In SI unit $K = \frac{\mu_0}{4\pi}$ and In CGS system $K = 1$

$\mu_0 \rightarrow$ absolute magnetic permeability of free space

$\mu_0 \rightarrow 4\pi \times 10^{-7}\ Wb\ A^{-1} m^{-1}$

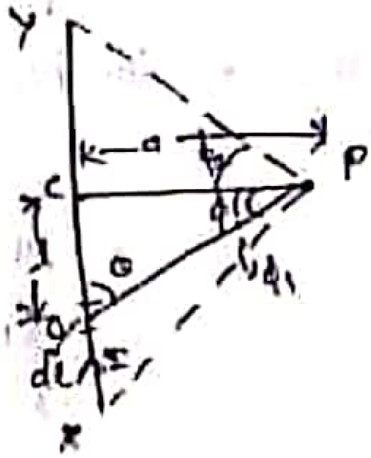
Imp formulae.
$$\boxed{dB = \frac{\mu_0}{4\pi} \frac{I\,dl \sin\theta}{r^2}}$$

Magnetic field due to a st. wire carrying current

Acc. to Biot-Savart's law

$$\vec{dB} = \frac{\mu_0}{4\pi} \frac{I\,\vec{dl} \times \vec{r}}{r^3}$$

$$dB = \frac{\mu_0}{4\pi} \frac{I\,dl \sin\theta}{r^2} \quad \text{--- (1)}$$



In ΔPOC,
$$\theta + \phi = 90°$$
$$\theta = 90° - \phi$$
$$\sin\theta = \sin(90 - \phi)$$
$$\sin\theta = \cos\phi$$

$\Rightarrow \cos\phi = \frac{a}{r}$

$r = \frac{a}{\cos\phi}$

$$dB = \frac{\mu_0}{4\pi} \frac{I\,(a\sec^2\phi\, d\phi)\cos\phi}{\left(\frac{a^2}{\cos^2\phi}\right)}$$

$\Rightarrow \tan\phi = \frac{l}{a}$

$l = a\tan\phi$

$dl = a\sec^2\phi\, d\phi$

$$\boxed{dB = \frac{\mu_0}{4\pi} \frac{I}{a} \cos\phi\, d\phi}$$

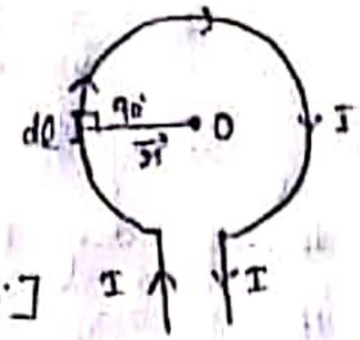
$$B = \int_{-\phi_1}^{\phi_2} \frac{\mu_0}{4\pi} \frac{I}{a} \cos\phi\, d\phi$$

$$B = \frac{\mu_0}{4\pi} \frac{I}{a} (\sin\phi_1 + \sin\phi_2)$$

⇒ Sp. Case ① when $\phi_1 = \phi_2 = 90°$ $\boxed{B = \frac{\mu_0 I}{2\pi a}}$

② when $\phi_1 = 90°$, $\phi_2 = 0$ $\boxed{B = \frac{\mu_0 I}{4\pi a}}$

Magnetic field at the centre of the circular coil carrying current :-



Acc. to Biot - Savart's law

$$dB = \frac{\mu_0}{4\pi} \frac{I dl \sin\theta}{r^2} \quad -①$$

$[\theta = 90°]$

$$dB = \frac{\mu_0}{4\pi} \frac{I dl}{r^2}$$

Integrating both sides

$$B = \int \frac{\mu_0}{4\pi} \frac{I dl}{r^2} = \frac{\mu_0}{4\pi} \frac{I}{r^2} \int dl$$

$$B = \frac{\mu_0}{4\pi} \times \frac{I}{r^2} \times 2\pi r = \frac{\mu_0}{4\pi} \times \frac{2\pi I}{r}$$

If the circular coil consist of 'n' turns, then

$$\boxed{B = \frac{\mu_0}{4\pi} \times \frac{2\pi n I}{r}}$$

Magnetic field at a point on the axis of a circular coil carrying current :-

Acc. to Biot-Savart's law, the magnitude of magnetic field induction at point P due to current element at c is given by