Problem 1 Consider the following transfer functions:

$$1)\ L(s) = \frac{1}{s(s^2+4s+8)} \qquad 2)\ L(s) = \frac{s}{(s-1)(s+1)^3}$$

For each one of these, do the following:

a) Mark the zeros and poles on the s-plane and use Rule 2 from class to plot the real-axis part of the root locus.

b) Use the phase condition from class to test whether or not the point $s = j$ is on the root locus. If you run into "non-obvious" angles, *estimate* rather than *calculate* them, this should be enough.

c) Apply Rules 3 and 4 to determine asymptotes and departure and arrival angles. Plot the root locus branches based on this information.

d) Apply Rule 5 to determine imaginary-axis crossings (if any), and complete the (positive) root locus by using Rule 6 to check for multiple roots.

e) Plot the (positive) root locus using the MATLAB `rlocus` command or equivalent in Python or other language.

Turn in your MATLAB (or equivalent) plots as well as hand sketches of root loci along with all accompanying calculations and explanations.

Problem 2 Consider the transfer function $L(s) = \dfrac{s^2+2s+2}{s^2-2s+2}$

a) Plot by hand the negative ($K < 0$) root locus for $L(s)$, using Rules 1–6 for negative root loci. Make your root locus as explicit as possible by specifying (when applicable) the real-axis part, asymptotes, arrival and departure angles, imaginary-axis crossings, and points of multiple roots. Turn in the hand plot and accompanying calculations and explanations.

b) Plot the same root locus in MATLAB (or equivalent); turn in the plots.