proprep

Workbook

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Ampere's Law

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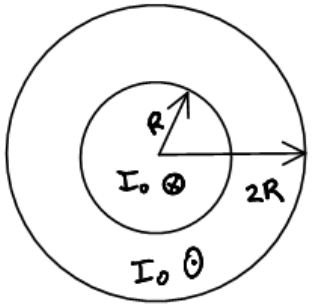
Questions

1) A wire has a current of Iflowing through it. Calculate the magnetic field.

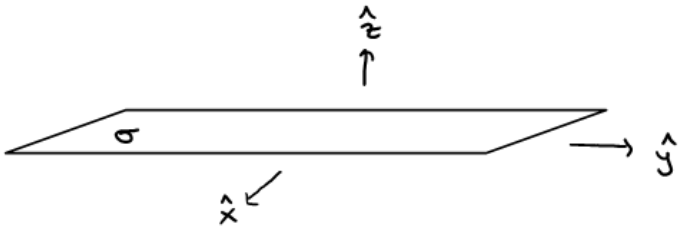
2) A conducting cylinder of radius R is surrounded by a thin insulating layer.
A uniform current I_0 flows into the page through the inner cylinder.
The current density is uniform. A thick conducting tube, of width $2R - R$, surrounds the cylinder and the thin insulating layer.
A uniform current I_0 flows out of the page through the outer tube, the current density here is uniform.



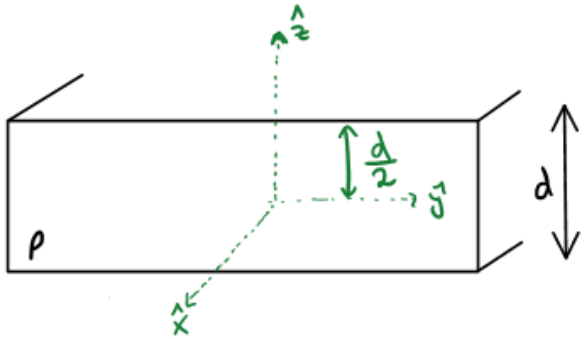
a. What is the current density,$\vec{J}$, throughout?

b. What is the magnetic field, $\vec{B}$, throughout?

3) Calculate the magnetic field of an infinite, thin plane with a uniform charge density σ, moving with a velocity $\vec{v} = v_0\hat{x}$.

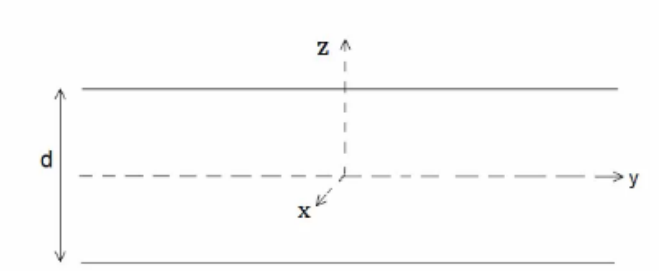


4) Calculate the magnetic field of an infinite plane of width d, with a uniform charge density ρ, moving with a velocity $\vec{v} = v_0\hat{x}$.

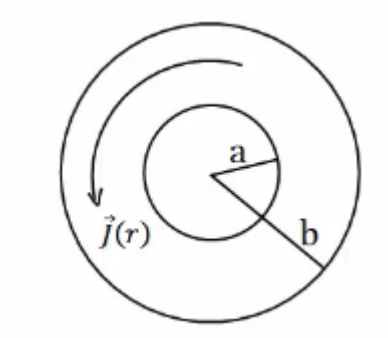


5) Calculate the magnetic field of a coil of length l, that has a current I flowing through. The radius of the coil is a and the total number of turns in the coil is N.

6) An infinite plane of width d has a changing charge density per unit volume, $\rho(z) = \rho_0 e^{\alpha z}$, where α is constant. The plane is parallel to the xy-plane, and the origin is at its center. The plane begins moving in the x-direction (out of the page) at a velocity v_0. Calculate the magnetic field both inside and outside the plane.



7) There is a current flowing through an infinite cylinder of inner radius a and outer radius b. The current density is $\vec{J}(r) = Ar^3\hat{\theta}$. Calculate the magnetic field throughout.



*For the solutions go see the videos