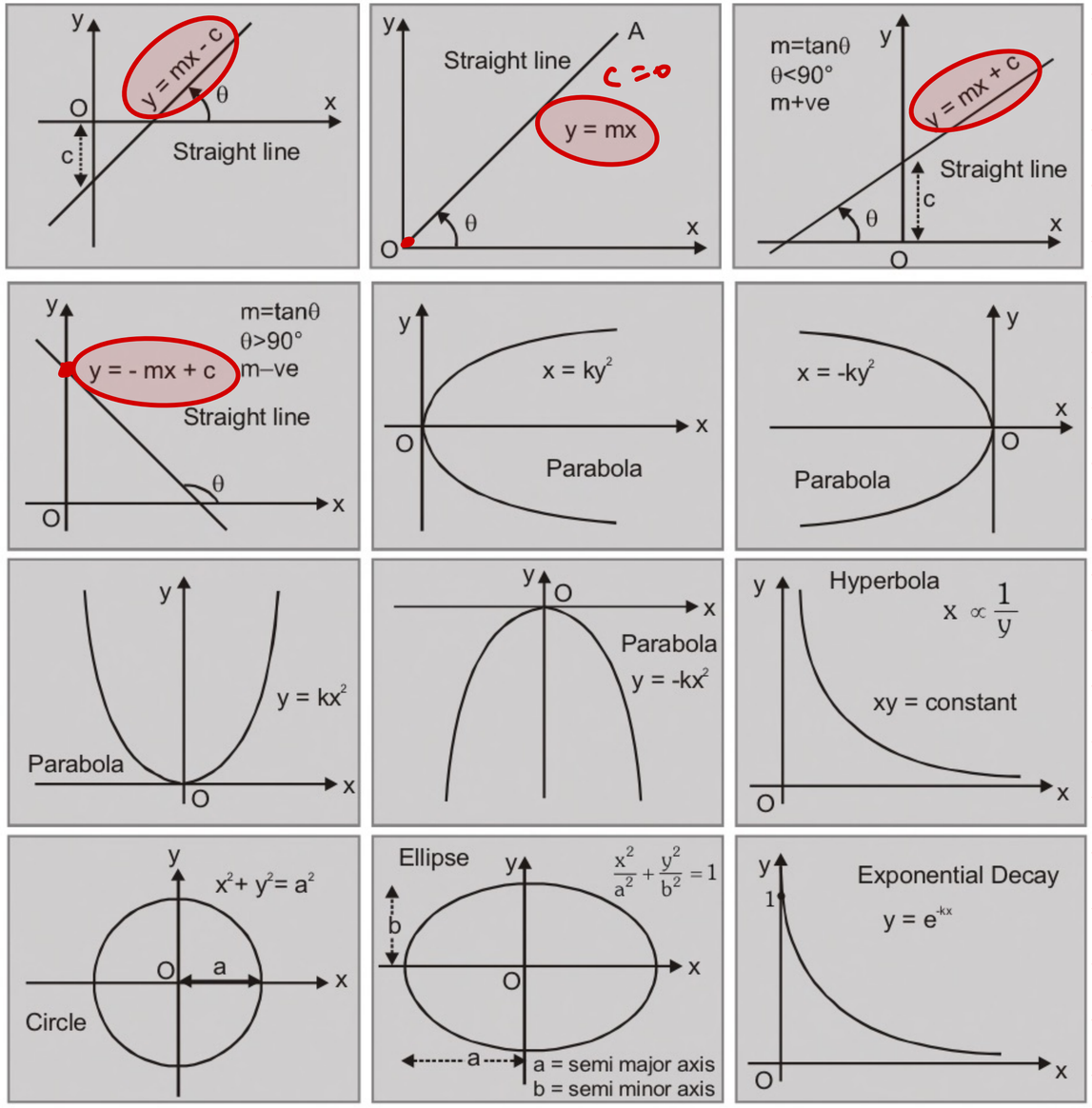
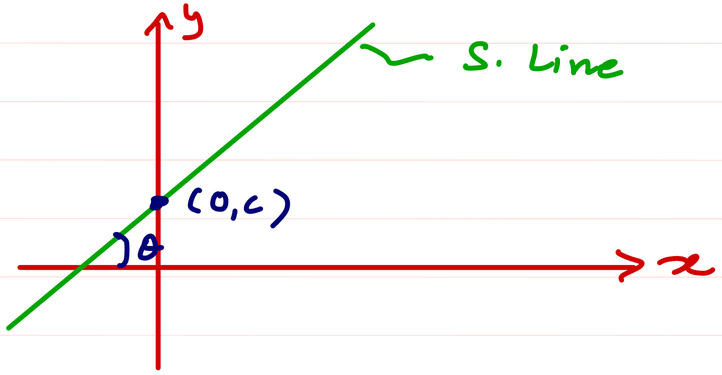
SOME STANDARD GRAPHS AND THEIR EQUATIONS



Straight line



$y = mx + c$

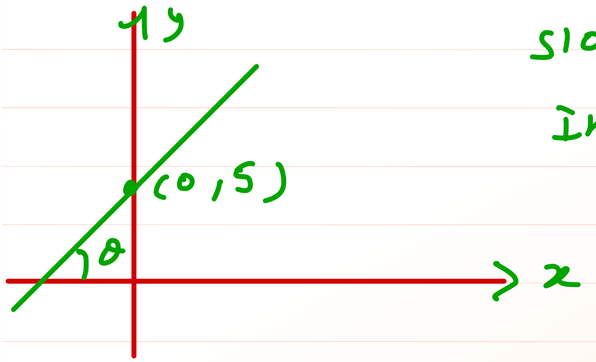
m = slope of S. Line

$m = \tan\theta = \frac{dy}{dx}$

c = Intercept at y-axis

θ = always from +ve x-axis

Ex Draw $y = 2x + 5$



slope = 2 = $\tan\theta \Rightarrow \theta = \tan^{-1}(2)$

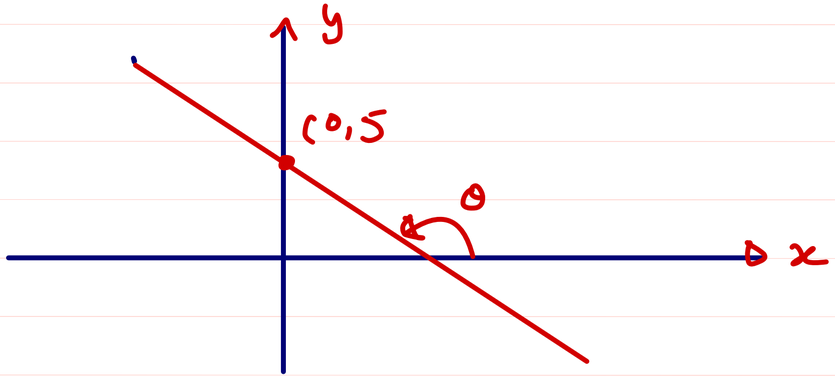
Intercept = 5

Ex $y = -2x + 5$

Slope $= m = \tan\theta = -2$

$\theta = \tan^{-1}(-2)$

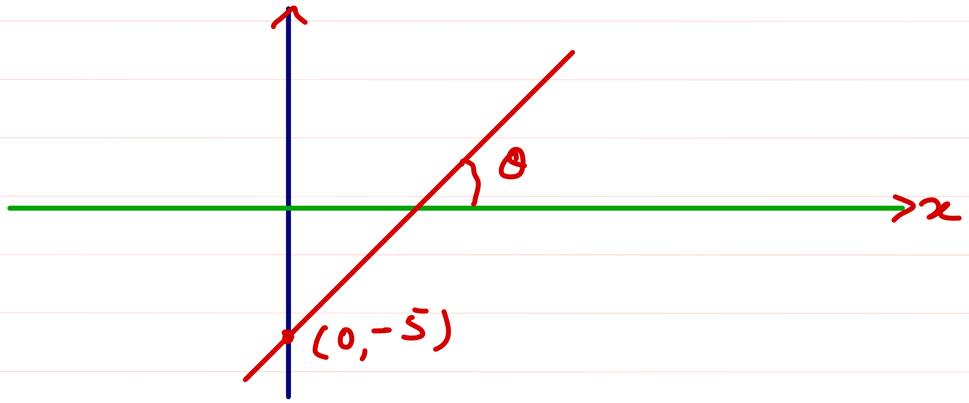
Intercept $= 5$



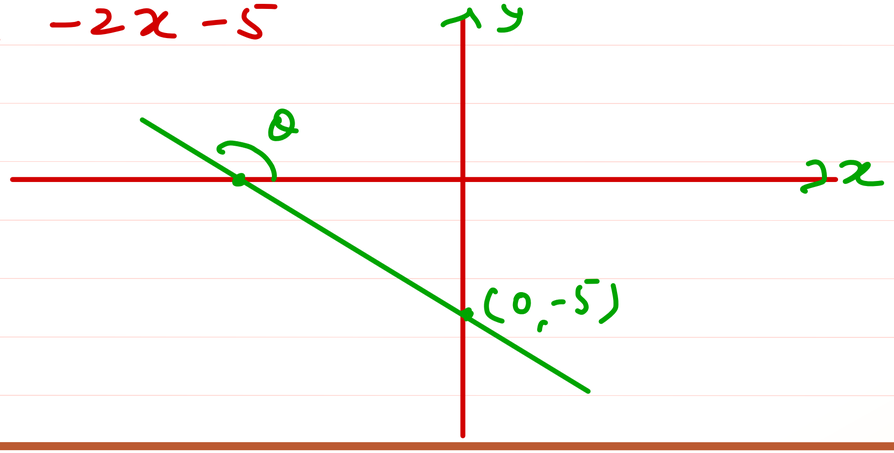
Ex $y = 2x - 5$

Slope $= m = \tan\theta = 2 \Rightarrow \theta = \tan^{-1}(2)$

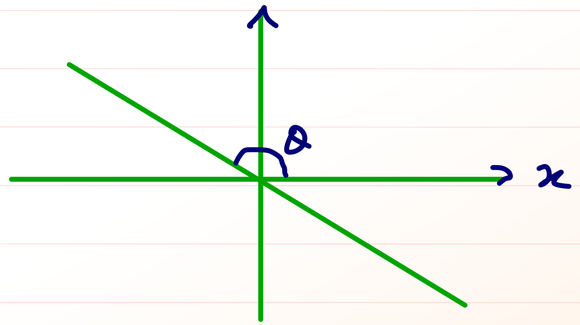
Intercept $= -5$



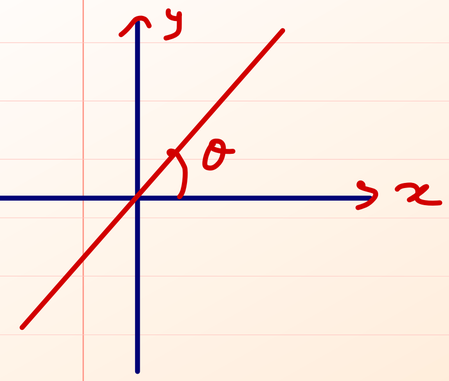
Ex $y = -2x - 5$



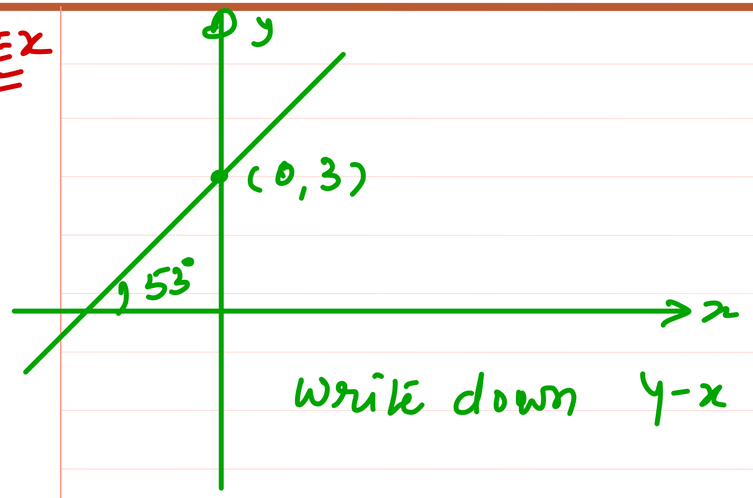
Ex $y = -2x$



Ex $y = +2x$



Ex



Write down y-x Relⁿ

$y = mx + c$

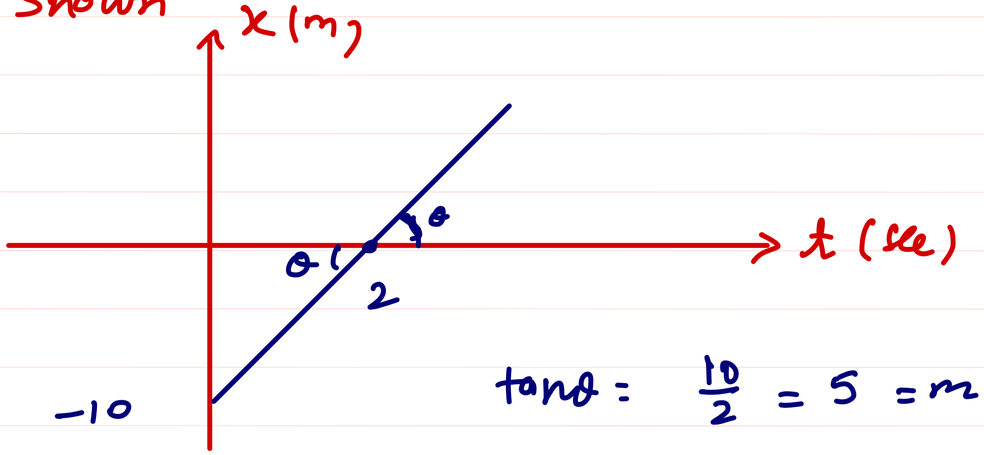
$m = \tan(53°) = 4/3$

$c = 3$

$y = \frac{4x}{3} + 3$

$\boxed{3y = 4x + 9}$ Ans

Ex Position - time Relⁿ of particle moving along x-axis as shown



Find (i) x - t Relⁿ

(ii) velocity at t = 2sec

$\tan\theta = \frac{10}{2} = 5 = m = \frac{dx}{dt} = v$

Intercept = $c = -10$

$\boxed{x = 5t - 10}$ Ans

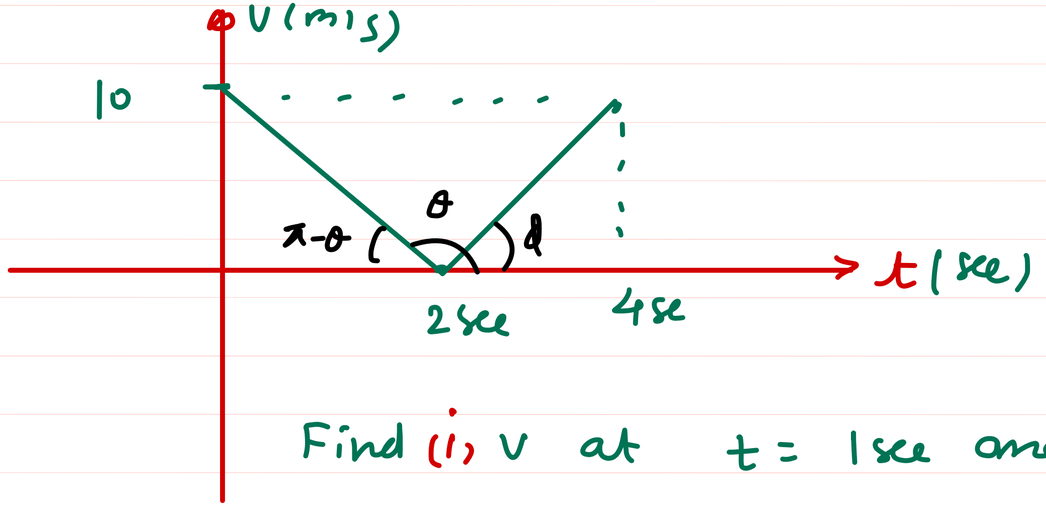
$\boxed{v = 5\ m/s}$ Ans

Acceleration = $\frac{dv}{dt} = 0\ m/s^2$

Position - time curve slope = Velocity

V-t Curve Slope = Acceleration

Ex V-t curve of particle



Find (i) v at t = 1sec and t = 3sec

(ii) a at t = 1sec and t = 3sec

Sol

b/w $0 < t < 2$ sec

$v = mt + 10$

$\tan(\pi-\theta) = \frac{10}{2} = 5$

$-\tan\theta = 5$

$\tan\theta = -5$

$m = -5$

$v = -5t + 10$

at $t = 1$sec

$v = -5\times1 + 10$

$v = 5$ m/s

$a = \frac{dv}{dt} = -5$ m/s²

(ii) $t > 2$sec

$m = \tan\alpha = \frac{dv}{dt} = \frac{10}{2} = 5 = a$

$a = 5$ m/s²

S. Line

$v = mt + c$

$v = 5t + c$

at $t = 2$sec $v = 0$ from curve

$0 = 5\times2 + c \Rightarrow c = -10$

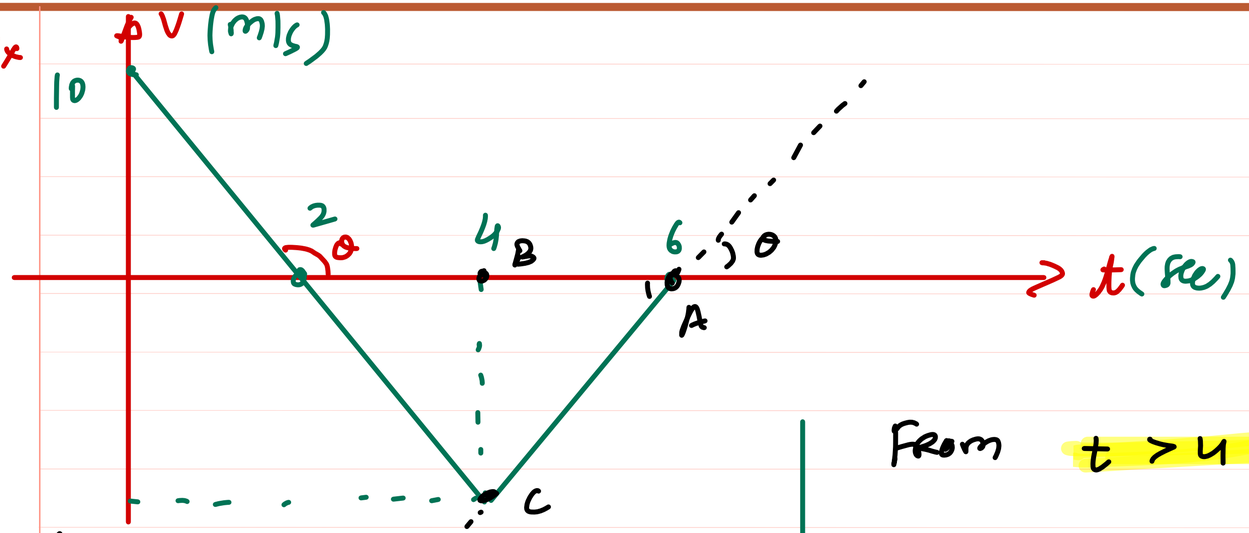
$v = 5t - 10$

at $t = 3$sec

$v = 5\times3 - 10$

$v = 5$ m/s

Ex



Find ① V-t Rel^n b/w $0 < t \leq 4$

② V-t Rel^n from $t > 4$ sec

③ acceleration at $t = 3$ sec and $t = 5$ sec

Sol $0 < t \leq 4$ sec

$y = mx + c$

$V = -5t + 10$

$a = \text{slope} = -5\ m/s^2$

at $t = 4$ sec

$V = -5 \times 4 + 10$

$V = -10\ m/s$

From $t > 4$ sec

$V = 5t + c$

at $t = 6$ sec $V = 0$ from curve

$0 = 5 \times 6 + c \Rightarrow c = -30$

$V = 5t - 30$

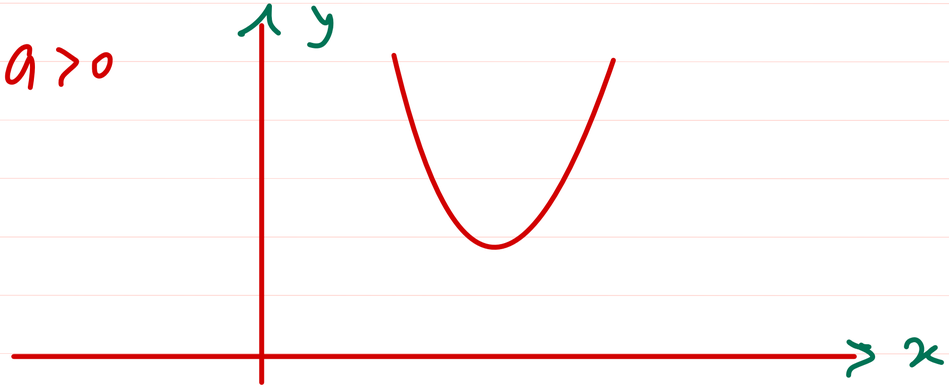
$acc = \text{slope} = +5\ m/s^2$ Ans

from ΔABC $\tan\theta = \frac{10}{6-4} = 5 = m = a$

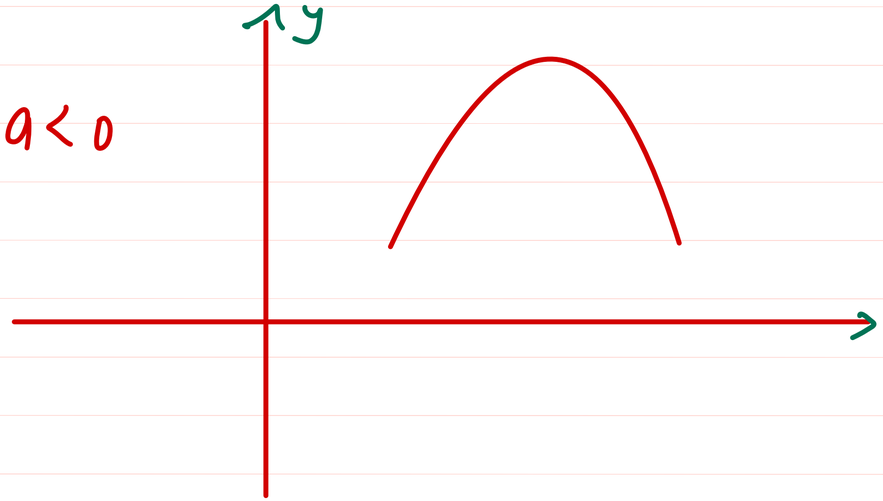
Parabolic Curve

$y = ax^2 + bx + c$

$a > 0$

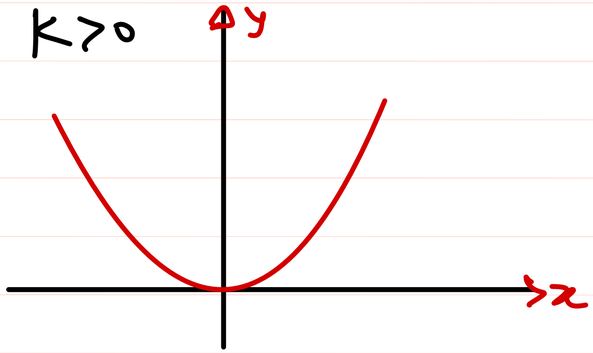


$a < 0$

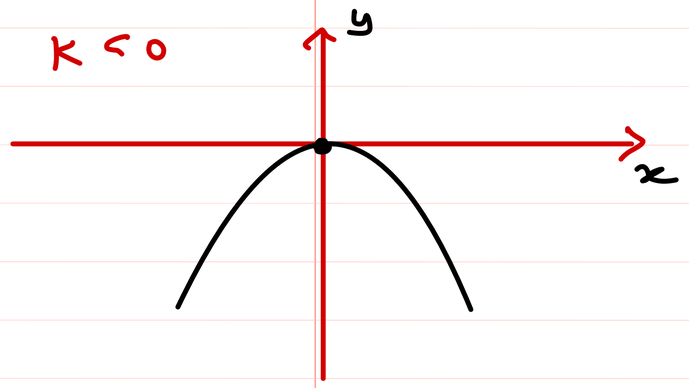


$y = kx^2$

$k > 0$

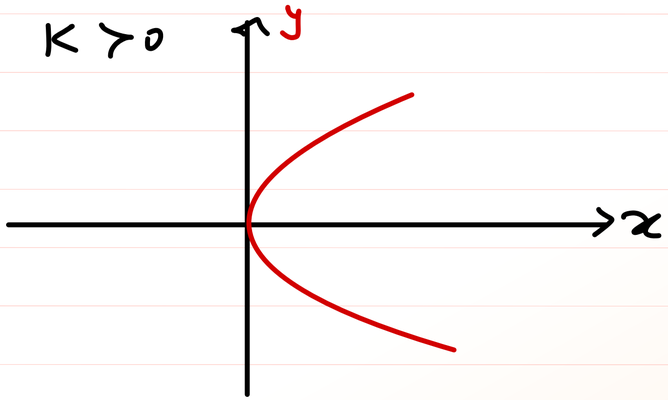


$k < 0$

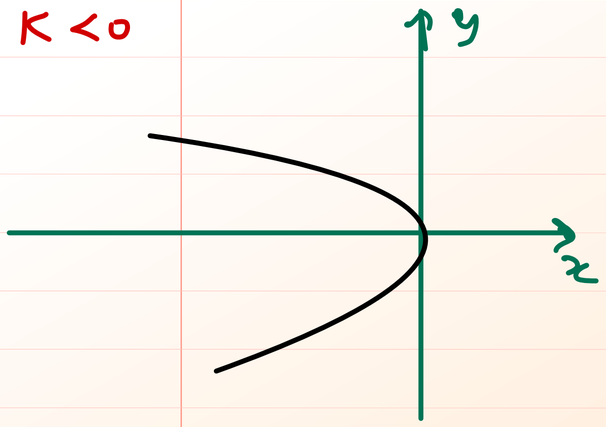


$x = ky^2$

$k > 0$



$k < 0$



Ex Position - time Rel^{n} of particle moving along x-axis is given as

$$x = t^2 + 3$$

(1) Draw x - t Curve

(2) Statement about motion

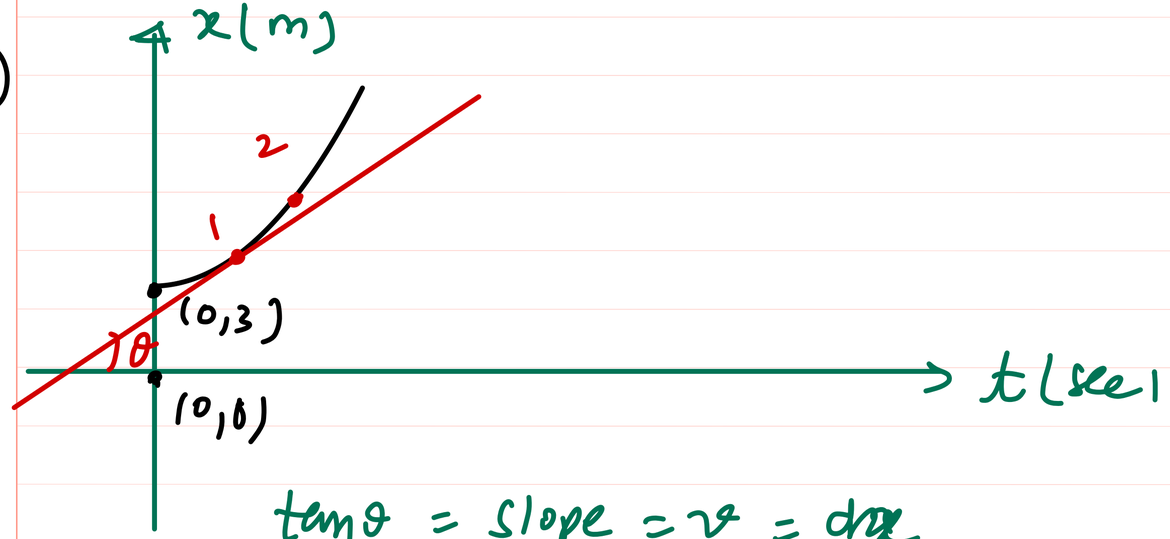
(2) as $t \uparrow$ $\theta \uparrow$ $\tan\theta \uparrow$ $x \uparrow$

motion $\rightarrow$ accelerating

$v > 0$

$a > 0$

(1)



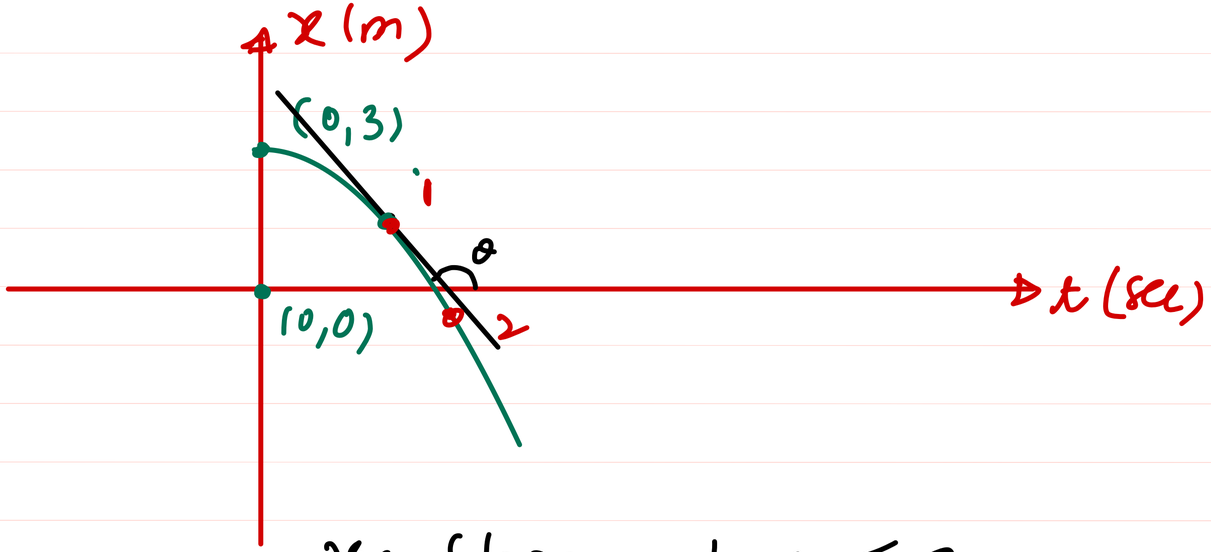
$\tan\theta$ = slope = $v = \frac{dx}{dt}$

Ex $x = -t^2 + 3$

① Draw x-t curve

② Statement about motion

Sol



v = Slope = $\tan\theta < 0$

$v < 0$ moving along -ve x-axis

Speed increases

As $t \uparrow$ θ shifting towards 90°

$\therefore 180 < \theta < 90$

$\tan\theta \uparrow$

$-\tan\theta \downarrow$

$|\tan\theta_1| < |\tan\theta_2|$

$|-3| < |-5|$

Motion is accelerating along x-axis

$v < 0$

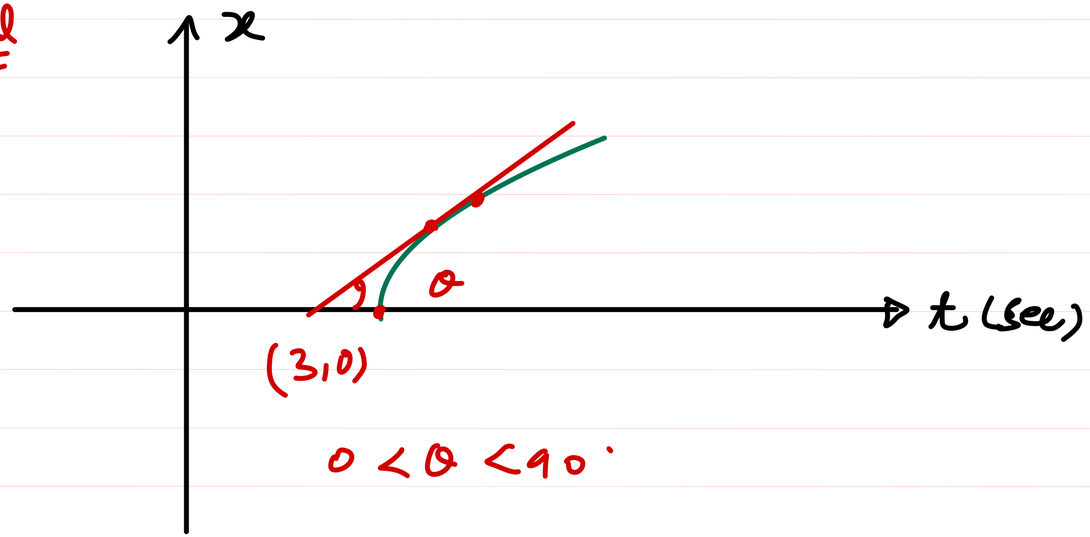
$a < 0$

Ex $t = x^2 + 3$ Position–time Relⁿ (moving along +ve x-axis)

Draw ① x - t Relⁿ

② Statement about motion

Sol



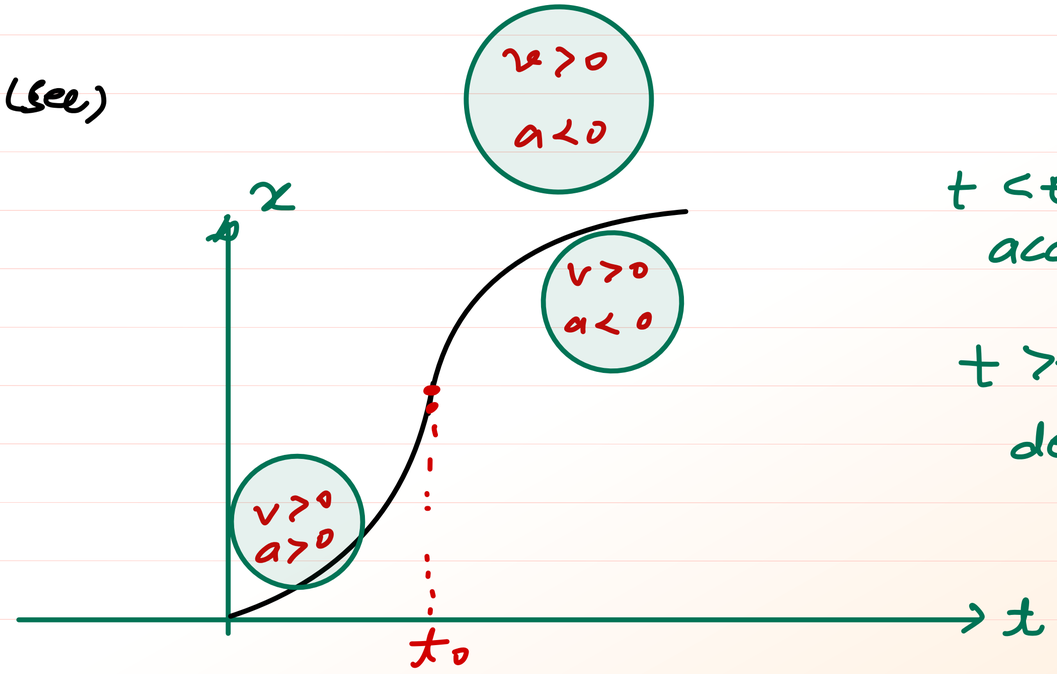
$0 < \theta < 90°$

$\tan\theta > 0$

$v > 0$

as $t \uparrow$ $\theta \downarrow$ $\tan\theta \downarrow$ $v \downarrow$

Motion is Retarding

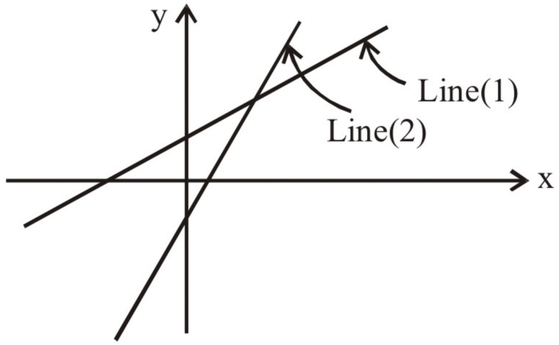


$t < t_0$ accelerating

$t > t_0$ decceleration

Ex

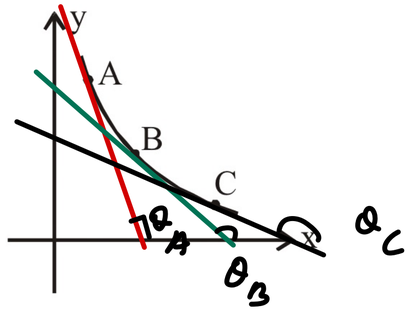
Which of the following statement is not correct for following straight line graph :-



(1) Line (2) has negative y intercept
(2) Line (1) has positive y intercept
(3) Line (2) has positive slope
(4) Line (1) has negative slope

Ex

The slope of graph in figure at point A, B and C is m_A, m_B and m_C respectively, then :



(1) $m_A > m_B > m_C$
(2) $m_A < m_B < m_C$
(3) $m_A = m_B = m_C$
(4) $m_A = m_C < m_B$

$|\tan\theta_A| > |\tan\theta_B| > |\tan\theta_C|$

let

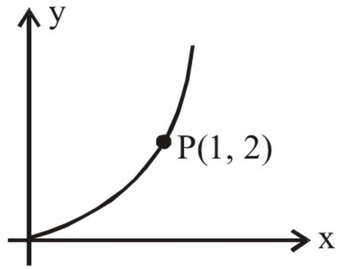
$|-5| > |-3| > |-1|$

$|m_A| > |m_B| > |m_C|$

$m_A < m_B < m_C$

Ex =

The equation of graph shown in figure is $y = 2x^2$. The slope of graph at point P is :



(1) 1 (2) 2 (3) 3 (4) 4

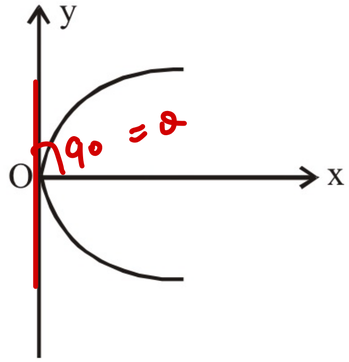
$\frac{dy}{dx} = 4x$

at P

$\left(\frac{dy}{dx}\right)_{(1,2)} = 4 \times 1 = 4$

Ex =

At x = 0, value of $\frac{dy}{dx}$ is :



$\frac{dy}{dx} = \tan\theta = \tan 90^\circ = \text{INFINITE}$

(1) 0 (2) 1 (3) –1 (4) Infinite