Q. 3 A current carrying circular loop of radius R is placed in the x-y plane with centre at the origin. Half of the loop with $x > 0$ is now bent so that it now lies in the y-z plane.

(a) The magnitude of magnetic moment now diminishes

(b) The magnetic moment does not change

(c) The magnitude of B at $(0,0,z)$, $z > R$ increases

(d) The magnitude of B at $(0,0,z)$, $z >> R$ is unchanged

K Thinking Process

The magnetic moment of circular loop and the net magnitudes of magnetic moment of each semicircular loop of radius R lie in the x-y plane and the y-z plane are compared.

Ans. *(a)* The direction of magnetic moment of circular loop of radius R is placed in the x-y plane is along z-direction and given by $M = I(\pi r^2)$, when half of the loop with $x > 0$ is now bent so that it now lies in the y-z plane, the magnitudes of magnetic moment of each semicircular loop of radius R lie in the x-y plane and the y-z plane is $M' = I(\pi r^2)/4$ and the direction of magnetic moments are along z-direction and x-direction respectively.

Their resultant

$$M_{net} = \sqrt{M'^2 + M'^2} = \sqrt{2}\, M' = \sqrt{2}\, I(\pi r^2)/4$$

So, $M_{net} < M$ or M diminishes.