20.43. **Visualize:** Please refer to Figure P20.43.
Solve: **(a)** We see from the history graph that the period $T = 0.20$ s and the wave speed $v = 4.0$ m/s. Thus, the wavelength is

$$\lambda = \frac{v}{f} = vT = (4.0 \text{ m/s})(0.20 \text{ s}) = 0.80 \text{ m}$$

(b) The phase constant ϕ_0 is obtained as follows:

$$D(0 \text{ m}, 0 \text{ s}) = A\sin\phi_0 \Rightarrow -2 \text{ mm} = (2 \text{ mm})\sin\phi_0 \Rightarrow \sin\phi_0 = -1 \Rightarrow \phi_0 = -\tfrac{1}{2}\pi \text{ rad}$$

(c) The displacement equation for the wave is

$$D(x, t) = A\sin\left(\frac{2\pi x}{\lambda} - 2\pi ft + \phi_0\right) = (2.0 \text{ mm})\sin\left(\frac{2\pi x}{0.80 \text{ m}} - \frac{2\pi t}{0.20 \text{ s}} - \frac{\pi}{2}\right) = (2.0 \text{ mm})\sin(2.5\pi x - 10\pi t - \tfrac{1}{2}\pi)$$

where x and t are in m and s, respectively.