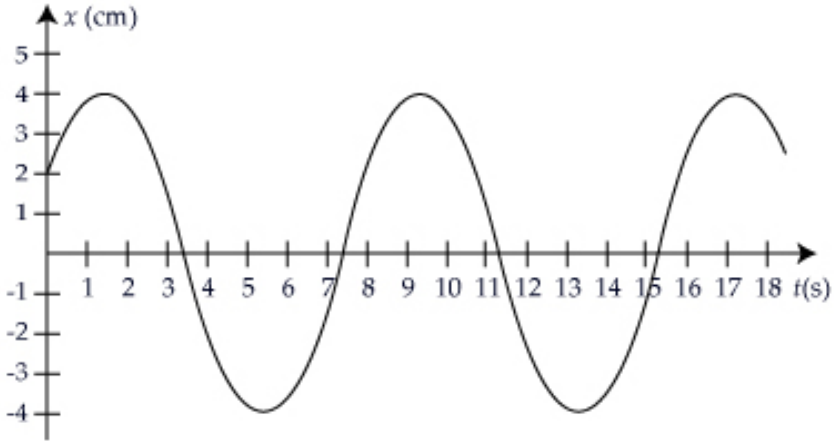
Matter and Motion – Tue. Jan 16, 2018
Physics Quiz #9 Name:_____

- This quiz is for you to display your personal understanding of program material
- You may use a single 3 inch by 5 inch note card and a calculator
- ***Show/explain all work/reasoning***. You will be evaluated on clarity/completeness of process, not simply on answer
- The quiz begins at 1:00 and ends promptly at 1:30

1. [4 points] The simple harmonic motion of an object is described by the graph shown in the figure. Why is the equation for the position $x(t)$ of the object as a function of time t choice e?

   e. $x(t) = (4.0\text{ cm})\cos\left[\left(\frac{2\pi}{8.0\text{ s}}\right)t - \frac{\pi}{3}\right]$



2. [6 points] A 0.25 kg ideal harmonic oscillator has a total mechanical energy of 6.2 J. If the oscillation amplitude is 20.0 cm, what is the oscillation frequency?

3. [10 points total] You've been asked to help design a system for astronauts to measure their mass while they fly in a large space station. The astronaut will be strapped into a harness attached to a spring, and they will be set in motion. A sensor will record the period of the astronaut's motion. Your job is to select a spring for this purpose. The amplitude of the spring's vibration will be 10.0 cm, and you've been asked to be sure a 45.0 kg astronaut will never experience an acceleration greater than 1.00 m/s^2 when in the device (whose mass you may neglect).
    a. [8 points] What value would you recommend for the spring constant?
    b. [2 points] Why is this a maximum value or minimum value for k_{sp}? In other words, why should the spring constant they choose *not* exceed the value you likely calculated?