

EGR 265, Math Tools for Engineering Problem Solving
October 13, 2010, 50 minutes

Name:

TEST II

Problem 1 (20 points)

Find the general solution of

$$y'' + 6y' + 9y = 3x.$$

Problem 2 (20 points)

Solve the initial value problem

$$y'' - 2y' + 5y = 0, \quad y(0) = 2, \quad y'(0) = -1.$$

Problem 3 (20 points)

Find the general solution of

$$y'' - y' - 2y = 5e^{2x}.$$

Problem 4 (20 points)

A 16 pound weight stretches an undamped spring by 2 feet.

- (a) Working in English units, find the value of the spring constant k in lb/ft and the mass m of the weight in slugs.
- (b) Find the equation of motion of the undamped spring-mass system.
- (c) Find the equation of motion if the mass is released from rest at a position of 2 feet above the equilibrium. Assume here that the positive x -direction is oriented downwards.

Problem 5 (10 points)

Suppose that a damping force is added to the spring-mass system in Problem 4 which is proportional to the instantaneous velocity with damping coefficient $\beta = 3$ pd-sec/ft. Does the resulting system become underdamped, critically damped, or overdamped? Justify your answer.

Problem 6 (10 points)

Find the general solution of

$$y''' - 9y' = 0.$$