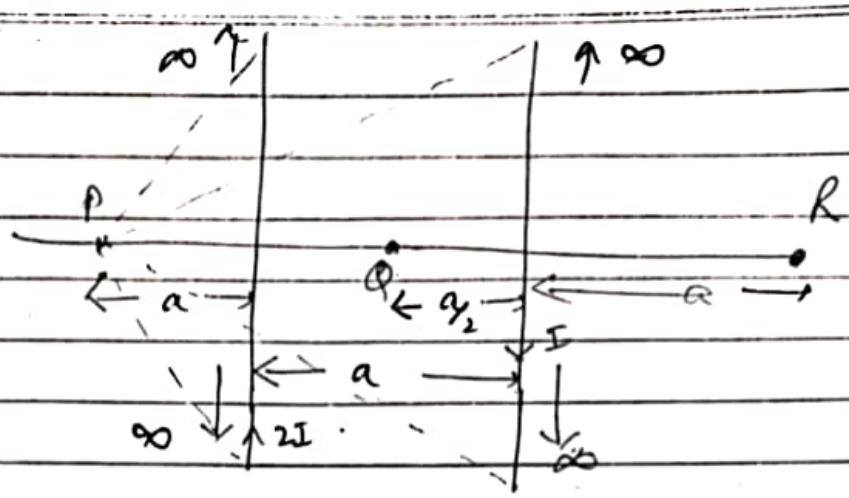
Q



at P

$$B = \frac{2k'I \times 2}{a} - \frac{2k'I}{2a}$$

$$= \frac{\mu_0 I}{\pi a} - \frac{\mu_0 I}{4\pi a}$$

$$= \frac{3\mu_0 I}{4\pi a}$$

at Q.

$$B = \frac{2k'2I}{a/2} + \frac{2k'I}{a/2}$$

$$= \frac{4 \times 2}{4} \frac{\mu_0 I}{\pi a} + \frac{2 \times 4}{4} \frac{\mu_0 I}{\pi a}$$

$$= \frac{3\mu_0 I}{\pi a}$$

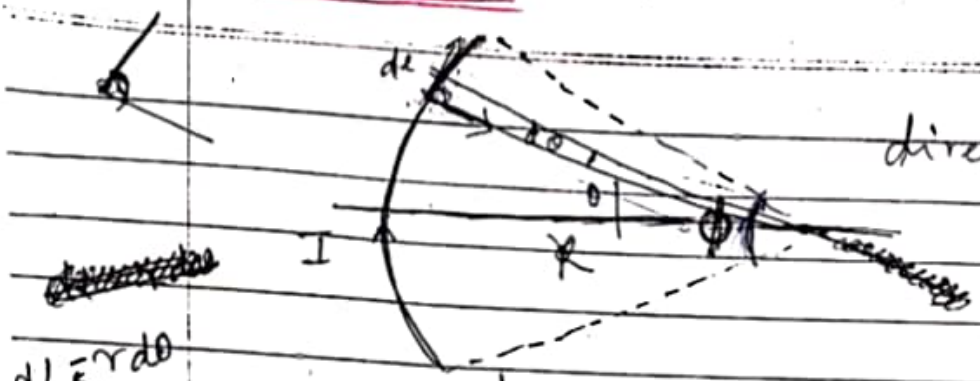
~~B R~~ at R.

$$B = \frac{2k'2I}{2a} - \frac{2k'I}{a}$$

$$= \frac{2}{\pi} \frac{\mu_0 I}{2a} - \frac{\mu_0 I}{2\pi a}$$

$$= 0$$

Circular Arc



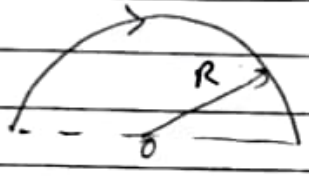
$$dB = \frac{K' I\, dl \sin 90^\circ}{R^2}$$

$$= \frac{K' I R\, d\theta}{R^2} = \left(\frac{K' I}{R^2}\right) dl$$

$$B = \frac{K' I}{R^2} \int dl = \frac{K' I}{R^2} R\phi$$

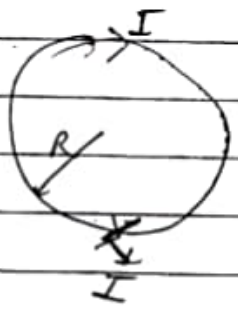
$$\boxed{B = \frac{K' I \phi}{R}}$$

Case I Semicircular loop



$$\vec{B} = \frac{\mu_0 I}{4R} \quad (\odot)$$

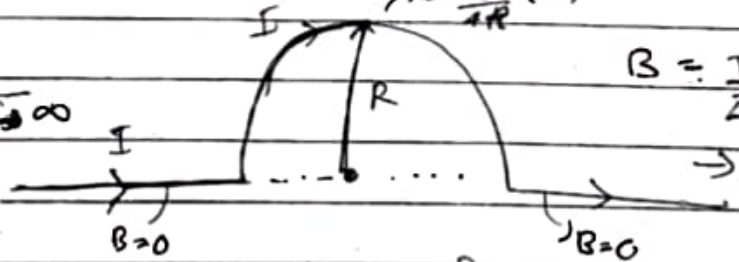
Case 2 Complete loop



$$B = \frac{\mu_0 I}{2R} \quad (\odot)$$

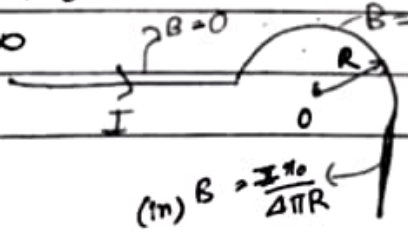
Q

1)



$$B = \frac{I \cdot \mu_0 \pi}{4\pi R} = \frac{I\mu_0}{4R}$$

(2)

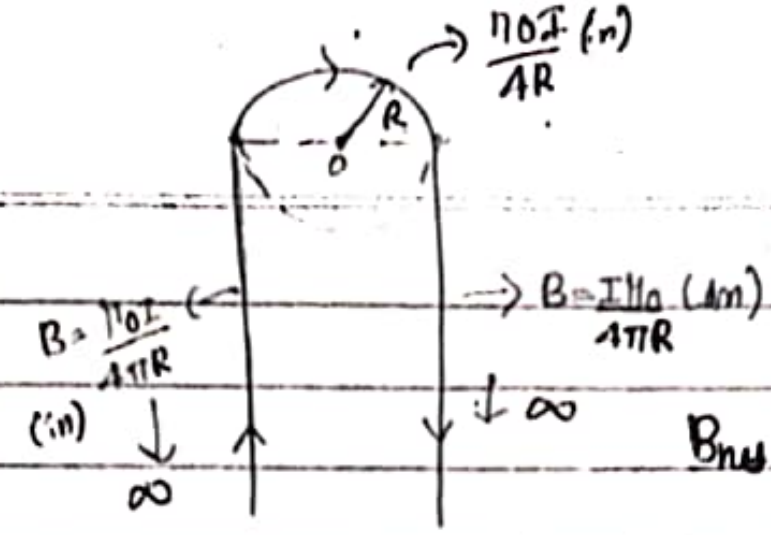


$$B = \frac{I\mu_0}{4R} + \frac{I\mu_0}{4\pi R}$$

$$= \frac{I\mu_0}{4R}\left(\frac{\pi+1}{\pi}\right)$$

(⊙) $B = \frac{I\mu_0}{4\pi R}$

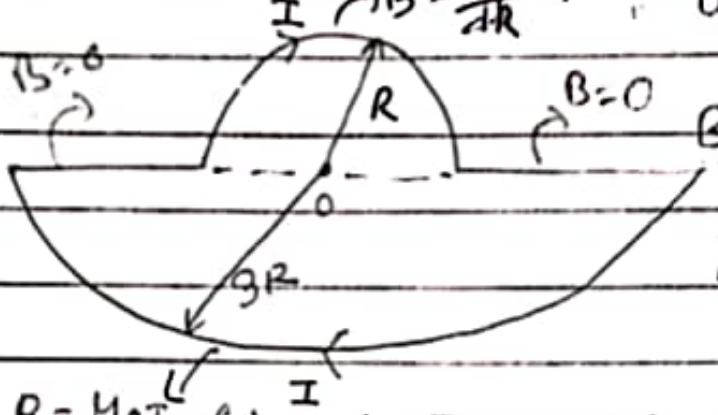
(3)



$$B_{net} = \frac{\mu_0 I}{4R} + \frac{\mu_0 I}{2\pi R}$$

$$= \frac{\mu_0 I}{4R}\left(\frac{\pi+2}{2\pi}\right)$$

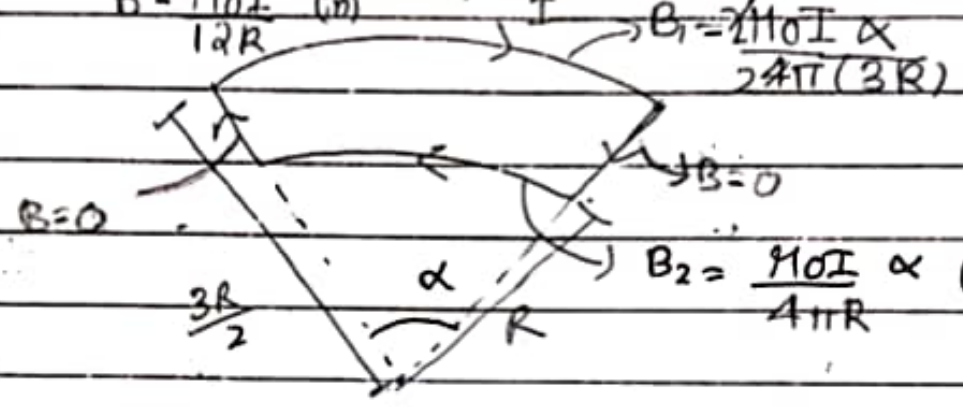
(4)



$$B_{net} = \frac{\mu_0 I}{4R} + \frac{\mu_0 I}{12R}$$

$$B_{net} = \frac{\mu_0 I}{3R}$$

(5)

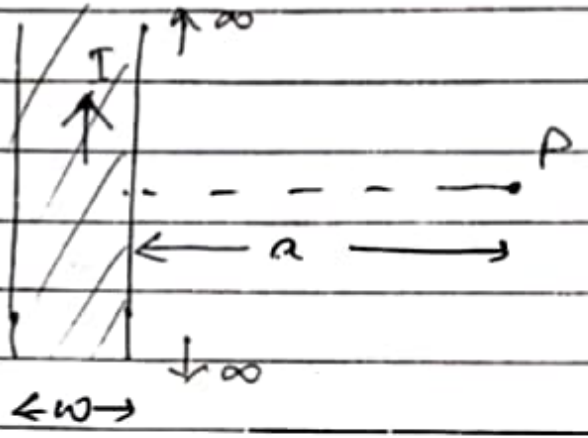


$$B_{net} = \frac{-2\mu_0 I\alpha}{4\pi 3R} + \frac{\mu_0 I\alpha}{4\pi R}$$

$$= \frac{3\mu_0 I\alpha - 2\mu_0 I\alpha}{4\times 3\times\pi\times R}$$

$$B_{net} = \frac{\mu_0 I\alpha}{12\pi R}$$

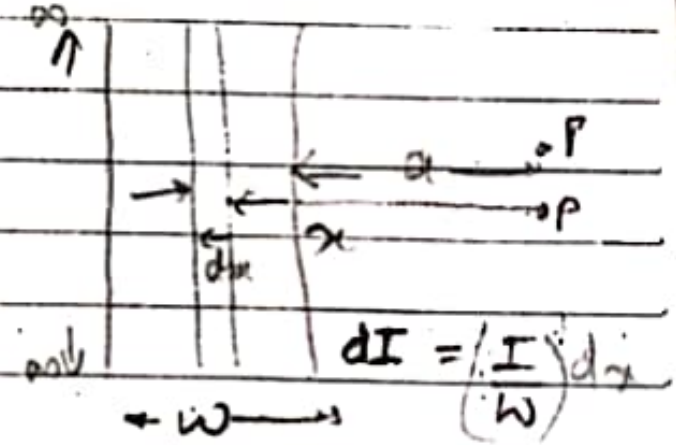
Q A large metal sheet of width W carries a current I (uniformly distributed in its width), find magnetic field at point P which lies in plane of sheet.



$$\therefore dB = \frac{\mu_0 dI}{4\pi x} \times 2$$

$$dB = \frac{\mu_0}{2\pi x}\left(\frac{I}{w}\right) dx$$

$$B = \frac{\mu_0 I}{2\pi w}\int_{a}^{a+w} \frac{dx}{x}$$



$$= \frac{\mu_0 I}{2\pi w} \ln\left(\frac{a+w}{a}\right)$$