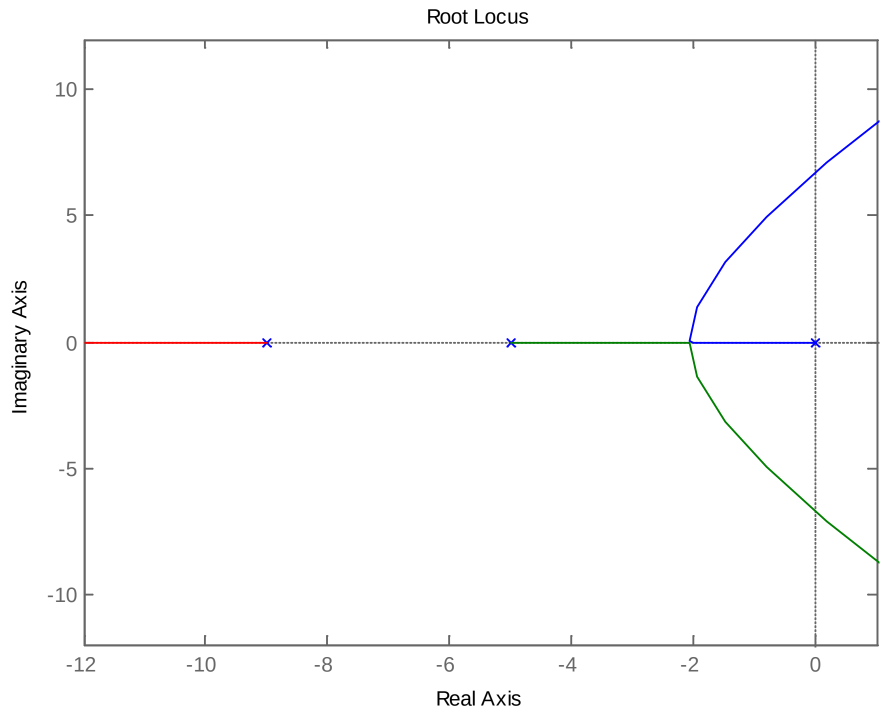
**ECE-320, Practice**
**Quiz #3**

Problems 1-5 refer to the following root locus plot for a unity feedback system.




**1)** Is it possible to find a value of $k$ so that -6 is a closed loop pole? a) Yes b) No

**2)** When k = 623 two poles of the closed loop system are purely imaginary. In order for the system to remain stable

a) $0 < k < 623$ b) $k > 623$ c) $k > 0$ d) $k < 0$

**3)** Is it possible to choose k so the system becomes unstable?

a) Yes b) No c) It is not possible to determine given this root locus plot

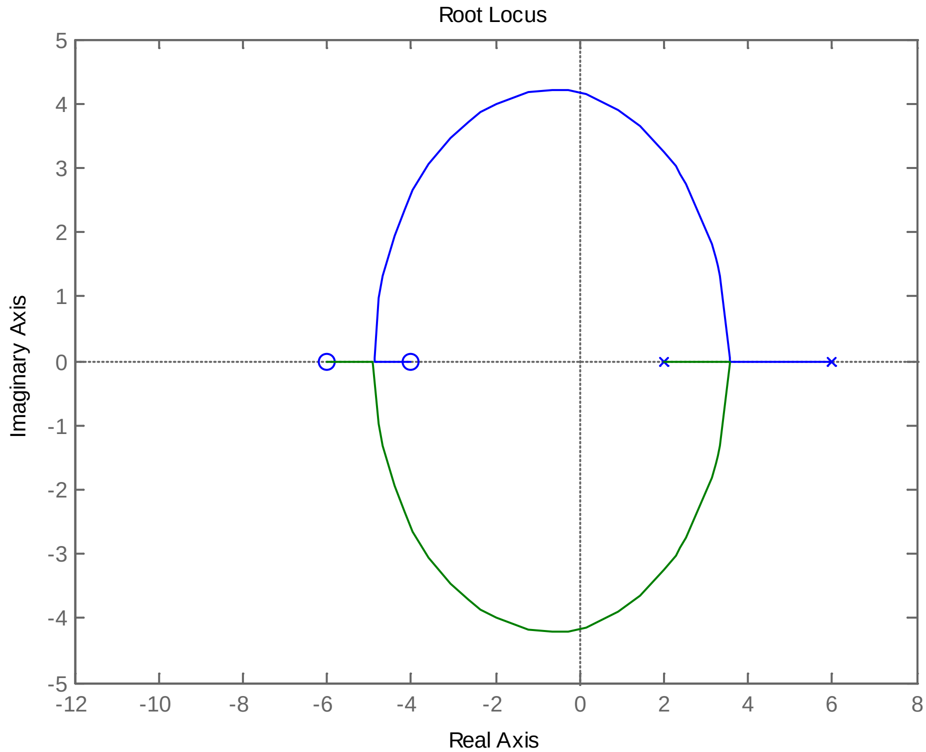
**4)** What type of system is this?

a) Type 0 b) Type 1 c) Type 2 d) Type 3 e) It is not possible to determine given this root locus plot

**5)** Is it possible to choose the poles so there is no overshoot (assuming the zeros do not affect the answer)?

a) Yes b) No c) It is not possible to determine given this root locus plot

Problems 6-10 refer to the following root locus plot for a unity feedback system.




**6)** Is it possible to find a value of $k$ so that -5 is a closed loop pole? a) Yes b) No

**7)** When k = 0.795 two poles of the closed loop system are purely imaginary. In order for the system to remain stable

a) $0 < k < 0.795$ b) $k > 0.795$ c) $k > 0$ d) $k < 0$

**8)** Is it possible to choose k so the system becomes unstable?

a) Yes b) No c) It is not possible to determine given this root locus plot

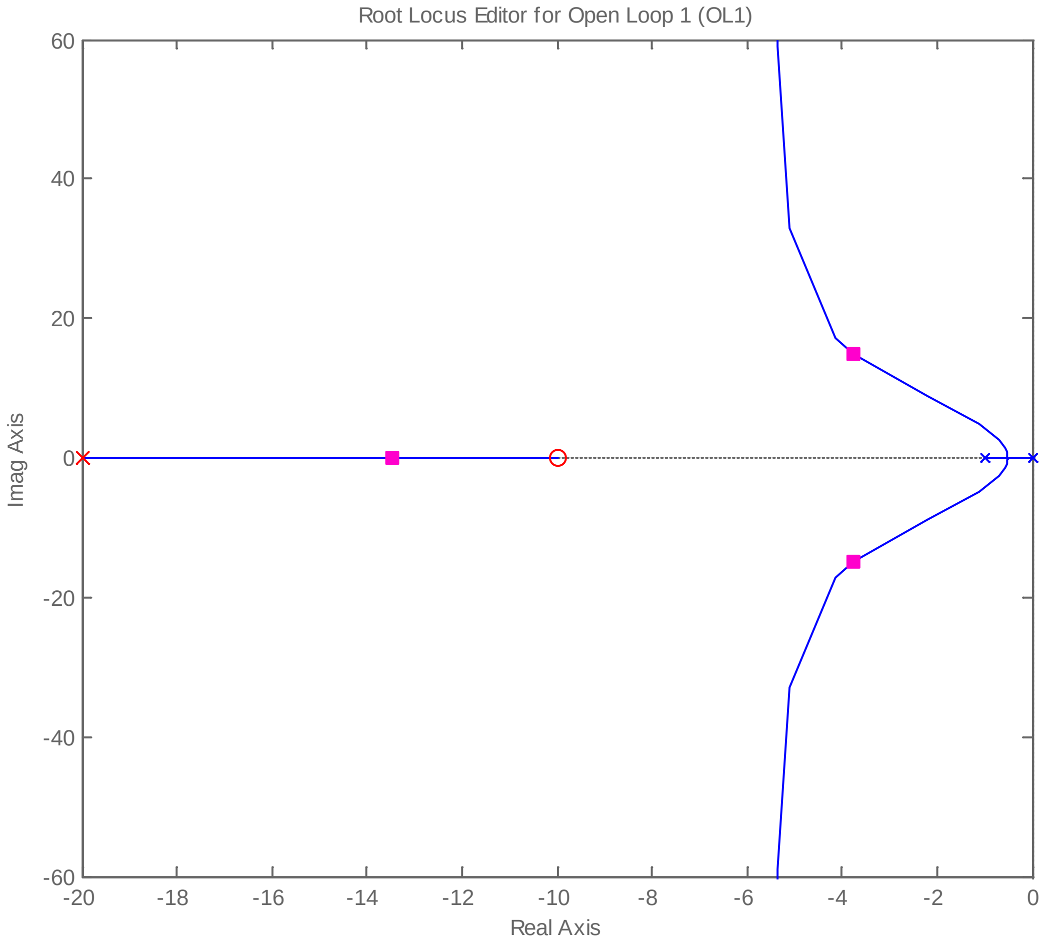
**9)** What type of system is this?

a) Type 0 b) Type 1 c) Type 2 d) Type 3 e) It is not possible to determine given this root locus plot

**10)** Is it possible to choose the poles so there is no overshoot (assuming the zeros do not affect the answer)?

a) Yes b) No c) It is not possible to determine given this root locus plot

Problems 11-13 refer to the following root locus plot for a unity feedback system.




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

a) 0, -2, and -20  b) -4+18j, -4-18j, -14

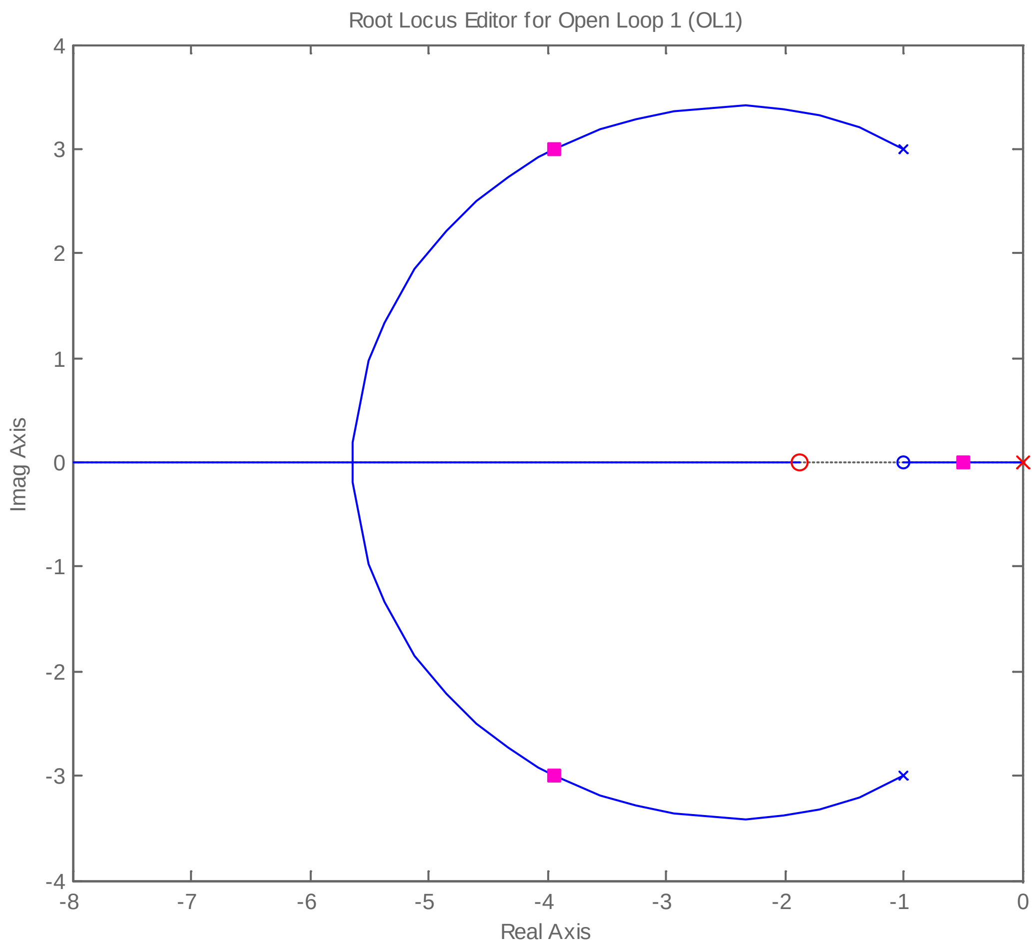
**12)** Is this a type one system?

a) yes  b) no

**13)** Is this a stable system?

a) yes  b) no

Problems 14-16 refer to the following root locus plot for a unity feedback system.




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

a) -1+j3, -1-3j   b) -4+3j, -4-3j, -0.5

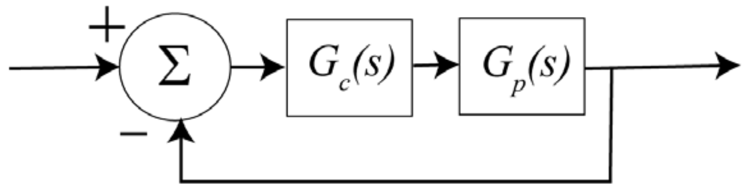
**15)** Is this a type one system?

a) yes  b) no

**16)** Is this a stable system?

a) yes  b) no

Problems 17-19 refer to the following system, where $G_p(s) = \dfrac{2}{s+3}$ and $G_c(s) = k$




**17)** For this system, the position error constant, $K_p$, is

a) $k$ b) $\dfrac{k}{3}$ c) $\dfrac{2k}{3}$ d) none of these

**18)** The steady state error for a unit step input is

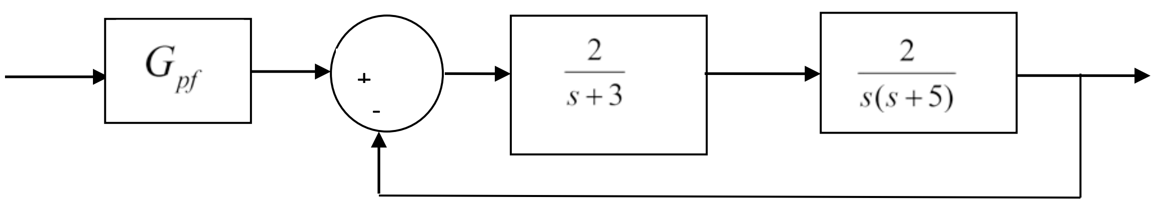
a) $e_{ss} = 0$ b) $e_{ss} = \dfrac{1}{k}$ c) $e_{ss} = \dfrac{1}{1+k}$ d) $e_{ss} = \dfrac{3}{k}$ e) $e_{ss} = \dfrac{3}{3+k}$ f) $e_{ss} = \dfrac{3}{2k}$ g) none of these

**19)** The (2%) settling time for this system is

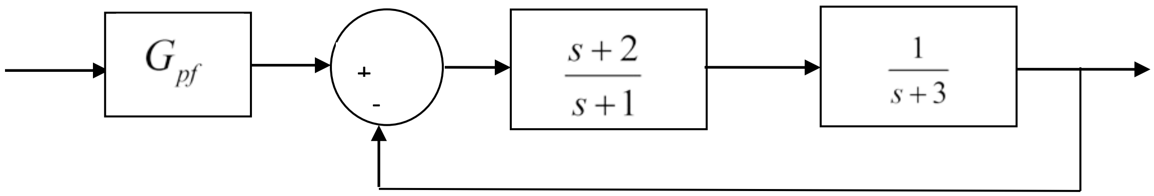
a) $T_s = \dfrac{4}{1+2k}$ b) $T_s = \dfrac{4}{3+2k}$ c) $T_s = \dfrac{4}{2+3k}$ d) none of these

**20)** For the block diagram below, the value of the prefilter $G_{pf}$ that produces zero **steady state error** for a unit step input is:

a) 1 b) 3/2 c) 3 d) 1/3



Problems 21-23 refer to the following system:




**21)** 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

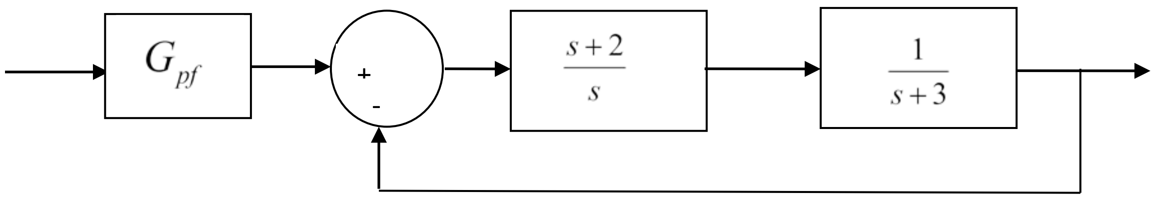
**22)** Assuming the prefilter $G_{pf}$ is 1, the **steady state error** for a unit step is best approximated as

a) 1/3 b) 3/2 c) 3/5 d) 2/5

**23)** The value of the prefilter $G_{pf}$ that produces **a steady state error** of zero is:

a) 1 b) 3/2 c) 5/2 d) 1/3

Problems 24-26 refer to the following system




**24)** Assuming the prefilter $G_{pf}$ is 1, the **velocity error constant** $K_v$ is best approximated as

a) 2/3 b) 2/5 c) 1 d) 0

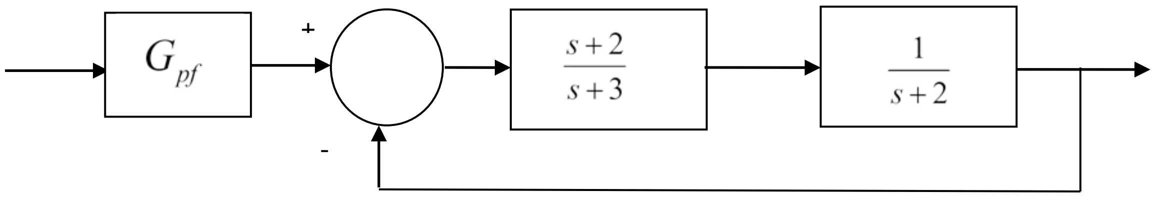
**25)** Assuming the prefilter $G_{pf}$ is 1, the **steady state error** for a unit ramp input is best approximated as

a) 1/3 b) 3/2 c) 3/5 d) 2/5

**26)** 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) 3/5 d) 2/5

Problems 27- 29 refer to the following system:




**27)** Assuming the prefilter $G_{pf}$ is 1, the **position error constant** $K_p$ is best approximated as

a) 2/3 b) 1/3 c) 1 d) 0

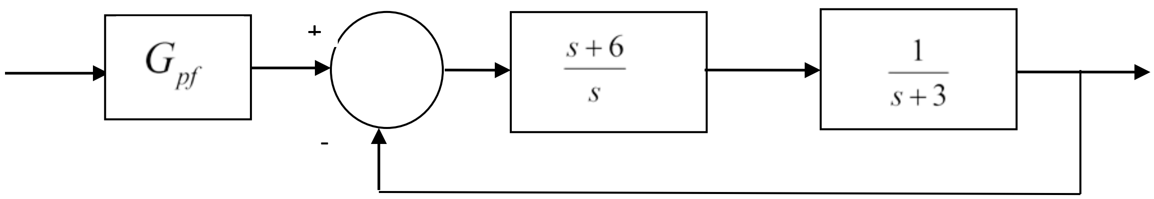
**28)** Assuming the prefilter $G_{pf}$ is 1, the **steady state error** for a unit step is best approximated as

a) 1/3 b) 2/3 c) 3/4 d) 4/3

**29)** The value of the prefilter $G_{pf}$ that produces **a steady state error** of zero is:

a) 1 b) 3/2 c) 4 d) 1/3

Problems 30-32 refer to the following system




**30)** Assuming the prefilter $G_{pf}$ is 1, the **velocity error constant** $K_v$ is best approximated as

a) 2/3 b) 2 c) 1 d) 0

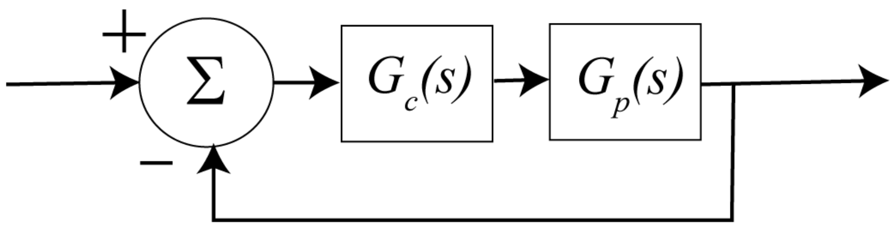
**31)** Assuming the prefilter $G_{pf}$ is 1, the **steady state error** for a unit ramp input is best approximated as

a) 1/2 b) 3/2 c) 2 d) 2/5

**32)** 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) 3/5 d) 2

Problems 33-38 refer to the following feedback system with plant $G_p(s) = \frac{1}{s+3}$




**33)** 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

**34)** 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

**35)** 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

**36)** 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

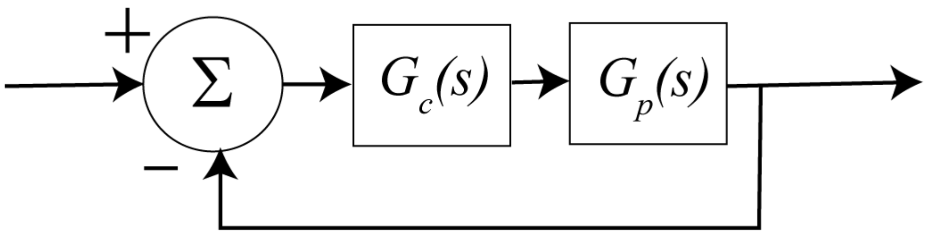
**37)** For which of the following PI controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = \frac{k(s+2)}{s}$   b) $G_c(s) = \frac{k(s+6)}{s}$   c) the results will be the same

**38)** For which of the following PD controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = k(s+5)$   b) $G_c(s) = k(s+10)$   c) the results will be the same

Problems 39-44 refer to the following feedback system with plant $G_p(s) = \frac{1}{(s+2+3j)(s+2-3j)}$




**39)** 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

**40)** 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

**41)** 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

**42)** 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

**43)** For which of the following PI controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = \frac{k(s+4)}{s}$  b) $G_c(s) = \frac{k(s+6)}{s}$  c) the results will be the same

**44)** For which of the following PD controllers will the settling time be smaller as $k \to \infty$

a) $G_c(s) = k(s+5)$  b) $G_c(s) = k(s+10)$  c) the results will be the same

*Answers: 1-b, 2-a, 3-a, 4-b, 5-a, 6-a, 7-b, 8-a, 9-a, 10-a, 11-b, 12-a, 13-a, 14-b, 15-a, 16-a, 17-c, 18-g, 19-b, 20-a, 21-a, 22-c, 23-c, 24-a, 25-b, 26-b, 27-b, 28-c, 29-c, 30-b, 31-a, 32-b, 33-a, 34-a, 35-a, 36-b, 37-b, 38-b, 39-a, 40-b, 41-b, 42-b, 43-a, 44-b*