33.13. Model: Assume the field is uniform across the loop.

Visualize: Please refer to Figure Ex33.13. There is a current in the loop so there must be an emf that is due to a changing flux. With the loop fixed the area is constant so the change in flux must be due to a changing field strength.

Solve: The induced emf is $\mathcal{E} = |d\Phi/dt|$ and the induced current is $I = \mathcal{E}/R$. The B field is changing, but the area A is not. Take $\vec{A}$ as being into the page and parallel to $\vec{B}$, so $\Phi = AB$ and $d\Phi/dt = A(dB/dt)$. We have

$$\mathcal{E} = \left|\frac{d\Phi}{dt}\right| = A\left|\frac{dB}{dt}\right| \Rightarrow \left|\frac{dB}{dt}\right| = \frac{IR}{A} = \frac{(150\times10^{-3}\text{ A})(0.10\ \Omega)}{(0.080\text{ m})^2} = 2.34\text{ T / s}$$

The original field and flux is into the page. The induced counterclockwise current produces an induced field and flux that is out of the page. Since the induced field opposes the change, the field must be *increasing*.