Only one force on segment 4 unbalanced.

\[ F_{\text{net}} = i l B = (25 \text{ A})(0.25 \text{ m})(2 \text{ T}) \]

\[ F = 12.5 \text{ N} \hat{j} \]
29-66

\[ B_{\text{single loop}} = \frac{\mu_0 i}{2r} \]

\[ B_{n \text{ loops}} = \frac{\mu_0 N_i}{2r} \]

\[ B = \frac{\mu_0 N_i v}{2r R} \]

\[ v = \frac{B_2 r R}{\mu_0 N} = \frac{(8 \times 10^{-\gamma})(2)(2m)(205)}{(4\pi \times 10^{-2} \text{ T.m} / \text{A})(150)} \approx 34 \text{ V} \]

39-73

The ends of the wire contribute nothing since \( \mathbf{d} \times \mathbf{v} = \mathbf{0} \).

Contribution of segment II,

\[ B_1 = \frac{\mu_0 I}{4\pi L} \left( \frac{L}{L^2 + L'^2/4} \right)^{\frac{3}{2}} \]

\[ = \frac{\mu_0 I}{4\pi L} \frac{2}{\sqrt{5}} \text{ (into paper)} \]

Contributions of segments I, III

(above paper) given by

\[ B_1 = \frac{\mu_0 2I}{4\pi L} \cos \alpha = \frac{\mu_0 2I}{4\pi L} \frac{2}{\sqrt{5}} = \frac{\mu_0 I}{4\pi L} \frac{4}{\sqrt{5}} = B_{\text{II}} \]

Since they all point the same way, they add. \( B \) at \( P \) is

\[ = B_1 + B_{\text{II}} + B_{\text{III}} = \frac{\mu_0 I}{4\pi L} \left( \frac{4}{\sqrt{5}} + \frac{2}{\sqrt{5}} + \frac{4}{\sqrt{5}} \right) = \frac{\mu_0 I}{4\pi L} \frac{10}{\sqrt{5}} = \frac{\mu_0 I \sqrt{5}}{2\pi L} \]
Segments 1, 3 do not contribute to $\vec{B}$ at $\rho$.

$d\vec{B}_\rho = \frac{\mu_0 I}{4\pi} \frac{de \times \hat{r}}{r^2}$

$\vec{B}_\rho = \frac{\mu_0 I}{4\pi} \frac{1}{r^2} \int_0^{\pi r} dl = \frac{\mu_0 I}{4\pi} \frac{\pi r}{r^2}$

$\vec{B}_\rho = \frac{\mu_0 I}{4 r}$

$\vec{B}_\rho$ segment 4 similar in magnitude but opposite in direction.

$\vec{B}_\rho = \left[ \frac{\mu_0 I}{4 r_1} - \frac{\mu_0 I}{4 r_2} \right]$ into paper
magnetic potential makes no sense because a magnetic field does no work on a charged particle moving through it.

\[ \mathbf{F} \cdot d\mathbf{s} = 0 \]

because \( \mathbf{F} \) is in direction of \( \mathbf{V} \times \mathbf{B} \)

\( \mathbf{F} \perp \mathbf{V} \) and thus \( \perp \) to \( d\mathbf{s} \)

Large \( I \) causes strong \( \mathbf{B} \) circulating as shown charges moving as part of the current on the outer part of the wire experience an inward (toward smaller \( r \)) force due to \( \mathbf{V} \times \mathbf{B} \).

This is compression on the wire.
By symmetry, B field is parallel to surface, and is perpendicular to direction of current. Take loop as shown, calculate $\int B \cdot d\ell$. Vertical sides do not contribute to integral. Contribution of horizontal sides is $B \cdot L$. Current through loop is $\sigma L$. Therefore Ampere's law gives:

$$2B \cdot L = \int B \cdot d\ell = \mu_0 I = \mu_0 \sigma L \Rightarrow B = \frac{\mu_0 \sigma}{2}$$

From problem 4, B-field from each plate is of magnitude $\mu_0 \sigma / 2$.
However, in the $y > 0$, $z > 0$, and $y < 0$, $z < 0$, segments, the fields of the two plates are in opposite directions, hence cancel. In other two segments, the magnitude is twice that of single plate, $\mu_0 \sigma$ (in direction shown).
\[ B = \mu_0 I / n \quad n = \frac{260}{2} / \text{cm} = 130 / \text{cm} = 13,000 / \text{m} \]

\[ B = (4\pi \times 10^{-7}) \times 13,000 \times 10^3 = 0.13 \text{T} \]

\[ B = \mu_0 I / (2\pi \rho) \quad \text{Ampère's law} \quad \oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I \text{and} \]

\[ B(2\pi R) = \mu_0 I \text{ and} \]

\[ \mathcal{J} = \text{const} = \frac{I}{\left[ \frac{1}{2} (2\pi R)^2 - \pi R^2 \right]} \]

\[ \mathcal{I}_\text{calc} = \frac{I}{3\pi R} \left[ \frac{\pi (\frac{3}{2} R)^2 - \pi R^2}{\pi R^2} \right] \]

\[ \mathcal{J}_\text{calc} = \frac{I}{3\pi R} = \frac{5I}{12} \]

\[ B = \frac{\mu_0 I}{2\pi \left( \frac{3}{2} R \right)} = \frac{5\mu_0 I}{36\pi R} \]

At radius \( \frac{3}{2} R \), \( B = \frac{\mu_0 I}{2\pi \left( \frac{3}{2} R \right)} \) where \( I \) = current inside \( \frac{3}{2} R \)

\[ f = I \left[ \frac{\frac{9}{4} R^2 - R^2}{4R^2 - R^2} \right] = I \left( \frac{5}{12} \right) \]

And

\[ B = \frac{\mu_0 I}{3\pi R^2} = \frac{5\mu_0 I}{36\pi R} \]

At \( 3R \),

\[ B = \frac{\mu_0 I}{2\pi (3R)} = \frac{\mu_0 I}{5\pi R} \]