ECE 461/661 - Test #2: Name _____

Feedback and Root Locus - Fall 2021

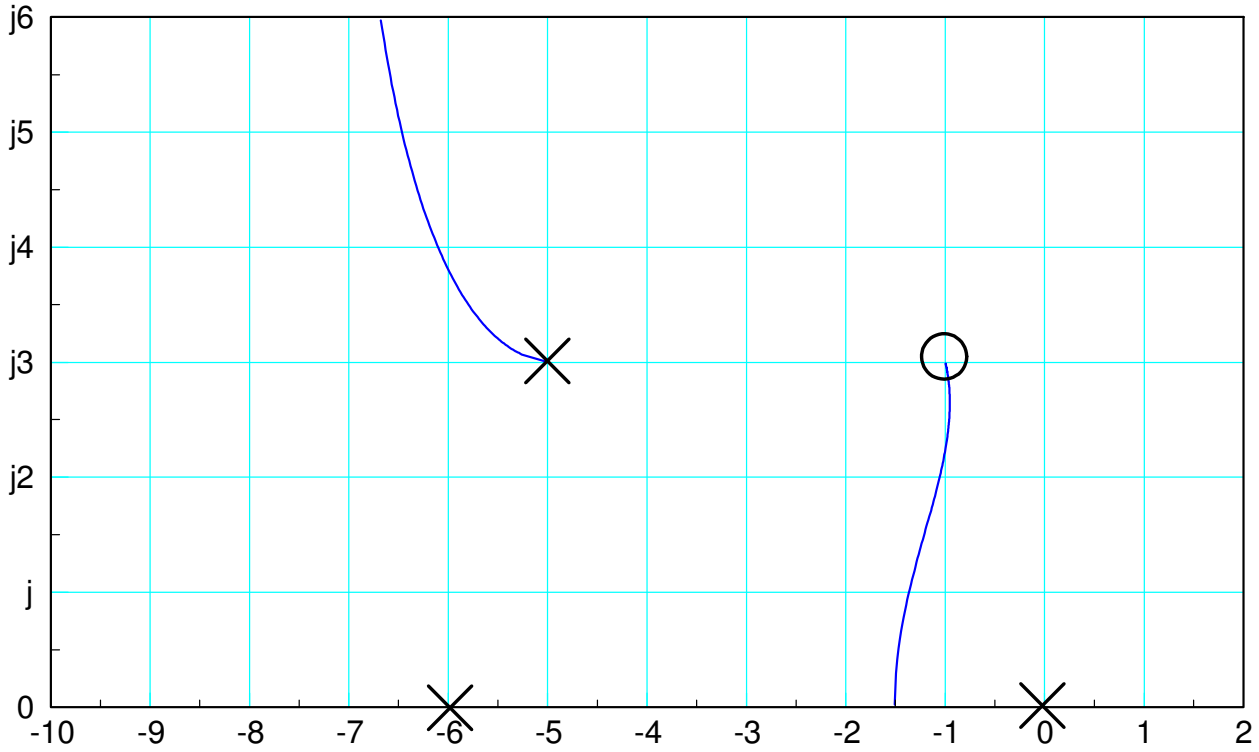
Root Locus

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

$$G(s) = \left(\frac{10(s+1+j3)(s+1-j3)}{s(s+6)(s+5+j3)(s+5-j3)} \right)$$

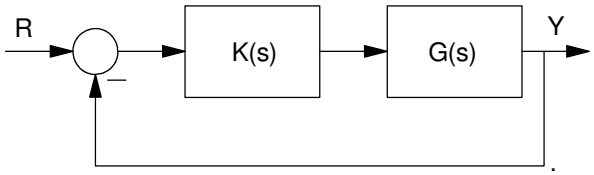
Determine the following

- Approach angle to the zero at -1 + j3,
- Departure angle from the pole at -5 + j3,
- The real axis loci,
- The breakaway point (approx), and
- The asymptotes (number, angle, intercept)



Gain Compensation

2) Design a gain compensator (K(s) = k) so that the feedback system has 50% overshoot for a step input.

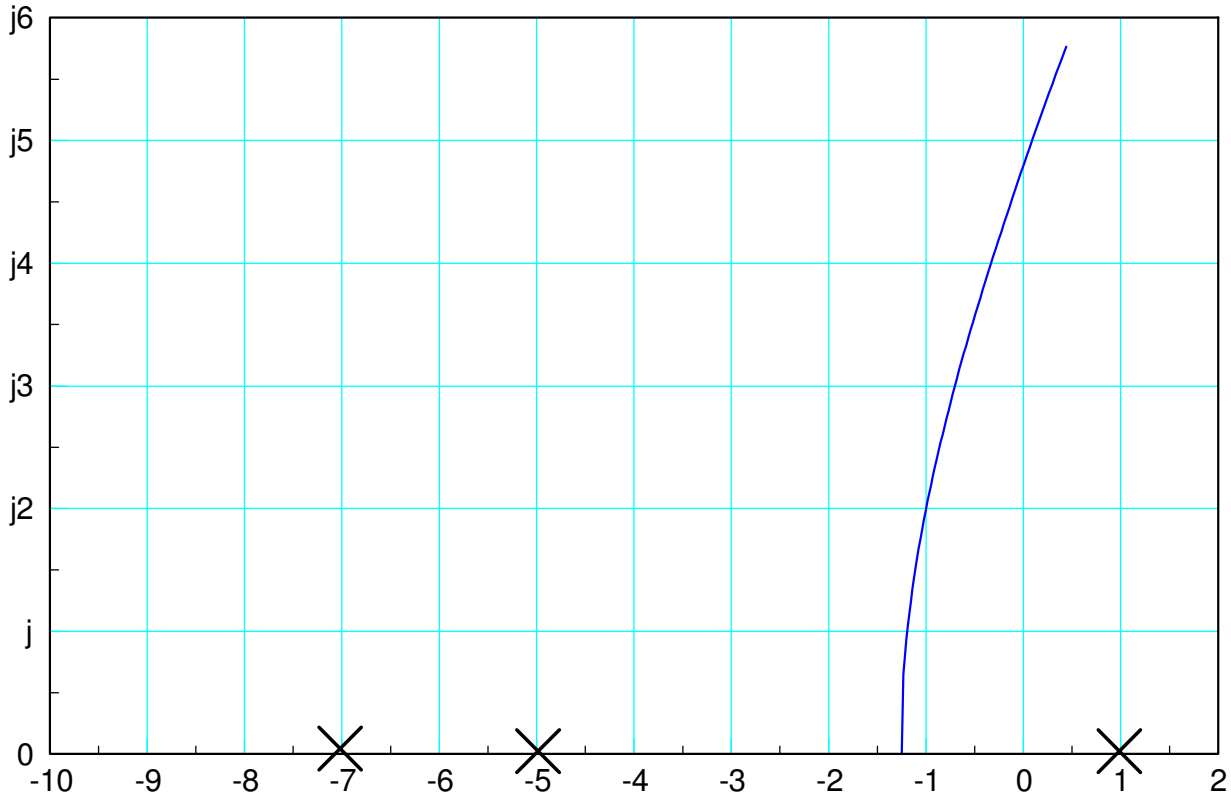


Also determine

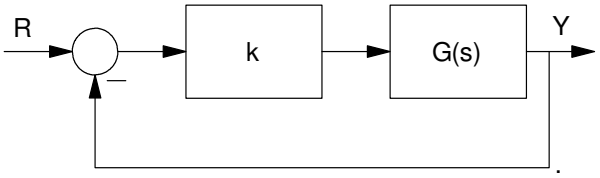
- The resulting error constant, Kp,
- The closed-loop dominant pole(s)

Assume

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



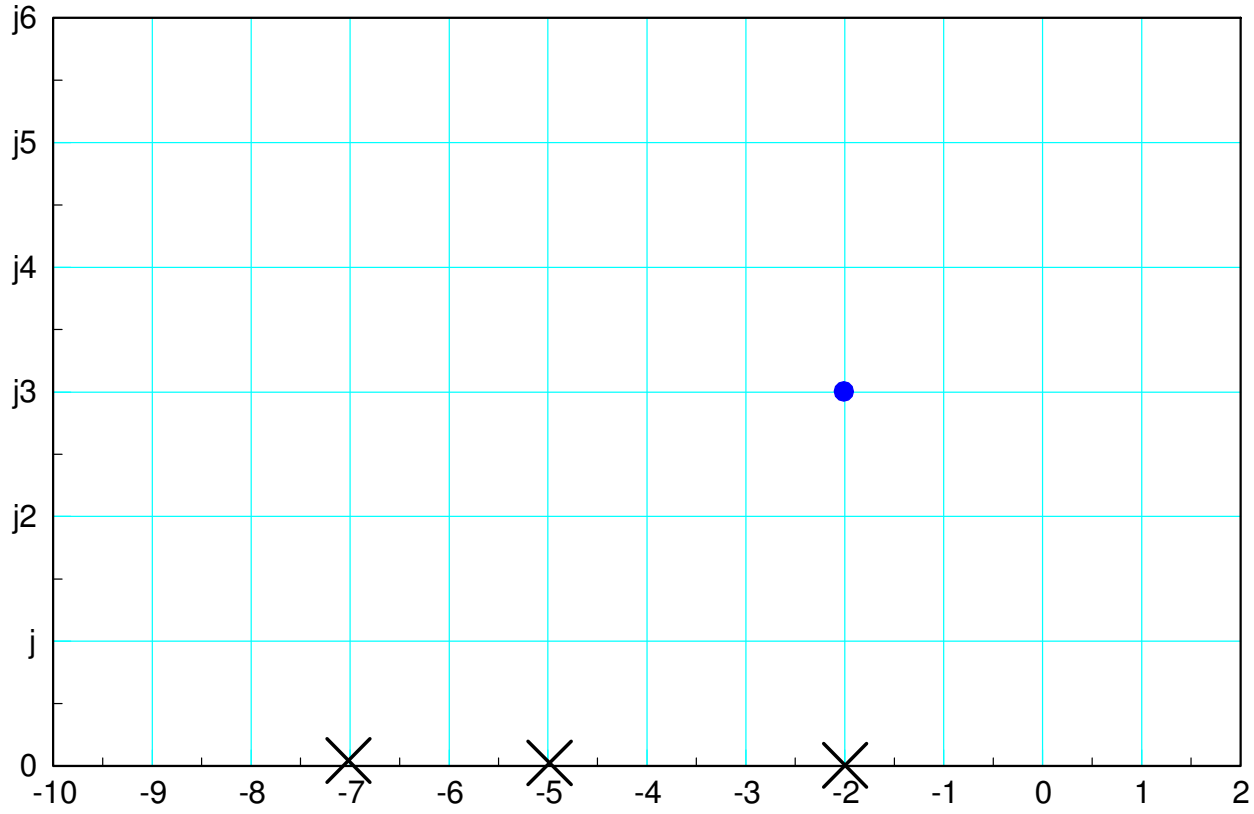
Lead/PI Compensation



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 = -2 + j3, and
- Finite gain as $s \rightarrow \infty$ (i.e. have at least as many poles as zeros)

$$G(s) = \left(\frac{100}{(s+2)(s+5)(s+7)} \right)$$



Compensator Design (hardware)

4) Design a circuit to implement K(s)

$$K(s) = \left(\frac{150(s+7)(s+11)}{s(s+22)} \right)$$