GRAPH

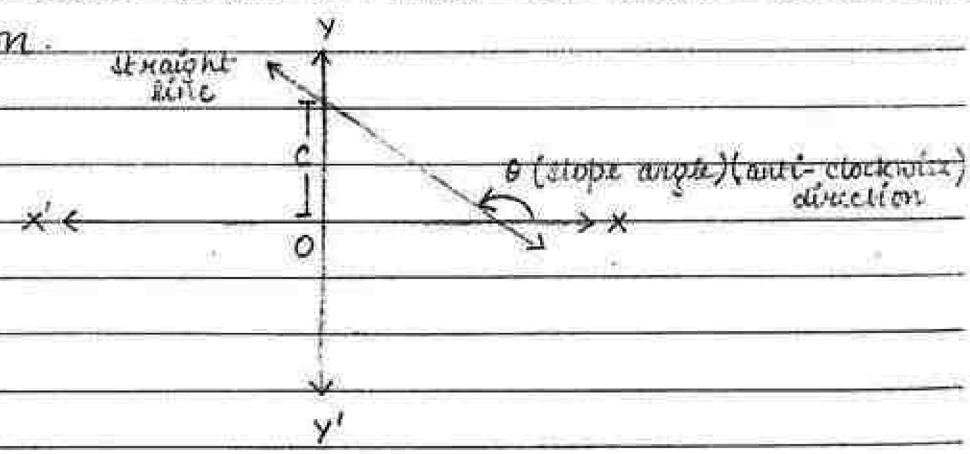
defination : It is a diagramatic representation of ~~data~~ physical relation between two physical quantities is called graph.

1 Straight line

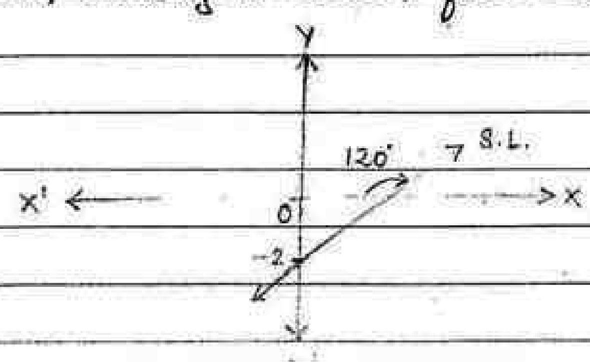
standard form of straight line :

$\boxed{y = mx + c}$, where x and y are two physical quantities; m = slope and slope = $\tan\theta$; c = intercept on y axis. where θ is a slope angle

Slope angle(θ) : It is the angle made by straight line with x- axis in anti- clockwise direction.



Q.1. For given, straight line, find the following :

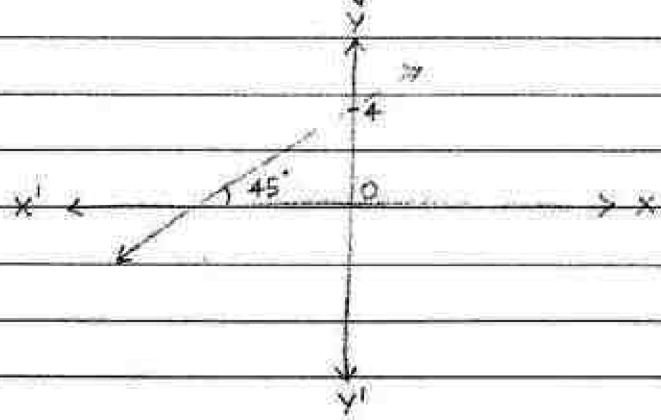


i) Slope angle (θ) : $(180^\circ - 120^\circ) = 60^\circ$
ii) Slope (m) : $\tan \theta = \tan 60^\circ = \sqrt{3}$.
iii) c (intercept) : -2
iv) eq of straight line : $y = mx + c$

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

$$y = \sqrt{3}x - 2$$

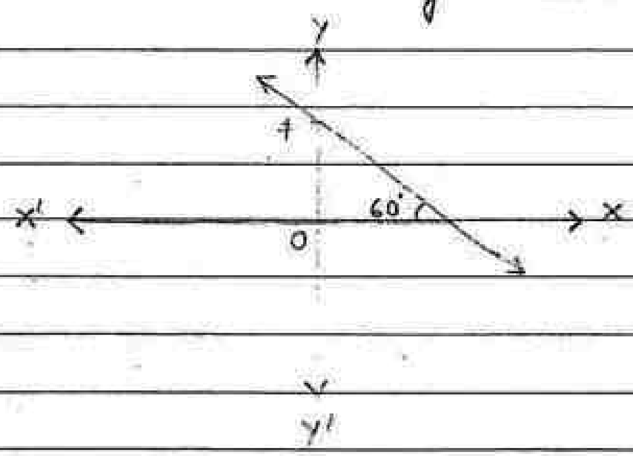
Q.2.



Find the following :
i) Slope angle (θ) : 45°
ii) Slope (m) : $\tan 45^\circ = 1$
iii) c (intercept) : 4
iv) eq of straight line : $y = mx + c$

$$y = x + 4$$

Q.3.



Find the following :
i) Slope angle (θ) : $(180^\circ - 60^\circ) = 120^\circ$
ii) Slope (m) : $\tan 120^\circ = \tan(180^\circ - 60^\circ) = -\tan 60^\circ$

$$= -\sqrt{3}$$

iii) c (intercept) : 4

iv) eq. of straight line : $y = mx + c$

$= \sqrt{3}x + 4$

Possible value of slope ($\tan\theta$) :

~~Sp~~ slope $= m = \tan\theta$

If

- $m = +ve$ or $\tan\theta = +ve$
  then $\theta < 90^\circ$ i.e acute angle

- $m = -ve$ or $\tan\theta = -ve$
  then $90^\circ < \theta < 180^\circ$ i.e obtuse angle

- $m = 0$ or $\tan\theta = 0$
  ie. $\theta = 0^\circ$, then straight line will be parallel to x-axis

- $m = \infty$ or $\tan\theta = \infty$
  ie. $\theta = 90^\circ$, then straight line will be parallel to y-axis.

Possible value of c (intercept)

If

- $c = +ve$
  then straight line cuts the y-axis above the origin.

- ~~I~~ $c = -ve$
  then straight line cuts the y-axis below the origin

• $c = 0$

then straight line passes through origin

Q.4. For the given equation of the straight line find, slope (m), slope angle (θ), c, draw the straight line

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

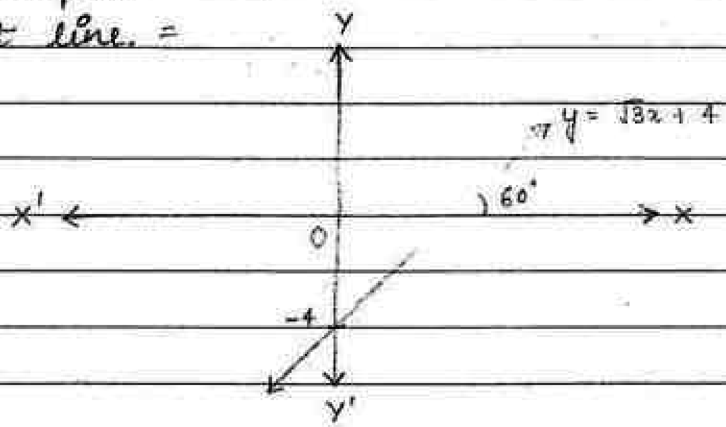
i) Slope (m) $= \sqrt{3}$

ii) Slope angle (θ) = $\tan\theta = \sqrt{3}$

$\therefore \theta = 60^\circ$

iii) c (intercept) $= -4$

iv) Straight line. =



Q.5. $3y = -\sqrt{3} - 9$

For the given equation of the straight line Find the following

$$y = \frac{-\sqrt{3}}{3}x - \frac{9}{3}$$

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

i) Slope (m) $= \frac{-1}{\sqrt{3}}$

ii) Slope angle (θ) = $\tan\theta = \frac{-1}{\sqrt{3}}$

$$\left[\because \theta \text{ is } -ve \therefore \text{ angle lies between } 90^\circ \text{ and } 180^\circ\right]$$

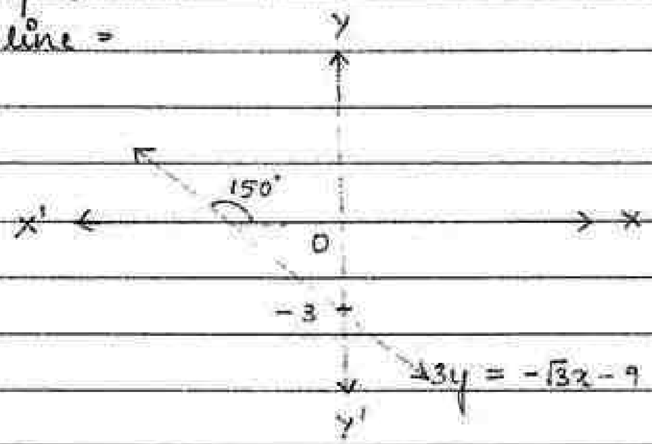
$$\tan(180^\circ - 30^\circ) = -\tan 30^\circ$$

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

$$\therefore \theta = 150^\circ$$

iii) c (intercept) $= -3$

iv) Straight line =



Trignometrical Inverse function:

For finding angle θ

i) $\sin\theta = \frac{\sqrt{3}}{2}$

$$\therefore \theta = \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$$

$$\therefore \theta = 60^\circ$$

ii) $\tan\theta = 1$

$$\therefore \theta = \sin^{-1}(1)$$

$$\therefore \theta = 45^\circ$$

iii) $\tan\theta = \frac{16}{5}$

$$\therefore \theta = \tan^{-1}\left(\frac{16}{5}\right)$$

(v) $\sin \theta = \frac{5}{6}$

$\therefore \theta = \sin^{-1}\left(\frac{5}{6}\right)$

Q.6 $5y + 7x - 10 = 0$

Find the following for the given equation of straight line

$5y = -7x + 10$

$\therefore y = \frac{-7}{5}x + \frac{10}{5}$

$\therefore y = \frac{-7}{5}x + 2$

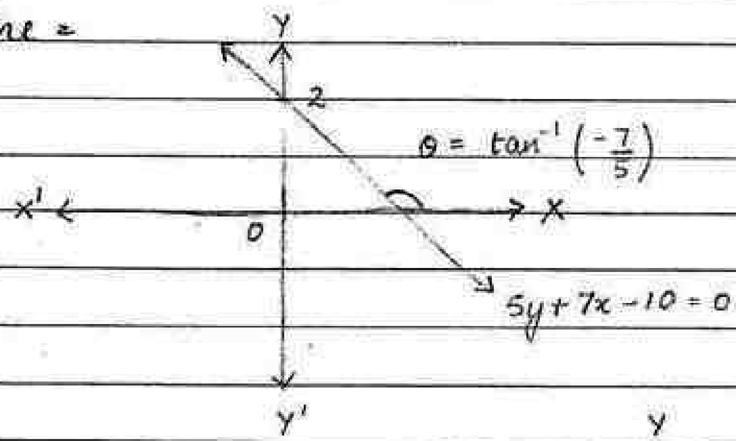
i) Slope $(m) = \frac{-7}{5}$

ii) Slope angle $(\theta) = \tan\theta = \frac{-7}{5}$

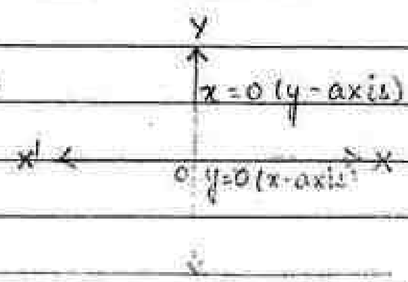
$\therefore \theta = \tan^{-1}\left(-\frac{7}{5}\right)$

iii) Intercept $(c) = 2$

iv) straight line =



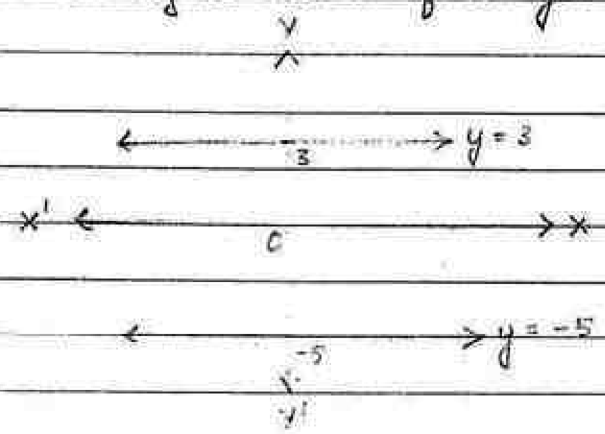
- equation of x-axis ie $y = 0$
- equation of y-axis ie $x = 0$



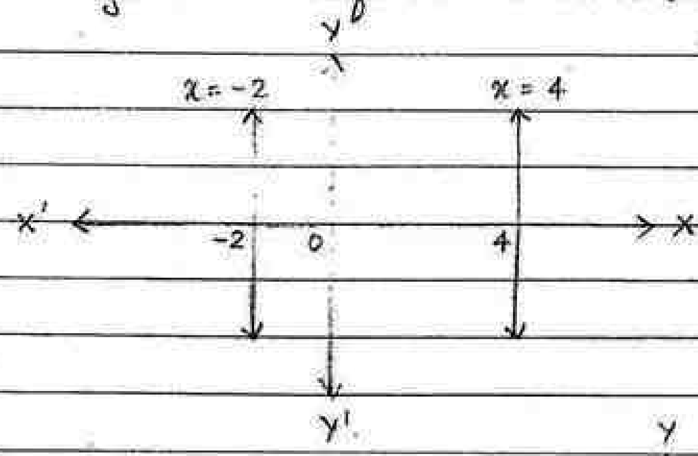
- If y = constant
then straight line will be $\perp$ to y-axis. or
parallel to x-axis

- If x = constant
then straight line will be $\perp$ to x-axis or
parallel to y-axis

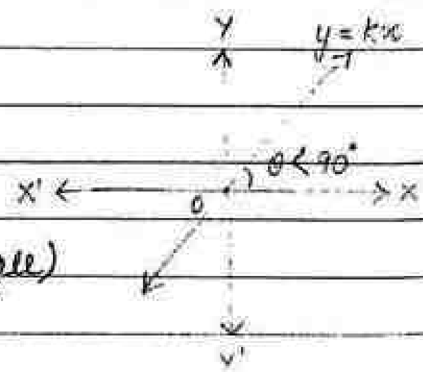
Q.7. Draw the straight line for $y = 3$. and $y = -5$



Q.8. Draw the straight line for $x = 4$ and $x = -2$



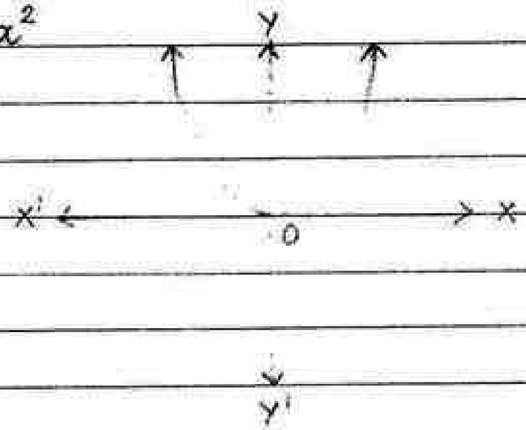
- If $y \propto x$
$y = kx$ (k is constant)
$\therefore y = kx + 0$
$m = +k$ (+ implies acute angle)
$\therefore \theta < 90^\circ$



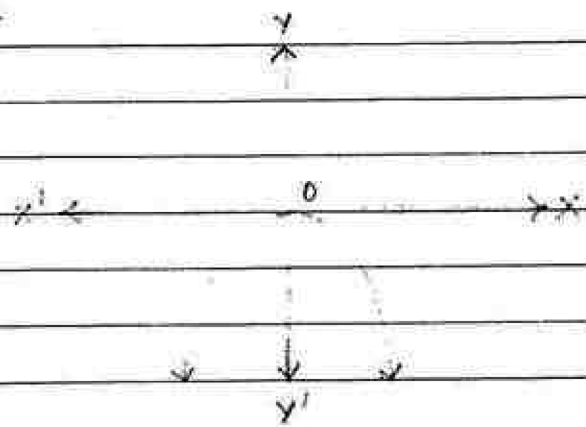
2. Parabola

There are four types of Parabolic graph.

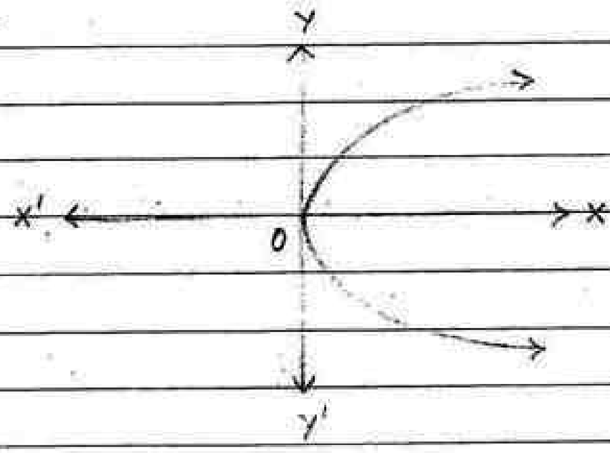
i) $y = kx^2$



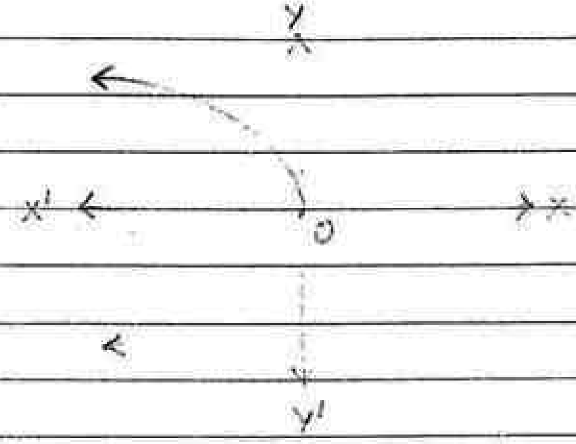
ii) $y = -kx^2$



iii) $x = ky^2$

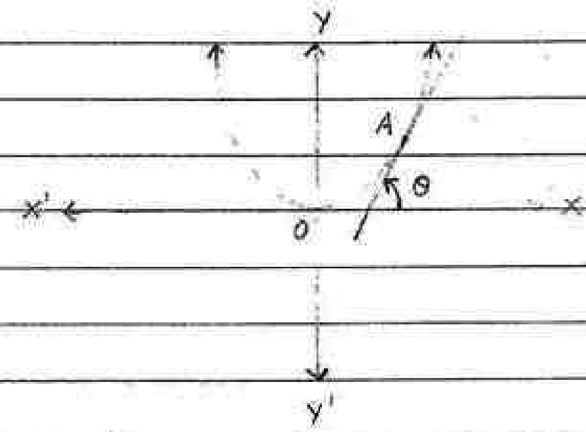


iv) $x = -ky^2$



Parabola always bends towards that variable whose power is smaller.

Slope:

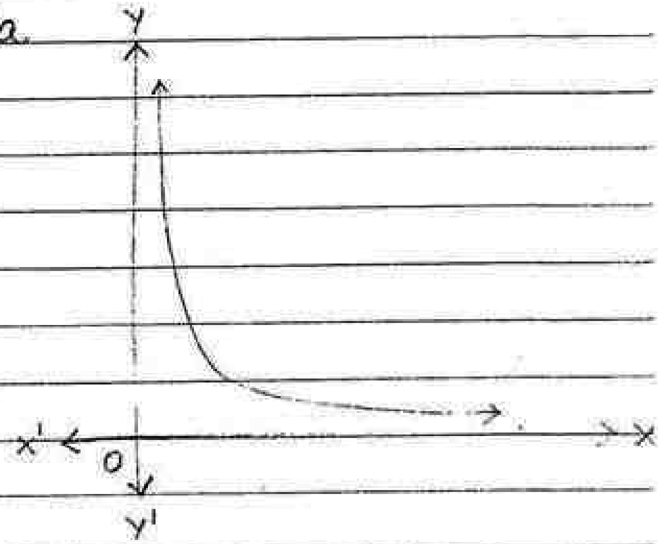


$[\text{Slope}]_A$: $\tan\theta$

To find slope at any point on a graph:

- Draw a tangent at a given point on a graph
- Let θ is the angle made by tangent with x- axis in anticlock wise direction.
- The value of tan θ will be slope of that graph at that particular point.

Q.3. Rectangular hyperbola



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

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

$$xy = K$$

$$xy = \text{constant}$$

- If $x = 0$,
  then $y = \frac{K}{x} = \frac{K}{0} = \infty$

- If $x = 1$
  then $y = \frac{K}{1} = K$

- If $x = 2$
  then $y = \frac{K}{x} = \frac{K}{2}$

- If $x = 10$
  then $y = \frac{K}{x} = \frac{K}{10}$

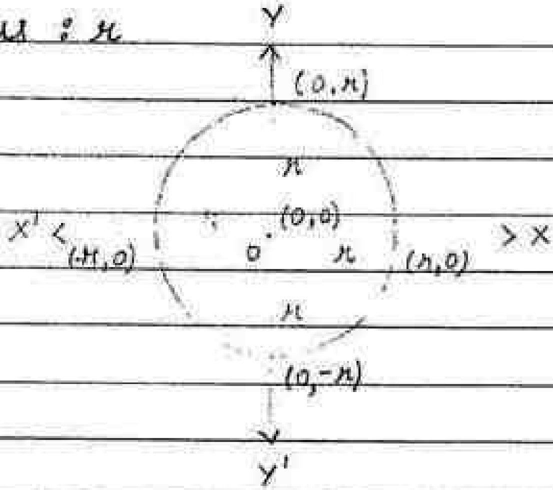
- If $x = \infty$
  then $y = \frac{K}{x} = \frac{K}{\infty} = 0$

4. Circle :

Standard equation : $x^2 + y^2 = (r)^2$

Centre : $(0,0)$

radius : r



Q.9. For a given equation of circle $x^2 + y^2 = 5$.

$$x^2 + y^2 = r^2 = 5 = (\sqrt{5})^2$$

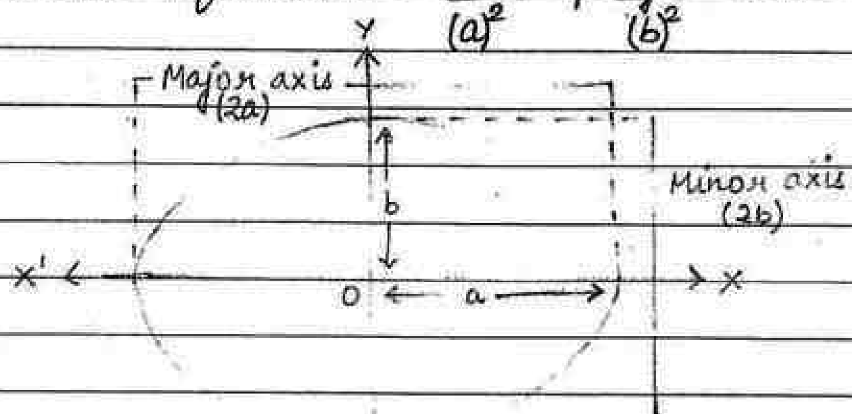
$\therefore$ centre $= (0,0)$.

radius $= \sqrt{5}$

5. Ellipse :

i) Horizontal ellipse

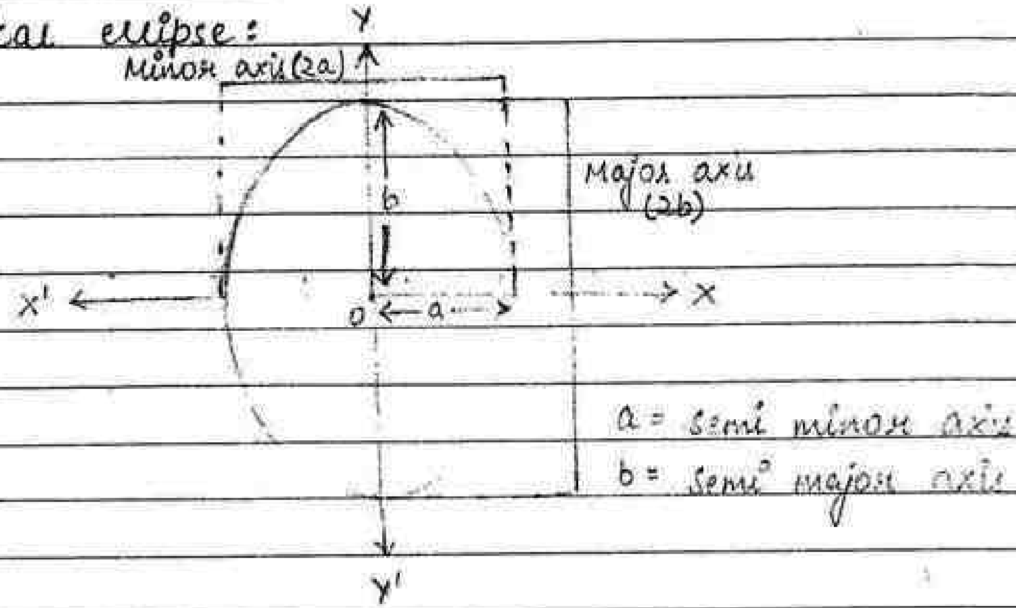
Standard equation : $\dfrac{x^2}{(a)^2} + \dfrac{y^2}{(b)^2} = 1$



a = semi major axis

b = semi minor axis

ii) Vertical ellipse :



- If $a = b$, then ellipse is converted into circle.

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

$$x^2 + y^2 = (a)^2$$

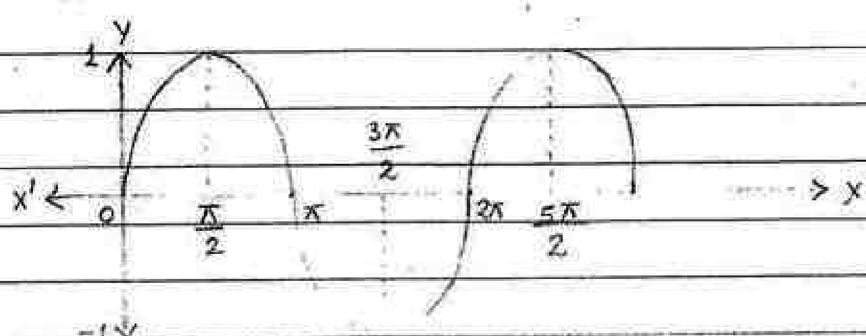
$\therefore x^2 + y^2 = (r)^2$ Hence, it is circle.

6. Graph of Trignometrical function :

i) sine curve (graph on sine graph) (sine view)

$y = \sin(x)$

y	0	1	0	−1	0	1	0
x	0	$\pi/2$	π	$3\pi/2$	2π	$5\pi/2$	3π

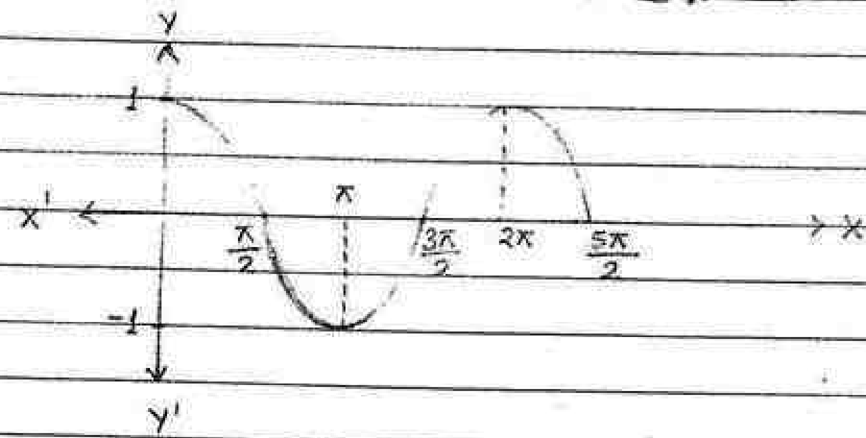


- Sine $(0, \pi, 2\pi, 3\pi, 4\pi \ldots\ldots) = 0$.
- Minimum value : -1 and Maximum value : 1

ii) Cosine curve (graph on cos graph).

$$y = \cos(x)$$

y	1	0	-1	0	1	0	-1
x	0	$\pi/2$	π	$3\pi/2$	2π	$5\pi/2$	3π



- Maximum value for cos : 1
  Minimum value for cos : -1.
- $\cos\left(\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2} \ldots\ldots\right) = 0$

7. Exponential graph

i) Exponential ~~graph~~ growth graph

$$y = ke^x$$

- $1^\infty = 1$
  $2^\infty = \infty$
  $e^\infty = \infty$ $\left\{ \text{value of } e = 2.718 \right\}$

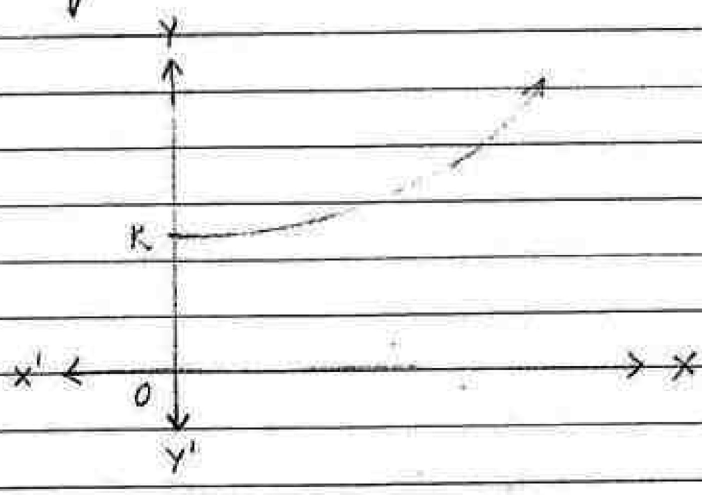
- If $x = 0$
  then $y = ke^0 = k$

- If $x = 1$
  then $y = ke^1 = ke$

- If $x = 2$
  then $y = ke^2$

- If $x = 10$
  then $y = ke^{10}$

- If $x = \infty$
  then $y = ke^{\infty} = k\infty = \infty$



ii) Exponential decay graph.

$$y = ke^{-x}$$

- If $x = 0$,
  then $y = ke^0 = k$

• If $x = 1$

then $y = ke^{-1} = \frac{k}{e}$

• If $x = 2$

then $y = ke^{-2} = \frac{k}{e^2}$

• If $x = 10$

then $y = ke^{-10} = \frac{k}{e^{10}}$

• If $x = \infty$

then $y = ke^{-\infty} = \frac{k}{e^{\infty}} = \frac{k}{\infty} = 0.$