

MATH 2850: TAKE HOME 10 (25 points.)

NAME: _____

DUE: Wednesday, April 3rd, at the beginning of class.

DIRECTIONS: Show all work.

1. (a) Write, but do not solve, the corresponding IVP for the spring-mass scenario described below.
(That is, write the DE which describes the motion along with the corresponding initial conditions.)

- A 4 kg mass stretches a spring 2.45 m from its equilibrium position.
- The motion is free and undamped.
- The mass is released from rest 1 meter below the equilibrium position.

NOTE: Use $g = 9.8\text{m/s}^2$ as the acceleration due to gravity.

- (b) Suppose a damping force is introduced which is numerically equal to β times the instantaneous velocity.
What values of β will result in an underdamped system?

2. A mass of 1 kilogram is suspended by a spring with spring constant 2 Newtons per meter in a medium which offers a damping force that is numerically twice the instantaneous velocity of the mass.

The entire apparatus is subject to motion modeled by the function $f(t) = 4\sin(2t)$.

Find the equation of motion if the mass is released from its equilibrium position with an upward velocity of 1 meter per second. Identify both the transient and steady-state parts of the solution.

