

16. (a) Since $\vec{B} = B \hat{i}$ uniformly, then only the area “projected” onto the yz plane will contribute to the flux (due to the scalar [dot] product). This “projected” area corresponds to one-fourth of a circle. Thus, the magnetic flux Φ_B through the loop is

$$\Phi_B = \int \vec{B} \cdot d\vec{A} = \frac{1}{4} \pi r^2 B .$$

Thus,

$$\begin{aligned} |\mathcal{E}| &= \left| \frac{d\Phi_B}{dt} \right| = \left| \frac{d}{dt} \left(\frac{1}{4} \pi r^2 B \right) \right| = \frac{\pi r^2}{4} \left| \frac{dB}{dt} \right| \\ &= \frac{1}{4} \pi (0.10 \text{ m})^2 (3.0 \times 10^{-3} \text{ T/s}) = 2.4 \times 10^{-5} \text{ V} . \end{aligned}$$

- (b) We have a situation analogous to that shown in Fig. 31-5(a). Thus, the current in segment bc flows from c to b (following Lenz’s law).