P1. Problem 5.2 (in 8/E & 7/E)

5.2 When a particle with charge \( q \) and mass \( m \) is introduced into a medium with a uniform field \( B \) such that the initial velocity of the particle \( u \) is perpendicular to \( B \) (Fig. P5.2), the magnetic force exerted on the particle causes it to move in a circle of radius \( a \). By equating \( F_m \) to the centripetal force on the particle, determine \( a \) in terms of \( q, m, u, \) and \( B \).

![Figure P5.2 Particle of charge \( q \) projected with velocity \( u \) into a medium with a uniform field \( B \) perpendicular to \( u \) (Problem 5.2).](image)

P2. Problem 5.4 (in 8/E & 7/E)

5.4 The rectangular loop shown in Fig. P5.4 consists of 20 closely wrapped turns and is hinged along the \( z \) axis. The plane of the loop makes an angle of 30° with the \( y \) axis, and the current in the windings is 0.5 A. What is the magnitude of the torque exerted on the loop in the presence of a uniform field \( B = \hat{y} 2.4 \) T? When viewed from above, is the expected direction of rotation clockwise or counterclockwise?

![Figure P5.4 Hinged rectangular loop of Problem 5.4.](image)

**Hint:** The angle that the plane of the loop makes with the \( y \) axis must be considered.

**Note:** Answer in Appendix E at end of book.
P3. Problem 5.7 (in 8/E & 7/E).
**Hint:** Add up the fields due to all four sides. “Magnetic flux density” means $B$.
**Note:** Answer in Appendix E at end of book.

**Note:** The problem is not well stated. Change “power cable” to “DC current-carrying wire”, as we usually understand a “power cable” as two wires carrying opposite AC currents.
**Hint:** The field is a vector! You know the direction of the earth’s magnetic field.
**Note:** Answer in Appendix E at end of book.

P5. Problem 5.16 (in 8/E & 7/E).
**Note:** Answer in Appendix E at end of book.

**Note:** Follow the same method as in example given in class. Just need a tad more math.
Answer: $H = J_0 \hat{\phi}$ for $r < a$, and $H = J_0(a/r) \hat{\phi}$ for $r > a$.

P7. Problem 3.58
**Note:** This is a Chapter 3 problem. Answer in Appendix E at end of book.
Do (b) thru (d). You answered whether the fields are solenoidal in HW #8. Now, only answer if the fields are conservative.
A field is said to be solenoidal if its divergence is zero.
A field is said to be conservative if its curl is zero.