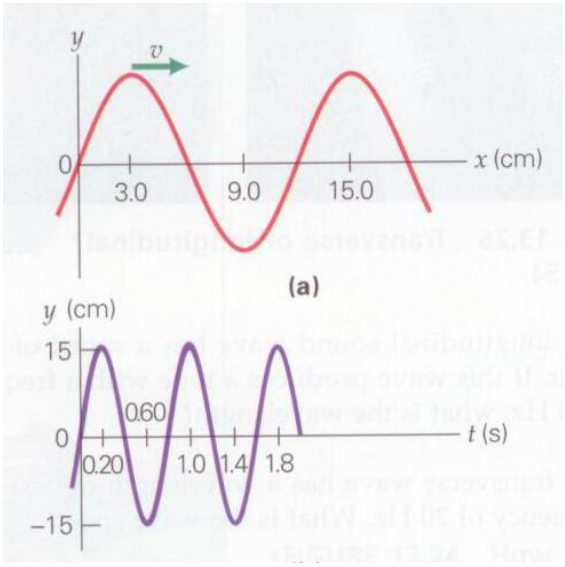
Physics 221 – Spring 2012
Exam 1

Name: _____

1. Consider the 3 dB and the 6 dB rules of thumb that we learned about.
    a. Describe the 3 dB rule.
    b. Describe the 6 dB rule.
    c. How are these different?
    d. Demonstrate each rule mathematically with an example of your choosing.
2. Derive the equation for elastic potential energy from Hooke's Law.
3. A pendulum on earth has a period of 5 seconds.
    a. How long is this pendulum?
    b. If this pendulum is taken to the moon, find its new period. The moon's gravity is 1/6 the Earth's.
4. A wave on a string is traveling in the +x direction at a certain time and is shown in the figure to the right. The displacement of a single particle of the string is shown in the lower graph.
    a. Write the equations of motion for a particle of this string.
    b. What is the speed of the particle at 1.0 second?
    c. What is the wave speed?



$f' = f\frac{v \pm v_o}{v \pm v_s}$, + observer moving towards, - observer moving away, - source moving towards, + source moving away.

$v = 331 \text{ m/s}\sqrt{1 + \frac{T}{273}}$ $\quad I = \frac{P}{4\pi r^2}$ $\quad \beta = 10 \log(\frac{I}{I_o})$ $\quad I_o = 1 \times 10^{-12} \text{ W/m}^2$

$F = -kx$ $\quad a = -\frac{k}{m}x$ $\quad v = \lambda f$ $\quad T = 1/f$

Period of a Spring: $T = 2\pi\sqrt{\frac{m}{k}}$ $\quad$ *Period of a pendulum:* $T = 2\pi\sqrt{\frac{L}{g}}$ $\quad g = 9.8 \text{ m/s}^2$

$PE_s = \frac{1}{2}kx^2$ $\quad PE_g = mgh$ $\quad KE = \frac{1}{2}mv^2$ $\quad v = \pm\sqrt{\frac{k}{m}(A^2 - x^2)}$

Equations of motion general: $x = A\cos(2\pi f t)$ $\quad v = -2\pi f A \sin(2\pi f t)$ $\quad a = -(2\pi f)^2 A\cos(2\pi f t)$

Equations of motion springs: $x = A\cos(\sqrt{\frac{k}{m}}t)$ $\quad v = -\sqrt{\frac{k}{m}}A\sin(\sqrt{\frac{k}{m}}t)$ $\quad a = -\frac{k}{m}A\cos(\sqrt{\frac{k}{m}}t)$