

ECE 461/661 - Test #2: Name _____

Feedback and Root Locus - Fall 2025

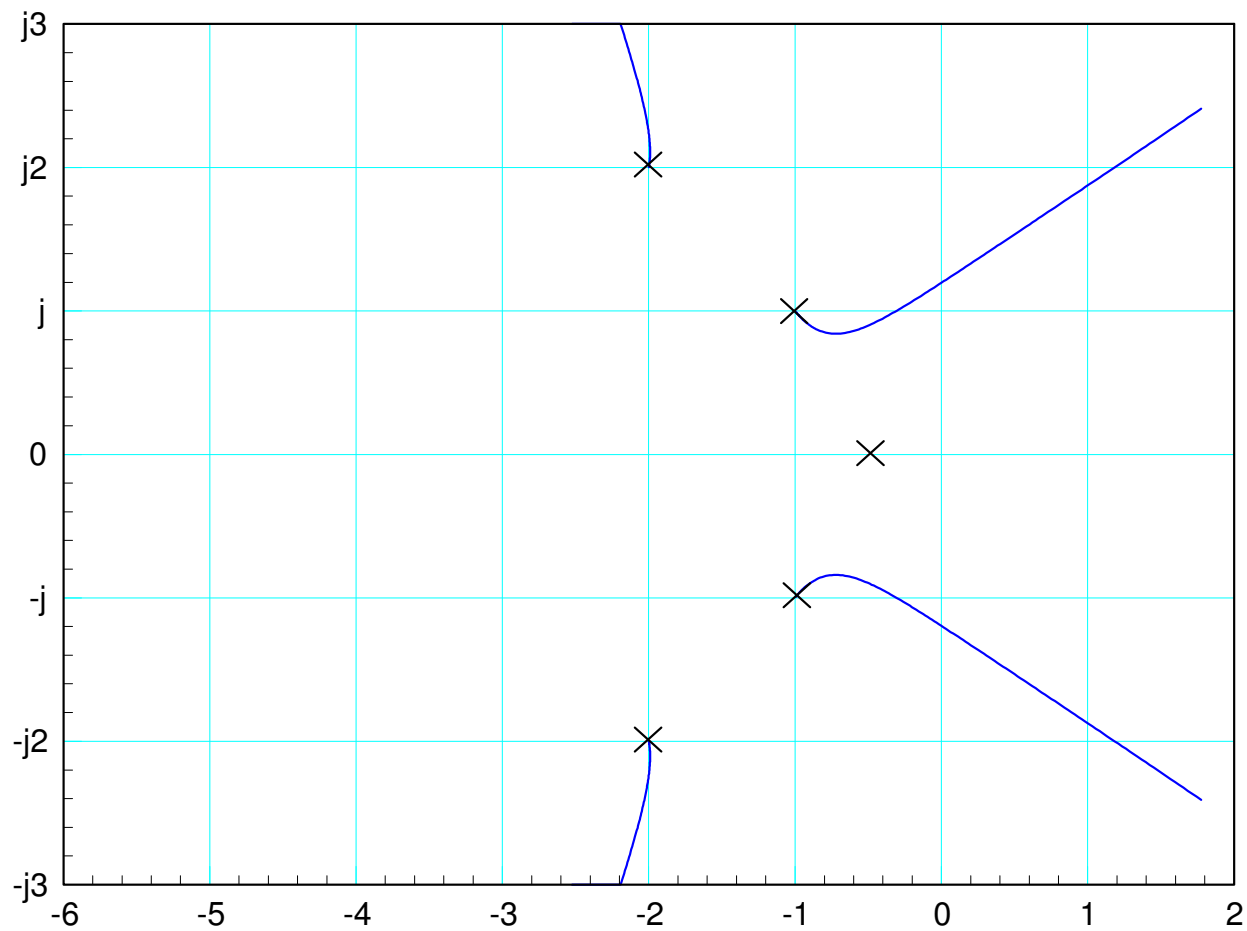
Root Locus

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

$$G(s) = \left(\frac{10}{(s+0.5)(s+1+j)(s+1-j)(s+2+j2)(s+2-j2)} \right)$$

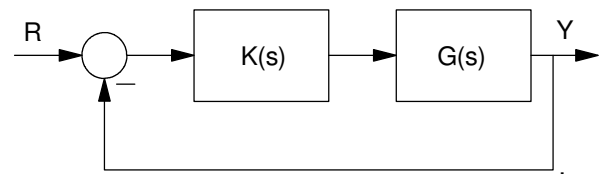
Determine the following

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



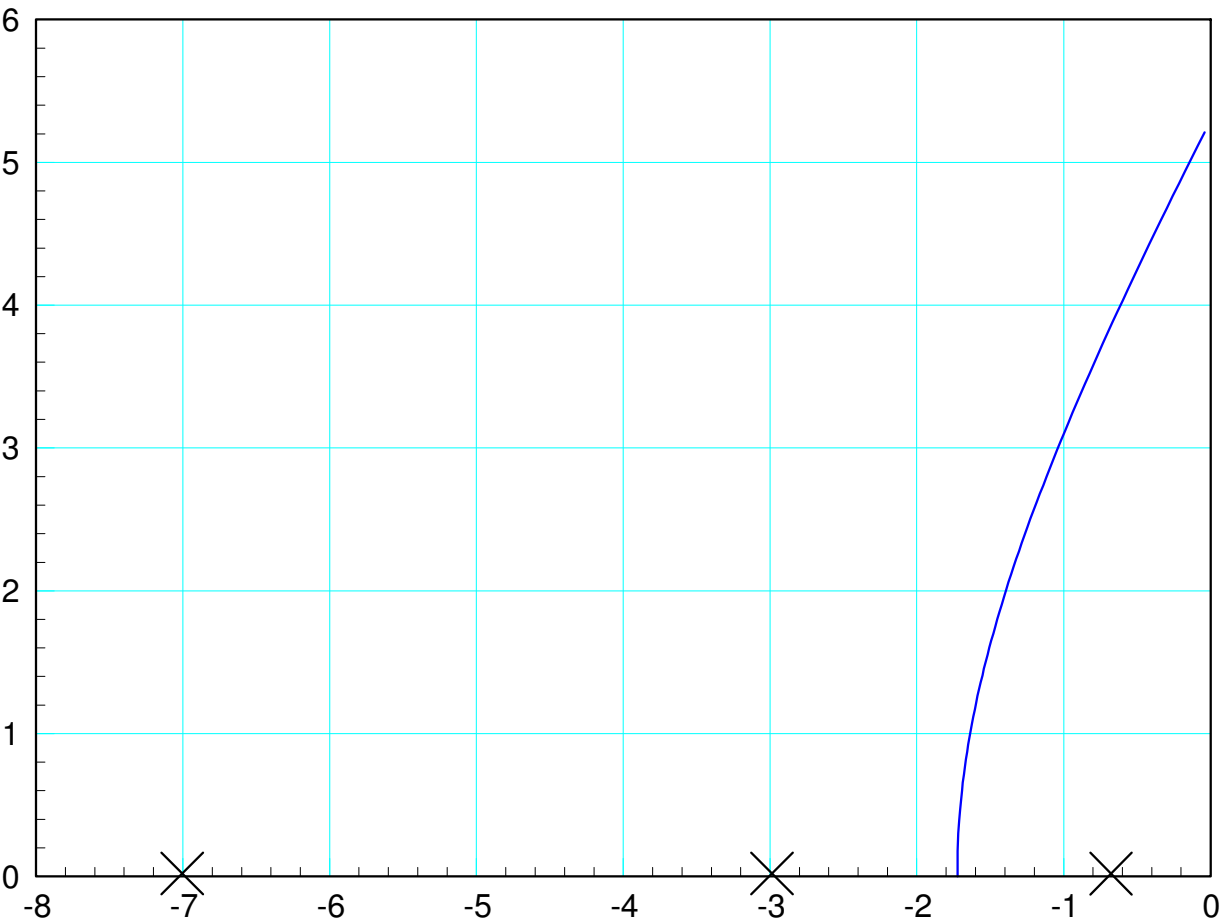
Gain Compensation

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



$$G(s) = \left(\frac{10}{(s+0.7)(s+3)(s+7)} \right)$$

Damping Ratio 60% overshoot	Angle of Pole	k 60% overshoot	Closed Loop Dominant Pole(s)	Kp Error Constant

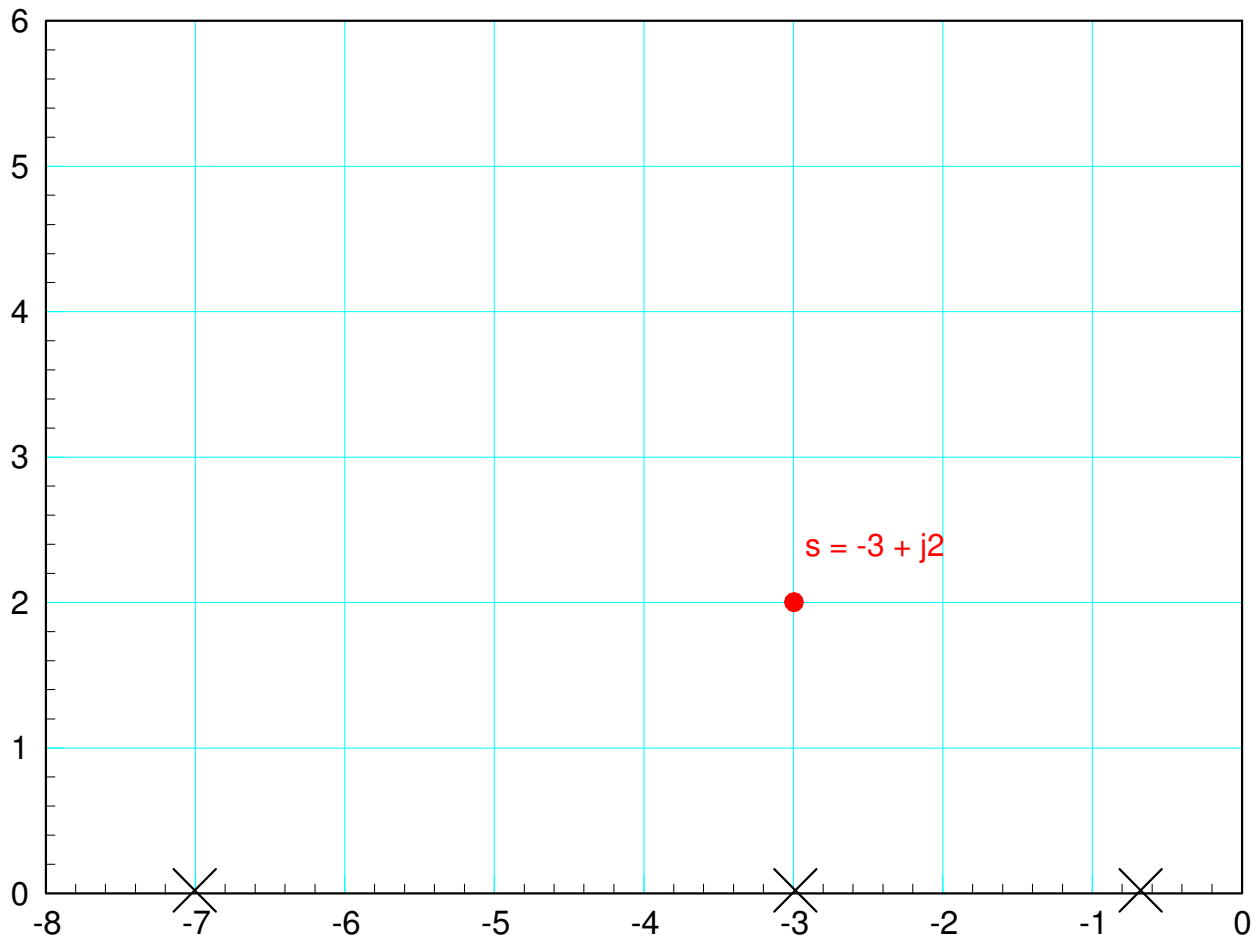
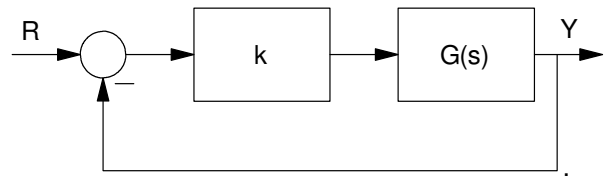


Lead/PI Compensation

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

- No error for a step input
- Closed-Loop dominant poles at $s = -3 + j2$, and
- Finite gain as $s \rightarrow \infty$ (i.e. have at least as many poles as zeros)

$$G(s) = \left(\frac{10}{(s+0.7)(s+3)(s+7)} \right)$$



Compensator Design (hardware)

4) Design a circuit to implement $K(s)$

$$K(s) = \left(\frac{25(s+3)(s+7)}{s(s+10)} \right)$$

