

**Control Theory**  
**Assignment #1**

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1. Using Laplace transform, solve  $2y''(t) + 20y'(t) + 48y = 3 + 13e^{-t}$  for  $y(t)$ , given the initial conditions  $y(0) = 3$  and  $y'(0) = 8$ . Confirm your solution using MATLAB.
2. Find the steady-state value for the system that is described by the differential equation above.
3. You are given a transfer function:

$$H(s) = \frac{1}{s^2 + 13s + C}$$

Find the interval of  $C$  for which the system is stable using the knowledge of the poles placement in the complex plane, using the Hurwitz criterion, and using the Routh-Shur criterion.

**Note:** Since the poles are placed in the complex domain, remember to expand all your calculations to the complex domain as well!

4. Using MATLAB, for the  $H(s)$  given above and  $C = 900$ , find the *rise time*, *settling time*, *peak time*, *peak value*, and *overshoot*. Also, plot the *impulse response* and *step response*.