Second Exam
Tuesday, March 20, 2018

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 33 points, and one point is free. Keep this exam sheet.

1. Find the general solution to $y'' + 6y' + 13y = \sin(t)$.

2. Consider
$$y(t) = \sin(t) - \cos(t) = R\cos(t - \delta)$$

   (a) Find R and δ.

   (b) What is the amplitude of the oscillation?

   (c) What is the period?

   (d) What is the phase shift?

3. A weight of 1 gram is hung from a spring. When the spring is stretched 1 centimeters from its equilibrium position, it exerts a restoring force of 1 dyne. There is an external force $f(t) = \sin(t)$ dynes being applied to the system. Assume damping forces are negligible. 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.

   (c) Solve the initial value problem.

   Note: A dyne is (1 gram) (centimeter / second^2).