Third Problem Set Phy132
Due Friday May 3rd

Problem 1.

The *amplitude* of a spring moving in simple harmonic motion is *doubled*. Determine the change in its:

a) Total energy
b) Maximum speed
c) Maximum acceleration
d) Period

Problem 2.

What will happen to the *Period* of a pendulum on earth if:

a) Its length is doubled?
b) Its mass is doubled?
c) It is taken to the moon where $g_{moon} \approx g_{earth}/6$?

Problem 3.

George, whose mass is 100 Kg, has an old car. The car has a mass of 2000 Kg. When George gets into the car, he notices that the car gets lower by a distance of 3 cm. George drives off and goes over a bump, and the car oscillates on the springs (he has no shock absorbers). What is the frequency of oscillation of the car as it bounces up and down on the springs?

Problem 4.

The position of a particle is given by the following formula:

$$x(t) = 6cos(3\pi t + \frac{\pi}{3}) \tag{1}$$

Find:

a)The amplitude of the motion.
b)The period of the motion.
c)The frequency of the motion.

Problem 5.

An object is undergoing simple harmonic motion with a period of 6 seconds. The amplitude of the motion is 5 cm. At time $t = 0$, the object is located at $x = 3$ cm. Find an expression for $x(t)$.

Problem 6.

Laila has spring, whose length unstretched is L. The spring constant of this spring is k. She wants to have two springs, so she cuts the spring in half. What is the spring constant of the shorter springs (of length $L/2$)?

Problem 7.

Thomas has two springs, one has a spring constant of k_1, and the other has a spring constant of k_2. He connects them in two different ways, in series and in parallel. See the figure on the figures page.

What is the period of oscillation of the mass for the springs

a) in series and b) in parallel

Problem 8.

Joshua has a cylindrical wooden disk with height L and area A, which he places in water. It floats, since wood is less dense than water. When he pushes the disk down in the water and lets go, the disk oscillates up and down. Show that the floating wooden disk oscillates with simple harmonic motion, and find the period of the motion. Express your answer in terms of the density of water, mass of the disk m, A, and g.

Problem 9.

Two pulses traveling on the same string are described by the following functions:

$$y_1(x,t) = \frac{5}{(3x-4t)^2+2} \tag{2}$$

and

$$y_2(x,t) = \frac{-5}{(3x+4t-6)^2+2} \tag{3}$$

a)In which direction do each of the pulses travel?
b)At what time do the two pulses cancel everywhere?

c)At what value of x do the two pulses cancel at all times?

Problem 10.

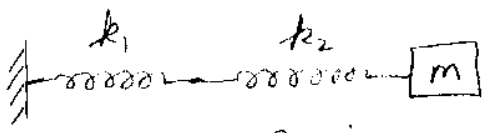
A uniform rope of mass m and legth L hangs from the ceiling.

a) Show that the speed of a transverse wave in the rope is a function of y, the distance from the lower end and is given by $v = \sqrt{gy}$.

b) Show that the time it takes a transverse wave to travel the length of the rope is given by $t = 2\sqrt{L/g}$.

Figures for Homework 3

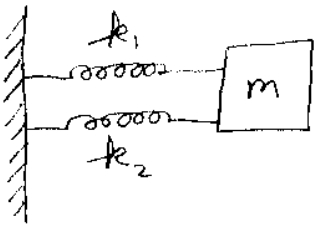
7) (a)



$T = ?$

Springs in Series

(b)



$T = ?$

Springs in parallel

8)