## MATH 246 Homework 2.8 Justin Wyss-Gallifent

## **Directions:**

- Work should be done neatly and on separate paper.
- Enough work must be shown so that the steps you are taking is clear.
- 1. Easy: A mass of 0.5 kg stretches a spring 2.45 m. It is then stretched an additional 0.5 m and released with zero velocity. There is no damping and no external force applied. Write down and solve the associated initial value problem. Provide a believable graph. Where is the object after ten seconds? If the system were damped, what would the critical damping value be?
- 2. Medium: A mass of 5 kg stretches a spring 9.8 m. It is then raised by 2 m and released with zero velocity. The system is submerged in a fluid which imparts a damping coefficient of  $\gamma = 1$  Ns/m. Write down and solve the associated initial value problem. Provide a believable graph.
- 3. Hard(er): A mass of 3 kg stretches a spring 0.98 m. It is then stretched an additional 0.1 m and released with upward velocity of 0.1 m/s. The system is submerged in a fluid which imparts a damping coefficient of  $\gamma = 0.9$  Ns/m. In addition there is an outside force F(t) = 5 acting on the mass. Write down and solve the associated initial value problem. Provide a believable graph. When you are done all this, algebraically find the limit as  $t \to \infty$ , make sure it matches the graph and provide some real-world insight as to what about the problem makes this answer nonzero.