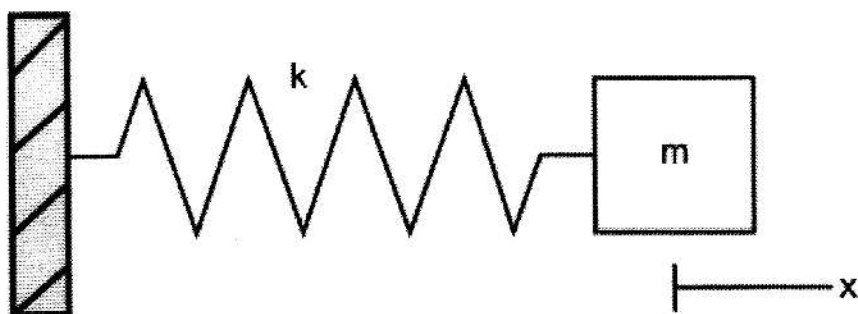


Physics 3500
Weekly Quiz 3

An object of mass 0.5 kg is attached to a spring with the spring constant 8 N/m. The object oscillates with amplitude of 10 cm on a frictionless surface. At the time $t = 0$, the object's location is measured at $x = 0$ as shown in the figure.

- Write the equation for $x(t)$, $v(t)$, and $a(t)$.
- Calculate the time t when the object is at $x = 6$ cm.
- Calculate the velocity when the object is at $x = 6$ cm.



$$a) \quad x(t) = A \sin(\omega_0 t + \varphi)$$

\downarrow $\quad \quad \quad \downarrow$
 $A = 10 \text{ cm} \quad \quad \quad \omega_0 = \sqrt{\frac{k}{m}} = \sqrt{\frac{8}{0.5}} = 4 \text{ rad/s}$

$$\Rightarrow x(t) = 10 \sin(4t + \varphi)$$

$$t = 0 \quad x = 0 \Rightarrow 10 \sin \varphi = 0 \rightarrow \varphi = 0$$

$$x(t) = 10 \sin 4t$$

$$v(t) = 40 \cos 4t$$

$$a(t) = -160 \sin 4t$$

b) $6 = 10 \sin 4t \rightarrow \sin(4t) = 0.6 \Rightarrow t = 0.16 \text{ s}$

c) $v(t = 0.16) = 40 \cos(4 \times 0.16) = 32 \text{ cm/s}$