Assignment #9 ***Math 290*** ***Name:***

1. A force of 3 N stretches a spring 1m.
   a) Find the spring constant k.
   b) A mass of 4 kg is attached to the spring. At t = 0, the mass is pulled down a distance 1 meter from equilibrium and released with a downward velocity of 0.5 m/sec. Assuming that damping is negligible, determine an expression for the position of the mass at time t. Find the circular frequency of the system and the amplitude, phase, and period of the motion.

2. A 16-lb weight is attached to a 5 ft long spring. At equilibrium the spring measures 8.2 feet. If the weight is pushed up and released from rest at a point 2 feet above the equilibrium position, find the displacements $x(t)$ if it is further known that the surrounding medium offers a resistance numerically equal to the instantaneous velocity.

3. For the following DE, do the following:
   a) Find the solution in phase – amplitude form.
   b) If we think of each equation as describing a linear mass-spring system, determine how often the mass crosses the equilibrium position.
   c) Find the time at which the mass first crosses the equilibrium position.
   d) Estimate the time for which $|x(t)| < 1/100$

   i) $x''+4x'+8x = 0;\ x(0) = 1;\ x'(0) = 2$

ii) $x''+2x'+10x=0;\ x(0)=1;\ x'(0)=1$

4. For the following DE, do the following:
   a) Find the solution.
   b) Determine whether the mass ever crosses the equilibrium and, if so, determine the velocity of the mass at the instant it crosses the equilibrium;
   c) Determine whether the mass ever crosses the equilibrium if the stated initial velocity is cut in half.
      i) $x''+2x'+x=0;\ x(0)=2; x'(0)=-3$

ii) $2x''-5x'-3x=0;\ x(0)=2,\ x'(0)=-10$