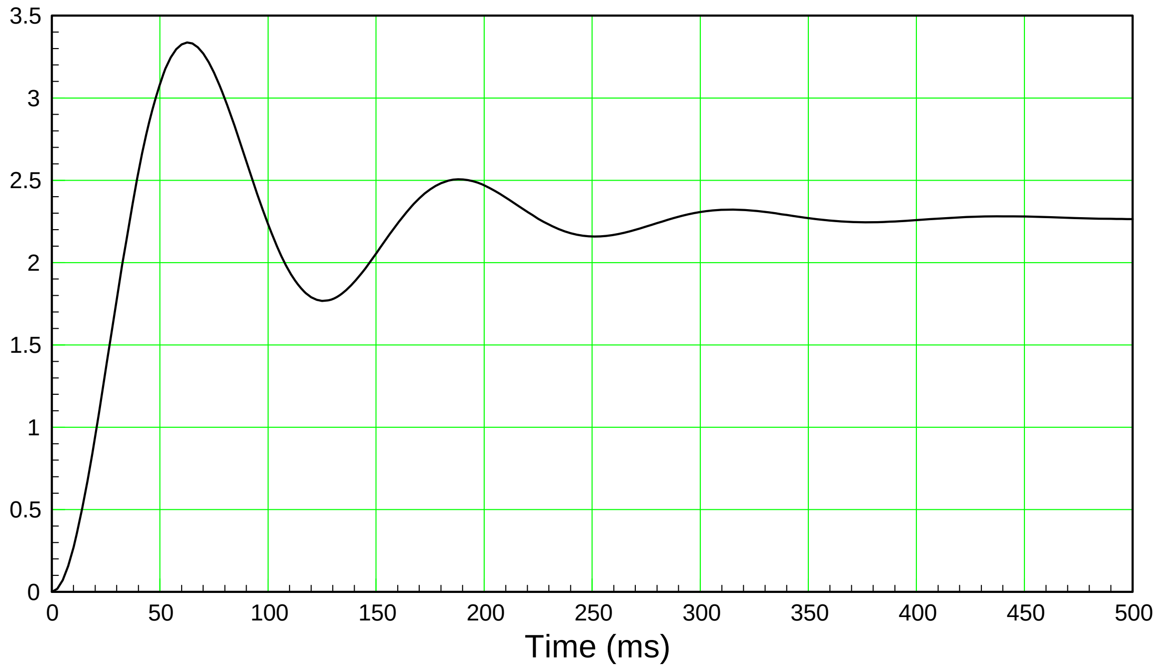
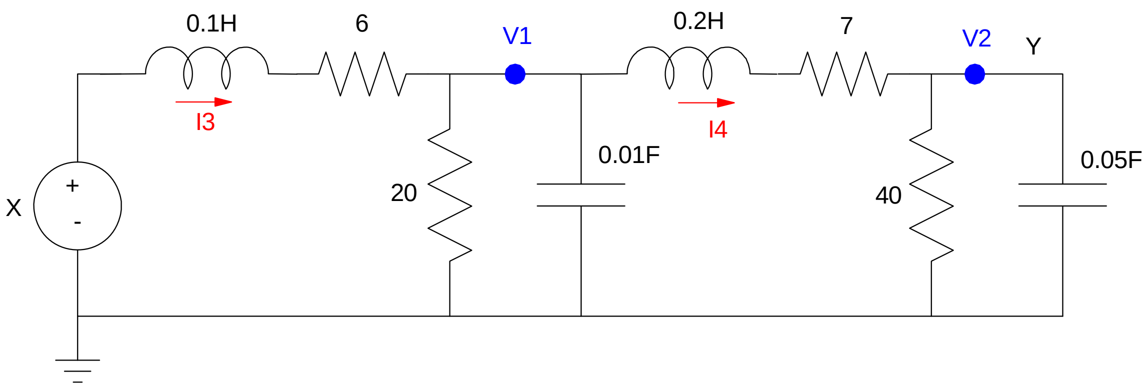
ECE 461/661 Final: Name ________________

Fall 2019

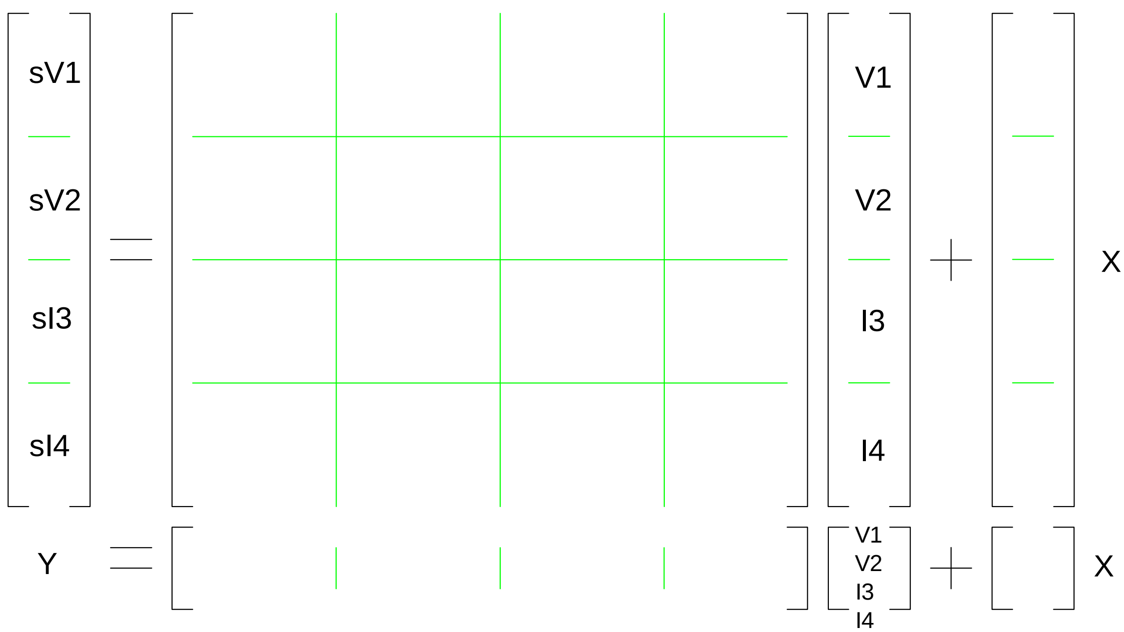
1) Find the transfer function for the system with the following step response



2) Write N coupled differential equations that describe the dynamics for the following circuit



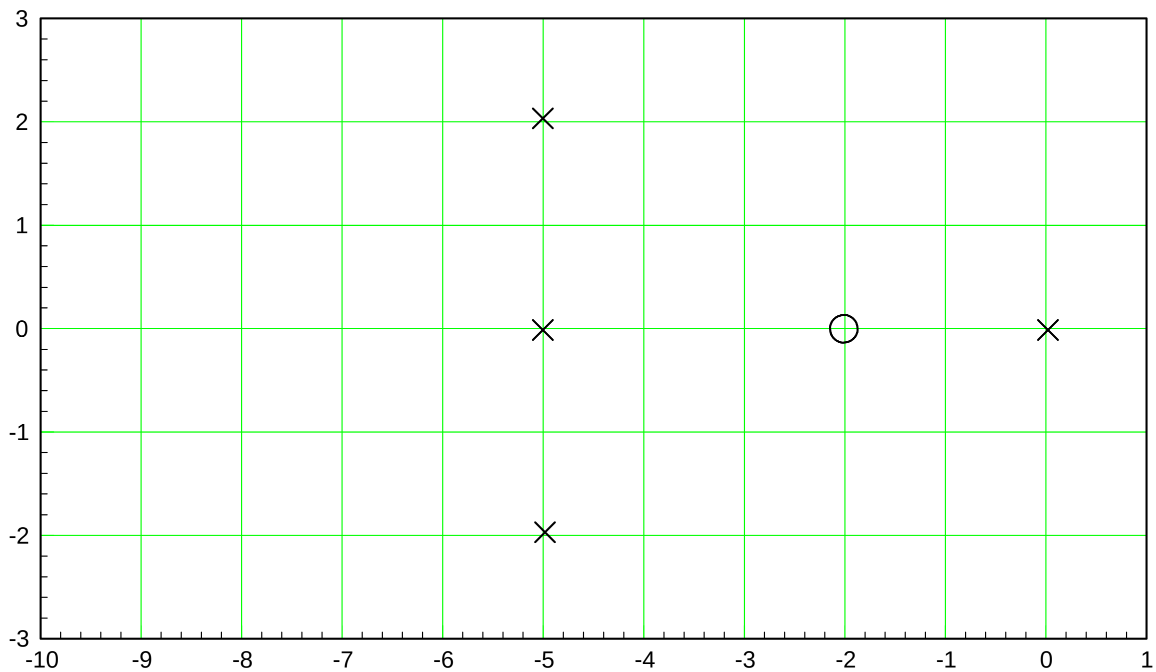
Express these dynamics in state-space form



3) Sketch the root locus for the following system. Include the following

$$G(s) = \left(\frac{100(s+2)}{s(s+5)(s+5+j2)(s+5-j2)}\right)$$

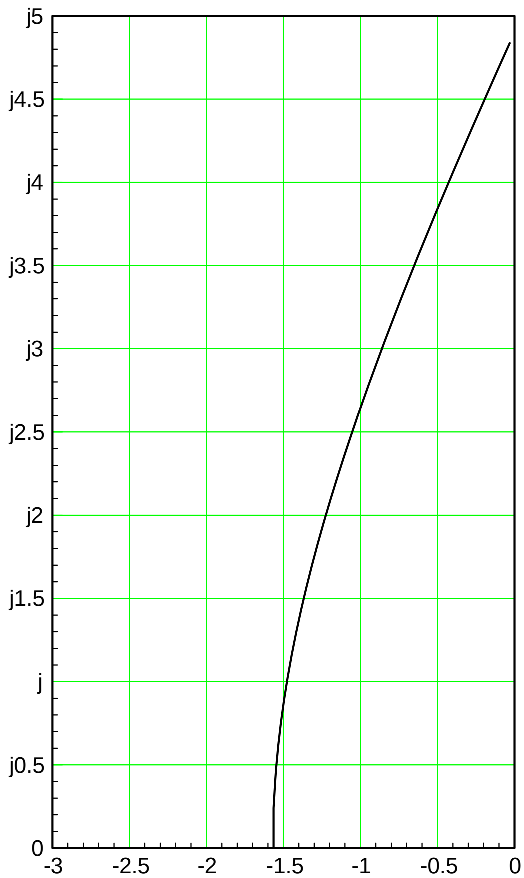
Root Locus Plot	show on graph
Real Axis Loci	
Breakaway Points (approx)	
jw crossing (approx)	
Asymptotes	show on graph
Departure Angle from pole at s = -5 + j2	



4) The root locus for G(s) is shown below. Determine the gain, k, which results in the closed-loop system having 30% overshoot for a step input.

$$G(s) = \left(\frac{200}{s(s+4)(s+6)}\right)$$

Damping Ratio (30% overshoot)	
Closed-Loop Domionant Poles	
Gain, k	



5) Assume

$$G(s) = \left(\frac{200}{(s+4)(s+6)(s+10)}\right)$$

Design a compensator, K(s), so that the closed-loop system has

- No error for a step input
- Closed-loop dominant poles at s = -3 + j6

6) Assume G(s) is

$$G(s) = \left(\frac{200}{(s+4)(s+6)(s+10)}\right)$$

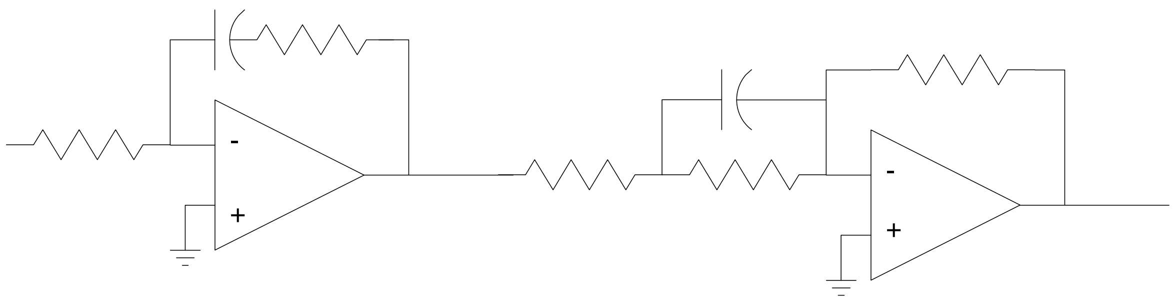
Design a compensator, K(s), so that the closed-loop system has

- No error for a step input
- A 0dB gain frequency of 6 rad/sec, and
- A 47 degree phase margin

7) Assume

$$K(s) = \left(\frac{50(s+3)(s+5)}{s(s+10)} \right)$$

a) Design a circuit to implement K(s)



b) Determine the discrete-time equivalent, K(z), with T = 0.01