(e) Write expressions for the velocity and acceleration of the object as a function of time.

Solution:

The linear velocity of the object has the x-component.

$$V_x = \frac{dx(t)}{dt} = -(0.50\,m)\cdot\left(2.0\,\frac{rad}{s}\right)\sin\left[\left(2.0\,\frac{rad}{s}\right)t + \frac{\pi}{6}\right]$$

$$= -1.00\,\frac{m}{s}\cdot\sin\left[\left(2.0\,\frac{rad}{s}\right)t + \frac{\pi}{6}\right]$$

The linear acceleration of the object then has the x-component

$$a_x(t) = \frac{dV_x(t)}{dt} = -\left(1.00\,\frac{m}{s}\right)\left(2.0\,\frac{rad}{sec}\right)\cos\left[\left(2.0\,\frac{rad}{s}\right)t + \frac{\pi}{6}\right] =$$

$$= -2.00\,\frac{m}{s^2}\cos\left[\left(2.0\,\frac{rad}{s}\right)t + \frac{\pi}{6}\right]$$

(f) Write 2 expressions for the force acting on the object, one as a function of time and the other as a function of X.?
What is the value of the spring coupling constant?

Solution: The force as a function of time is most easily determined by