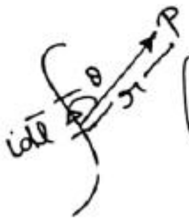
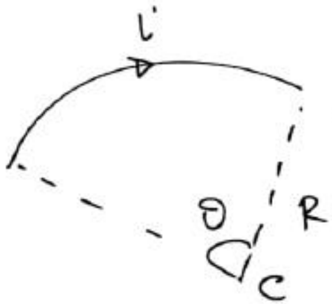
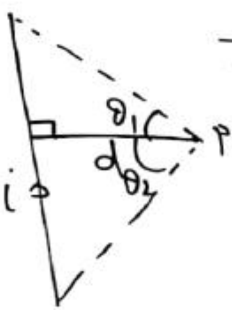
$\Rightarrow$



$$dB = \frac{\mu_0}{4\pi}\frac{i\,dl\sin\theta}{r^2}$$

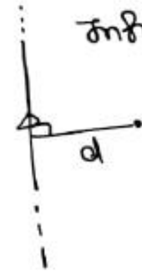


$$B_C = \frac{\mu_0 i}{4\pi R}\theta \quad (\theta \text{ in radian})$$



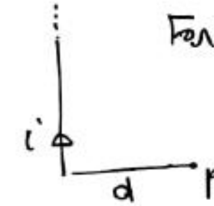
$$B_P = \frac{\mu_0 i}{4\pi d}(\sin\theta_1 + \sin\theta_2)$$

Infinite wire

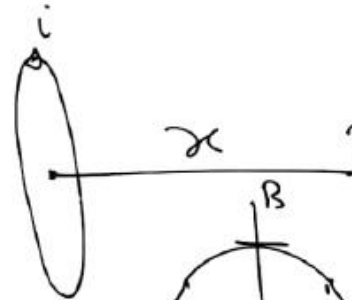


$$B = \frac{\mu_0 i}{2\pi d}$$

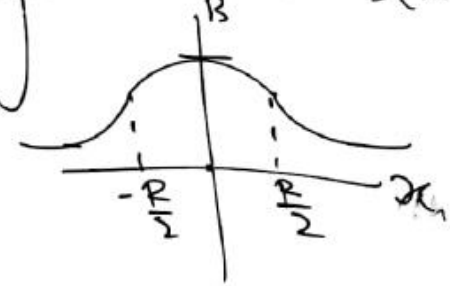
For semiinfinite wire



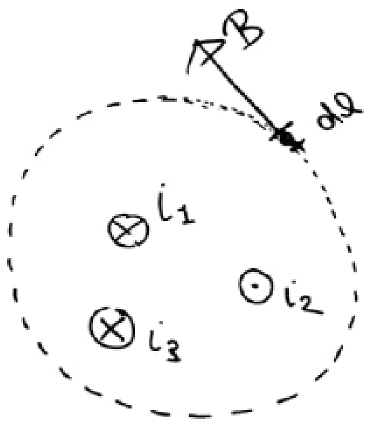
$$B_P = \frac{\mu_0 i}{4\pi d}$$



$$B = \frac{\mu_0 i R^2}{2(x^2+R^2)}$$



iv) Ampere Circuital Law :-



$$\oint \vec{B} \cdot \vec{dl} = \mu_0 \, i_{in}$$

$$\oint \bar{B} \cdot d\bar{l} = \mu_0 (i_2 - i_1 - i_3)$$

$$\oint \bar{B} \cdot d\bar{l} = \mu_0 (i_2 - i_1 - i_3)$$

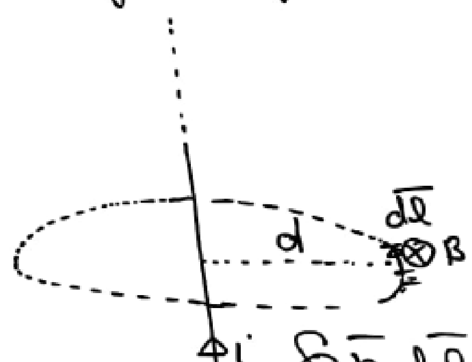
→ Ampere-Circuit

Integral multiple of magnetic field & $d\bar{l}$ vector of Ampere Circuit is always equal to μ_0 times Net current inside the loop.

(ii) Ampere Circuital Law :-

Application of Ampere's Law :-

(i) magnetic field due to infinite current carrying wire.



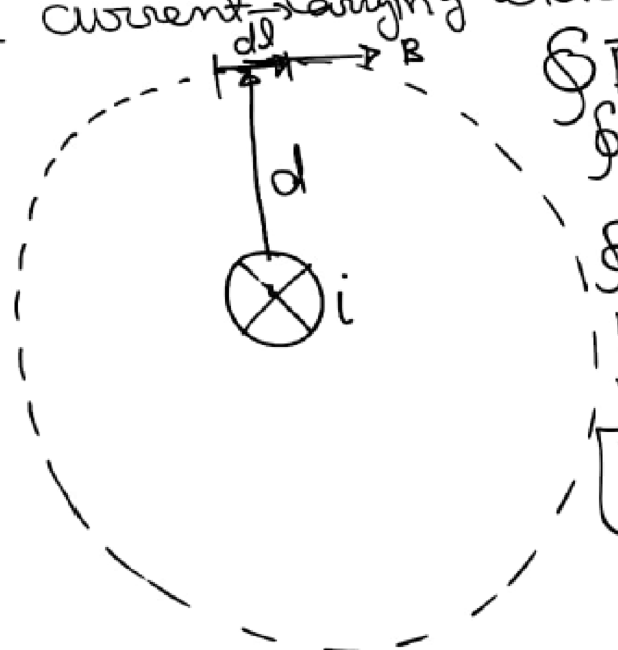
$$\oint \overline{B}\cdot \overline{dl} = \mu_0 i_{in}$$

$$\oint B\, dl \cos 0 = \mu_0 i$$

$$B \oint dl = \mu_0 i$$

$$B \times 2\pi d = \mu_0 i$$

$$B = \frac{\mu_0 i}{2\pi d}$$



$$\oint \overline{B}\cdot \overline{dl} = \mu_0 i_{in}$$

$$\oint B\, dl \cos 0 = \mu_0 i_{in}$$

$$\oint B\cdot dl = \mu_0 i$$

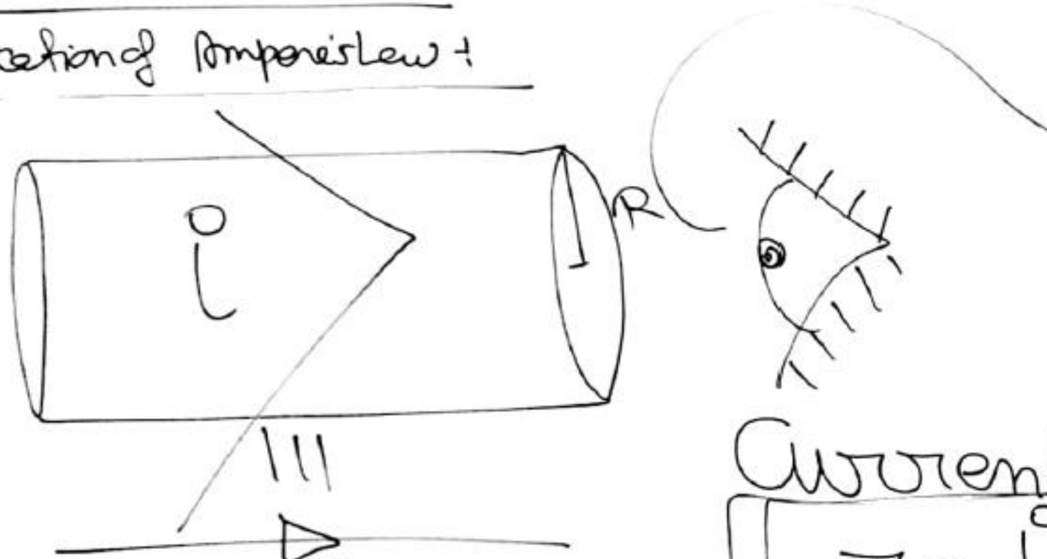
$$B \oint dl = \mu_0 i$$

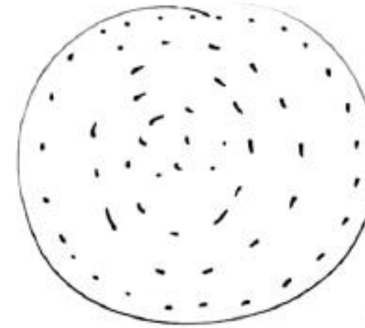
$$B \times 2\pi d = \mu_0 i$$

$$B = \frac{\mu_0 i}{2\pi d}$$

(I) Ampere Circuital Law :-

Application of Ampere's Law :-





i

$$\text{Current density} = \frac{i}{\pi R^2}$$

$$J = \frac{i}{A}$$

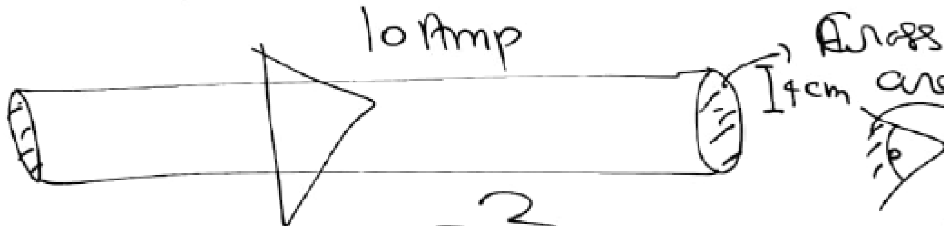
$10^{-2}\ m^2$

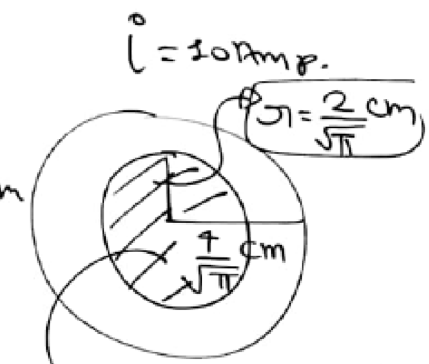
$i = 10\ \text{Amp}$

$$\text{Current density } j = \frac{10}{10^{-2}} = 1000\ \text{Amp}/m^2$$

Ampere Circuital Law :-

Application of Ampere's Law :-





$$A = \pi\left[\frac{4\times10^{-2}}{\sqrt{\pi}}\right]^2$$

$$= \frac{\pi\times16\times10^{-4}}{\pi}$$

$$A = 16\times10^{-4}$$

$$\hat{J} = \frac{10}{16\times10^{-4}}$$

$$J = \frac{10^5}{16}\ \text{Amp}/m$$

$$\pi\left[\frac{2\times10^{-2}}{\sqrt{\pi}}\right]^2$$

$$\frac{\pi\times4\times10^{-4}}{\pi}$$

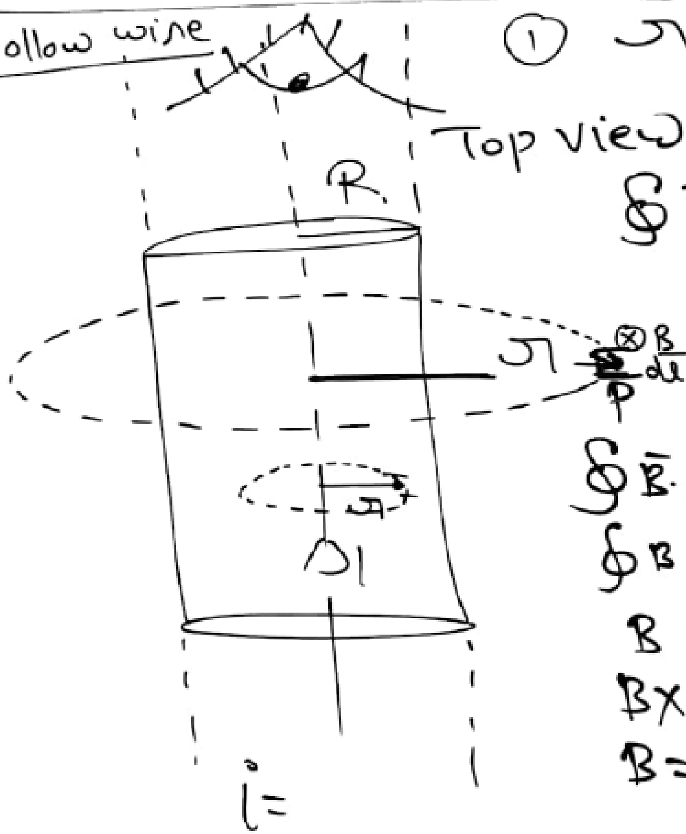
$$= 4\times10^{-4}$$

$$i = J\cdot A$$

$$i = \frac{10^5}{16}\times4\times10^{-4} = \frac{10}{4} = 2.5\ \text{Amp}$$

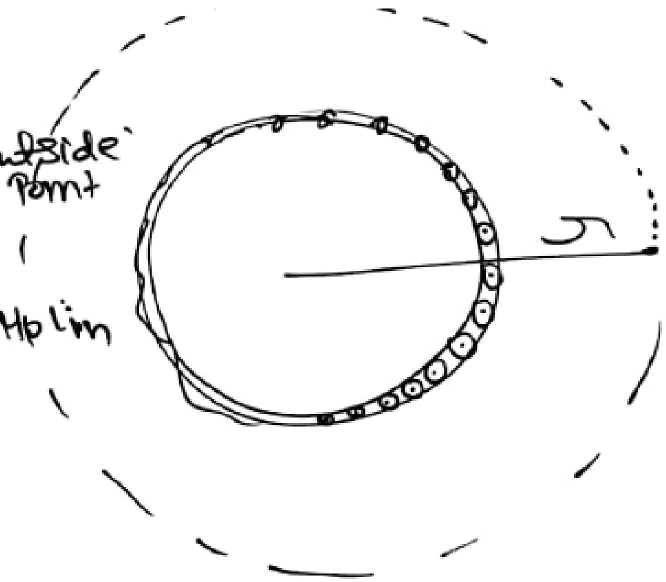
⇒ Application of Ampere Circuit Law:-

① Hollow wire



① $r > R$ [outside point]

$$\oint \vec{B} \cdot \vec{dl} = \mu_0 I_{in}$$



$$\oint \vec{B} \cdot \vec{dl} = \mu_0 i$$

$$\oint B\, dl \cos 0 = \mu_0 i$$

$$B \oint dl = \mu_0 i$$

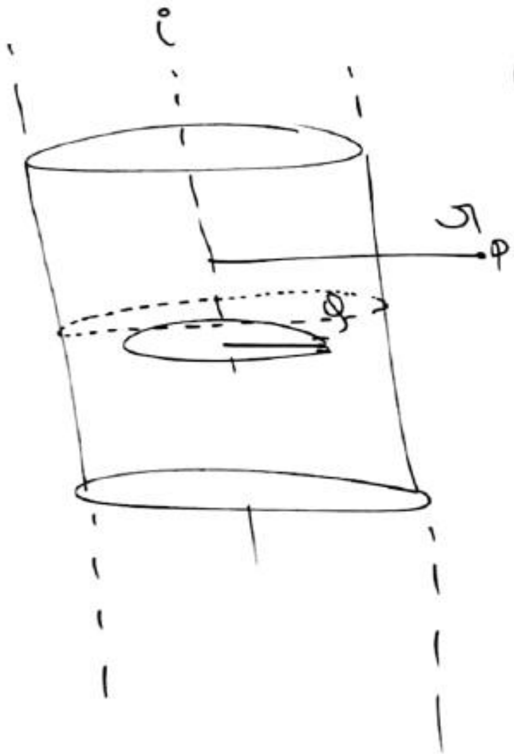
$$B \times 2\pi r = \mu_0 i$$

$$B = \frac{\mu_0 i}{2\pi r}$$

$$\boxed{B \propto \frac{1}{r}}$$

⇒ Application of Ampere Circuit Law :-

magnetic field due to Hollow (C) Infinite Current Carrying wire)



(i) $r > R$

$$B = \frac{\mu_0 i}{2\pi r}$$

$$B \propto \frac{1}{r}$$

(iii) $r = R$

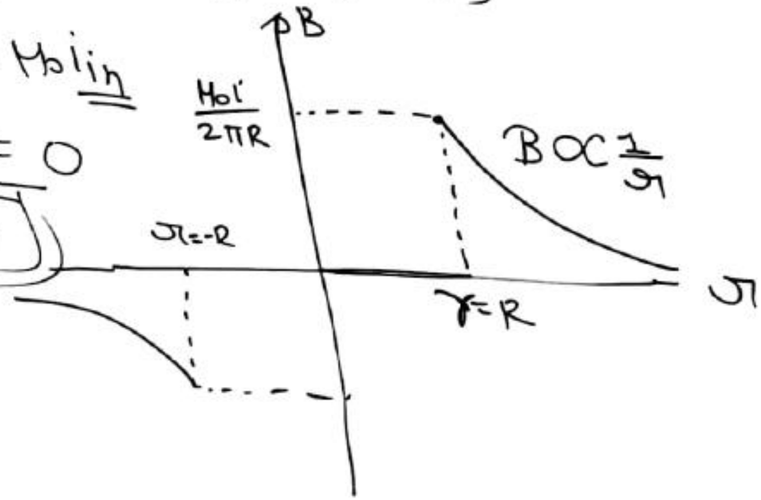
$$B = \frac{\mu_0 i}{2\pi R}$$

(ii) $r < R$ [Inside point]

$$\oint \bar{B} \cdot \bar{dl} = \mu_0 i_{in}$$

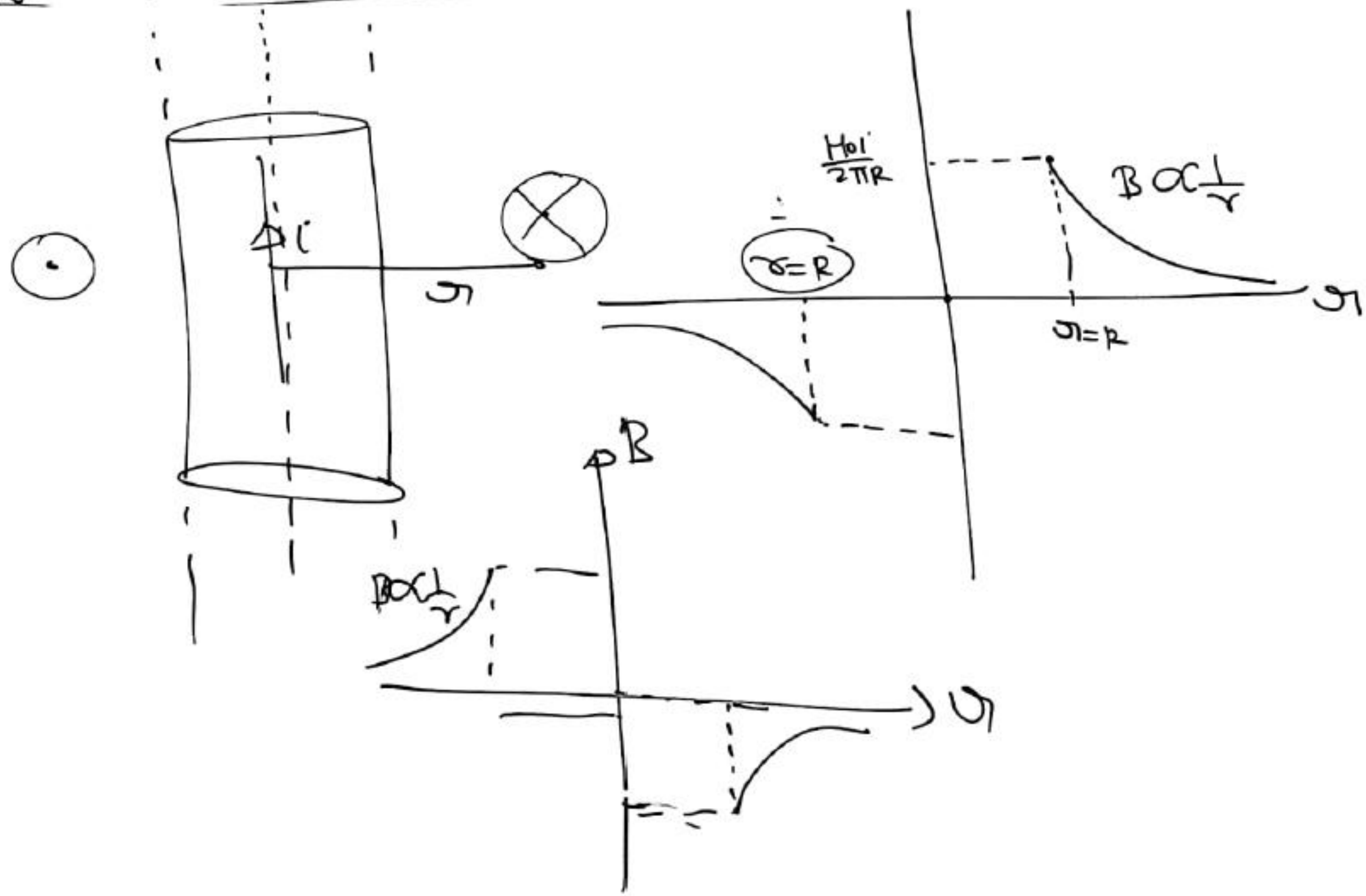
$$\oint \bar{B} \cdot \bar{dl} = 0$$

$$B = 0$$



⇒ Application of Ampere Circuit Law:-

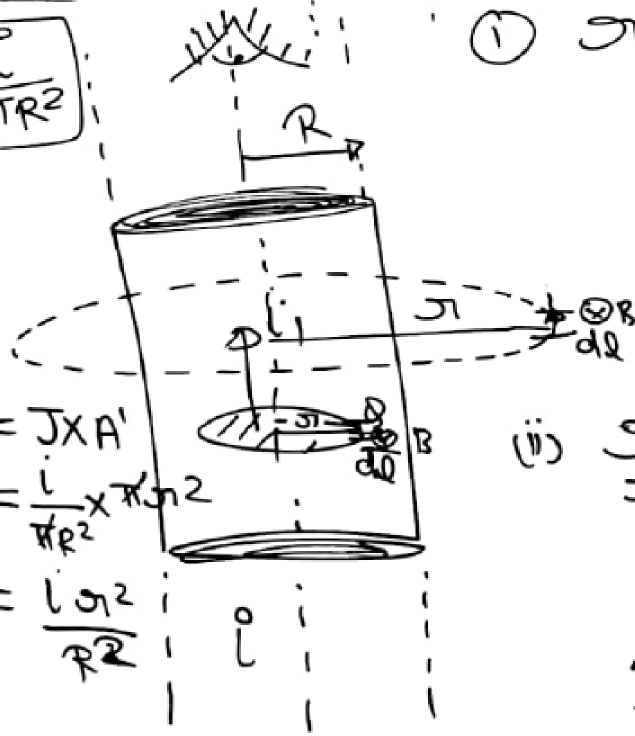
(#) magnetic field due to Hollow (C) Infinite Current Carrying wire)



⇒ Application of Ampere Circuit Law:-

magnetic field due to Solid Infinite Current Carrying wire)

(1) $J = \frac{i}{\pi R^2}$



$i' = J \times A'$

$= \frac{i}{\pi R^2} \times \pi r^2$

$i' = \frac{i r^2}{R^2}$

(i) $r > R$ [outside point)

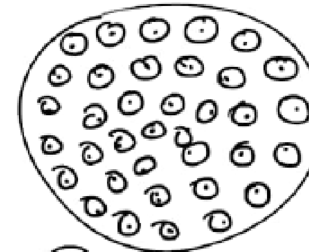
$\oint \bar{B} \cdot \bar{dl} = \mu_0 i_{in}$

$\oint B\, dl \cos 0 = \mu_0 i$

$B \times 2\pi r = \mu_0 i$

$B = \frac{\mu_0 i}{2\pi r}$

$B \propto \frac{1}{r}$



πr^2

से करना

OK

(ii) $r < R$

$\oint \bar{B} \cdot \bar{dl} = \mu_0 i_{in}$

$\oint B\, dl \cos 0 = \mu_0 i_{in}$

$B \times 2\pi r = \mu_0 \frac{i r^2}{R^2}$

$B = \frac{\mu_0 i r}{2\pi R^2}$

$B = \frac{\mu_0 i r}{2\pi R^2}$

$B \propto r$