Warm-up Problems - March 7, 2007

1. Use the steps discussed in class Monday to solve the differential equation:

   \[ x^4 y' + 2x^3 y = 5 \quad y(1) = 4 \]

   (1.) Write in standard form
   (2.) \( A(t) = \)
       \( I = e^{A} = \)

   (3.) Multiply the differential equation by the integrating factor \( I \)

   (4.) Integrate and solve for \( y \) (find a general solution):

   (5.) If there is an initial condition use it and find a particular solution.

Lecture Problems

2. Set up (and solve if you have time) the differential equations for the following problems.

   (a) Let \( y \) be the amount of money you have in the bank. You make no withdrawal or deposits, just let your money sit earning 5% annual interest compounded continuously. You start with $100 in the bank.
   
   Set up the differential equation (with initial values).

   (b) Let \( y \) be the amount of money you have in the bank. You make continuous deposits of $500 per year. You earn 5% annual interest compounded continuously. You start with $0 in the bank.
   
   Set up the differential equation (with initial values).

   (c) Let \( y \) be the amount of money you have in the bank. You make continuous withdrawals of $500 per year. You earn 5% annual interest compounded continuously. You start with $5,000 in the bank.
   
   Set up the differential equation (with initial values).

   (d) Let \( y \) be the amount of money you have in the bank. You make continuous withdrawals of $500 per year. You earn 5% annual interest compounded continuously. You start with $10,000 in the bank.
   
   Set up the differential equation (with initial values).
3. Set up (and solve if you have time) the differential equations for the following problems. Determine the steps to take to solve the problems.

(a) Let \( y \) be the amount of money you have in the bank. You make no withdrawal or deposits, just let your money sit earning 5\% annual interest compounded continuously. You start with $100 in the bank.
How long until you have $5000?

(b) Let \( y \) be the amount of money you have in the bank. You make continuous deposits of $500 per year. You earn 5\% annual interest compounded continuously. You start with $0 in the bank.
How long until you have $5000?

(c) Let \( y \) be the amount of money you have in the bank. You make continuous withdrawals of $500 per year. You earn 5\% annual interest compounded continuously. You start with $5,000 in the bank.
Will you run out of money? If so when?

(d) Let \( y \) be the amount of money you have in the bank. You make continuous withdrawals of $500 per year. You earn 5\% annual interest compounded continuously. You start with $10,000 in the bank.
Will you run out of money? If so when?