

**Math 513 (071) / Exam 1****Show your Work.****Total Grade: 25****Time: 75 min**

1. Find the transfer functions, impulse response, and step response for  $y'' - y' + 6y = f(t)$ . Assume that all of the necessary initial conditions are zero.

2. Find the Fourier series for

$$f(x) = \begin{cases} 2, & 0 < x < 1, \\ 0, & 1 < x < 4. \end{cases}$$

To what value does this series converge to at  $x = -3$ ?

3. Find the convolution  $e^{-t}H(t) * e^{-t}H(t)$  related to the Fourier transform.

4. Find the Fourier transform for

$$f(t) = e^{-|t|}.$$

5. Find the particular solution for  $y'' - 4y = \delta(t)$

6. Find  $\mathcal{L}\{f(t)\}$  of  $f(t) = \begin{cases} 1, & 0 \leq t \leq 2, \\ -1, & t > 2. \end{cases}$