For the second order under-damped system shown in Figure 1, find:

\[ T_p \text{ (time to peak)} = \frac{1}{\omega_n} \text{ sec} \]

\[ \text{Percent overshoot} = \frac{207\%}{1 + \frac{\omega_n}{100} + \frac{207}{\omega_n}} \]

\[ T_s \text{ (settle time)} = \frac{\pi}{2} \frac{3}{\omega_n} \text{ sec} \]

(approximate answer is OK – show on graph)

For the first order system shown in Figure 2, find:

\[ \text{Time constant, } \tau = \frac{10s}{405} \text{ (show on graph)} \]

\[ T_s \text{ (settle time)} = \frac{405}{405} \text{ (approximate answer is OK – show on graph)} \]

\[ T_r \text{ (rise time)} = \frac{e^{2\pi/2}}{2\pi e} \text{ (approximate answer is OK – show on graph)} \]

more problems on the back side
Problem 2
For the signal \( v(t) = 3 \sin(2t) + 5 \sin(3t + \frac{\pi}{2}) + 2 \sin(7t) \), make a graph of the frequency spectrum.

Problem 3
For the system shown above, \( V_i(t) = 0.1 \sin (2000t) + 4 \sin (60t) + 0.02 \sin (200000t) \). Write an equation for \( V_o(t) \) if the filter is: (Assume ideal filter behavior)

1. A low pass filter with a cut-off frequency of 200 rad/sec.
   \[ v_o(t) = 4 \sin (40t) \]

2. A high pass filter with a cut-off frequency of 10,000 rad/sec.
   \[ v_o(t) = 0.02 \sin (200000t) + v_o'(t) \]

3. A bandpass filter with a center frequency of 2000 rad/sec.
   \[ v_o(t) = 0.1 \sin (2000t) \]

   \[ v_o(t) = 4 \sin (40t) - 0.02 \sin (200000t) \]