Covers Root Locus. Your notes and the textbook should be ample material to solve these problems.

1. The control of a satellite’s attitude is described by the simple equation: \( G(s) = \frac{1}{s^2} \). Use the root locus plotting rules to sketch the rough root locus for a unity feedback system with feedforward transfer function (a) \( G(s) = \frac{K}{s^2} \), (b) \( G(s) = \frac{K(s + 1)}{s^2} \), (c) \( G(s) = \frac{K(s + 1)}{s^2(s + 12)} \), (d) \( G(s) = \frac{K(s + 1)}{s^2(s + 4)} \), and (e) \( G(s) = \frac{K(s + 1)}{s^2(s + 9)} \). Also use MATLAB to plot the root locus for these transfer functions. Comment on the relationship of the change in root-locus shape to the addition of the zero in (b) and the addition of the poles in various locations in (c)-(e) to the transfer function given in (a).

2. For a time-delay unity feedback system with feedforward transfer function given by \( G(s) = K \frac{2}{100s + 1} e^{-4s} \), find the stability range for gain K.

3. Plot root-locus diagrams for the following non-minimum phase systems: (a) \( G(s) = \frac{K(s - 1)}{(s + 2)(s + 4)} \), and (b) \( G(s) = \frac{K(1 - s)}{(s + 2)(s + 4)} \).