McGill University
Math 325B: Differential Equations

Assignment 7: due Thursday, March 28, 2002

1. Find the general solution of the differential equation

$$y^{iv} + 7y'' - 18y' + 10y = xe^x + \sin 3x.$$

2. Using variation of parameters, find the general solution of the differential equation

$$y'' + 2y' + 2y = e^{-x} \ln x.$$

3. Find the general solution of the differential equation

$$x^2y'' + 2xy' - 6y = \ln x.$$

4. Find the general solution of the differential equations

   (a) $y'' - xy' + (x-1)y = 0$ (Hint: Show that e^x is a solution.)

   (b) $xy'' + (x+1)y' + y = x$.

5. Two large tanks filled with brine are connected by two separate pipes. Tank A contains 200L and tank B contains 100L. Brine with a concentration of .2kg/L flows into tank A at a rate of 2L/sec and brine is drained out of tank B at 2L/sec. Also fluid is pumped from tank A into tank B at the rate of 4L/sec and fluid is pumped from tank B to tank A at the rate of 2L/sec. The liquids inside each tank are kept well stirred, so that each mixture is homogeneous. If initially, there are 2 kg of salt in tank A and 5 kg of salt in tank B, determine the mass of salt in each tank at any time $t \geq 0$. What are the equilibrium concentrations of salt in each tank.