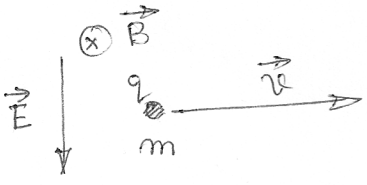
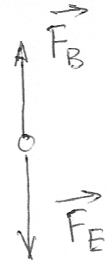
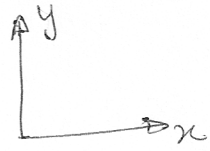
SOLUTION

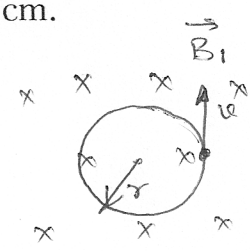
NAME:	Quiz #9d: Phys270
_____	SECTION 0102

[10 pts] An unknown charged particle passes without deflection throug h crossed electric and magnetic fields of strengths 200,000 V/m and 0.10 T, respectively. The velocity of the particle is perpendicular to both fields. The particle then passes out of this region and into a region of uniform magnetic field of 0.2 T in which the particle makes a semicircle of diameter 20 cm. What is the particle's charge-to-mass ratio?









Magnetic force $\vec{F}_B = q\vec{v} \times \vec{B}$

$= qvB\,\hat{y}$

Electric force $\vec{F}_E = qE(-\hat{y})$

for no deflection the forces cancel each other

$\vec{F}_B = -\vec{F}_E$

$qvB = qE \Rightarrow v = \frac{E}{B}$

we have $r = \frac{mv}{qB_1} \Rightarrow \frac{q}{m} = \frac{\frac{E}{B}}{rB_1}$

we have $E = 2\times10^5$ V/m ; $B = 0.1$ T ; $B_1 = 0.2$ T; $r = 0.2$m

$\therefore \frac{q}{m} = \frac{2\times10^5}{0.2\times0.1\times0.2} = 5\times10^7$ Columb/kg