Unified Engineering **Spring 2008**

Signals and Systems Problems S13, S14, S15
Reading: O&W-9.1, 9.2, 9.9

S13) Determine the Laplace transform (unilateral), and the region of convergence for each of the following functions of time

a) $x(t) = e^{-2t} + e^{-3t}$

b) $x(t) = e^{2t} + e^{3t}$

c) $x(t) = e^{-4t} + e^{-5t}\sin(5t)$

d) $x(t) = te^{-2t}$

e) $x(t) = \begin{cases} 1 & 0 < t \le 1 \\ 0 & \text{elsewhere} \end{cases}$

f) $x(t) = \begin{cases} t & 0 < t \le 1 \\ 2 - t & 1 < t \le 2 \end{cases}$

g) $x(t) = \delta(t) + u(t)$

h) $x(t) = \delta(3t) + u(5t)$

S14) Create the pole/zero plot for each of the Laplace transforms that you derived in S13

S15) A LTI system with input *x(t)* and output *y(t)* is described by the following differential equation

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t)$$

Use Laplace transforms to determine the output if the input and initial conditions are

$$x(t) = u(t) \qquad y(0) = 1.0 \qquad \left.\frac{dy(t)}{dt}\right|_{t=0} = 0$$