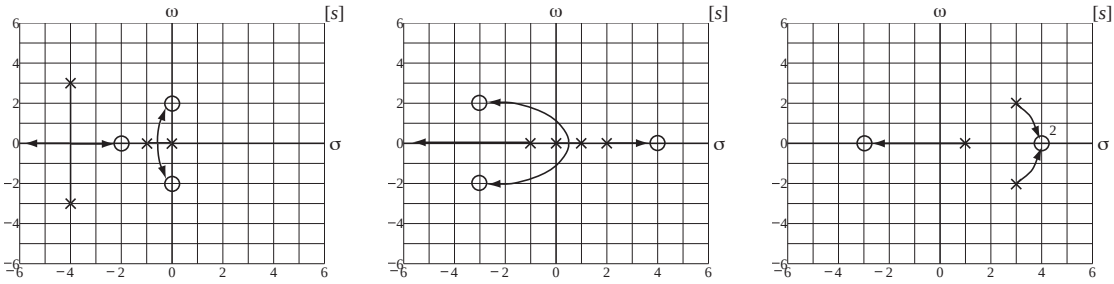
Solution to ECE Test #6 S07 #1

1. A feedback system has a forward-path transfer function $H_1(s) = \dfrac{K(s-3)}{s+6}$ and a feedback-path transfer function $H_2(s) = \dfrac{s+10}{s^2+2s+4}$.

Is there a finite, positive value of *K* that makes this system unstable? Yes

Explain how you know $T(s)$ has a zero at $s = 3$. Therefore as *K* is increased from zero, one branch of the root locus approaches this point which is in the right half-plane. Therefore, before *K* reaches infinity, a pole of $H(s)$ is in the right half-plane.

2. The pole-zero plots below are for the loop transfer function of a feedback system. Sketch, directly on the pole-zero plots the root locus for each.



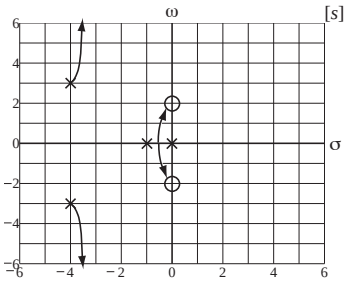
Solution to ECE Test #6 S07 #2

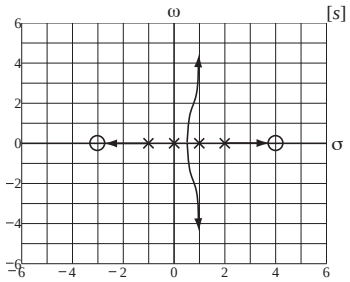
1. A feedback system has a forward-path transfer function $H_1(s) = \dfrac{K(s+3)}{s+6}$ and a feedback-path transfer function $H_2(s) = \dfrac{s+10}{s^2+2s+4}$.

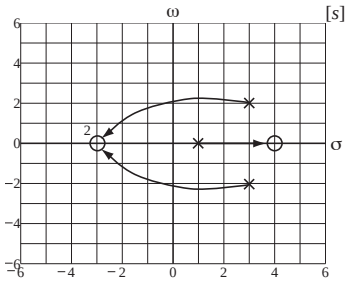
Is there a finite, positive value of *K* that makes this system unstable? No

Explain how you know $T(s)$ has zeros at $s = -3, -10$. All three poles are in the left half-plane. Two root locus branches terminate on the two finite zeros without going into the right half-plane. The other root locus branch terminates on a zero at infinity and the asymptote is π radians so it approaches negative infinity and never goes into the right half-plane.

2. The pole-zero plots below are for the loop transfer function of a feedback system. Sketch, directly on the pole-zero plots the root locus for each.







Solution to ECE Test #6 S07 #3

1. A feedback system has a forward-path transfer function $H_1(s) = \dfrac{K(s+3)}{s+6}$ and a feedback-path transfer function $H_2(s) = \dfrac{s-10}{s^2+2s+4}$.

Is there a finite, positive value of *K* that makes this system unstable? Yes

Explain how you know $T(s)$ has a zero at $s = 10$. Therefore as *K* is increased from zero, one branch of the root locus approaches this point which is in the right half-plane. Therefore, before *K* reaches infinity, a pole of $H(s)$ is in the right half-plane.

2. The pole-zero plots below are for the loop transfer function of a feedback system. Sketch, directly on the pole-zero plots the root locus for each.