

# ECE 461/661 Handout #21

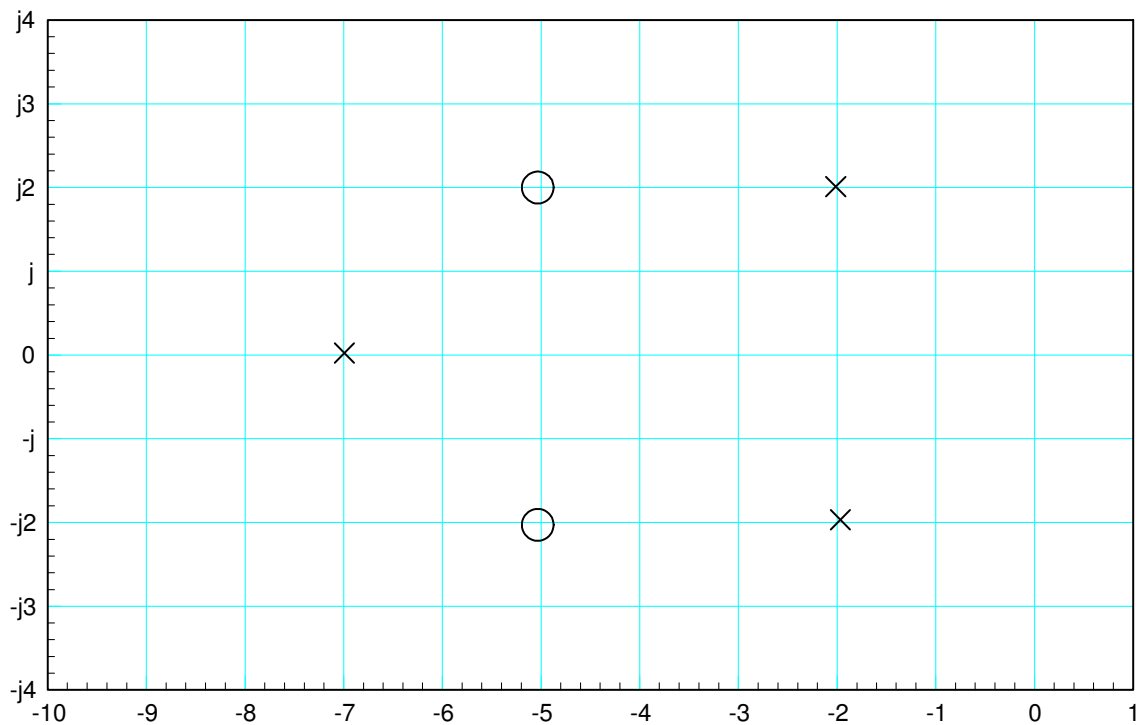
Root Locus (complex poles)

Sketch the root locus for

$$G(s) = \left( \frac{200(s^2+10s+29)}{(s+7)(s^2+4s+8)} \right) = \left( \frac{200(s+5+j2)(s+5-j2)}{(s+7)(s+2+j2)(s+2-j2)} \right)$$

Determine

Real Axis Loci	
Departure Angle from pole at $-2 + j2$	
Approach angle to zero at $-5 + j2$	



## Solution

$$G(s) = \left( \frac{200(s^2+10s+29)}{(s+7)(s^2+4s+8)} \right) = \left( \frac{200(s+5+j2)(s+5-j2)}{(s+7)(s+2+j2)(s+2-j2)} \right)$$

Departure Angle

$$\left( \frac{200(s+5+j2)(s+5-j2)}{(s+7)(s+2+j2)(s+2-j2)} \right)_{s=-2+j2} = x \angle 180^\circ$$

$$\left( \frac{200(s+5+j2)(s+5-j2)}{(s+7)(s+2+j2)} \right)_{s=-2+j2} = 139.272 \angle -58.671^\circ$$

$$\text{angle} \left( \frac{1}{s+2-j2} \right) = -121.329^\circ$$

$$\text{angle}(s+2-j2) = +121.329^\circ = \text{departure angle}$$

Approach Angle

$$\left( \frac{200(s+5+j2)(s+5-j2)}{(s+7)(s+2+j2)(s+2-j2)} \right)_{s=-5+j2} = x \angle 180^\circ$$

$$\left( \frac{200(s+5+j2)}{(s+7)(s+2+j2)(s+2-j2)} \right)_{s=-5+j2} = 18.856 \angle 98.130^\circ$$

$$\text{angle}(s+5-j2) = 81.87^\circ = \text{approach angle}$$

