**Math 237, Introduction to Differential Equations, Fall 2011**

**Queen's University, Department of Mathematics**

**Homework 4, Due Thursday October 27**

**1. a)** Find the general solution to the homogeneous equation

$$\left(D^3 + D^2 + 3D - 5\right)[y] = 0$$

using the fact that the differential operator has a factor (D-1).

**b)** By factoring the differential operator and using the exponential shift, find four real valued linearly independent solutions to the homogenous equation

$$\left(D^4 + 2D^2 + 1\right)[y] = 0, \quad D = \frac{d}{dx}$$

**2.** Using the methods of undetermined coefficients, find the solution to the nonhomogeneous initial value problem

$$\left(D^2 + 3D + 2\right)[y] = \sin(x), \quad y(0) = 0, \quad y'(0) = 0, \quad D = \frac{d}{dx}$$

**3.** Using your answer from question 2 and the principle of superposition for nonhomogenous equations, find the general solution to the equation

$$\left(D^2 + 3D + 2\right)[y] = \sin(x) + 10e^{3x}$$

**4.** Using the exponential shift again find the solution to the initial value problem

$$\left(D^2 - 1\right)[y] = 3e^t, \quad y(0) = 0, y'(0) = -1, \quad D = \frac{d}{dt}$$