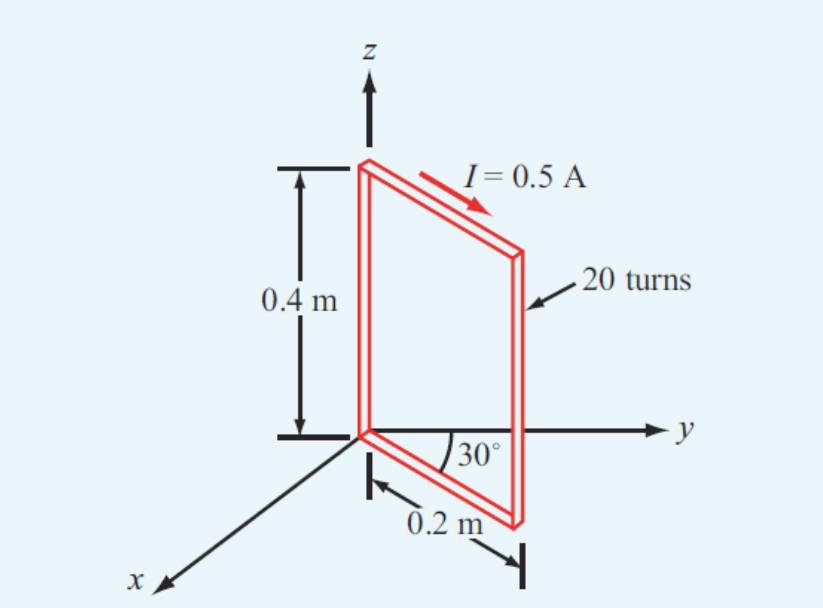
HW2 due to 10/19 (submit online at NTUCOOL before 9 am)

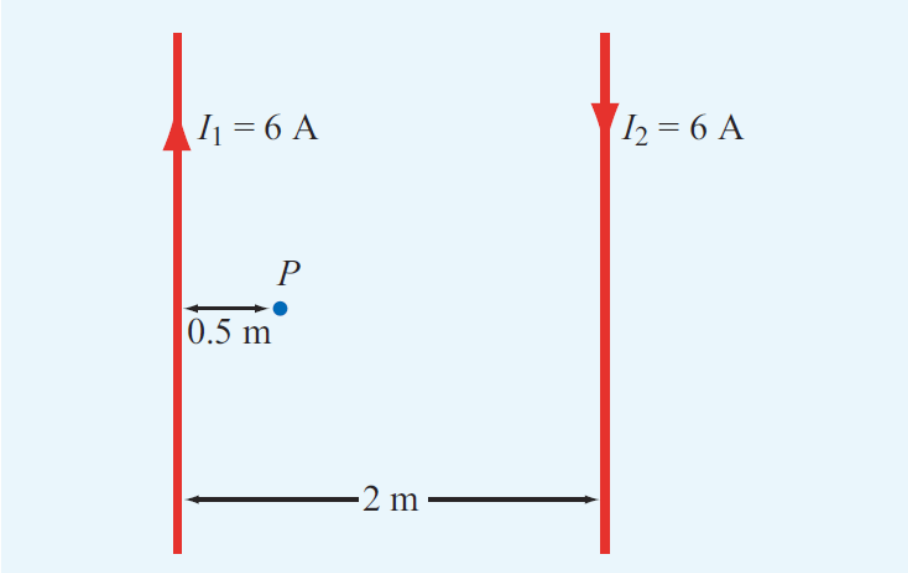
1.

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 $\mathbf{B} = \hat{\mathbf{y}}2.4$ T? When viewed from above, is the expected direction of rotation clockwise or counterclockwise?



2.

5.12 Two infinitely long, parallel wires are carrying 6-A currents in opposite directions. Determine the magnetic flux density at point P in Fig. P5.12.



3.

5.35 The plane boundary defined by $z = 0$ separates air from a block of iron. If $\mathbf{B}_1 = \hat{\mathbf{x}}4 - \hat{\mathbf{y}}6 + \hat{\mathbf{z}}12$ in air ($z \geq 0$), find $\mathbf{B}_2$ in iron ($z \leq 0$), given that $\mu = 5000\mu_0$ for iron.

4.

5.27 A uniform current density given by

$$\mathbf{J} = \hat{\mathbf{z}} J_0 \qquad (\text{A/m}^2)$$

gives rise to a vector magnetic potential

$$\mathbf{A} = -\hat{\mathbf{z}} \frac{\mu_0 J_0}{4}(x^2 + y^2) \qquad (\text{Wb/m})$$

(a) Apply the vector Poisson's equation to confirm the above statement.

(b) Use the expression for **A** to find **H**.

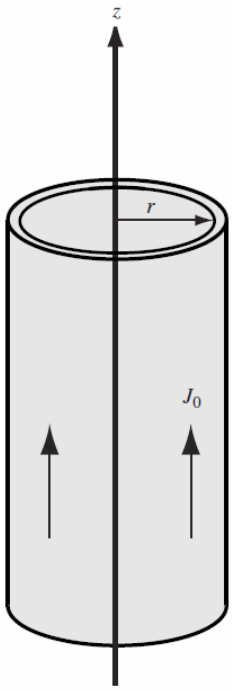


Figure P5.27 Current cylinder of Problem 5.27.