**Dr. Z.'s Calc5 Homework assignment 1**

**1.** Use the **definition** of the Laplace Transform to compute $\mathcal{L}\{f(t)\}$ if

$$f(t) = t + 2$$

**2.** Use the **definition** of the Laplace Transform to compute $\mathcal{L}\{f(t)\}$ if

$$f(t) = 4e^t + 2e^{-t}$$

**3.** [corrected thanks to Chris Grud] Use the **definition** of the Laplace Transform to compute $\mathcal{L}\{f(t)\}$ if

$$f(t) = \begin{cases} 2, & \text{if } 0 \le t \le 3; \\ -2, & \text{if } t > 3. \end{cases}$$

**4.** Prove, by induction on $k$, that

$$\mathcal{L}\{t^k\} = \frac{k!}{s^{k+1}} \quad (k = 0, 1, 2, 3, \ldots),$$

**Hint:**: The statement for $k$ is

$$\int_0^\infty t^k e^{-st} \;=\; \frac{k!}{s^{k+1}}$$

Now differentiate both sides with respect to $s$, and get the analogous statement for $k + 1$.

In 5-9 use *any* method to compute $\mathcal{L}\{f(t)\}$ if

**5.** $f(t) = t^3 + 2t + 11$ .

**6.** $f(t) = (t + 1)(t - 2)$ .

**7.** $f(t) = e^t + 2e^{3t} + t^3$ .

**8.** $f(t) = (e^t + 1)(e^t + 2)$ .

**9.** $f(t) = 2e^t - 3\sin t + 2\cos 5t$ .