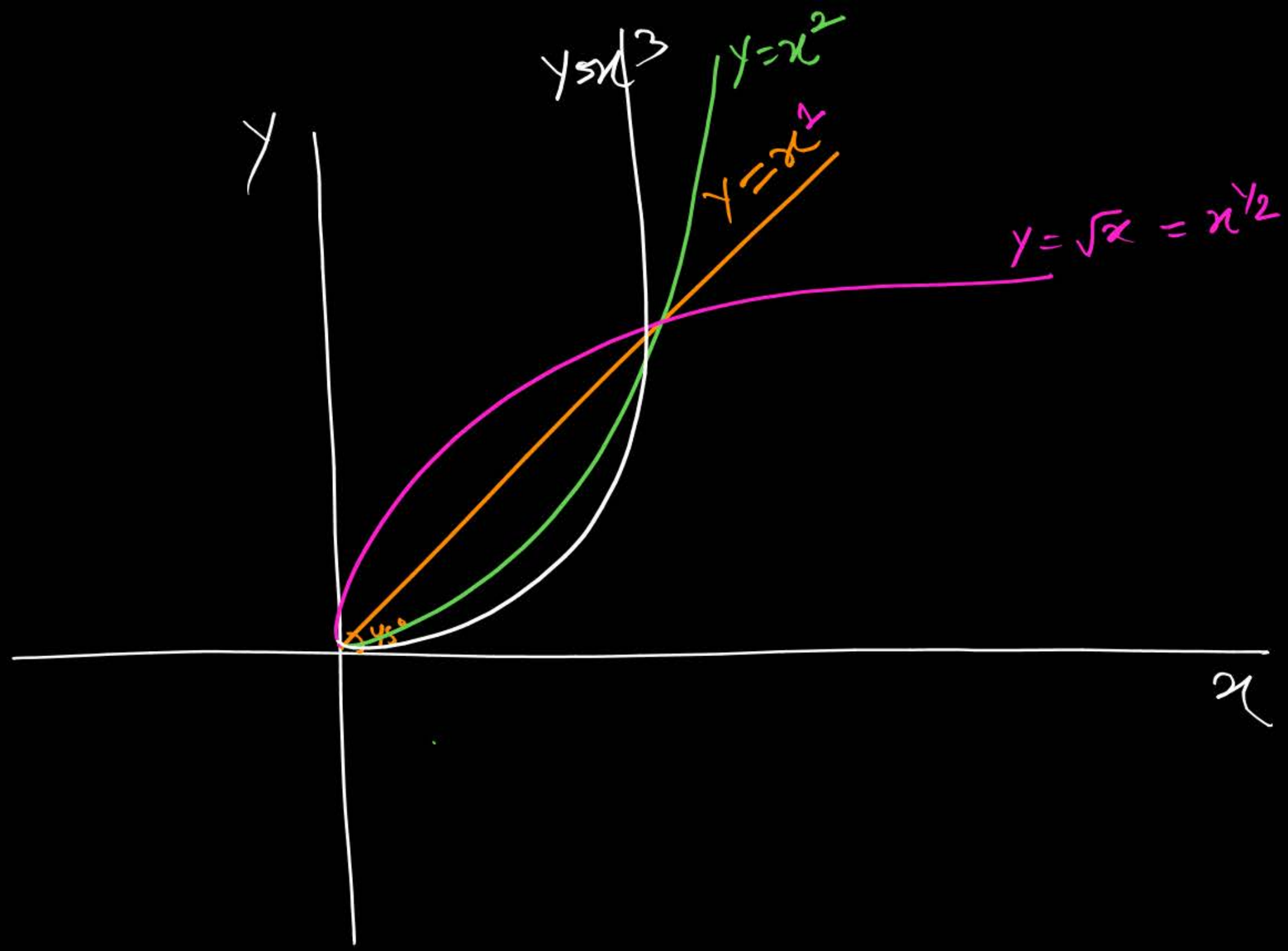
$K.E = \frac{1}{2} m v^2$

$y = k x$

$y \propto x$

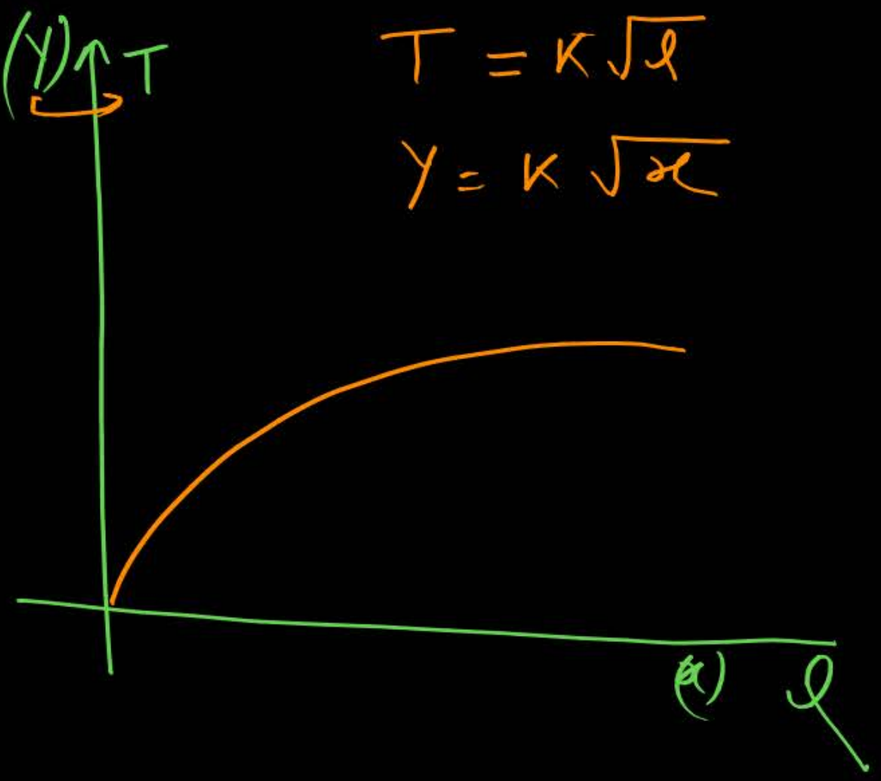


inR* Box → Jis physical quantity of x & y axis par aayega hai, usko formula me Y & X se Replace karega


y=x^3
y=x^2
y=x^1
y=√x = x^1/2
y
x
45°

We know $T = 2\pi\sqrt{\frac{l}{g}}$ ⟵ given.

(i) Draw graph b/w T & l.



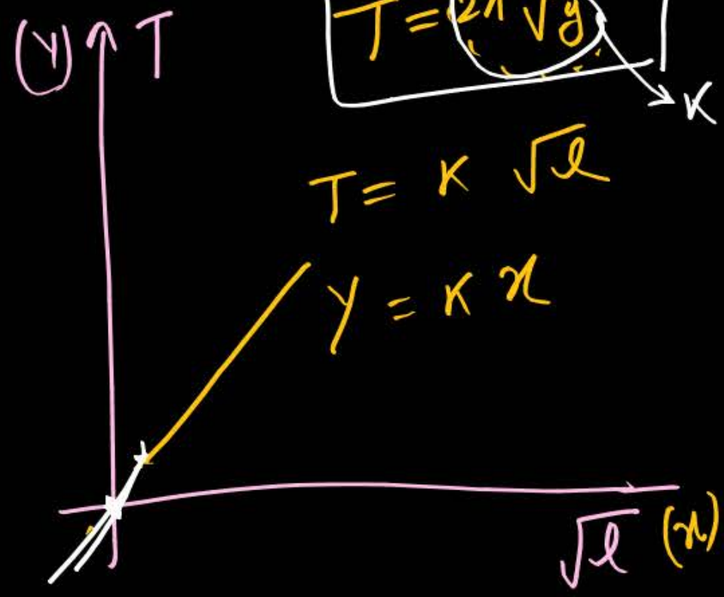
$T = K\sqrt{l}$

$Y = K\sqrt{x}$

(ii) Draw graph b/w T & $\sqrt{l}$

$T = 2\pi\sqrt{\frac{l}{g}}$

K



$T = K\sqrt{l}$

$Y = Kx$

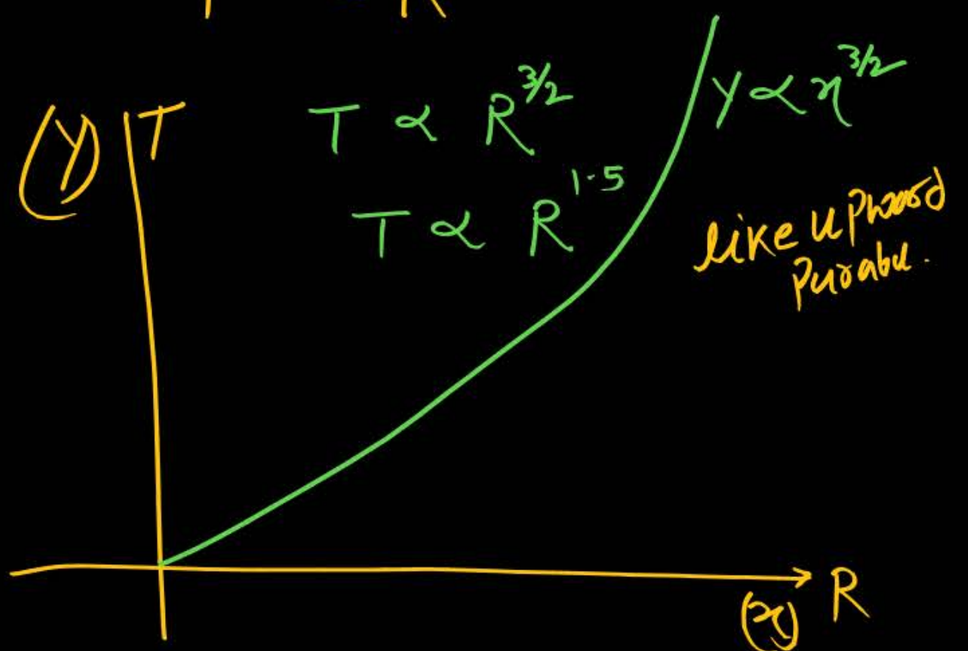
Keppler's Law :

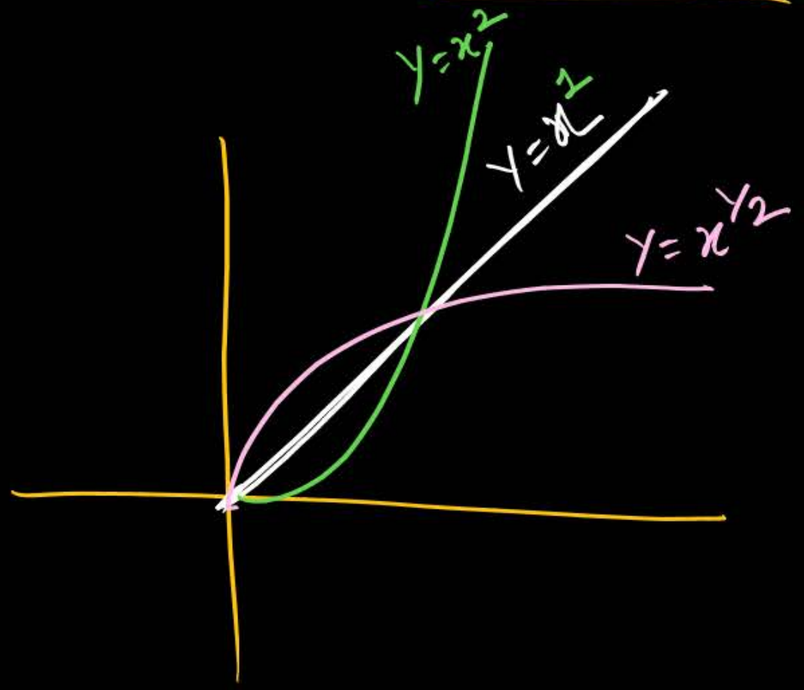
⇒ square of time period is propotional to cube of radius, $T^2 \propto R^3$ Draw Graph between 'T' and 'R'.

$T^2 \propto R^3$

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

$T \propto R^{1.5}$



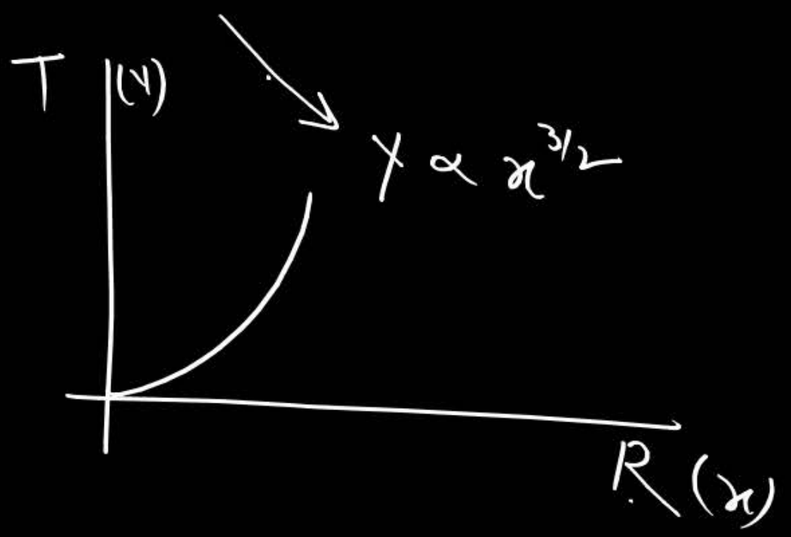


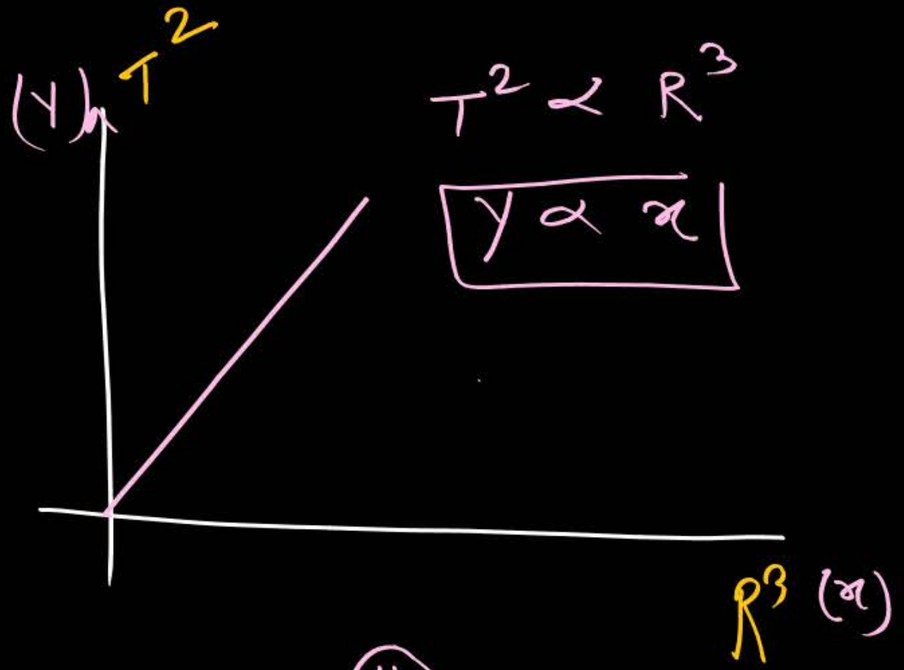
Keppler's Law :

→ square of time period is propotional to cube of radius, $T^2 \propto R^3$ Draw Graph between '$\frac{1}{T^2}$' and 'R^3'. (IIT)

* $\boxed{T^2 \propto R^3}$

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





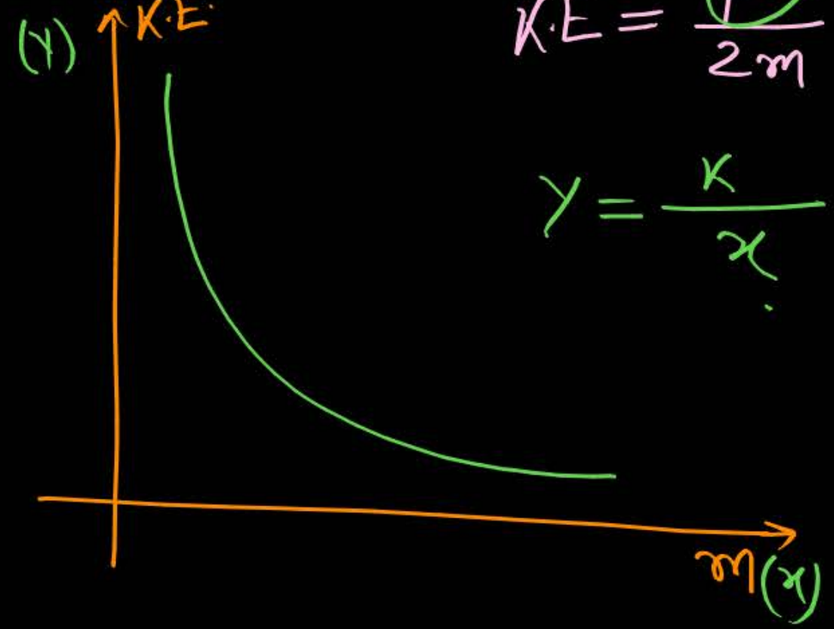
#

$$K.E = \frac{p^2}{2m}$$ ← given formula.

(1) Draw graph b/w K.E & m.

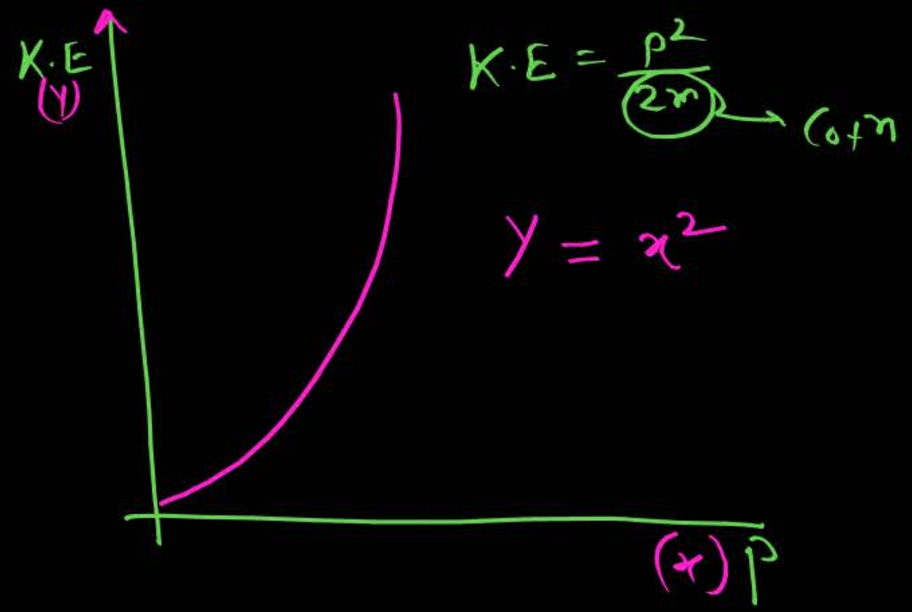
$$K.E = \frac{p^2}{2m}$$ → (of m)

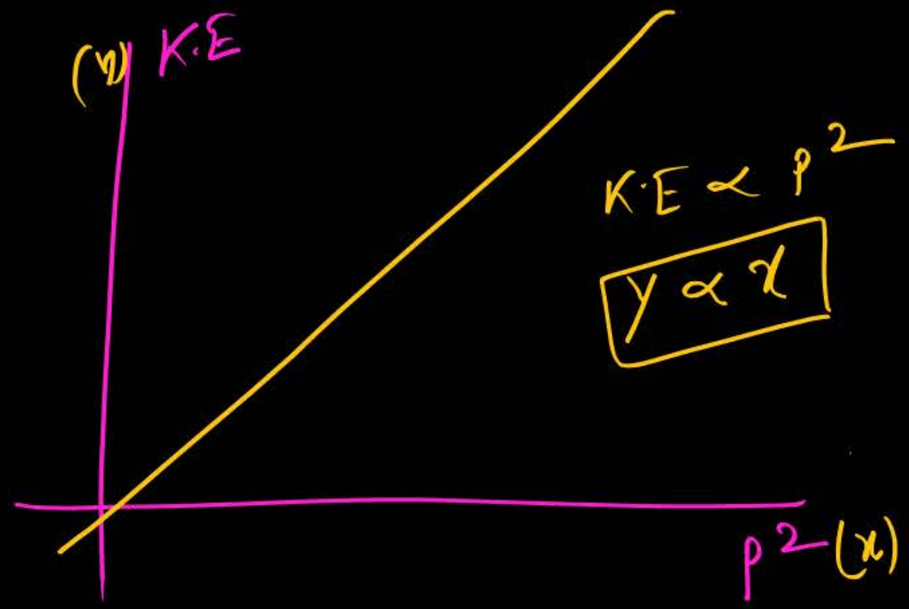
$$y = \frac{k}{x}$$



$$K.E = \frac{p^2}{2m}$$ ← given formula.

① Draw graph B/w K.E & P





Quadratic equation.

Where a, b & c are constantant

$$ax^2 + bx + c = 0$$

x → varible value (x have two value for this quadratic equation)

Class-10th

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2 \times a}$$

$$x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Sum of roots

$$x_1 + x_2 = -\frac{b}{2a} - \frac{b}{2a}$$

$$= \frac{-2b}{2a} = -\frac{b}{a}$$

$$x_1 \cdot x_2 = \frac{c}{a}$$

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

Sol^n $ax^2 + bx + c = 0$

$a = 1 \quad b = -5 \quad c = 6$

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

$$= \frac{-(-5) \pm \sqrt{25 - 4 \times 1 \times 6}}{2 \times 1}$$

$$= \frac{+5 \pm \sqrt{1}}{2} = \frac{5 \pm 1}{2}$$

$\frac{6}{2} = 3$

$\frac{4}{2} = 2$

Sum of root $= -\frac{b}{a}$

$= -\left(\frac{-5}{1}\right) = +5$

Sum of root $x_1 + x_2 = 3 + 2 = 5$

Product of root $x_1 x_2 = \frac{c}{a}$

$= \frac{6}{1}$

$= 6$

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

2nd method

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

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

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

$x-3=0 \quad x-2=0$

$x=3 \quad x=2$

find root of the equation

(i) $x^2 + 7x + 12 = 0$

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

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

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

$x = -4$

$x = -3$

(ii) $x^2 - 4x = 0$

$x \cdot x = 4x$

$x = 4$ ← wrong.

$x^2 - 4x = 0$

$x(x-4) = 0$

$x = 0$ ✓

$x - 4 = 0$

$x = 4$ ✓

$y = x^2 - 4x - 12$

Draw graph b/w y and x.

$y = x^2 - 4x - 12$

y intercept = value of y when x is zero.

$y_0 = -12$

x - intercept = value of x when y is zero

$x^2 - 4x - 12 = 0$

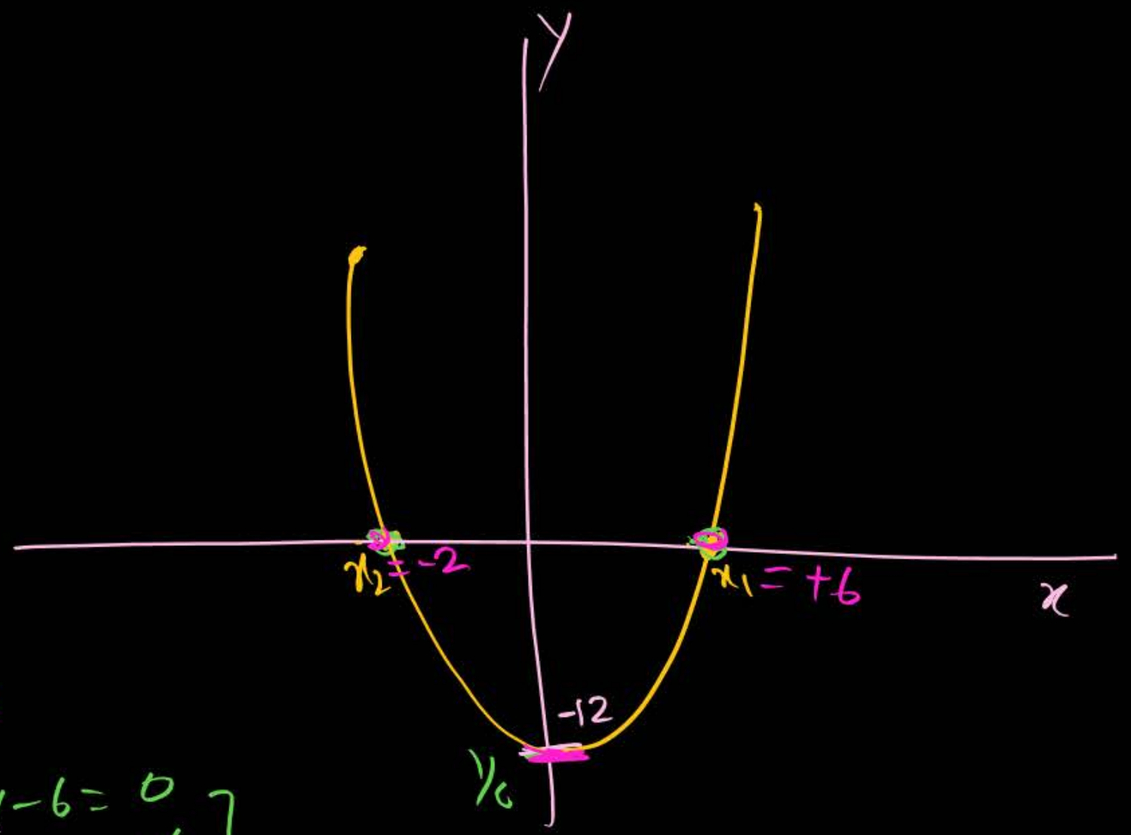
$x^2 - 6x + 2x - 12 = 0$

$x(x-6) + 2(x-6) = 0$

$x - 6 = 0$

$x_1 = +6$

$x_2 = -2$



$$y = x^2 - 4$$

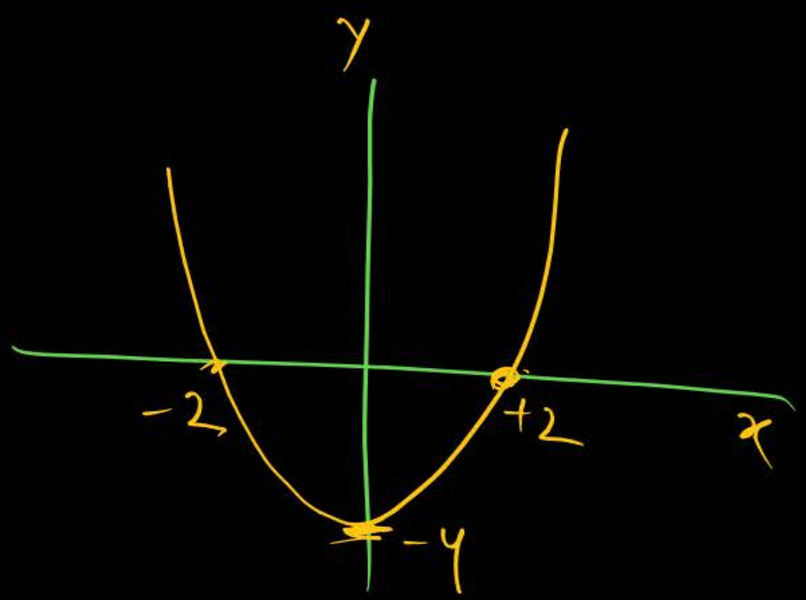
y intercept $(x=0) = -4$ ✓

x intercept $(y=0) = x^2 - 4 = 0$

$$x^2 = 4$$

$$x = \sqrt{4}$$

$$x = \pm 2$$



(#)

$$y = x^2 + 4$$

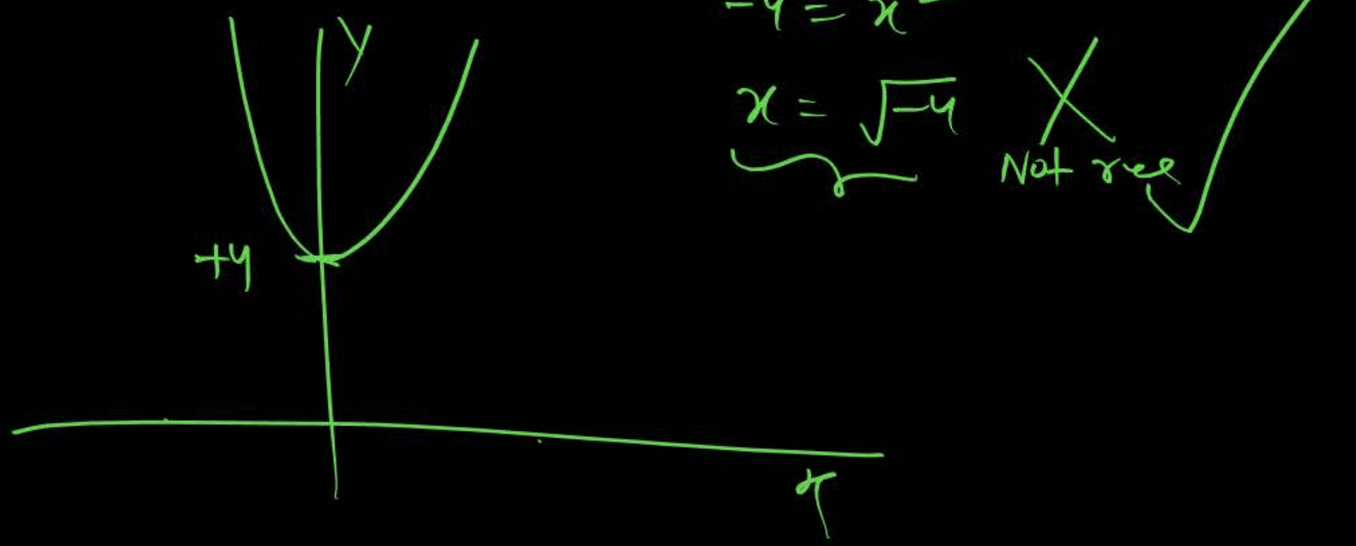
Draw graph.

y Interpt $(x=0) = +4$

x intercep $(y=0)$ $\quad 0 = x^2 + 4$

$-4 = x^2$

$x = \sqrt{-4}$ ✗ Not real



Equation of circle $\rightleftharpoons$ distance formula.

$$R = \sqrt{(x-x_0)^2+(y-y_0)^2}$$

$$\boxed{R^2 = (x-x_0)^2+(y-y_0)^2}$$ → eqn of circle

centre (x_0, y_0)

R = Radius

If centre at origine $(x_0, y_0) = (0,0)$

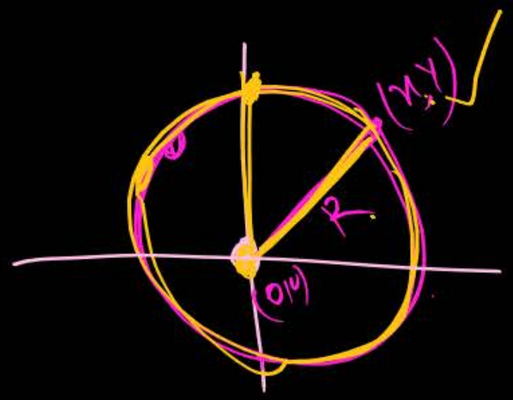
$$R = \sqrt{x^2+y^2}$$

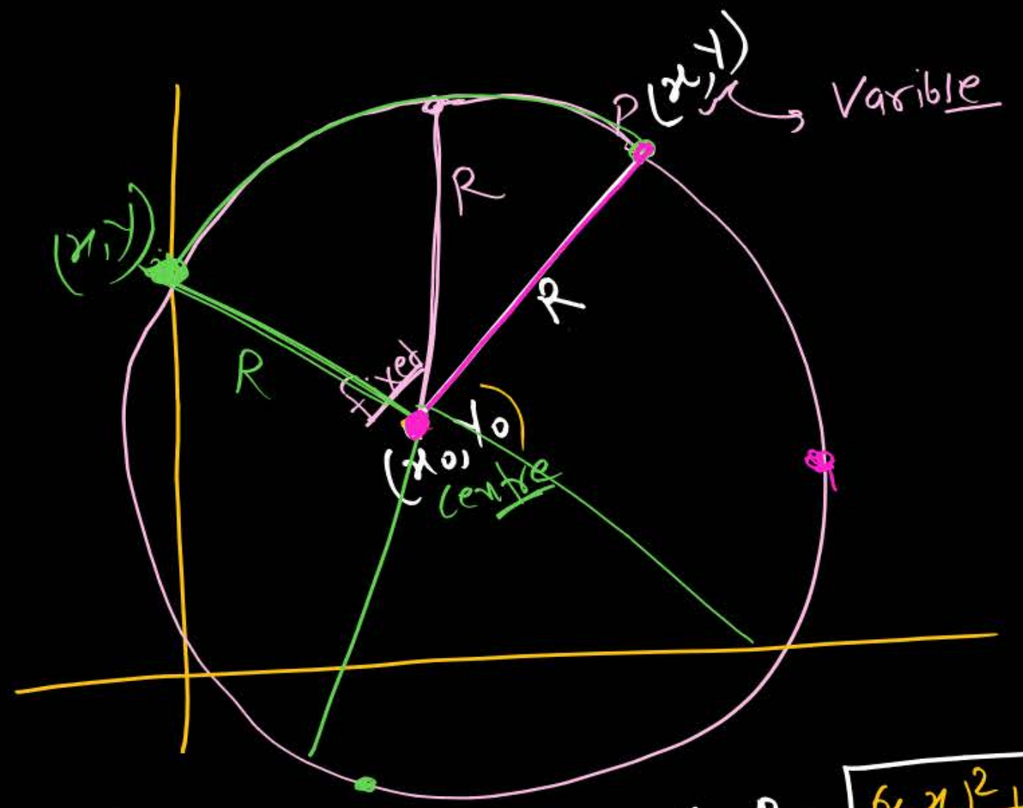
$$\# \boxed{R^2 = x^2+y^2}$$

→ equation of circle

R = Radius

centre at origin.





dist^n = $R = \sqrt{(x-x_0)^2+(y-y_0)^2}$

Question

$(x-4)^2+(y-3)^2=25$. Find radial and centre of circle.

eqn of circle = distance formula.

$$R=\sqrt{(x-x_0)^2+(Y-Y_0)^2}$$

$$R^2=(x-x_0)^2+(Y-Y_0)^2$$

centre

$x_0=4$

$Y_0=3$

$R^2=25$

$\#\ R=5m$

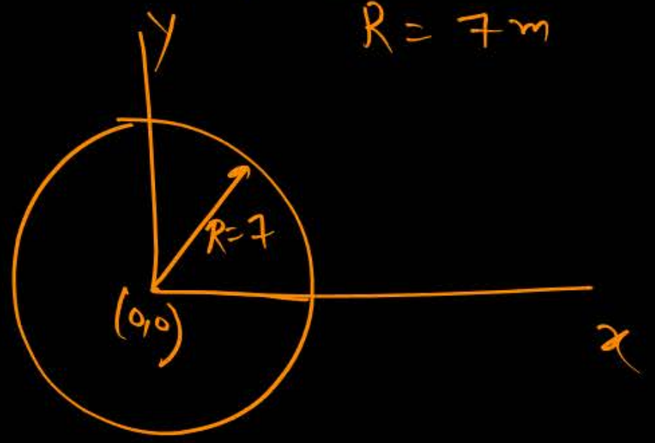
gf $x^2+y^2=49$

Draw graph B/w x & y

Soln $x^2+y^2=7^2$

↳ centre $=(0,0)$

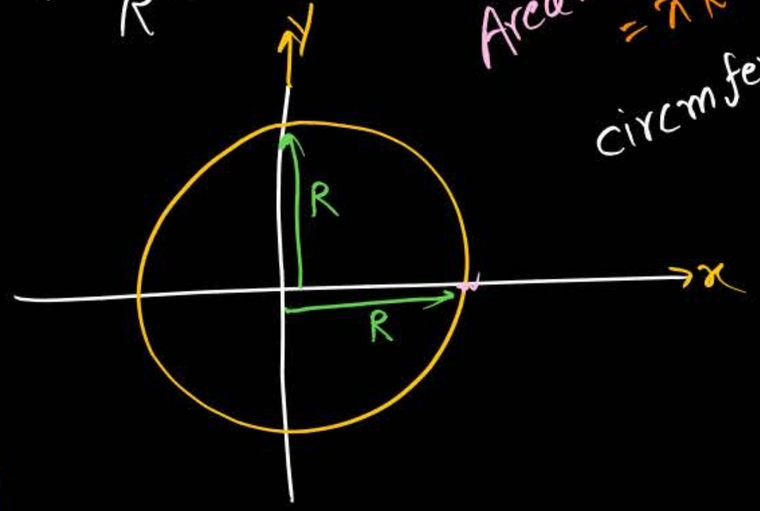
$R=7m$



- # $y=mx+c$ → straight line
- # $y=x^2+c$ ← Parabol.
- # $y=\sqrt{x}$ → lateral Parm
- # $y=\frac{1}{x}$ → Rectangular hyperbola.
- # $x^2+y^2=R^2$ → circle.

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

Equation of circle $\frac{x^2}{R^2} + \frac{y^2}{R^2} = 1$

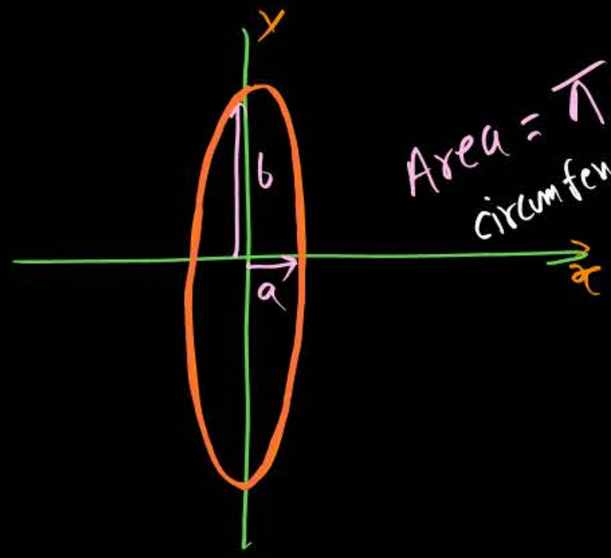


Area $= \pi(R \times R) = \pi R^2$

circumference $= 2\pi R = \pi(R+R)$

सरल circle → ellipse

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



Area $= \pi ab$

circumfen $= \pi(a+b)$

→ If $a = b = R$

circle

ellipse → elliptical Graph

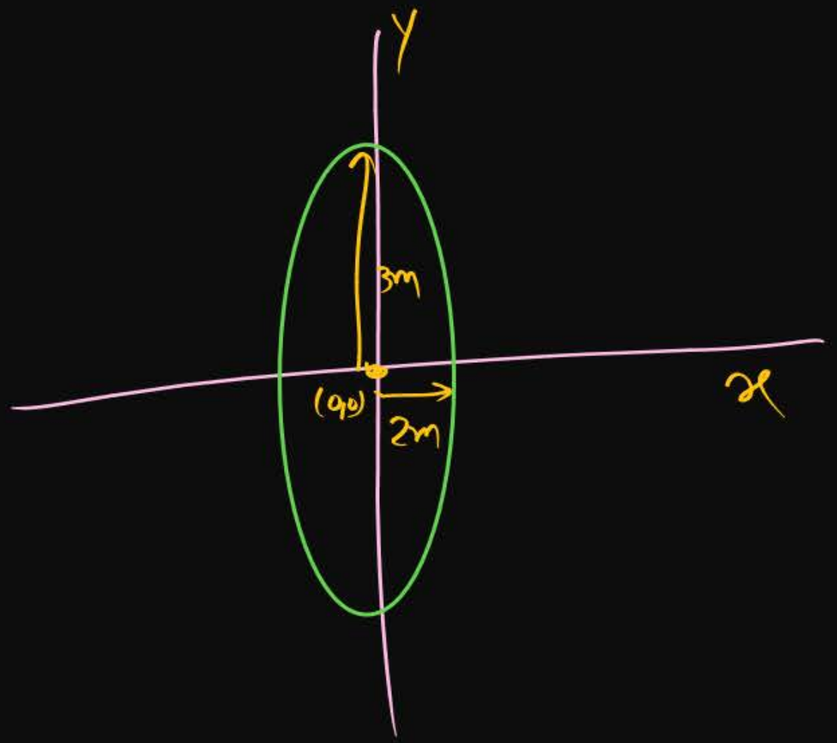
Question

$$\frac{x^2}{4}+\frac{y^2}{9}=1$$

ellispse

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

Draw graph between x and y



Relation B/w Velocity & Position of oscillating Particle.

given in question → $\{ V = \omega\sqrt{A^2 - x^2} \}$ $\omega, A \rightarrow$ Const^n

Draw graph B/w 'V' & 'x'

Soln

$$\frac{V}{\omega} = \sqrt{A^2 - x^2}$$

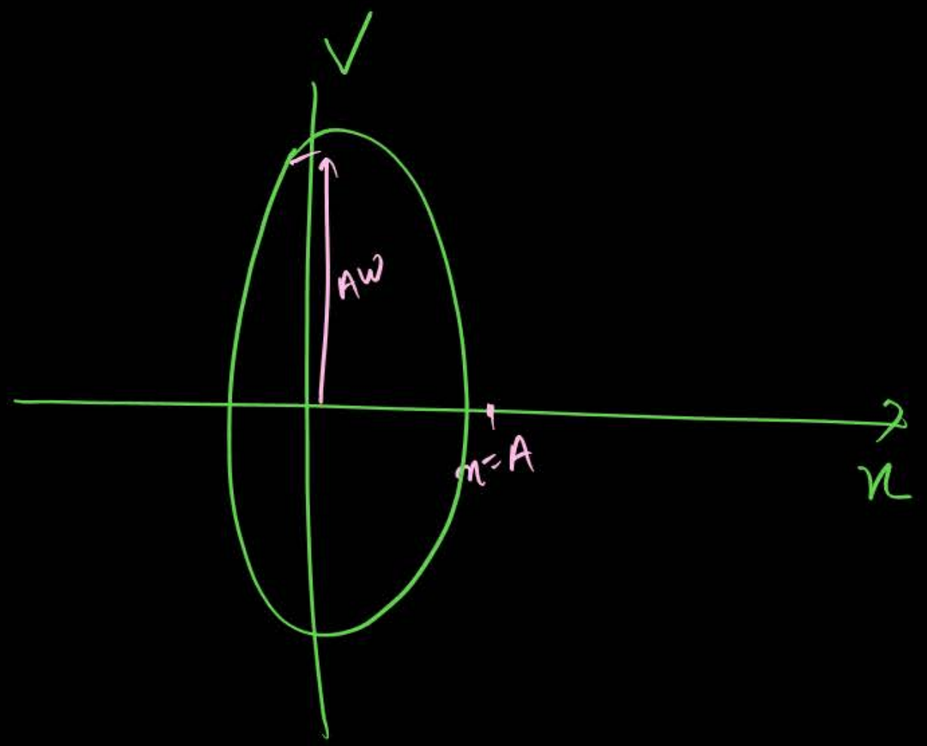
Square both side.

$$\frac{V^2}{\omega^2} = A^2 - x^2$$

$$\frac{V^2}{\omega^2} + x^2 = A^2$$

divided by A^2 both side

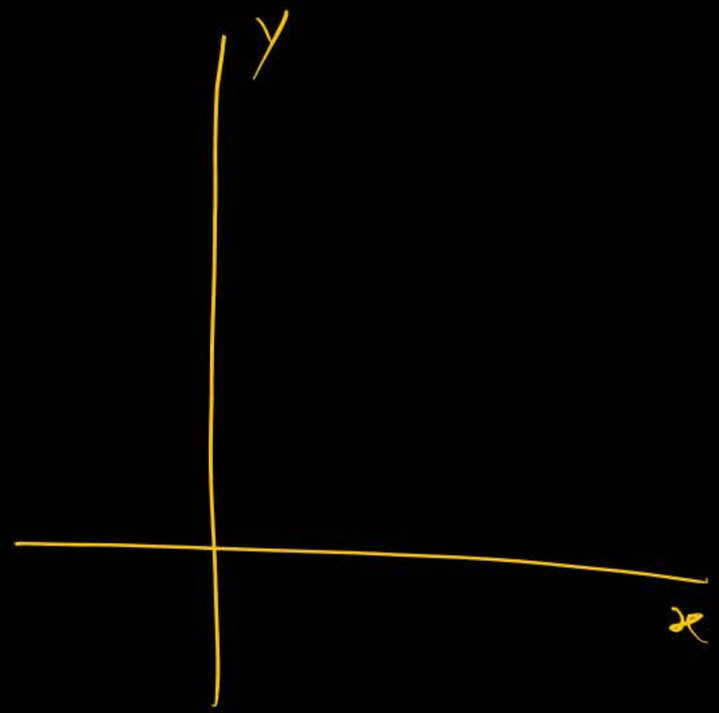
$$\boxed{\frac{V^2}{A^2\omega^2} + \frac{x^2}{A^2} = 1}$$



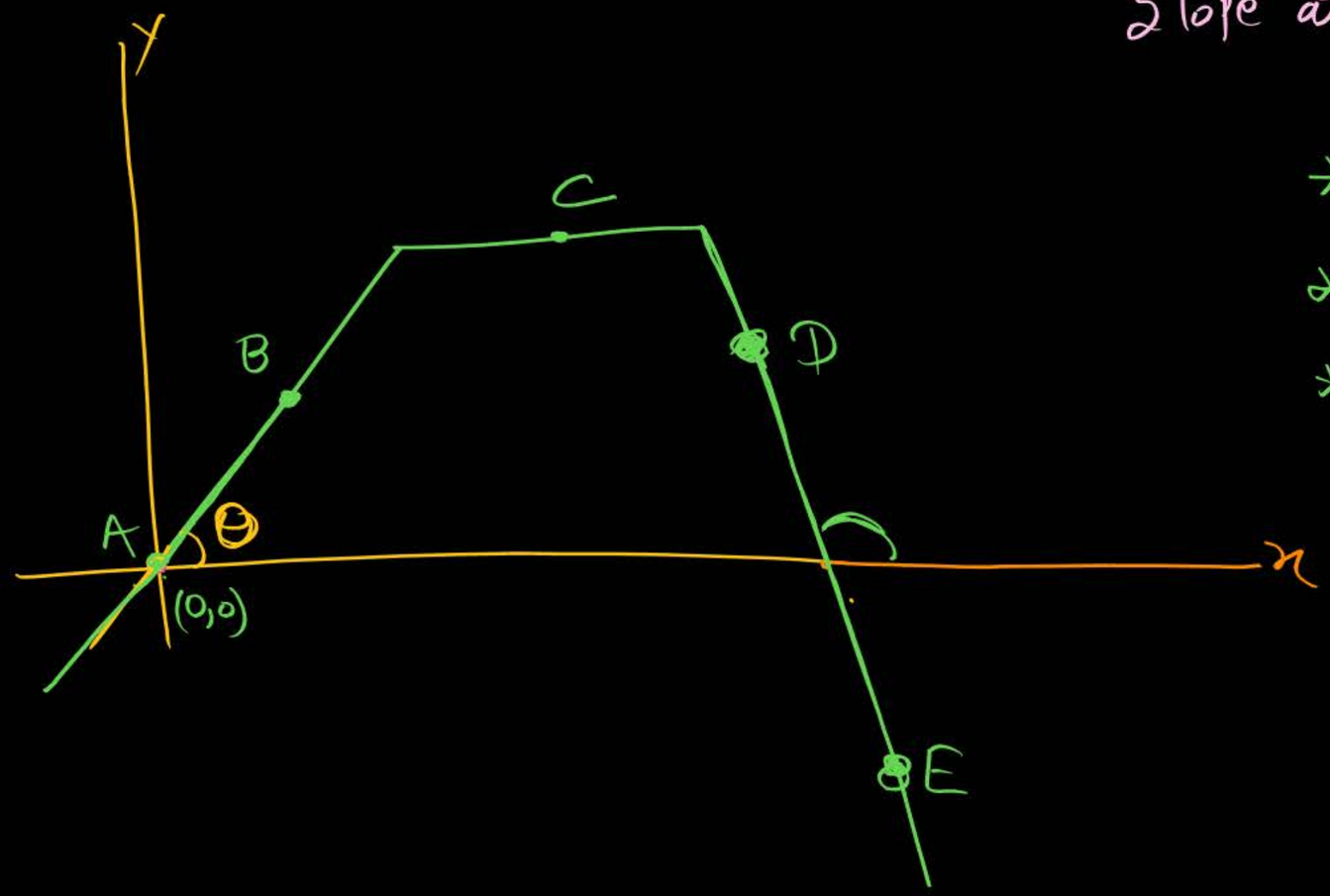
H/W → Kosis Karna

$$y = e^x$$

y	x
	0
	1
	2
	-1
	-2



Discussion on slope



Slope at Point A at origin (0,0) = $\tan\theta$ = +ve non-zero

* $m_A = m_B$ = +ve
* $m_C = 0$
* m_D = -ve = m_E

Slope matlab x ya y ki value nahi hai.

Slope of Curved

Chhoo-Kar Mere ~~Man~~ Tan Ko, Kiya Tune Kya Ishara
(Tangent draw)

→ Slope Ka ishara.

A → B → C

Slope ↑

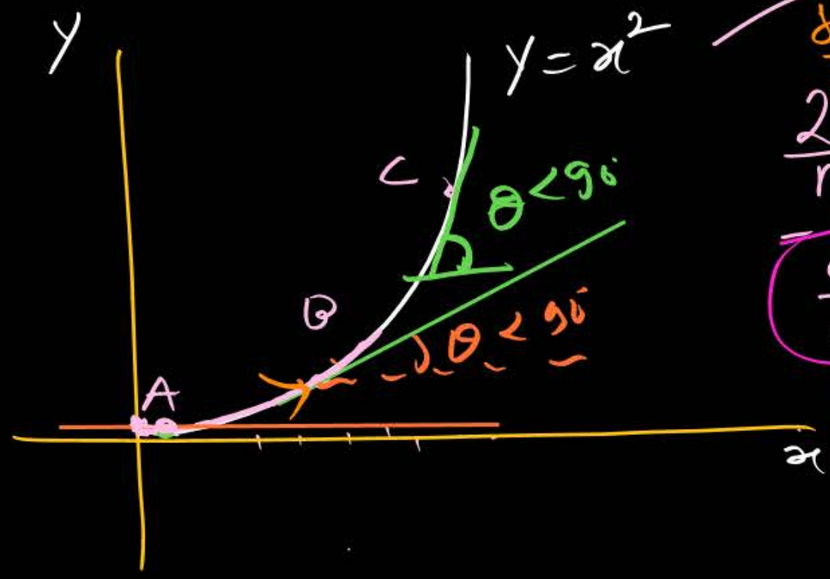
(Magnitude) ↑

m_A = zero

m_B = +ve (कम)

m_C = +ve

$m_C > m_B$



differentiation

2nd method

mRT feel.

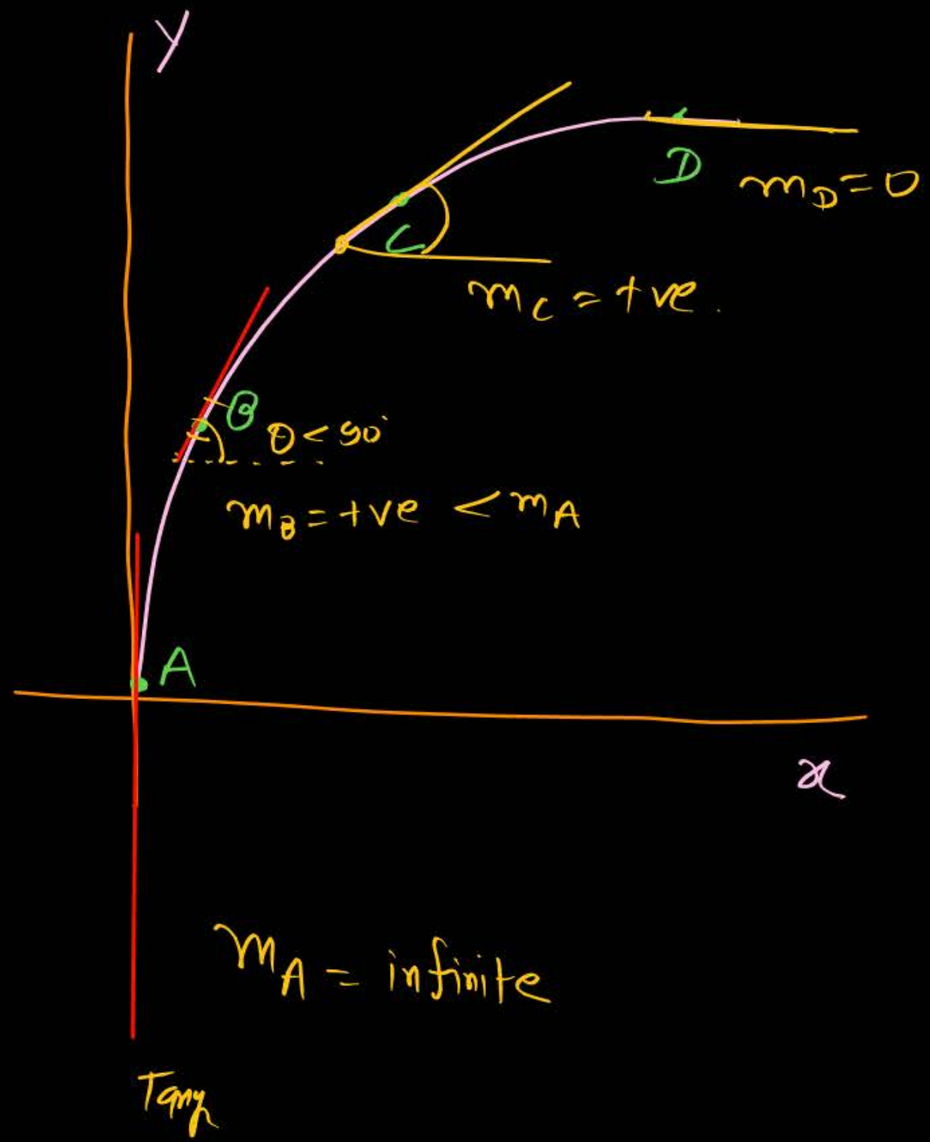
$\frac{dy}{dx}$ = slope = 2x

(Slope) = 2 × 0

orign = 0

#

(#)



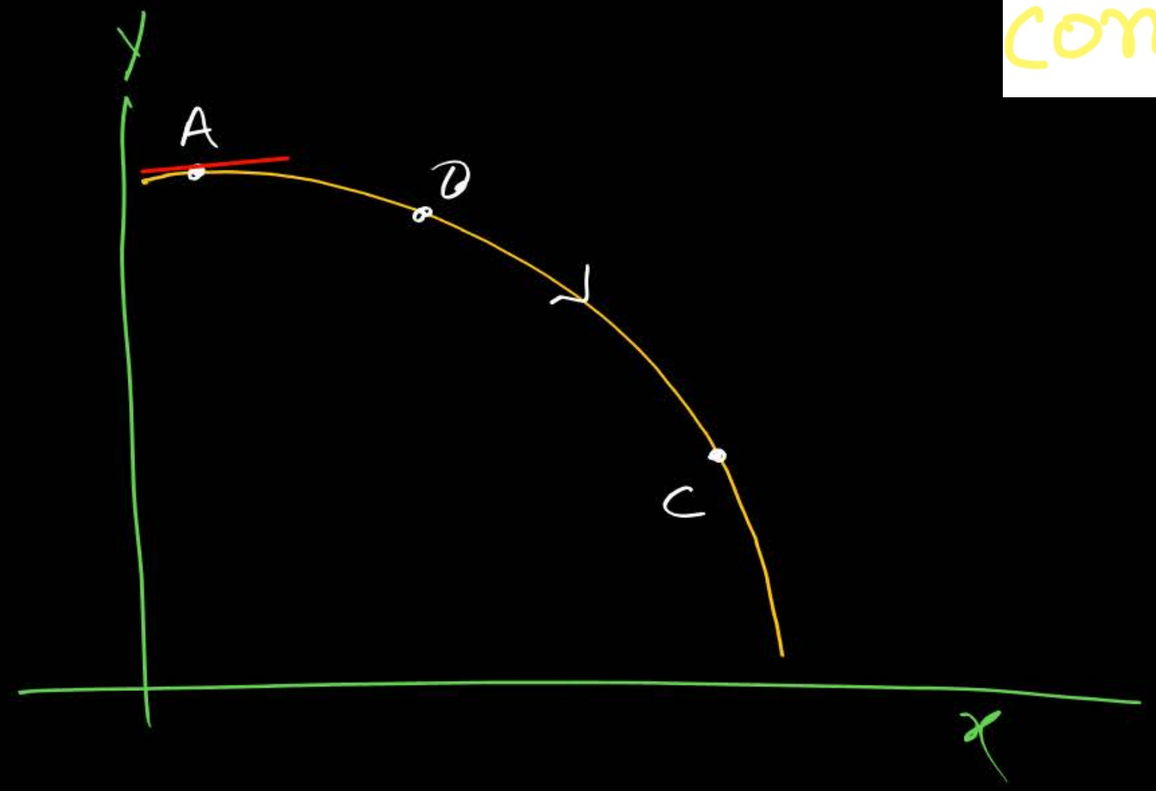
$m_D = 0$

$m_A > m_B > m_C$

Slope +ve & decreas

magnitude of Slope → decreasing

compair slope at a, b & c

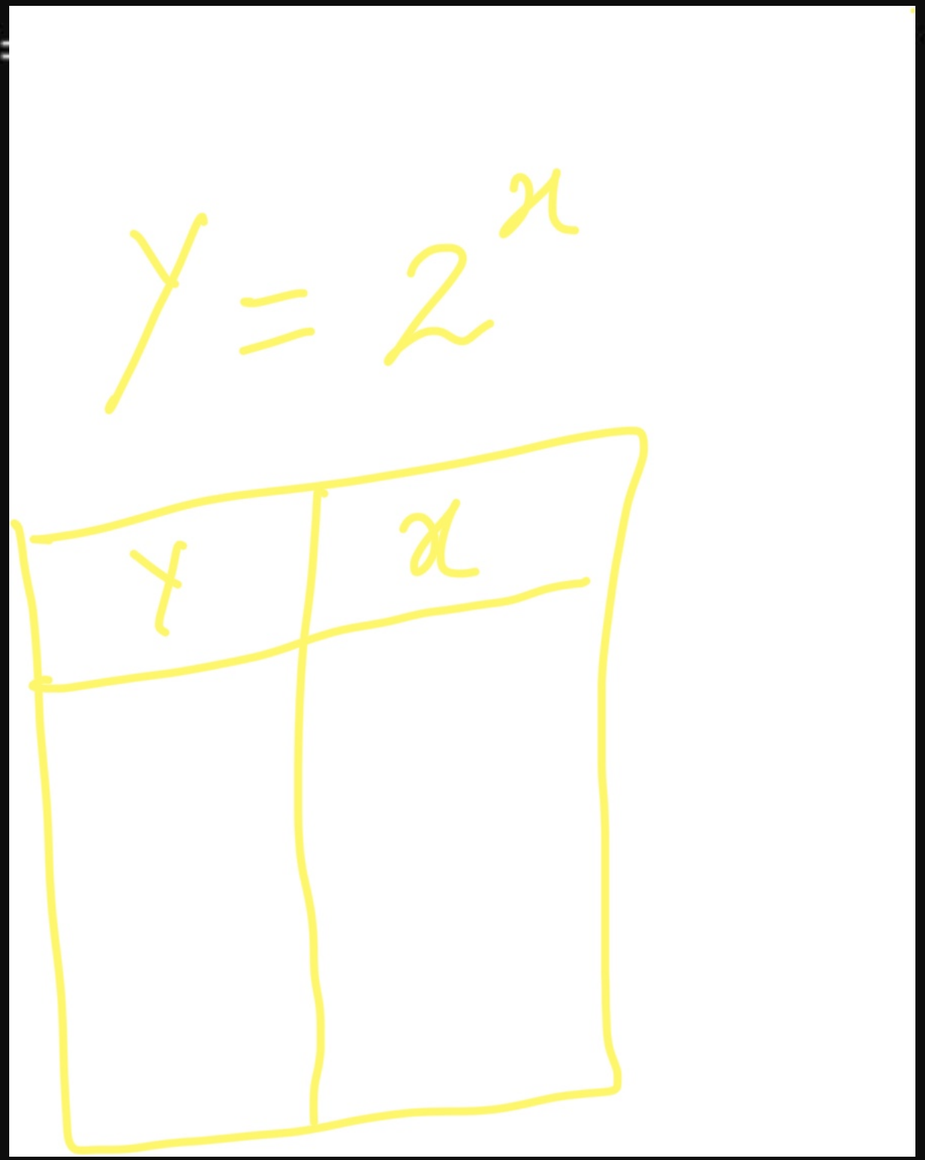


4/w.

$m_A =$

Question

If $y =$

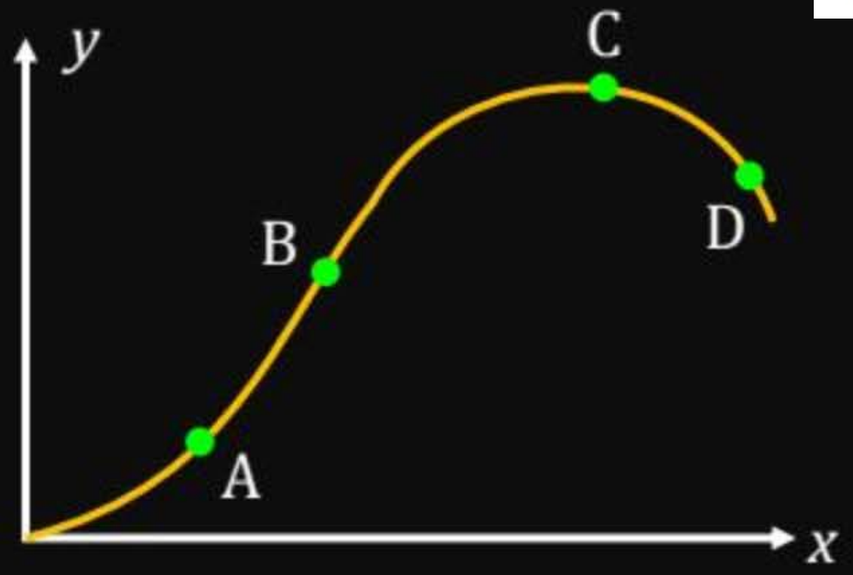


π/2

Question

Match the matrix:

Point	Slope
A	Zero
B	negative
C	Maximum
D	Positive



gf $T = 2\pi\sqrt{l/g}$ Draw graph b/w

(i) T & g

(ii) T & $\left(\frac{1}{\sqrt{g}}\right)$

$T = \frac{1}{f}$ Draw Graph b/w T and f

& T and $\frac{1}{f}$

THANK YOU