

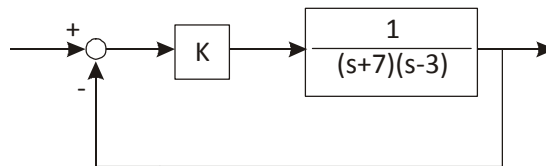
Name _____

Section _____

ME 422**Quiz 3**

3 November 2010

In answering this problem, show all work. It is your obligation to show clearly how you arrived at your solution, that is the complete train of logic that leads to your answer. In your solution clearly label each part of the solution with the lower case letter to which it pertains.



1. For the system above
 - a. Draw the root locus. Give all distances/dimensions possible on your diagram.
 - b. Calculate the closed-loop transfer function.
 - c. Give the characteristic equation of the system.
 - d. At the margin of stability, where are the closed-loop poles? Draw them as small squares on your root-locus diagram. Give the rationale for fixing your pole locations.
 - e. According to the root locations at marginal stability, write the corresponding characteristic equation for this state.
 - f. What gain would you need to get your system to marginal stability?
 - g. To get rid of steady-state error, you add a PI controller with $K_i = 4 \cdot K_p$. Draw the root locus for this case (including asymptotes) and say what impact this would have on the system.
 - h. Then you try a PI controller with $K_i = K_p$. Draw also the root locus for this case, including asymptotes. Comment on which would be better, g or h. Again, give the complete rationale for your evaluation.

Formulae: $\theta_a = \frac{(2k-1)\pi}{\#poles - \#zeros}$, $\sigma_a = \frac{\sum poles - \sum zeros}{\#poles - \#zeros}$