

Second Exam
Friday, July 7, 2017

This exam is closed book, but you may use calculators. Make sure your name is on all pages. Show all work, and show it in a logical and organized manner. Each entire problem is worth — points. Keep this exam sheet.

1. (*30 points*) A weight weighing 1 kilogram is hung from a spring to which a motion damper is attached. When the spring is stretched 10 centimeters from its equilibrium position, it exerts a restoring force of 0.1 Newtons. When the damper is moved at 1 meter per second, it exerts a slowing force of 1 Newton. There is an external force $f(t) = \sin(t)$ being applied to the system. The system is in its resting position ($y = 0$) and at rest ($y' = 0$) at time $t = 0$.
 - (a) Write down an initial value problem for the displacement $y(t)$ of the weight from its resting position as a function of time t .
 - (b) State the units of y and t , and state other units used in the problem.

Note: A Newton is (1 Kilogram) (meter / second²).

2. (*70 points*) Solve the following initial value problem.

$$y'' + y' + y = \sin(t), \quad y(0) = 0, \quad y'(0) = 0.$$