EE422G Homework #3 (12 points)

Due February 1, 2007

1. (2 points)
   a. Prove the Integration Theorem

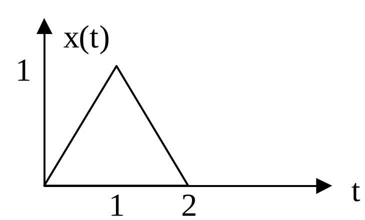
   b. Find the integral-differential equation that corresponds to the following equation in s domain.

$$s^2Y(s) + 2sY(s) = s^3X(s) + \frac{X(s)}{s} - e^{-s}/s$$

2. (2 points) Solve for x(t) and y(t) which are governed by the following system of differential equations:

$$\frac{dx(t)}{dt} + 3x(t) + 2y(t) = u(t)$$
$$\frac{dy(t)}{dt} - x(t) = 0$$
$$\text{Boundary conditions}: x(0) = y(0) = 0$$

3. (2 points) Obtain the Laplace transform of the triangular signal $x(t) = \Lambda(t-1)$ by using the differentiation theorem, the time-delay theorem, and expressing $\frac{dx}{dt}$ in terms of unit steps.



4. (4 points) Find the initial and final values, if exists, of the signals with Laplace transforms given below:
   a. $\frac{5}{s^3 + s^2 + 9s + 9}$
   b. $\frac{s^2 + 5s + 7}{s^2 + 3s + 2}$

5. (4 points) Obtain the inverse Laplace transform of
   a. $X(s) = \frac{7s^2 + 15s + 10}{(s+1)^2(s+3)}$
   b. $X(s) = \frac{s^4 + 8s^2 + s + 17}{(s^2+4)^2(s+1)}$

6. (4 points) Given $Y_1(s) = \dfrac{s^3 + 6s^2 + 11s + 6}{(s^2 + 4)^2}$ and $Y_2(s) = \dfrac{s^3 + 6s^2 + 11s + 6}{s^2 + 4s + 4}$

   a. Use MATLAB to find $x(t) = y_1(t) * y_2(t)$
   b. Use MATLAB's residue function to find the partial fraction expansions for $Y_1(s)$ and $Y_2(s)$