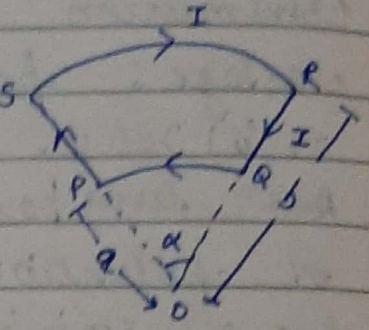
Chapter - 4 Assignment - 1

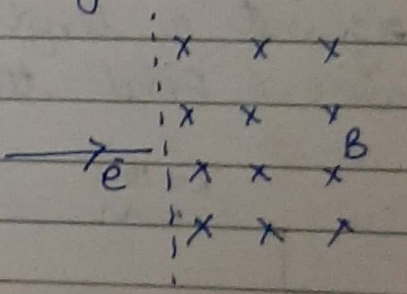
Q1. Figure shows a current loop having two circular segments and joined by two radial lines. Find the magnetic field at the centre O.



Ans: $B = \frac{\mu_0 I \alpha (b-a)}{4\pi ab}$

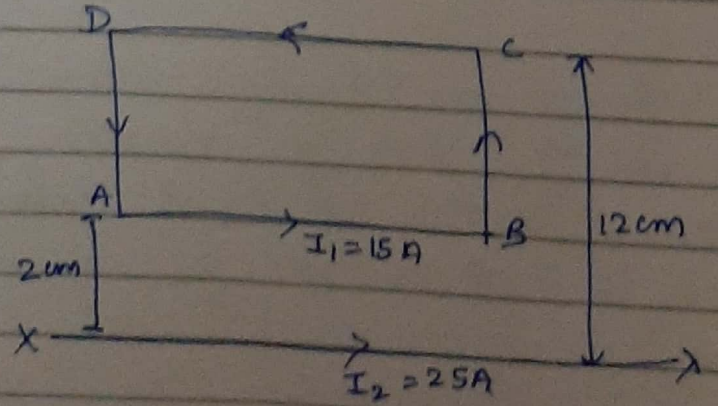
Q2. An electron moving horizontally with a velocity of 4×10^4 m/s enters a region of uniform magnetic field of 10^{-5} T acting vertically downward as shown in figure.

Draw its trajectory and find out time it takes to come out of the region of magnetic field.



Ans: $t = 1.8 \times 10^{-6}$ s.

Q3. A rectangular loop of sides 25 cm and 10 cm carrying a current of 1.5 A is placed with its longer side parallel to a long straight conductor 2.0 cm apart carrying a current of 25 A. What is net force on loop.



Ans: $F = 7.8 \times 10^{-4}$ N

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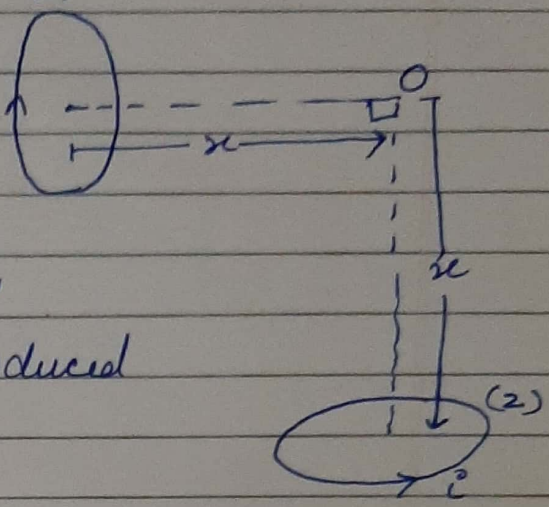
Q4. Two small identical circular loops, marked (1) and (2), carrying equal currents are placed with the geometrical axis perpendicular to each other as shown in figure. Find the magnitude and direction of the net magnetic field produced at point O



Ans: $B = \frac{\mu_0 I R^2 \sqrt{2}}{2(x^2+R^2)^{3/2}}$

Q5. A charged particle of mass 'm', charge 'q' moving at uniform velocity 'v' enters a uniform magnetic field 'B' acting normal to the plane of the paper. Deduce expression for the (i) radius of circular path in which it travels, (ii) kinetic energy of the particle (assuming $v << c$).

Ans: $r = \frac{mv}{qB}$, $K.E = \frac{B^2 q^2 r^2}{2m}$