Problems 1-3 refer to the following system:

1) Assuming the prefilter $G_{pf}$ is 1, the position error constant $K_p$ is best approximated as
   a) $2/3$  b) $2/5$  c) 1  d) 0

2) Assuming the prefilter $G_{pf}$ is 1, the steady state error for a unit step is best approximated as
   a) $1/3$  b) $5/7$  c) $3/5$  d) $2/5$

3) The value of the prefilter $G_{pf}$ that produces a steady state error of zero is:
   a) 1  b) $7/2$  c) $5/2$  d) $7/5$

4) For the following system

   The dynamic prefilter which cancels the closed loop zeros and produces a zero steady state error for a unit step input is
   a) $\frac{11}{s + 4}$  b) $\frac{11}{s + 4}$  c) $\frac{11}{s + 4}$  d) $\frac{3}{s + 4}$
Problems 5-7 refer to the following system

5) Assuming the prefilter $G_{pf}$ is 1, the velocity error constant $K_v$ is best approximated as
   a) $\frac{2}{3}$  b) $\frac{2}{5}$  c) 1  d) 0

6) Assuming the prefilter $G_{pf}$ is 1, the steady state error for a unit ramp input is best approximated as
   a) $\frac{1}{2}$  b) 1  c) 2  d) $\frac{1}{2}$

7) Assuming the prefilter $G_{pf}$ is 1, the steady state error for a unit step input is best approximated as
   a) $\infty$  b) 0  c) 1  d) $\frac{2}{5}$

8) Consider the closed loop system below:

   If we want to use a dynamic prefilter to cancel the closed loop zero and produce a zero steady state error for a unit step, we should choose the prefilter as

   a) $G_{pf}(s) = \frac{1}{s + 1}$  b) $G_{pf}(s) = \frac{5}{s + 1}$  c) $G_{pf}(s) = \frac{6}{s + 1}$  d) $G_{pf}(s) = \frac{7}{s + 1}$
9) Is \( G_{pf}(s) = \frac{1}{(s-1)(s+2)} \) an acceptable prefilter (for any system)?

a) Yes  b) No

Problems 10-12 refer to the following root locus plot for a unity feedback system with a plant and a controller.

10) Based on this root locus plot, the best estimate of the poles of the closed loop system are

a) -0.3+j7, -0.3-j7, -0.6  b) 1+j2, 1-j2, and -3

11) Is this a type one system?  
a) yes  b) no

12) Is this a stable system?  
a) yes  b) no
13) Consider the following root locus plot for a plant and controller in a unity feedback configuration.

If we want the system to be stable, should we

a) increase the gain  b) decrease the gain  c) do nothing
Problems 14-19 refer to the following feedback system with plant $G_p(s) = \frac{1}{(s + 3)(s + 4)}$.

14) If we use a proportional controller $G_c(s) = k_p$ will the system remain stable for all positive values of $k_p$?
   
   a) yes  b) no

15) If we use a proportional controller $G_c(s) = k_p$ is there any value of $k_p$ for which the settling time is less than 0.5 seconds?
   
   a) yes  b) no

16) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ will the system remain stable for all positive values of $k_i$?
   
   a) yes  b) no

17) If we use an integral controller $G_c(s) = \frac{k_i}{s}$ is there any value of $k_i$ for which the settling time is less than 0.5 seconds?
   
   a) yes  b) no

18) For which of the following PID controllers will the settling time be smaller as $k \rightarrow \infty$
   
   a) $G_c(s) = \frac{k(s + 2 + j)(s + 2 - j)}{s}$  b) $G_c(s) = \frac{k(s + 4 + 2j)(s + 4 - 2j)}{s}$
   
   c) the results will be the same

19) For which of the following PD controllers will the settling time be smaller as $k \rightarrow \infty$
   
   a) $G_c(s) = k(s + 5)$  b) $G_c(s) = k(s + 10)$  c) the results will be the same