Due Thursday, April, 3 at the beginning of class.

1. Use definition to find the Laplace transform of the given function.

   (a) $f(t) = e^{6t}$

   (b) $f(t) = \begin{cases} 1 - t, & 0 < t < 1, \\ 0, & t > 1. \end{cases}$

2. Use the table and properties of Laplace transform to determine the following transforms.

   (a) $\mathcal{L}\{t^3 - te^t + e^{4t}\cos t\}$

   (b) $\mathcal{L}\{t\sin^2 t\}$ (HINT: use the half-angle identity)

   (c) $\mathcal{L}\{e^{-2t}\sin 2t + e^{3t}t^2\}$

3. Find the inverse Laplace transform of the given function.

   (a) $\dfrac{4}{s^2 + 9}$

   (b) $\dfrac{2s + 16}{s^2 + 4s + 13}$

   (c) $\dfrac{5}{(s + 2)^4}$

4. Solve the initial value problem using the method of Laplace transform.

   (a) $y'' - y' - 2y = 0$, $y(0) = -2$, $y'(0) = 5$

   (b) $y'' - 2y' + 5y = -8e^{-t}$, $y(0) = 2$, $y'(0) = 12$