

Solutions To Sample Midterm I

SM1-1

- ① a) Since the block starts at rest a distance d to the left of its equilibrium point, it will again be at rest when it is at a distance d to the right of equilibrium.

$$\text{Max distance} = L + d = 0.10\text{m} + 0.020\text{m} = 0.12\text{m} \checkmark$$

- ⑥ It takes half a period to go from one endpoint to the other.

$$t = \frac{1}{2} T = \frac{1}{2} \frac{2\pi}{\omega} = \frac{1}{2} \frac{2\pi}{\sqrt{k/m}} = \pi \sqrt{\frac{m}{k}}$$
$$= \pi \sqrt{\frac{8.0\text{ kg}}{2.0\text{ N/m}}} = 2\pi \text{ seconds} \checkmark$$

② a) $\frac{\Delta x}{\lambda} = \frac{\Delta \phi}{2\pi} \Rightarrow \lambda = \frac{2\pi}{\Delta \phi} \Delta x = \frac{2\pi}{\pi/6} (5\text{ cm}) = 60\text{ cm} \checkmark$

⑥ $y_2 = A \sin \phi_2 = A \sin(\phi_1 + \Delta \phi)$

We need ϕ_1 :

$$y_1 = A \sin \phi_1 \Rightarrow \phi_1 = \sin^{-1} y_1 / A = \sin^{-1} \frac{2.0\text{ cm}}{10\text{ cm}} = \frac{0.201}{\pi - 0.201}$$

$$\left. \begin{aligned} y_2 &= 10\text{ cm} \sin(0.201 + \pi/6) = 6.6\text{ cm} \\ \text{or} \\ &= 10\text{ cm} \sin(\pi - 0.201 + \pi/6) = -3.2\text{ cm} \end{aligned} \right\} \checkmark$$

