EXAM III Physics 208 2017

Last Name.....First Name .....Section Number.....

USEFUL INFORMATION

$$\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$d\vec{B} = \frac{\mu_0 i}{4\pi}\frac{d\vec{s} \times \vec{r}}{r^3}$$

$$\frac{d\vec{r}}{dt} = \frac{dx}{dt}\vec{i}_x + \frac{dy}{dt}\vec{i}_y = \frac{dr}{dt}\vec{i}_r + r\frac{d\theta}{dt}\vec{i}_\theta$$

$$\oint \vec{E} \cdot d\vec{r} = -\frac{d}{dt}\int \vec{B} \cdot d\vec{S}$$

$$C = \frac{Q}{V} = \frac{A\epsilon_0}{d} \qquad R = \rho\frac{l}{A}$$

$$\int \vec{B} \cdot d\vec{S} = \pm Li$$

$$\oint \vec{B} \cdot d\vec{r} = \mu_0 i_{enclosed}$$

$$\frac{d\ln U}{dx} = \frac{dU}{dx}\frac{1}{U}$$

1.

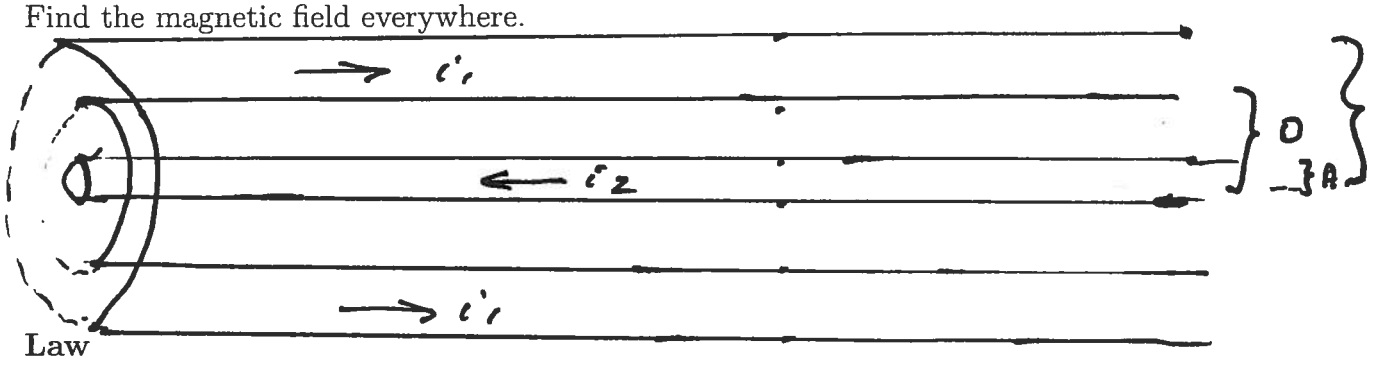
2.

3.

4.

Please mark all charges and currents on the appropriate figure so that your symbols are defined. Do not waste time on non-trivial integrals.

1. (25 points)Consider an infinitely long, hollow cylindrical wire The wire has outer radius F and the cylindrical hole at its center has radius D. A current i_1 flows from left to right and the current is uniformly spread over the region between F and D. At the center of this wire is an infinitely long cylindrical wire of radius A. It has a current i_2 flowing from right to left and that current is uniformly spread over its area.
Find the magnetic field everywhere.

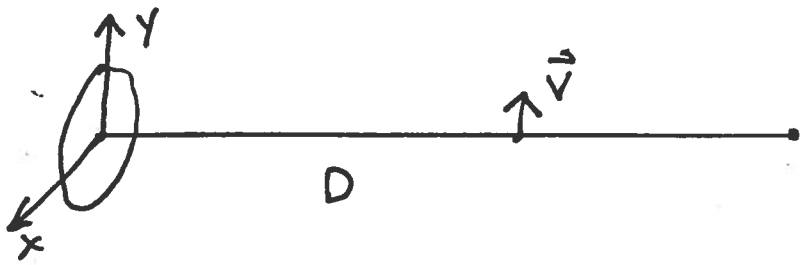


Law

Application

Result

2. (25 points) A very thin circle of wire lies in the x, y plane. It radius R. A positively charged particle, charge q, is a distance D away from the center of the circle moving with a velocity $\vec{v}$ as shown. The force on the particle when it is at the point shown is measured and has the known magnitude F and points into the page, in the negative x direction. What is the current in the circle of wire?

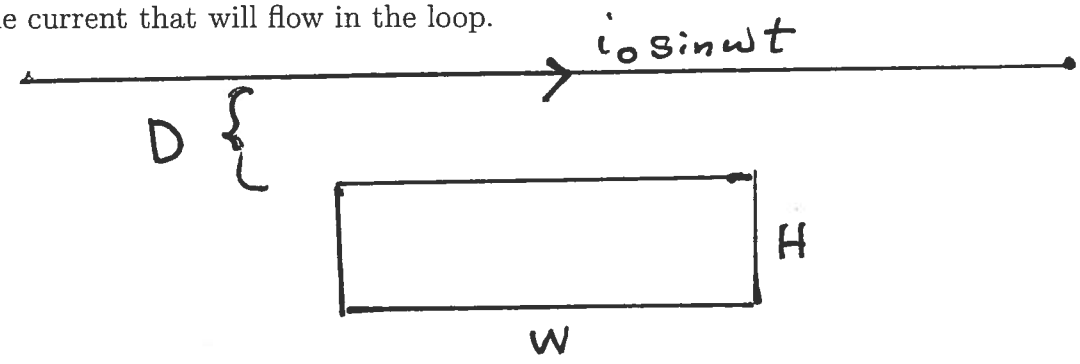


Law

Application

Result

3. (25 points) An infinitely long wire carries a current $i_o \sin \omega t$ as shown, where i_0 and ω are known. Nearby is a rectangular loop of wire with resistivity ρ which has cross sectional area A and dimensions W and H as shown. Ignoring self inductance find the current that will flow in the loop.



Law

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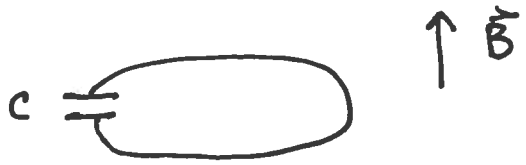
4. (25 points)A circular loop of wire has resistance R and contains a capacitor with capacitance C. It is in the horizontal plane. There is a constant vertical magnetic field of magnitude B_0 pointing up. At time $t = 0$ the loop begins to mysteriously expand so that its area is given by $A(t) = A_0(1 + \gamma t)$ where γ and A_0 are known constants. (The resistance does not change during this expansion.)
Find the charge on the capacitor as a function of time. (Ignoring self inductance.)



Law

Application

Result