EECE4130/16.413 Problem Set #5

1. Show that the root locus for the unity negative feedback system

\[ G(s)H(s) = \frac{K(s^2 + 6s + 10)}{s^2 + 2s + 10} \]

are arcs of a circle centered at the origin with radius equal to \( \sqrt{10} \).

2. The system

\[ G(s)H(s) = \frac{K}{(s^2 + 2s + 2)(s^2 + 2s + 5)} \]

Determine the exact points where the root locus crosses the \( j\omega \) axis.

3. Consider the system

\[ GH = \frac{K(1 + sK_h)}{s^2} \]

a. For what value of \( K \) and \( K_h \) are the poles equal \( -1 + j\sqrt{3} \) and \( -1 - j\sqrt{3} \)

b. Given \( K_h = 1/2 \) draw the root locus as \( K \) varies.

4. For the system

\[ GH = \frac{K(s + 5)(1/5)}{s(s + 1)(s + 2)} \]

a. Draw the root locus

b. What value of \( K \) should you use to yield \( \zeta = 0.5 \).