Draft solution. Consider cylindrical coordinates and \( \mathbf{E} \) and \( \mathbf{B} \) fields at a point \((\rho, \phi, z) = (r, 0, 0)\) above a wire. Since the wire is neutral, \( V = 0 \) and \( \mathbf{E} = 0 \) in each case.

1. \[
\mathbf{A}(r, 0, 0, t) = \frac{\mu_0}{4\pi} \int \frac{I(z, t - \frac{r}{c})}{r} \, dz
\]

with \( r = \sqrt{z^2 + r^2} \).

\[
A_z = \frac{\mu_0}{4\pi} \int_{-z_0}^{z_0} \frac{I_0}{\sqrt{z^2 + r^2}} \, dz
\]

where \( z_0 = \sqrt{c^2 t^2 - r^2} \). Integrating,

\[
A_z = \frac{\mu_0 I_0}{4\pi} \ln \left[ \frac{ct + \sqrt{c^2 t^2 - r^2}}{ct - \sqrt{c^2 t^2 - r^2}} \right].
\]

Using \( \mathbf{B} = \nabla \times \mathbf{A} \),

\[
B_\phi = -\frac{\partial A_z}{\partial r} = \frac{\mu_0 I_0 ct}{2\pi r \sqrt{c^2 t^2 - r^2}}.
\]

The force per unit length may then be obtained as

\[
F_l = B_\phi I_0 = \frac{\mu_0 I_0^2 ct}{2\pi r \sqrt{c^2 t^2 - r^2}}.
\]
Singular at $r = ct$ -- physically unrealistic.

2. We divide the wire into segment $[-z_0, z_0]$ where the current is increasing linearly and two segments $[\pm z_0, \pm z_1]$ where the current has it's maximum value.

$$A_z = \frac{\mu_0}{4\pi} \int_{-z_0}^{z_0} dz \frac{I_0}{\sqrt{z^2 + r^2}} + 2 \frac{\mu_0 b}{4\pi} \int_{z_0}^{z_1} dz \left[ \frac{t}{\sqrt{z^2 + r^2}} - \frac{1}{c} \right]$$

where $z_0 = \sqrt{c^2(t - (I_0 / b))^2 - r^2}$ and $z_1 = \sqrt{c^2t^2 - r^2}$. The $\mathbf{B}$-field and force per unit length may then be obtained as before.

$$B_\phi = -\frac{\partial A_z}{\partial r}$$

$$F_l = B_\phi I_0$$