ECE 461/661 - Test #2: Name ____________________

Feedback and Root Locus - Fall 2024

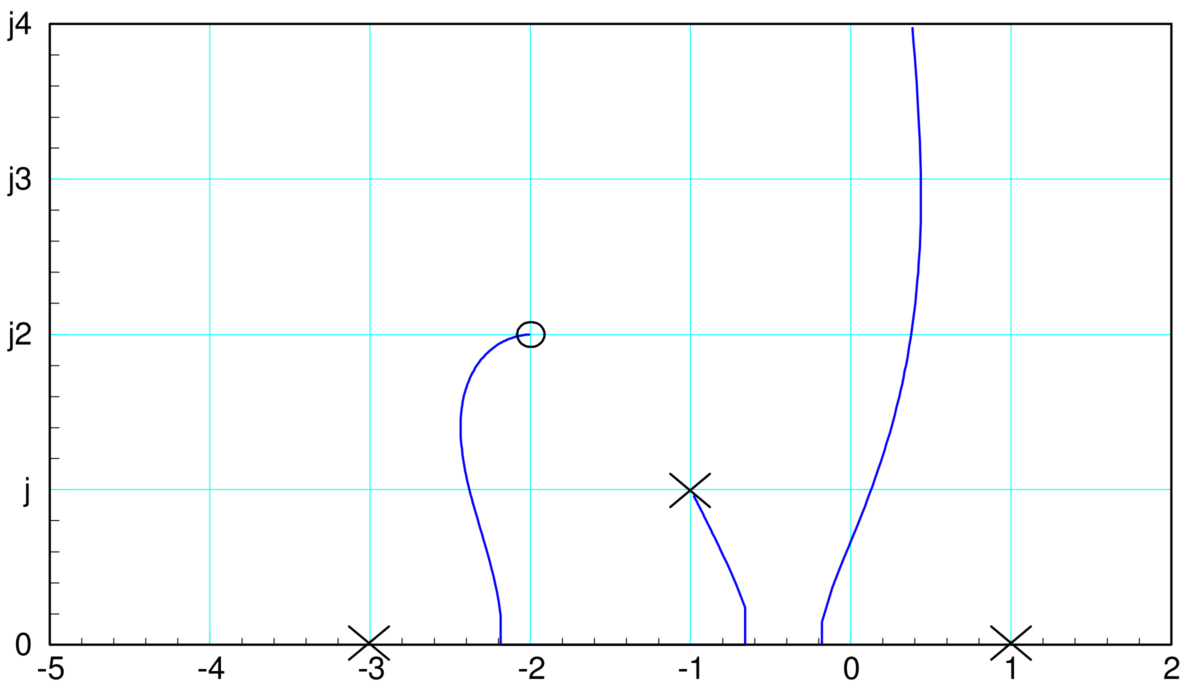
Root Locus

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

$$G(s) = \left(\frac{10(s+2+j2)(s+2-j2)}{(s-1)(s+3)(s+1+j)(s+1-j)} \right)$$

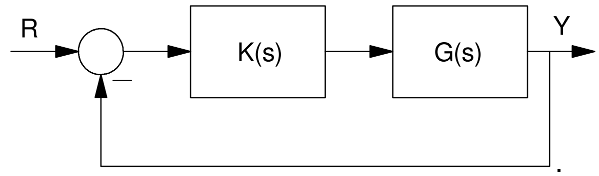
Determine the following

Approach Angle to the zero at -2+j2	Departure Angle from the pole at -1+j1	Real Axis Loci
Breakaway Points (approx)	**Asymptotes**	**jw Crossing(s)**
	show on graph	



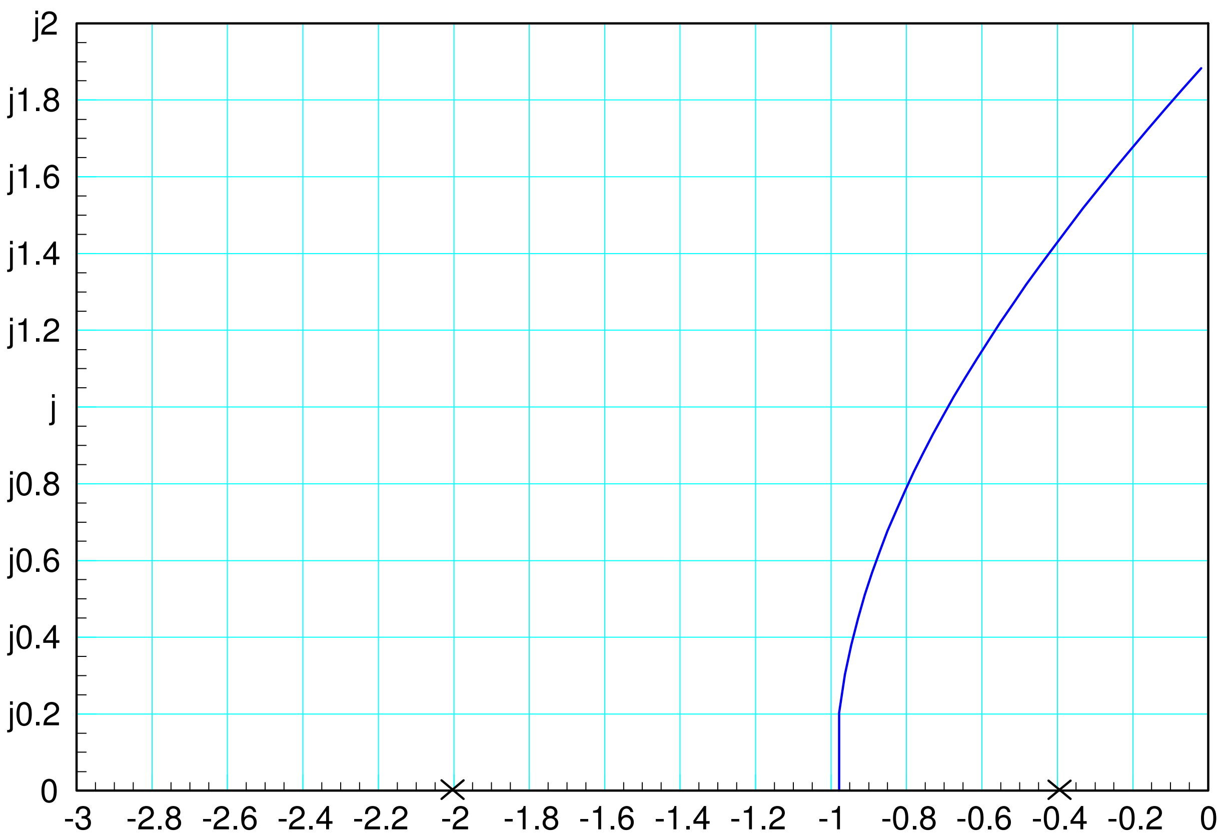
Gain Compensation

2) Determine the gain (K(s) = k) so that the feedback system has 40% overshoot for a step input. Also determine the closed-loop dominant pole(s) and error constant, Kp

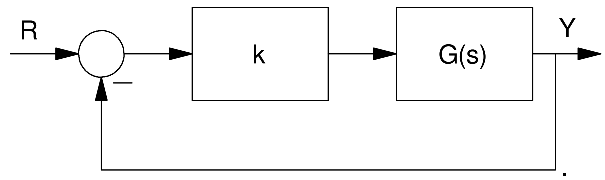


$$G(s) = \left(\frac{100}{(s+0.4)(s+2)(s+4)(s+6)(s+7)} \right)$$

Damping Ratio 40% overshoot	Angle of Pole	k 40% overshoot	Closed Loop Dominant Pole(s)	Kp Error Constant



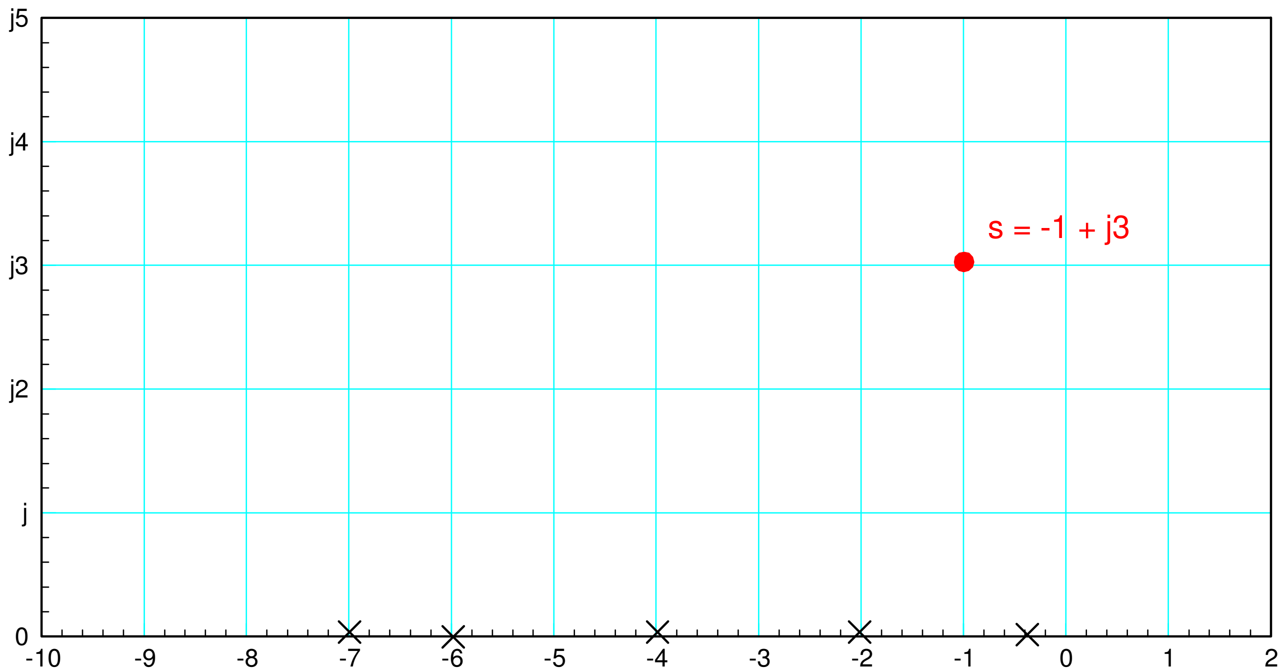
Lead/PI Compensation



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)

$$G(s) = \left(\frac{100}{(s+0.4)(s+2)(s+4)(s+6)(s+7)} \right)$$



Compensator Design (hardware)

4) Design a circuit to implement K(s)

$$K(s) = \left(\frac{50(s+2)(s+6)}{s(s+7)} \right)$$