**34.32.** **Model:** A polarized radio wave is an electromagnetic wave.
**Solve:** **(a)** From Equation 34.40,

$$B_0 = \frac{E_0}{c} = \frac{1000 \text{ V/m}}{3.0\times10^8 \text{ m/s}} = 3.33\times10^{-6} \text{ T}$$

**(b)** Likewise,

$$B = \frac{E}{c} = \frac{500 \text{ V/m}}{3.0\times10^8 \text{ m/s}} = 1.67\times10^{-6} \text{ T}$$

The direction of the wave is into the page ($-\hat{k}$ direction) and $\vec{E}$ is down ($-\hat{j}$ direction). Using the right-hand rule and $\vec{S} = \mu_0^{-1}\vec{E}\times\vec{B}$, $\vec{B}$ is to the left ($-\hat{i}$ direction).
**(c)** The wavelength of the radio wave is

$$\lambda = \frac{3\times10^8 \text{ m/s}}{f} = \frac{3\times10^8 \text{ m/s}}{1.0\times10^6 \text{ Hz}} = 300 \text{ m}$$

The magnetic field has half its maximum value at a point where

$$\cos\left(\frac{2\pi x}{\lambda}\right) = \frac{1}{2} \Rightarrow \frac{2\pi x}{\lambda} = 1.05 \text{ rad} \Rightarrow x = 0.1667\lambda = 50 \text{ m}$$