Print Your Name

Problem	Total Points	Score
1	15	
2	10	
3	10	
4	10	
5	15	
Total	60	

You should:

- write complete solutions or you may not receive credit.
- box your final answer.
- check that your exam contains a total of 6 pages.

You may:

- use ten sheets of notes and a calculator.
- write on the backs of the pages if you need more room.

Please do not:

- come to the front of the room to ask questions (raise your hand).
- share notes or calculators.
- use any electronic device other than a calculator.

Signature. Please sign below to indicate that you have not and will not give or receive any unauthorized assistance on this exam.

Signature: ______________________________

1. (10 points) A 64 lb object stretches a spring 64/29 feet. There is a damper with damping constant $\gamma = 6$ lb $\cdot$ s/ft. The object is pulled down 1 foot and released. Use $g = 32$ ft/s as your gravitational constant.

   (a) Find a formula that describes the position of the object as a function of time.

   (b) (5 points) Determine the amount of time it takes before the object is confined to a space within one quarter inch of equilibrium.

2. (10 points) Find the general solution to the differential equation $y'' - 3y' - 10y = -te^{5t}$.

3. (10 points) Any constant function is a solution to the differential equation

$$ty'' - 5y' = 0, \qquad t > 0.$$

Find a nonconstant solution.

4. (10 points) An object of mass 1 kg is attached to a spring with spring constant 1 N/m. The system is damped so that when the object is moving 1 m/s it experiences a force of 1 N in the opposite direction. An external force given by the function $\sin 2t + 2\cos 2t$ acts on the object. Give a function describing the steady state of the system.

5. For this problem you are working with a spring with spring constant 49 N/m. Assume there is no damping.

   (a) (10 points) An object of unknown mass hangs from the spring. It is pulled 25 cm down from equilibrium and set in motion with an upward velocity of 1 m/s. You measure the amplitude of the resulting oscillation to be 50 cm. What is the mass of the object?

   (b) (5 points) Now suppose I want to attach a different object to the same spring so that it oscillates exactly once every second. What mass should the object have?