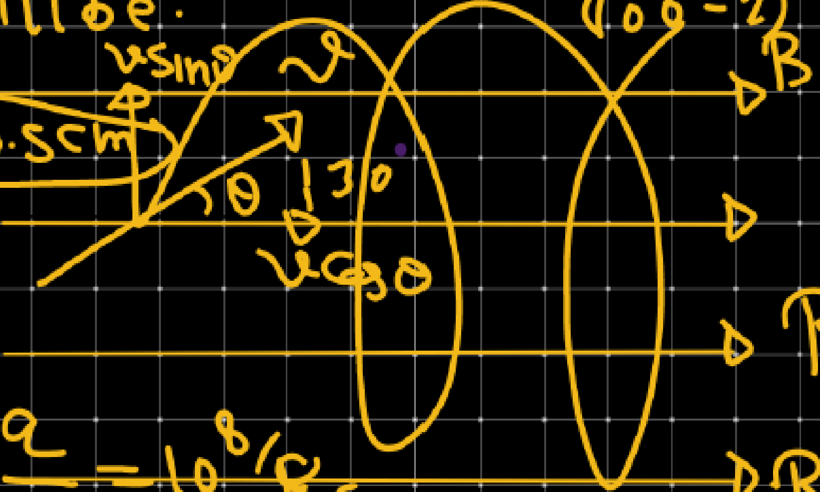
Q1) A charge having $\frac{e}{m}$ equal to 10^8 C/kg & with velocity 3×10^5 m/s enters into a uniform magnetic field $B = 0.3T$ at an angle $30°$ with dirn of field. The radius of curvature will be.

(a) 2cm. $R = 0.5cm$

(b) 0.5cm.

(c) 0.01cm.

(d) 1cm.



(100 - 2)

100 - 30 - 90

$$R = \frac{mv\sin\theta}{qB}$$

$$R = \left(\frac{m}{q}\right)\frac{3\times10^5\times\frac{1}{2}}{0.3}$$

$$\frac{q}{m} = 10^8/kg$$

$$\frac{m}{q} = 10^{-8}\,kg/C$$

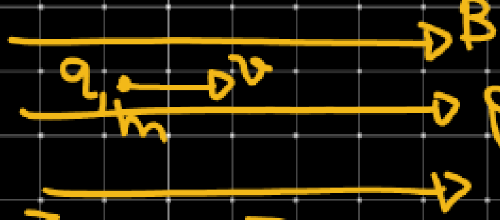
$$R = \frac{10^{-8}\times3\times10^5\times\frac{1}{2}}{3\times10^{-1}}$$

$$R = \frac{10^{-3}}{2}$$

$$= \frac{0.5\times10^{-3}}{10^{-1}}\,cm = 0.5\times10^{-2}\,m$$

Moving charge in magnetic field :-

(i)



$\theta = 0$

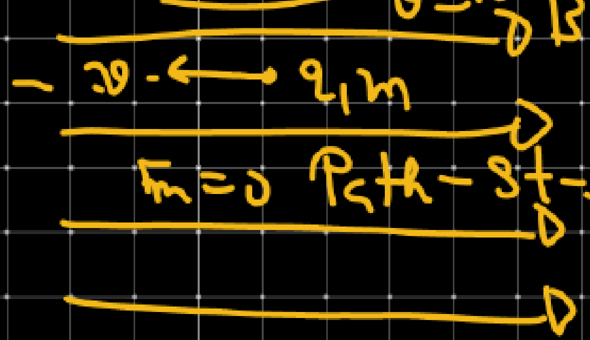
$\bar{F}_m = q\,\bar{v} \times \bar{B}$

$F_m = qvB\sin\theta$

$F_m = 0$,

Path - st - line.

(ii) $\theta = 180$



$F_m = 0$ Path - st - line

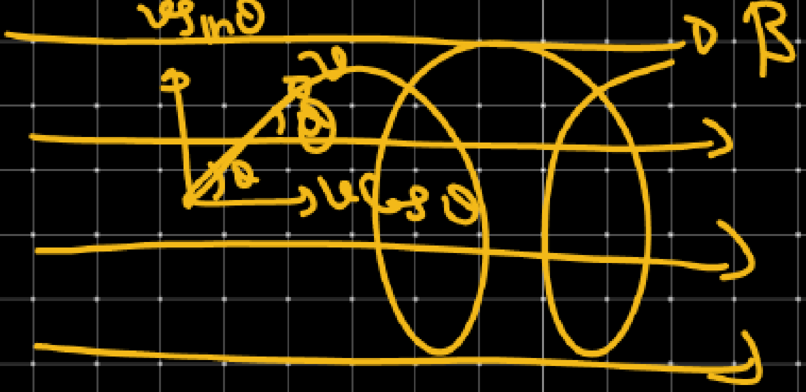
(iii) $\theta = 90$

Path ⇓ Circular

$\bar{v} \perp \bar{B}$

$|\bar{v}|$ = Constant

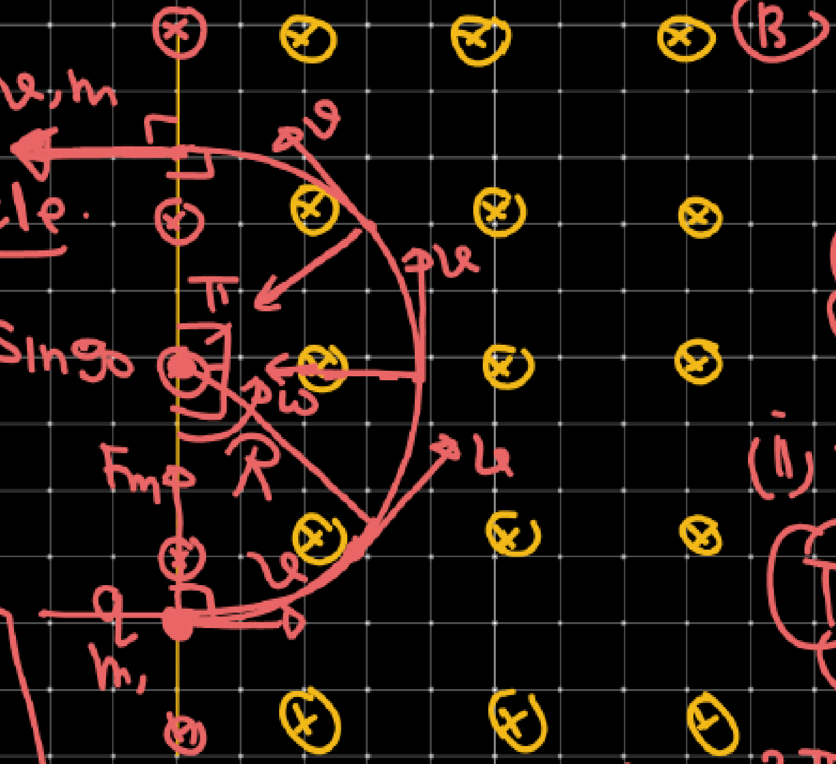
(iv)



Moving charge in magnetic field: [$\vec{v} \perp \vec{B}$]

(Case I)

Semi-circle.



$F_m = qvB\sin 90$

$F_m = qvB$

$F_m = F_c$

$qvB = \frac{mv^2}{R}$

$$R = \frac{mv}{qB}$$

(ii) $T = \frac{\pi R}{v} = \frac{\pi}{v}\left[\frac{mv}{qB}\right]$

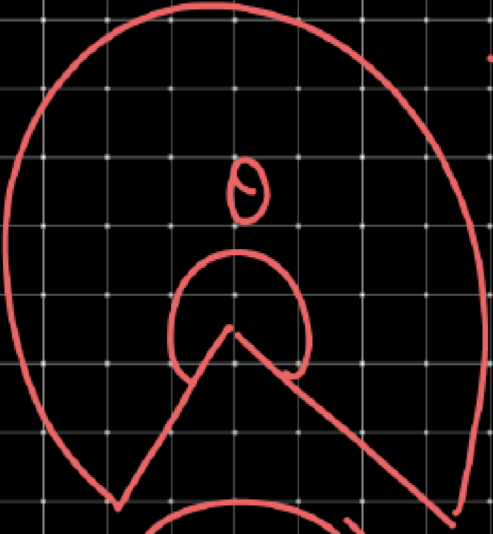
$$T = \frac{\pi m}{qB}$$

$$T = \frac{2\pi m}{qB}$$

$$T = \frac{(\theta) m}{qB}$$

$\omega = \frac{2\pi}{T}$, $f = \frac{1}{T}$

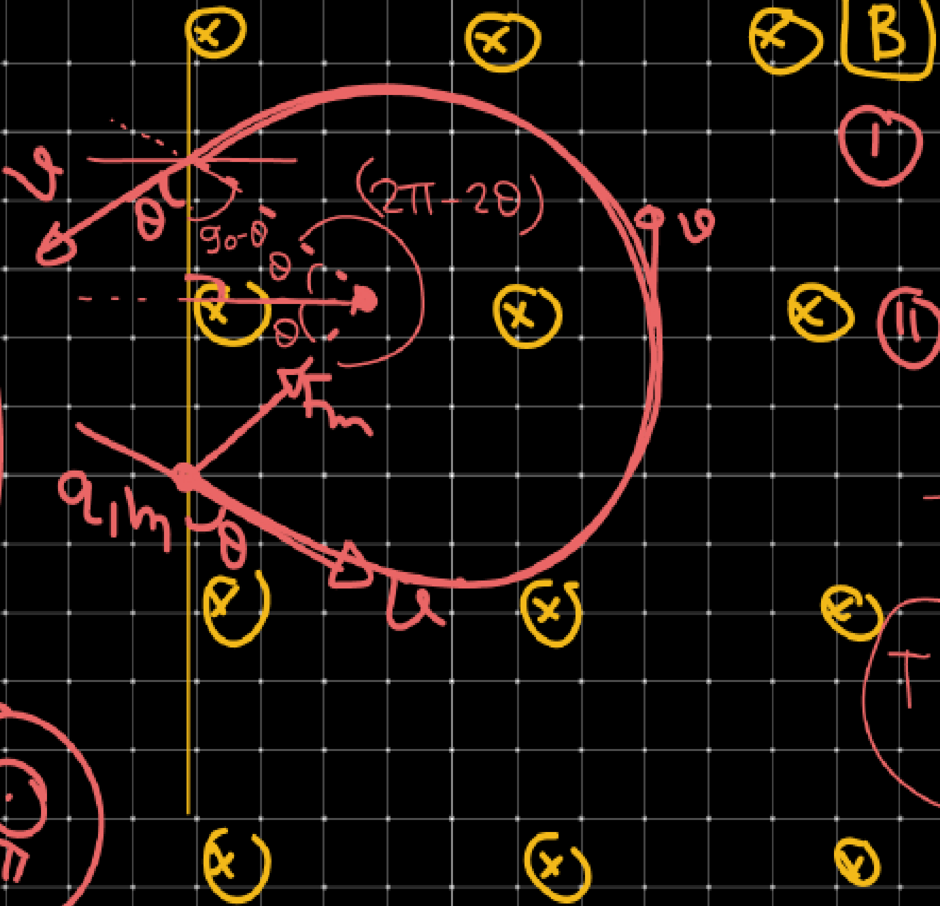
$\bar{v} \perp \bar{B}$



$\theta \times R$

$C = 2\pi R$

2π



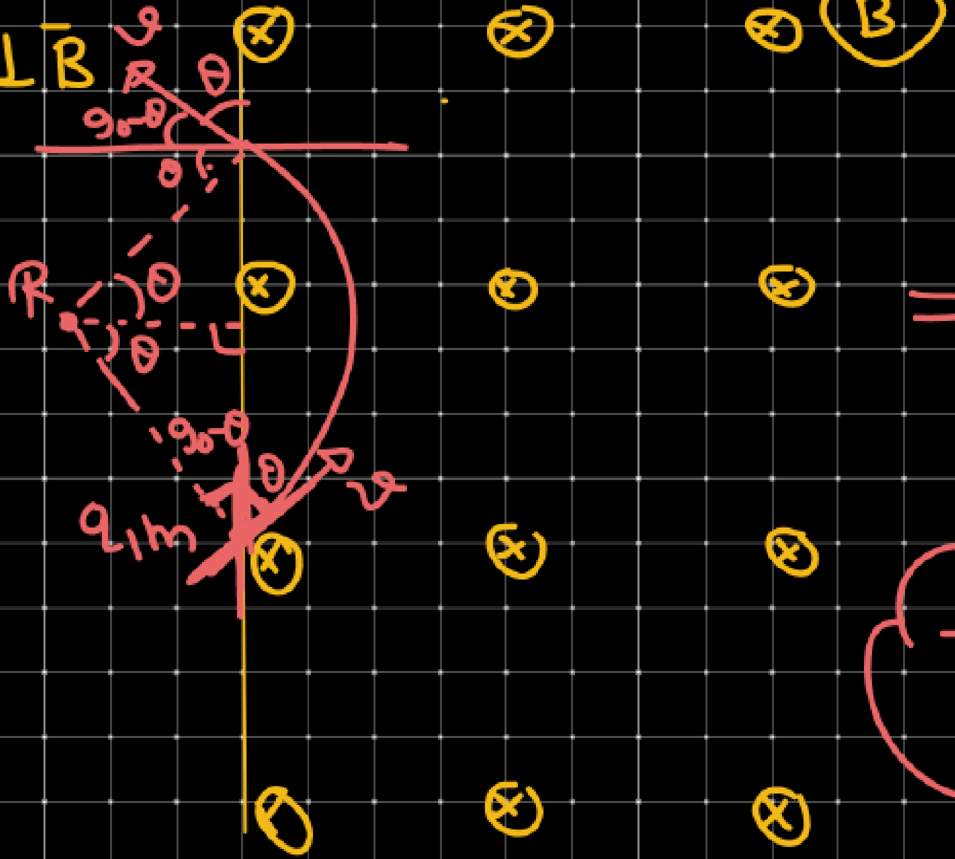
(i) $R = \frac{mv}{qB}$

(ii) $T = \frac{(2\pi - 2\theta)R}{v}$

$T = \frac{(2\pi - 2\theta)}{v} \cdot \frac{mv}{qB}$

$T = \frac{(2\pi - 2\theta)m}{qB}$

(iii) $\bar{v} \perp \bar{B}$



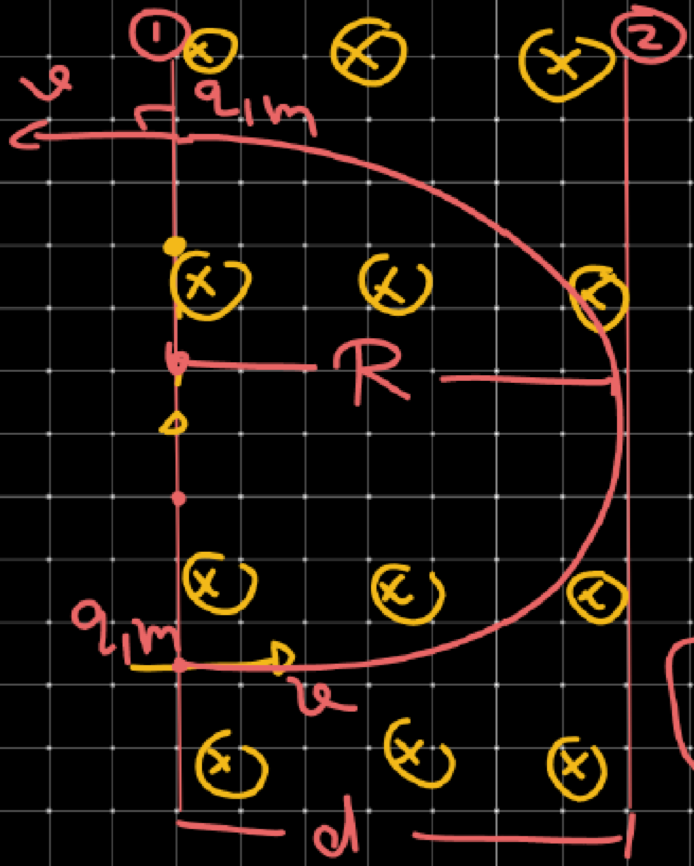
$$R = \frac{mv}{qB}$$

$$\Rightarrow T = \frac{(\text{Angle})\, R}{v}$$

$$T = \frac{(2\theta)}{v} \frac{mv}{qB}$$

$$T = \frac{2\theta m}{qB}$$

Type (iv)



Find minimum value of d such that Particle goes through Plate (1).

$d \geq R$

$d_{min} = R$

Q1) A test charge 1.6×10^{-19} C is moving with $\bar{v} = (2i + 3j)$ m/s. in a magnetic field $\bar{B} = (2i + 3j)$ Tesla. The magnetic Force on test charge. [3 min].

$\bar{F}_m = q(\bar{v} \times \bar{B})$

$$\bar{F}_m = q[\bar{v} \times \bar{B}] =$$

$$\bar{v} \times \bar{B} = \begin{bmatrix} i & j & k \\ 2 & 3 & 0 \\ 2 & 3 & 0 \end{bmatrix} = i\begin{bmatrix} 3 & 0 \\ 3 & 0 \end{bmatrix} - j\begin{vmatrix} 2 & 0 \\ 2 & 0 \end{vmatrix} + k\begin{vmatrix} 2 & 3 \\ 2 & 3 \end{vmatrix}$$

$$= i[0-0] - j[0-0] + k[6-6]$$

$$= 0i + 0j + 0k$$

$$\bar{F}_m = q \times 0 = 0$$

$$\bar{A} = a_1\hat{i} + a_2 j + a_3 k$$

$$\bar{B} = b_1 i + b_2 j + b_3 k$$

$$\bar{A} \parallel \bar{B}$$

$$\boxed{\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3}}$$

Q.2) A Charge with 10^{-11} C & mass 10^{-7} kg moving with a velocity of 10^{8} m/s along x-axis. A Uniform Static magnetic field of 0.5 T is acting along the Y-axis. The magnetic force [magnitude & dirn] on charge.

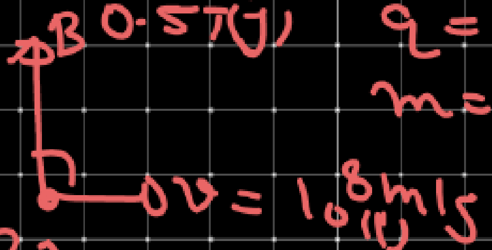
(a) zero

(b) 5×10^{-4} N along +z axis.

(c) 5×10^{-4} N along Y-axis

(d) 5×10^{-4} N — " x-axis.

$$\left[\bar{F}_m = q(\bar{v}\times\bar{B})\right]$$



$q = 10^{-11}$ C

$m = 10^{-7}$ kg

$\bar{v} = 10^{8}\,\hat{i}$ m/s

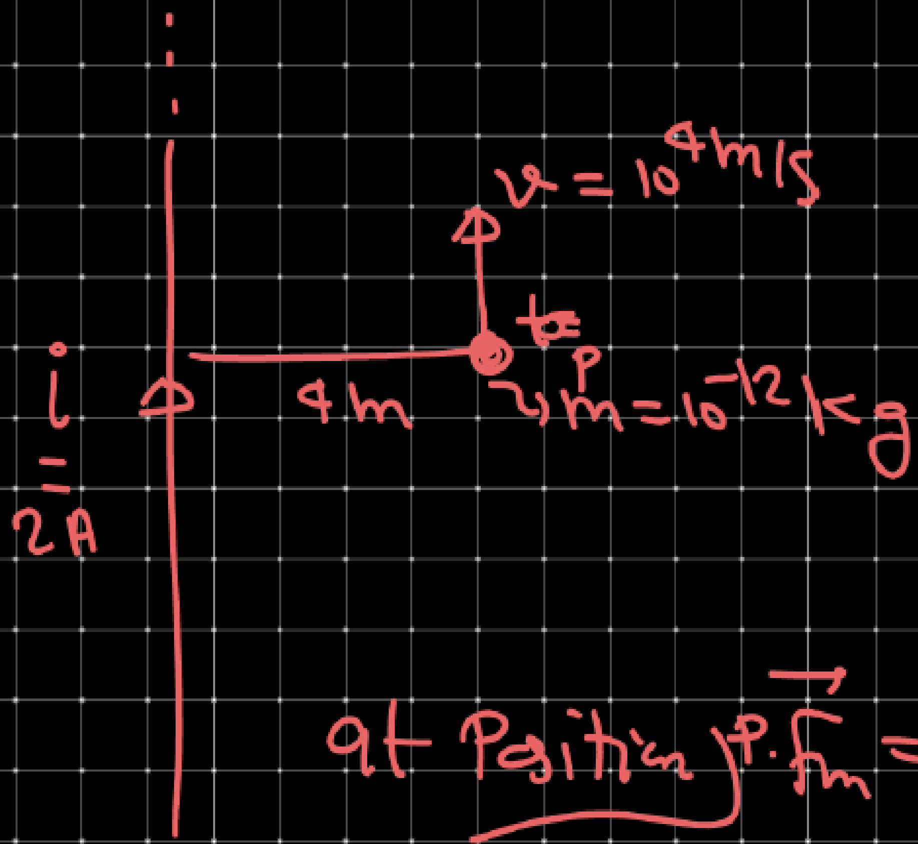
$\bar{B} = 0.5\,\hat{j}$ T

$F_m = qvB\sin\theta$

$= 10^{-11}\times10^{8}\times\frac{1}{2}\times\sin 90^\circ$

$= \frac{10^{-3}}{2} = \frac{10}{2}\times10^{-4}$ N

5×10^{-4} N (+z)



at Position P. $\vec{F_m} = ?$