MATH 308 – 530, 531 **Homework 7** **Spring 2016**

Due Thursday, March 24 at the beginning of class.

1. A mass weighting 8 lb is attached to a spring hanging from the ceiling and comes to rest at its equilibrium position. At $t = 0$, an external force $F(t) = 2\cos 2t$ lb is applied to the system. If the spring constant is 10 lb/ft and the damping constant is 1 lb-sec/ft, find the steady-state solution for the system. What is the resonance force for the system?

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

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

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

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

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

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

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

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