Where 'A' is the vector whose components are the areas enclosed by projection of the curve 'c' on the yz and zx and xy planes. The quantity 'IA' appears very frequently in magnetic theory & It is reffersed to as Magnetic moment of the circuit. The symbol 'm' is used for magnetic Moment.

$$m = I\vec{A} \rightarrow (1)$$

The Integral of $\vec{r} \times d\vec{l}$ around a closed path gives twice the area Enclosed by the curve. Thus

$$\frac{1}{2}\oint_c \vec{r} \times d\vec{l} = A$$

This can be used to obtain.

$$m = \frac{1}{2} I \oint_c \vec{r} \times d\vec{l} \rightarrow (2)$$

This is the alternative Expression of Magnetic Moment.

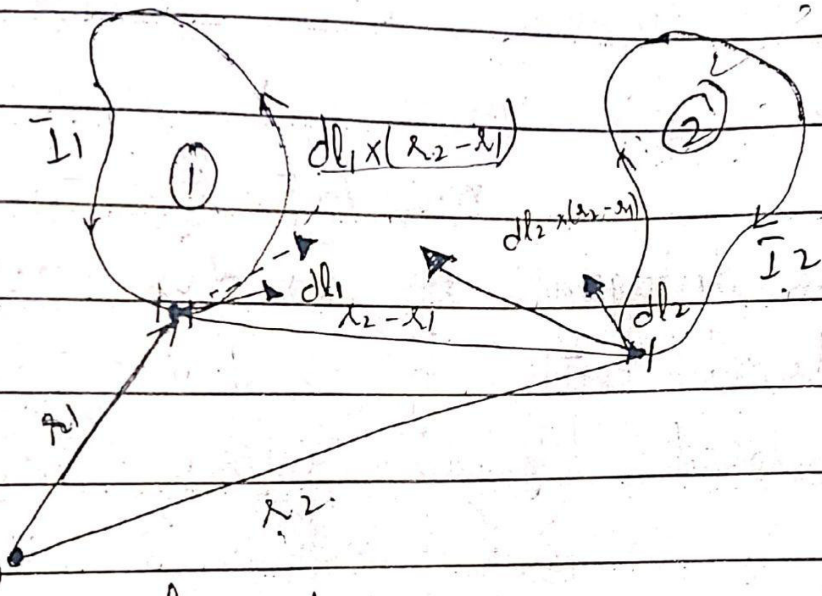
Biot-Savrat Law:-

In 1820, just a few weeks after Oersted announced

Effects. Ampere presented the result of a series of experiments that may be generalized & expressed in modern mathematical language as.

$$F_2 = \frac{\mu_0 I_1 I_2}{4\pi} \int_1\int_2 \frac{dl_2 \times [dl_1 \times (r_2 - r_1)}{(r_2 - r_1)^3}$$

Example:-



we take two bodies which are at certain distence apart. 'I_2' is flowing clock wise while 'I_1' is flowing Anti clock wise. we want to find out force entered by the two bodies on certain point 'O', with distances 'r_1' & 'r_2' from origin. we have to find out force (total) by using or writing $\vec{F}$ as follows.

F ... by body '2', calculated

by body '1'. ...(2)

$$F_2 = \frac{\mu_0}{4\pi} I_1 I_2 \oint_1 \oint_2 dl_2 \times \left[\frac{dl_1 \times (\vec{r_2} - \vec{r_1})}{|r_2 - r_1|^3} \right]$$

$$\text{As } \frac{\mu_0}{4\pi} = 10^{-7}\ N/A^2$$

Superficially, it violate Newton's third law because of the lack of symme[try]. However by using some of the theorems of vector Analysis it is shows that forces are equal but opposite in direction.

$$\vec{F_2} = -\vec{F_1}$$

The induction is generated in body '1' due to body '2'. i.e

$$B(r_2) = \frac{\mu_0}{4\pi} I_1 \oint_1 \frac{dl_1 \times (r_2 - r_1)}{|r_2 - r_1|^3}$$

This equation is a generalization of Biot-Savart law. The differential form is

$$dB(r_2) = \frac{\mu_0}{4\pi} I_1 \oint_1 \frac{dl_1 \times (r_2 - r_1)}{|r_2 - r_1|^3}$$

Electric current p...