Sources of the magnetic field

~~Biology~~

Biot -sovart law

⟹ moving charges causes magnetic field

$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{I \, d\vec{s} \times \hat{r}}{r^2}$$

μ_0 = permeability of free space
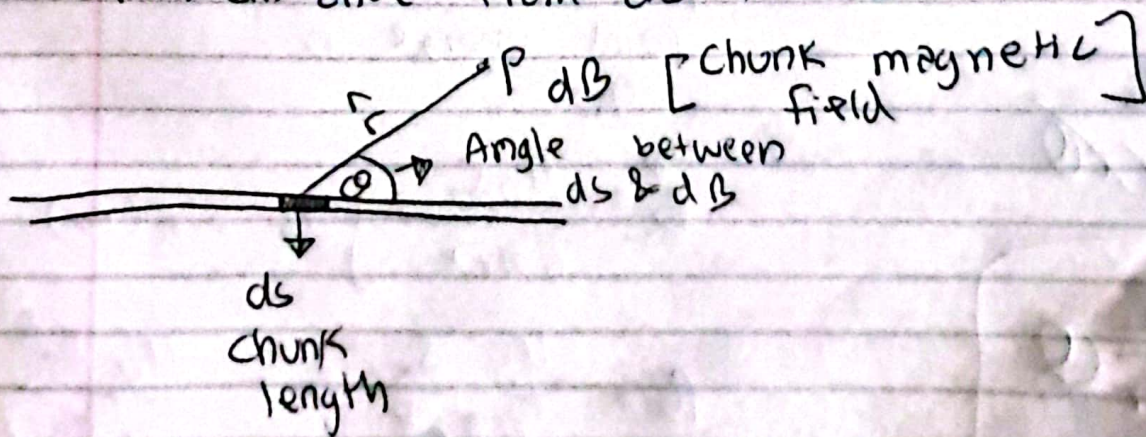$$= 4\pi \times 10^{-7} \, \frac{Tm}{A}$$

Biot -savart law

$$\text{Chunk magnetic field} = \frac{\mu_0}{4\pi} \frac{\overset{\text{Current going through}}{I} \times \overset{\text{a segment of wire}}{d\vec{s}} \times \hat{r}}{r^2}$$

⟹ I = current passing through a segment
   length $d\vec{s}$

⟹ $\hat{r}$ ÷ unit vector pointing from $d\vec{s}$ to $d\vec{B}$
   r^2 ÷ distance from $d\vec{s}$ to $d\vec{B}$

$P \, dB \left[\begin{array}{c} \text{chunk magnetic} \\ \text{field} \end{array}\right]$

Angle between
ds & dB

ds
chunk
length

⇒ To find the total magnetic field

$$\int dB = \int \frac{\mu_0 I \; d\vec{s} \times \hat{r}}{4\pi s}$$

$$B = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{r^2}$$

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direction of
where the
point p is
located
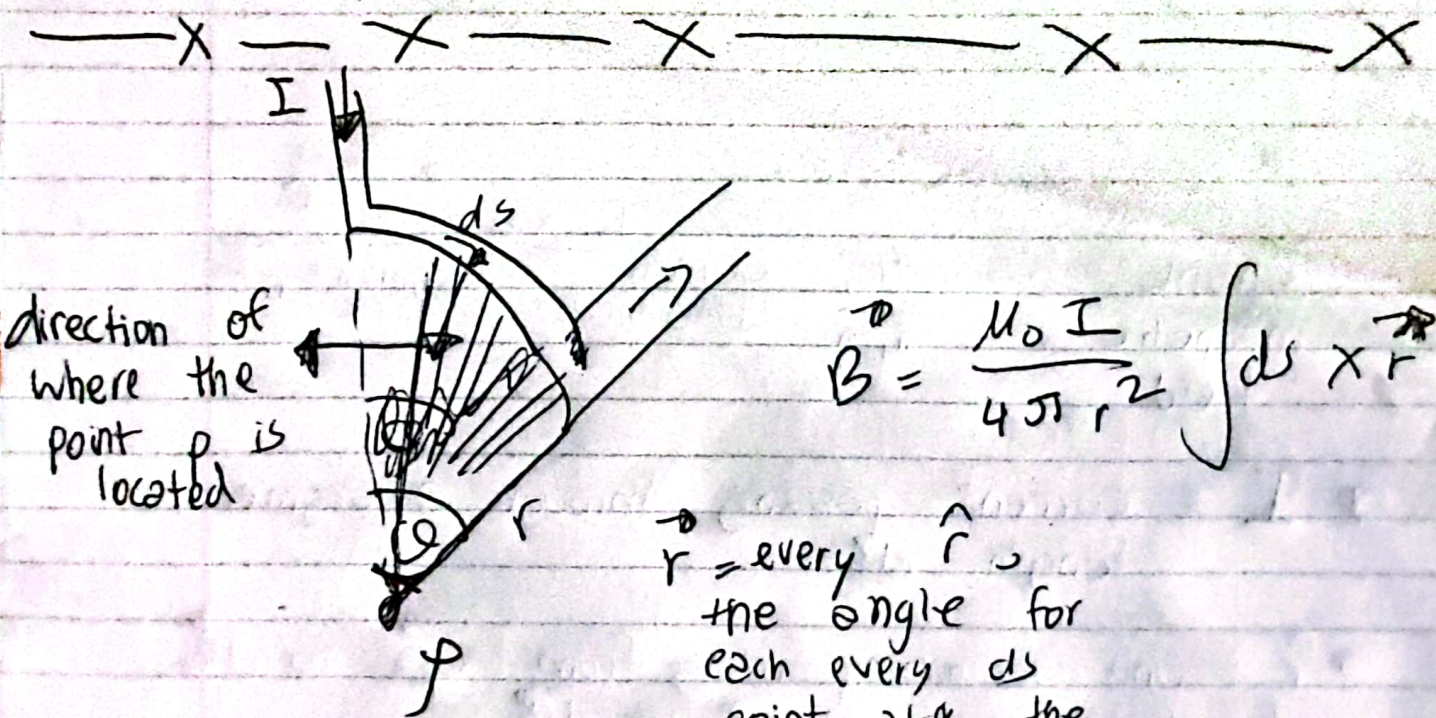
$$\vec{B} = \frac{\mu_0 I}{4\pi r^2} \int d\vec{s} \times \hat{r}$$

$\vec{r}$ = every $\hat{r}$
the angle for
each every ds
point at φ the
point charge is
$90°$

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

$$\boxed{\vec{B} = \frac{\mu_0 I}{4\pi r} Q}$$

$$\vec{B} = \frac{\mu_0 I}{4\pi r^2} \int ds \; \sin(90)$$

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