ECE 461/661 - Test #2: Name ____________________

Feedback and Root Locus - Fall 2022

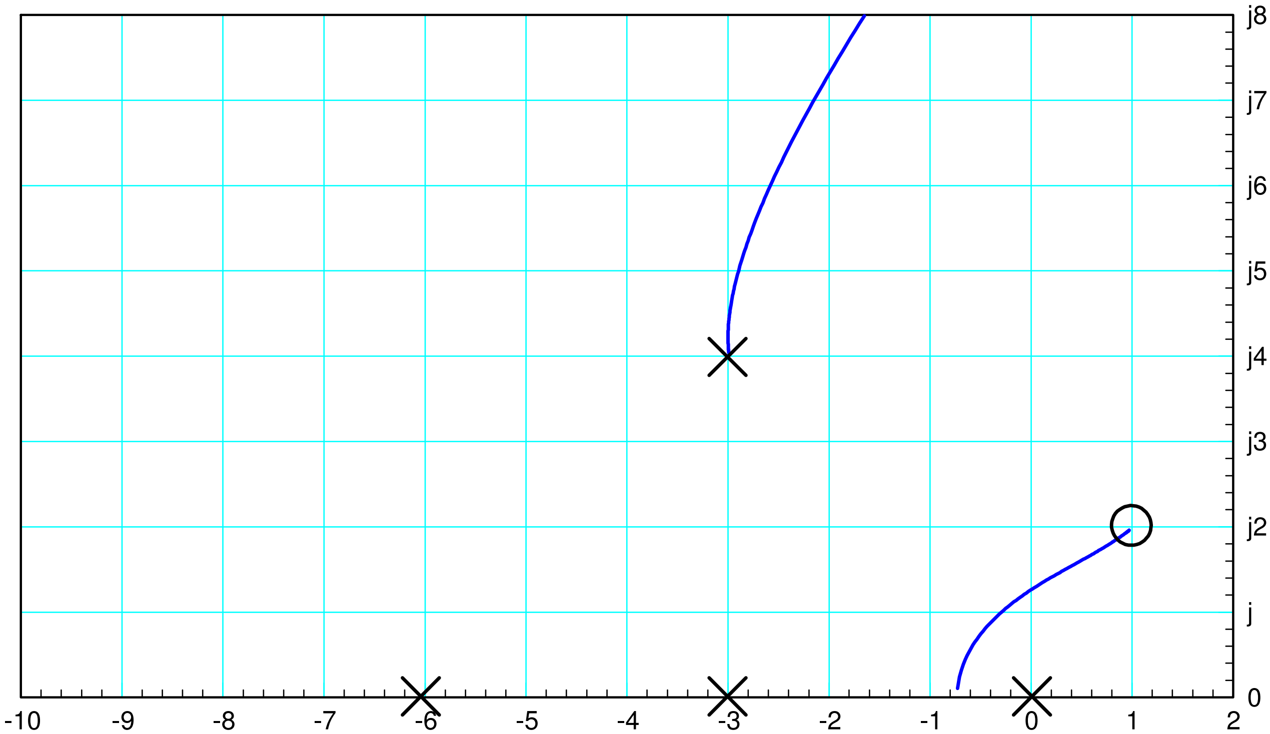
Root Locus

1) The root locus of G(s) is shown below.

$$G(s) = \left(\frac{10(s-1+j2)(s-1-j2)}{s(s+3)(s+6)(s+3+j4)(s+3-j4)} \right)$$

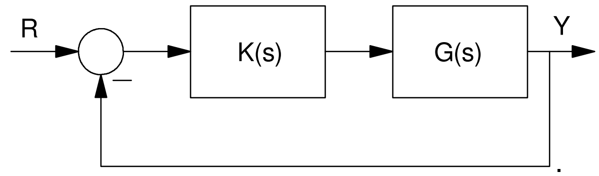
Determine the following

Approach Angle to the zero at +1+j2	Departure Angle from the pole at -3+j4	Real Axis Loci
Breakaway Point (approx)	**Asymptotes**	**jw Crossing(s)**
	show on graph	



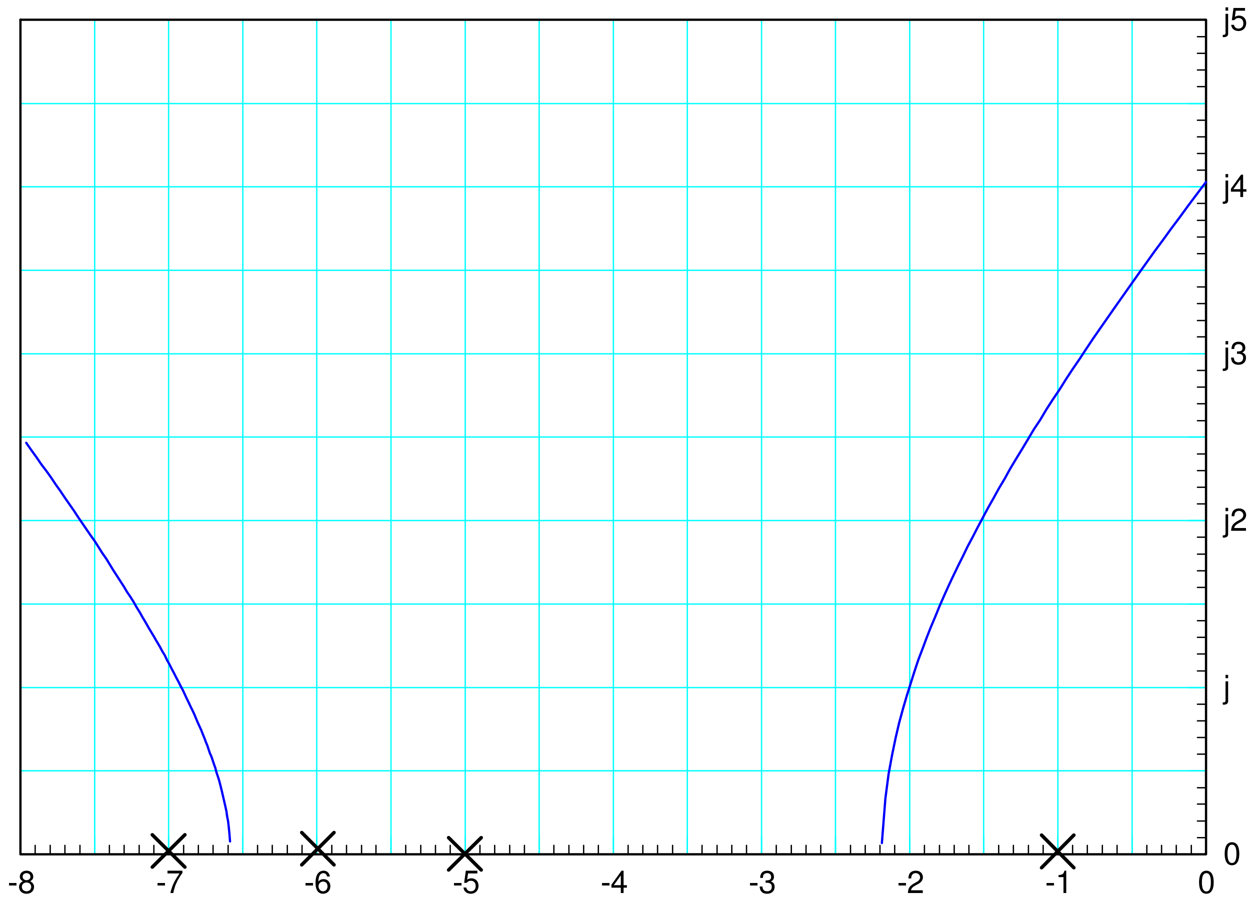
Gain Compensation

2) Determine the gain (K(s) = k) so that the feedback system has 60% overshoot for a step input. Also determine the closed-loop dominant pole(s) and error constant, Kp

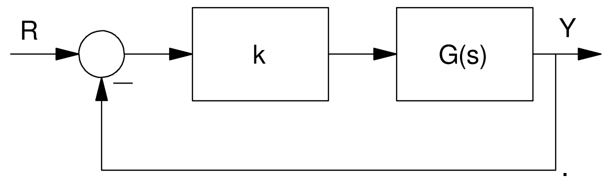


$$G(s) = \left(\frac{100}{(s+1)(s+5)(s+6)(s+7)}\right)$$

k 60% overshoot	Closed-Loop dominant pole(s)	Kp Error Constant



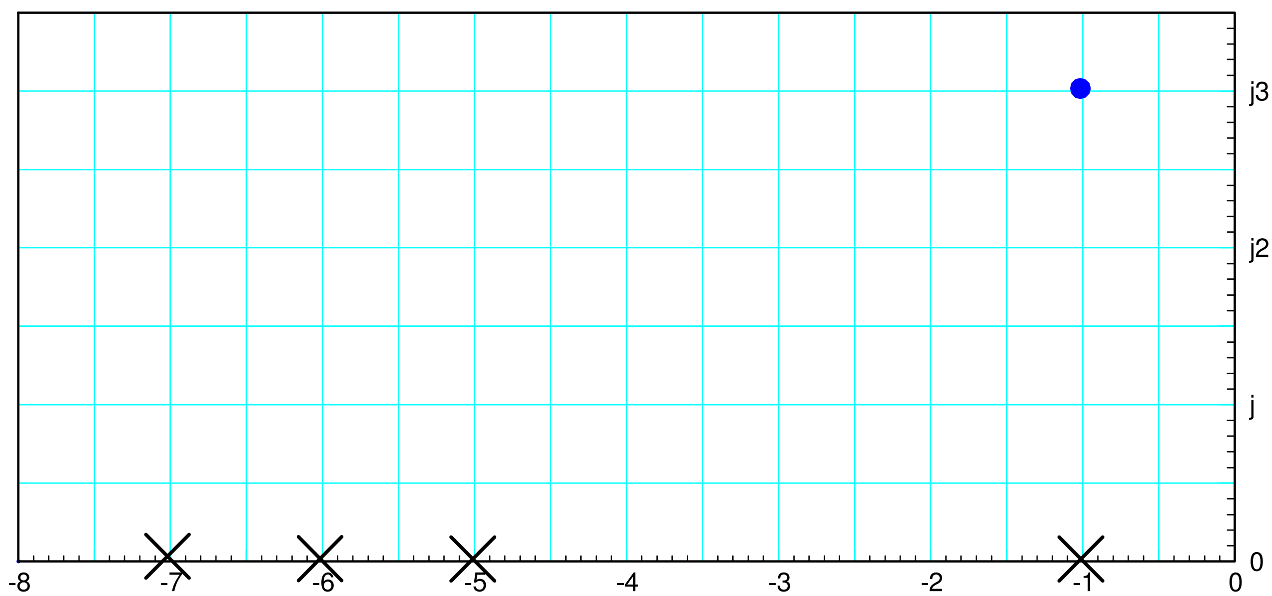
Lead/PI Compensation



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

- No error for a step input
- Closed-Loop dominant poles at s = -1 + j3, and
- Finite gain as s→ ∞ (i.e. have at least as many poles as zeros)

$$G(s) = \left(\frac{100}{(s+1)(s+5)(s+6)(s+7)}\right)$$



Compensator Design (hardware)

4) Design a circuit to implement K(s)

$$K(s) = \left(\frac{40(s+5)(s+6)}{s(s+17)} \right)$$