Math 285
Fall 2009

Lab #2

The differential equation

$$\frac{\omega}{g} y''(t) + by'(t) + ky(t) = \frac{\omega}{g} F(t)$$

models the oscillating motion of an object on the end of a spring. In the equation, y is the displacement from equilibrium (positive direction is downward) measured in feet, and t is time in seconds. The constant ω is the weight of the object, g is the acceleration due to gravity, b measures the magnitude of the resistance to the motion, k is the spring constant from Hooke's Law, and F(t) is the acceleration imposed on the system.

Use Maple to find and graph the particular solution of the DE

$$\frac{8}{32} y'' + by' + ky = \frac{8}{32} F(t), \quad y(0) = \frac{1}{2}, y'(0) = 0$$

for a given b, k, and F(t).

a) $b = 0, k = 1, F(t) = 24\sin(\omega t)$
b) $b = 0, k = 2, F(t) = 24\sin(2\sqrt{2}t)$
c) $b = 0, k = 2, F(t) = 0$
d) $b = 1, k = 2, F(t) = 0$

Describe the effect of increasing the resistance to motion, b.
How do you think the motion of the object would change if a stiffer (increased k) spring were used? Explain.
Matching of the input and natural frequencies of a system is known as resonance. In which of the above did this occur and what was the result?

Due Wednesday, December 2. No late labs accepted.