1. The net magnetic force on the current loop in a uniform magnetic field is always zero.

$$F_{AB} + F_{BCDA} = 0$$
$$F_{BCDA} = -F_{AB} = -F$$

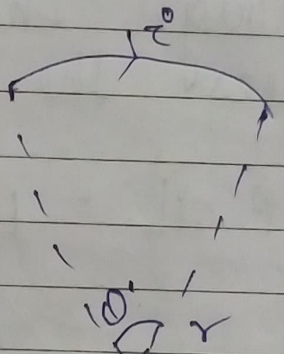
2. a) According to ampere ~~circle~~ circuital law, the line integral of magnetic feild iduction along a closed curve is equal to the total current passing through the surface enclosed curve lines the premeability of the medium

$$\oint \vec{B}.\vec{dl} = \mu_0 I_{enclosed}$$

Applying ampere's law for

Q3)

$\overset{\frown}{DC}$ ⊗ $B_1 = \frac{\mu_0 i}{4\pi b}(\theta)$



$\overset{\frown}{AB}$ ⊙ $B_2 = \frac{\mu_0 i}{4\pi a}(\theta)$

$B = \frac{\mu_0 i}{4\pi r} \times (\theta)$

$B = B_2 - B_1 = \frac{\mu_0 i \theta}{4\pi}\left(\frac{1}{a} - \frac{1}{b}\right)$

$= \frac{\mu_0 i}{4\pi ab}(b-a) \times \theta$

$= \frac{\mu_0 i \theta}{4\pi ab}(b-a)$

4) $R_P = R_Q = R$, $I_P = I$ and $I_Q = \sqrt{3}I$

Magnitude of magnetic field at common centre O due to current flowing in coil P is

$$B_P = \frac{\mu_0 I_P}{2R_P} = \frac{\mu_0 I}{2R}$$

Direction of B_P is perpendicular to the plane of coil P as shown

$$B_Q = \frac{\mu_0 I_Q}{2R_Q} = \frac{\mu_0 (\sqrt{3}I)}{2R}$$

∴ Magnitude of resultant field

$$B = \sqrt{B_P^2 + B_Q^2} = \sqrt{\left(\frac{\mu_0 I}{2R}\right)^2 + \left(\frac{\mu_0 \sqrt{3}I}{2R}\right)}$$

$$= \frac{\mu_0 I}{R}$$

The resultant magnetic field subtends an angle β from direction of B_Q where

$$\tan\beta = \frac{B_P}{B_Q} = \frac{1}{\sqrt{3}} \quad \beta = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) = 30^\circ$$

5) $B = \frac{\mu_0 I R^2}{2x^3}$

∴ Magnetic feild ⓞ due to Current Loop number 1

$B_1 = \frac{\mu_0 I R^2}{2x^3}$ along +ve X-axis

and Magnetic feild at point O due to Current Loop number 2

$B_2 = \frac{\mu_0 I R^2}{2x^3}$ along +ve Y-axis

As B_1 and B_2 are in mutually perpendicular direction fig. the resultant Magnetic feild subtends one angle β from horizontal, where

$\tan\beta = \frac{B_2}{B_1} = 1 \Rightarrow \beta = 45^\circ$