1. Which of the following functions x(t) of the variable t have a second derivative which is proportional to the negative of the function

$$d^2x/dt^2 \sim -x$$

1. $x(t) = (1/2)at^2$
2. $x(t) = Ae^{t/T}$
3. $x(t) = Ae^{-t/T}$
4. $x(t) = A\cos((2\pi/T)t)$

2. The first derivative v = dx/dt of the sinusoidal function

$$x(t) = A\cos((2\pi/T)t)$$

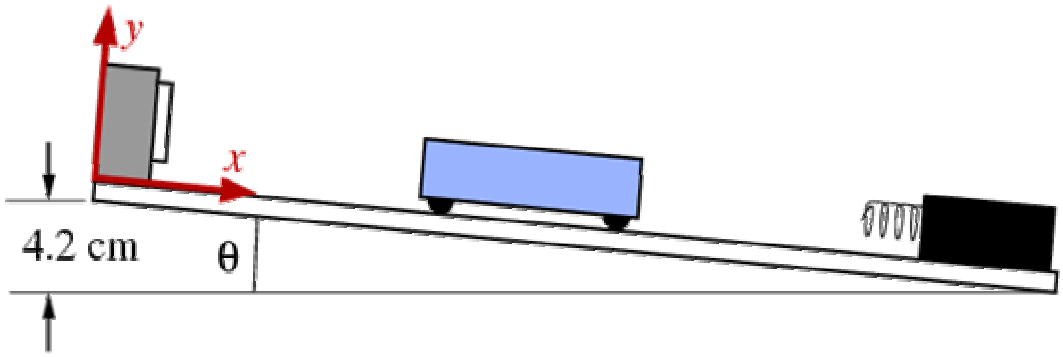
is:

1. $v(t) = A\cos((2\pi/T)t)$
2. $v(t) = -A\sin((2\pi/T)t)$
3. $v(t) = -(2\pi/T)\,A\sin((2\pi/T)t)$
4. $v(t) = (2\pi/T)\,A\cos((2\pi/T)t)$

3. A block of mass m is attached to a spring and is free to slide along a horizontal frictionless surface. At t = 0 the block-spring system is stretched an amount x_0 from the equilibrium position and is released from rest. What is the velocity of the block when it first comes back to the equilibrium?

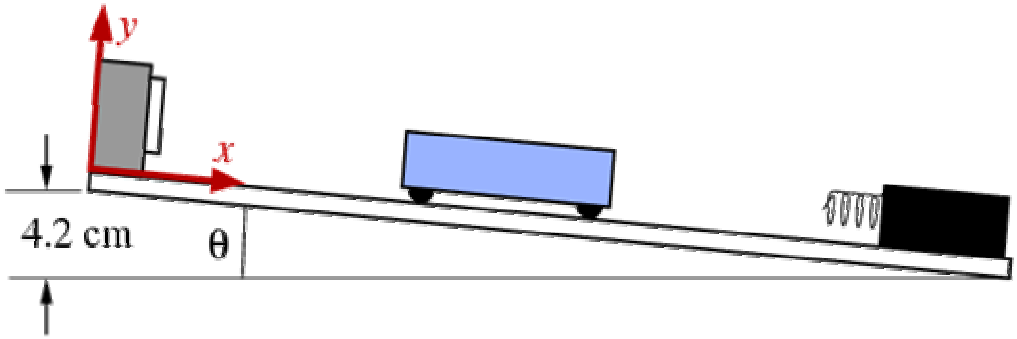
1. $V_{eq} = -x_0 T/4$
2. $V_{eq} = x_0 T/4$
3. $V_{eq} = -(k/m)^{1/2} x_0$
4. $V_{eq} = (k/m)^{1/2} x_0$

4. When the car maximally compresses the spring at the bottom of the track, the cart's



1. velocity and acceleration are zero
2. velocity is nonzero but its acceleration is zero
3. acceleration is nonzero, but its velocity is zero
4. velocity and acceleration are both nonzero.

5. Is the acceleration of the cart as it moves up the inclined plane,



1. greater than
2. equal to
3. less than

the acceleration of the cart as it moves down the inclined plane?