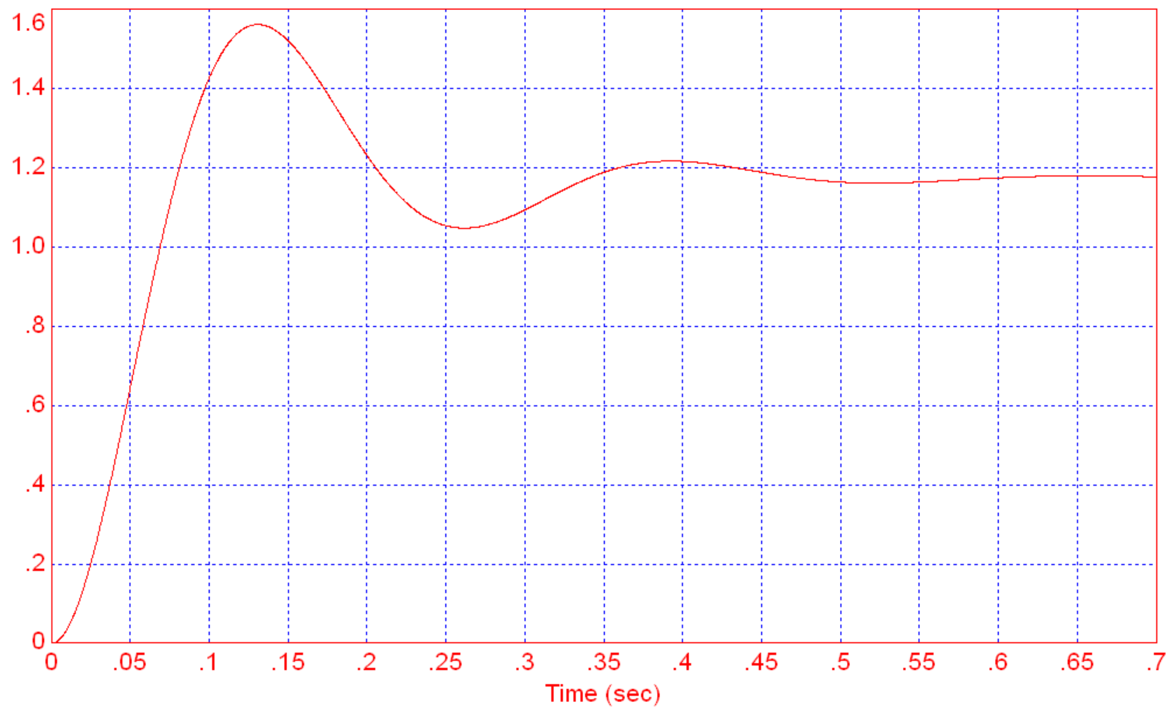
Final: ECE 461 / 661: Name ________________

Closed Book. Closed Notes. Calculators Permitted.

1) Determine the system with the following step response:

G(s) =



2a) Determine y(t) given

$$Y = \left(\frac{20}{(s+2)(s+5)}\right)X$$

$$x(t) = 2 + 3\cos(4t)$$

2b) Determine y(t) given

$$Y = \left(\frac{20}{(s+2)(s+5)}\right)X$$

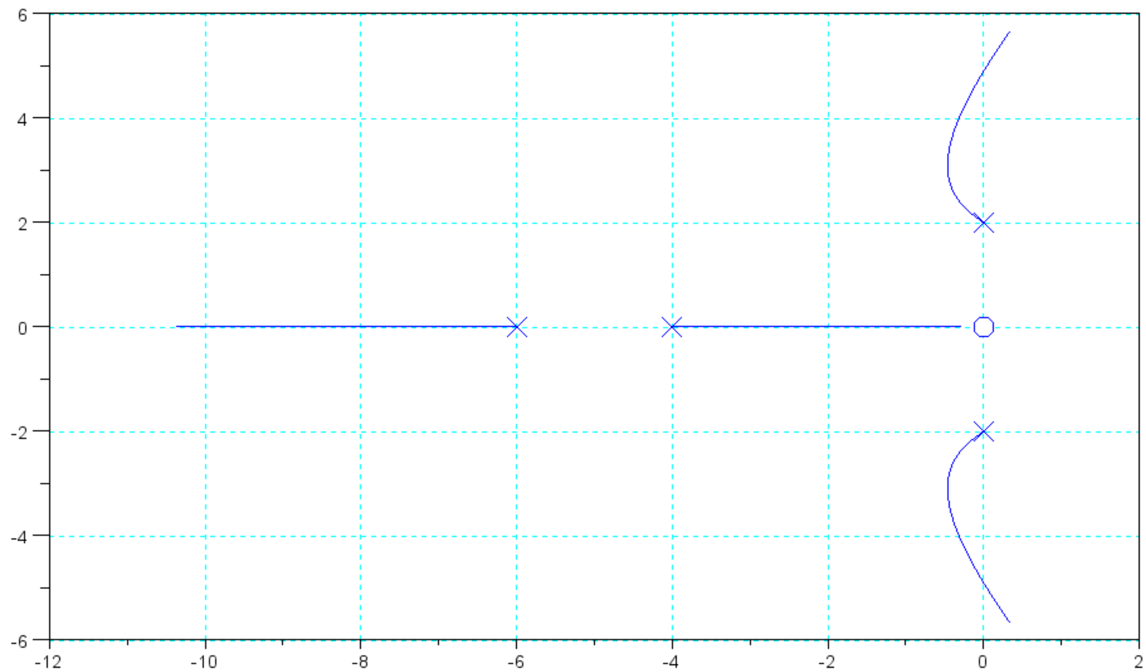
$$x(t) = 2u(t)$$

3) The root locus for

$$G(s) = \left(\frac{2s}{(s+j2)(s-j2)(s+4)(s+6)}\right)$$

is shown below. Determine the following:

Real Axis Loci		# Asymptotes	
jw Crossing		Asymptote Angles	
Departure Angle from the Pole at j2		Asymptote Intersect	

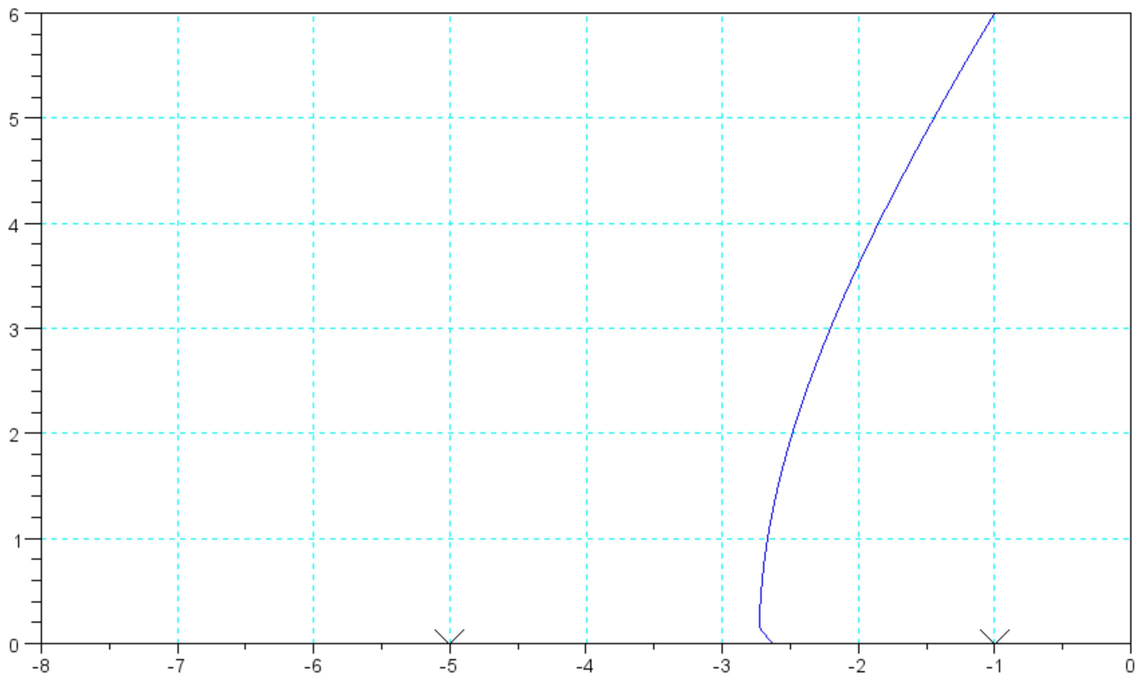


4) The root locus for

$$G(s) = \left(\frac{10}{(s+1)(s+5)(s+10)}\right)$$

is shown below. Determing a gain compensator, K(s) = k, which results in 20% overshoot for a step input. For this value of k, determine the following:

k	
Closed-Loop Dominant Pole(s)	
Error Constant, Kp	



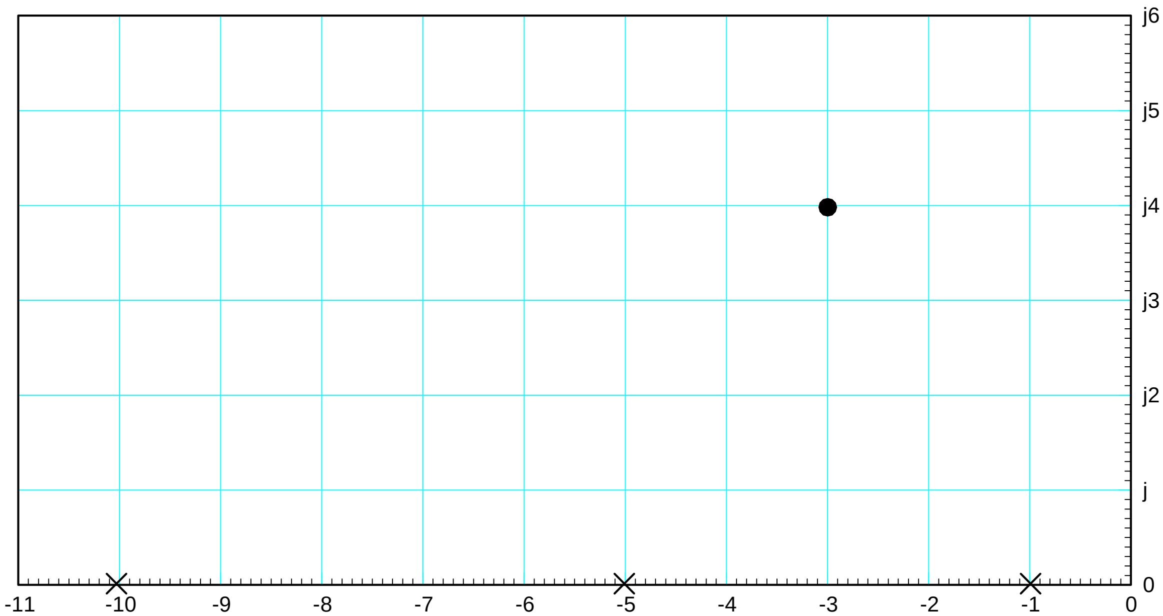
5) Compensator Design: For the system

$$G(s) = \left(\frac{10}{(s+1)(s+5)(s+10)}\right)$$

design a compensator, K(s), which results in

- No error for a step input, and
- A Closed-Loop Dominant pole at s = -3 + j4

K(s) =



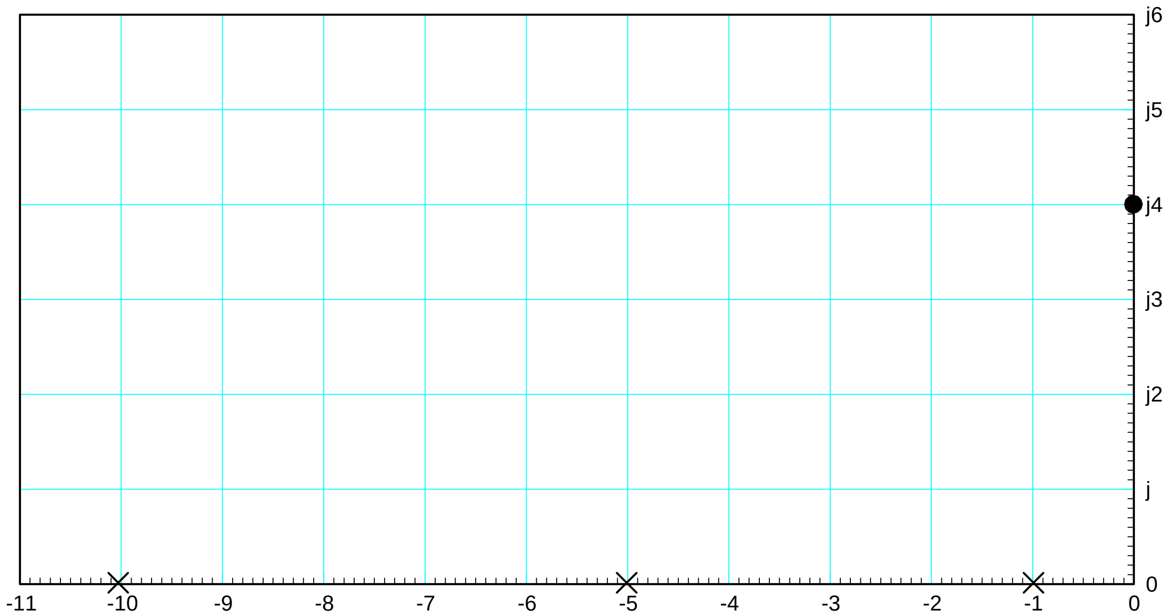
6) Compensator Design: For the system

$$G(s) = \left(\frac{10}{(s+1)(s+5)(s+10)} \right)$$

design a compensator, K(s), which results in

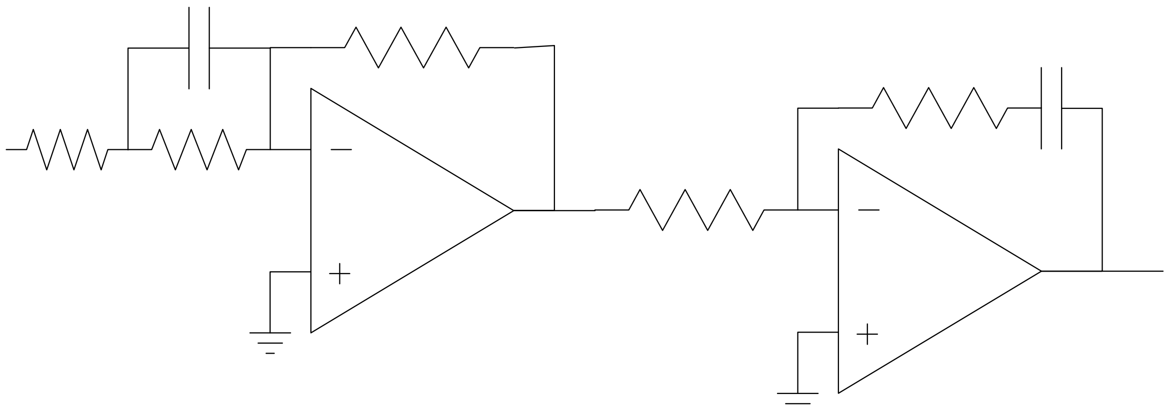
- No error for a step input,
- A 0dB Gain Frequency of 4 rad/sec, and
- A 60 degree phase margin

K(s) =



7a) Design a circuit to implement K(s)

$$K(s) = 10\left(\frac{(s+2)(s+3)}{s(s+7)}\right)$$



7b) Determine a discrete-time compensator, K(z), which corresponds to K(s). Assume a sampling rate of 10ms (T = 0.01).

$$K(s) = 10\left(\frac{(s+2)(s+3)}{s(s+7)}\right)$$

Bonus! Three of the following are U.S. Senators, three are monsters who faced Godzilla. Which are the Senators?

Biollante - Cornyn - Destroyah - Murkowski - Shaheen - Varan