ECE-320, Practice Quiz #2

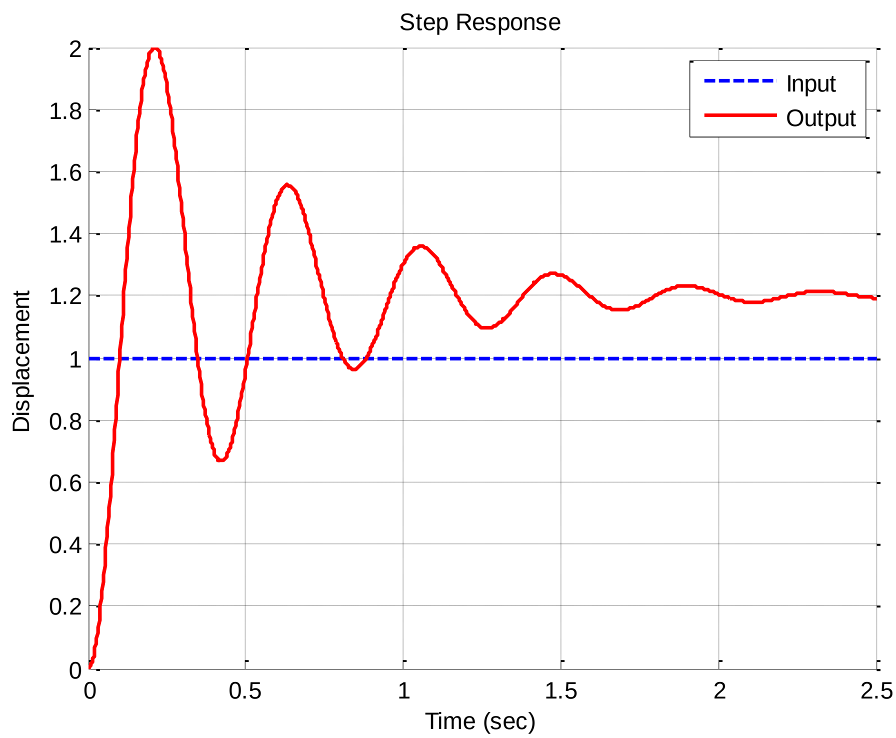
Problems 1 and 2 refer to a system with poles at -2+5j. -2-5j. -10+j, -10-j, and -20

1) The best estimate of the **settling time** for this system is

a) 2 seconds   b) 0.4 seconds   c) 4/5 seconds   d) 0.2 seconds

2) The **dominant pole(s)** of this system are   a) -2+5j and -2-5j   b) -10+j and -10-j   c) -20

Problems 3 and 4 refer to the **unit step response** of a system, shown below



3) The best estimate of the **steady state error** for a **unit step input** is a) 0.2 b) -0.2 c) 1.0 d) -0.0

4) The best estimate of the **percent overshoot** is   a) 200% b) 100% c) 67% d) 20%

5) The **unit step response** of a system is given by $y(t) = 0.5u(t) - tu(t) - t^4e^{-t}u(t) + e^{-t}u(t)$

The **steady state error** for a unit step input for this system is best estimated as

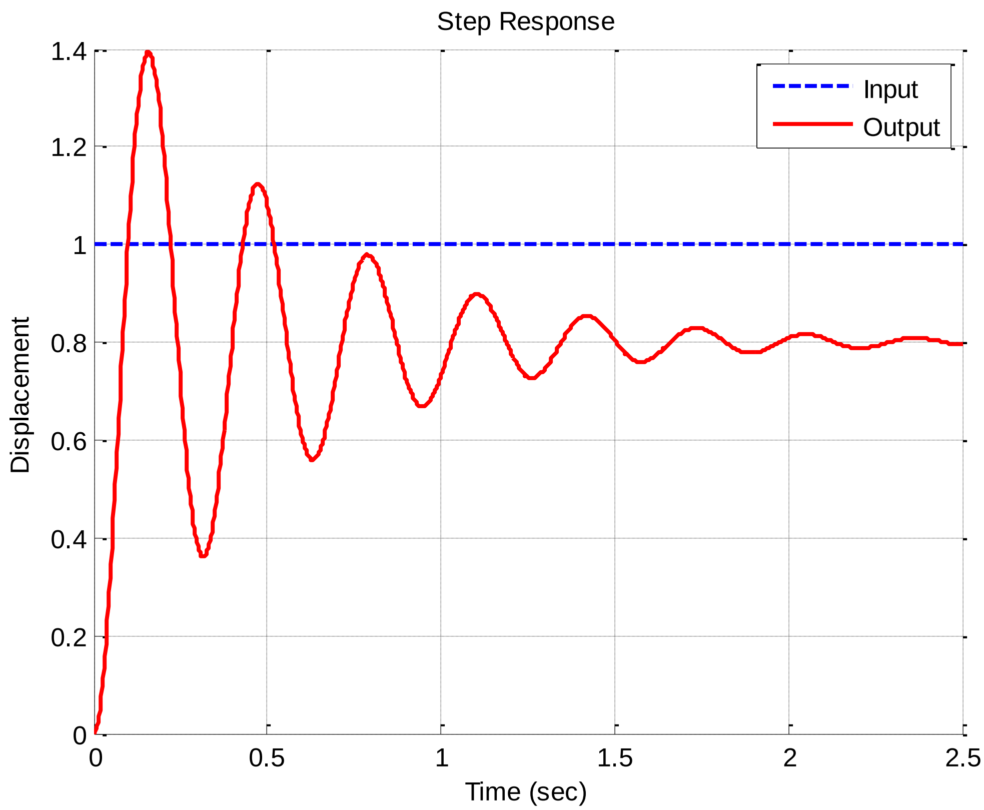
a) ∞ b) 0.5 c) 2.0 d) -0.5 e) impossible to determine

6) The unit step response of a system is given by $y(t) = 0.5u(t) - t^4e^{-t}u(t) + e^{-t}u(t)$

The **steady state error** for a **unit step input** for this system is best estimated as

a) ∞ b) 0.5 c) 2.0 d) -0.5 e) impossible to determine

Problems 7 and 8 refer to the **unit step response** of a system, shown below

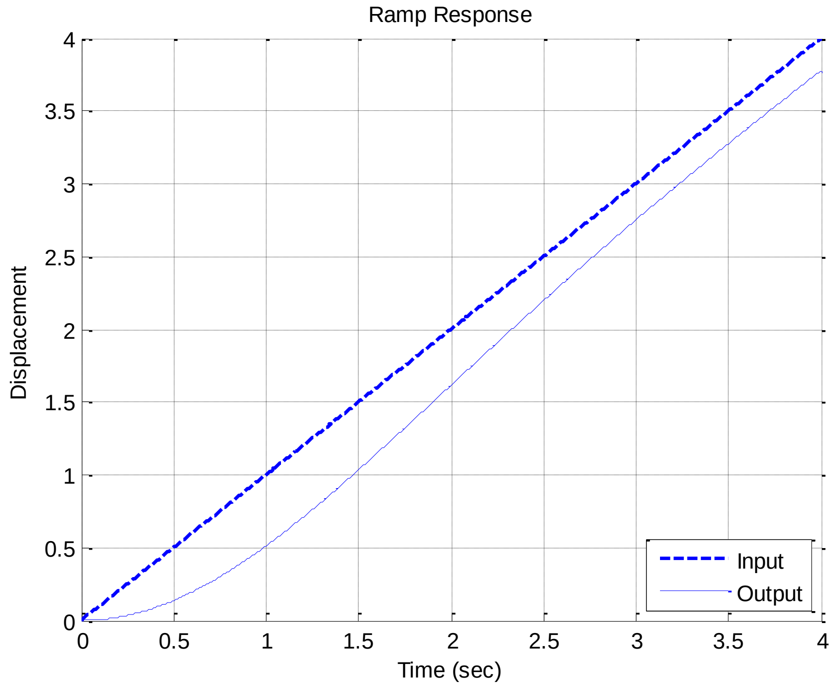


7) The best estimate of the **steady state error** for a **unit step input** is

a) 0.2 b) -0.2 c) 0.3 d) 0.0 e) impossible to determine

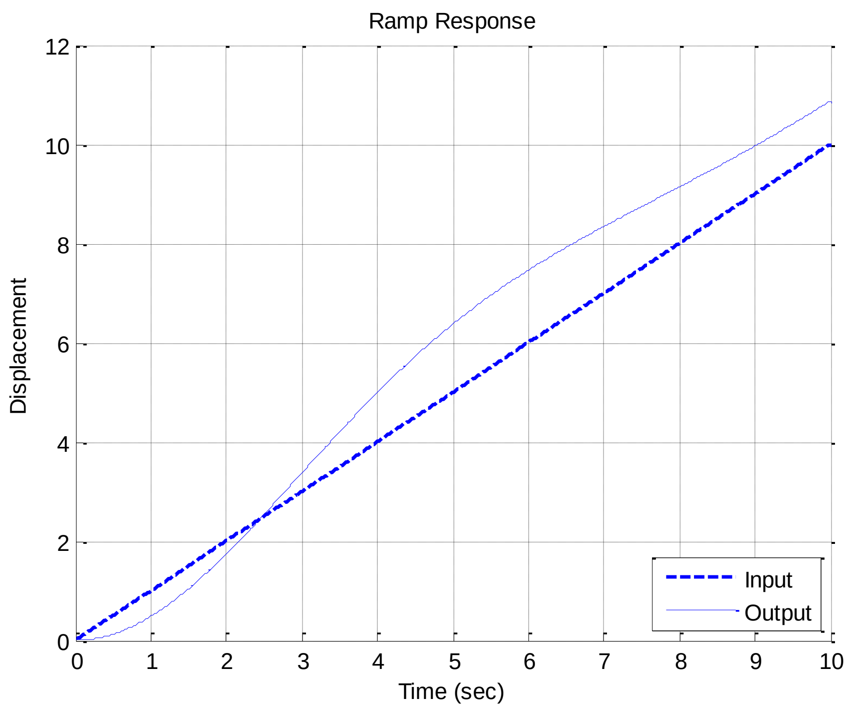
8) The best estimate of the **percent overshoot** is a) 75% b) 50% c) 40% d) 25%

9) The **unit ramp response** of a system is shown below:



The best estimate of the **steady state error** is a) 0.3 b) -0.3 c) 0 d) 0.5 e) -0.5

10) The **unit ramp response** of a system is shown below:



The best estimate of the **steady state error** is a) 0.75 b) -0.75 c) 1.5 d) -0.5

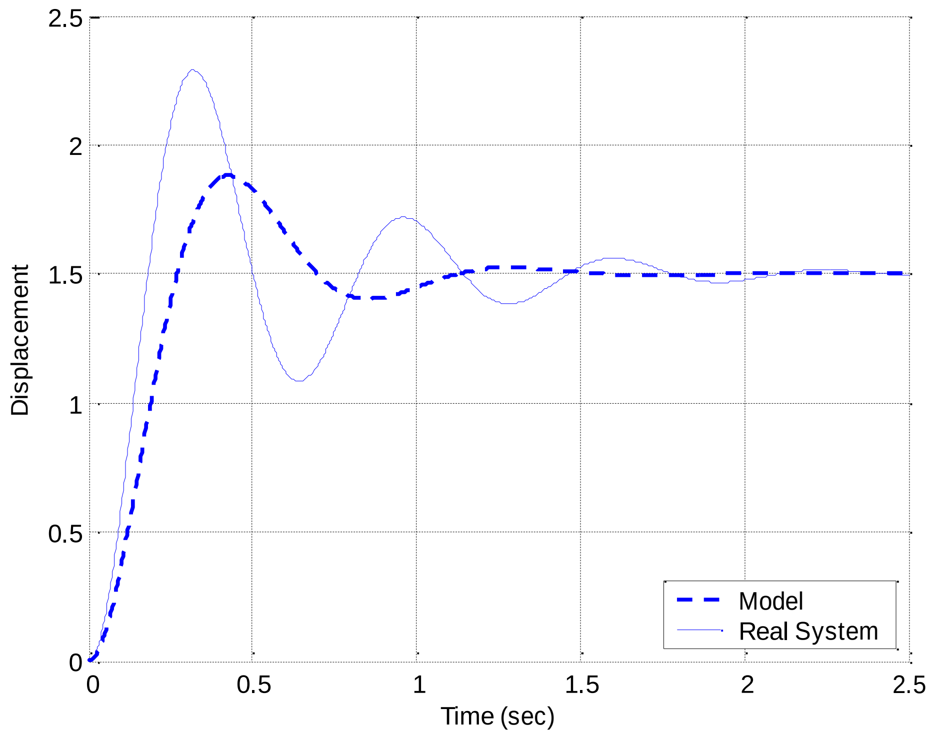
11) The **unit ramp response** of a system is given by $y(t) = -0.5u(t) + tu(t) + e^{-t}u(t)$.
The best estimate of the steady state error is

a) 0.5 b) 2.0 c) 1.0 d) ∞ e) -0.5

12) The **unit ramp response** of a system is given by $y(t) = -0.5u(t) - 2tu(t) + e^{-t}u(t)$
The best estimate of the steady state error is

a) 0.5 b) 2.0 c) 1.0 d) ∞ e) -0.5

Problems 13 and 14 refer to the figure below, which shows the unit step response of a real 2nd order system and the unit step response of a second order model we are trying to match to the real system.



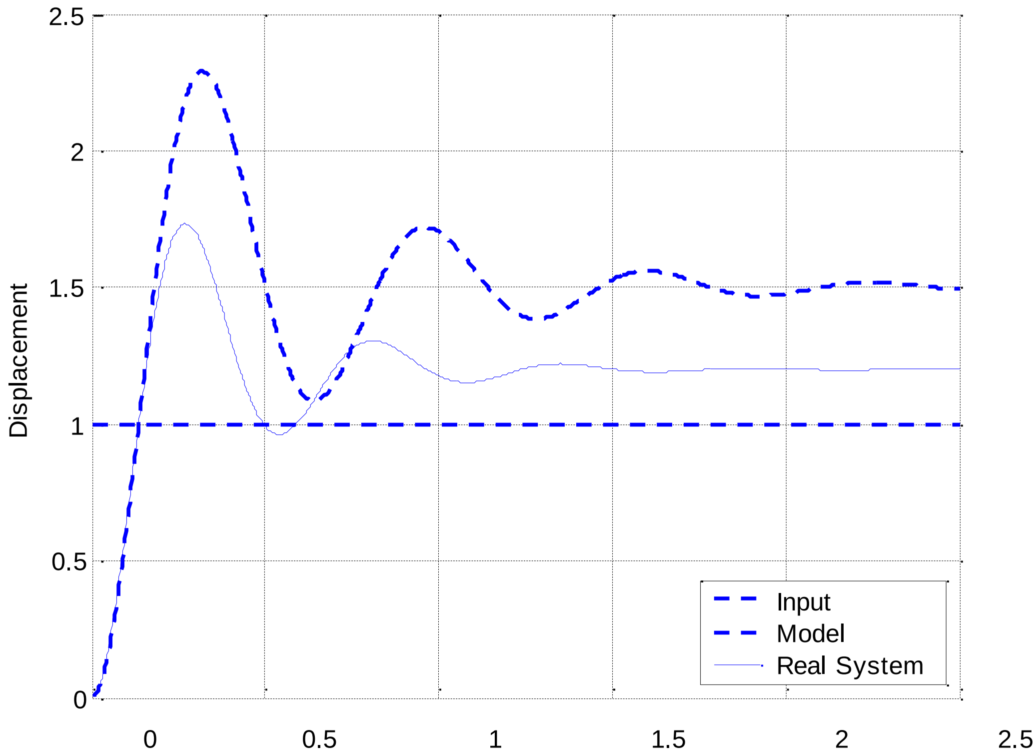
13) In order to make the model better match the real system, the ***damping ratio*** of the ***model*** should be

a) increased b) decreased c) left alone d) impossible to determine

14) In order to make the model better match the real system, the ***natural frequency*** of the ***model*** should be

a) increased b) decreased c) left alone d) impossible to determine

Problems 15-17 refer to the figure below, which shows the unit step response of a real 2nd order system and the unit step response of a second order model we are trying to match to the real system.



15) In order to make the model better match the real system, the **<u>damping ratio</u>** of the ***model*** should be

a) increased b) decreased c) left alone d) impossible to determine

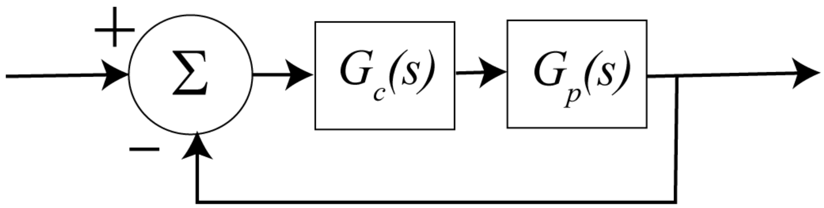
16) In order to make the model better match the real system, the **<u>natural frequency</u>** of the ***model*** should be

a) increased b) decreased c) left alone d) impossible to determine

17) In order to make the model better match the real system, the **<u>static gain</u>** of the ***model*** should be

a) increased b) decreased c) left alone d) impossible to determine

18) For the following system



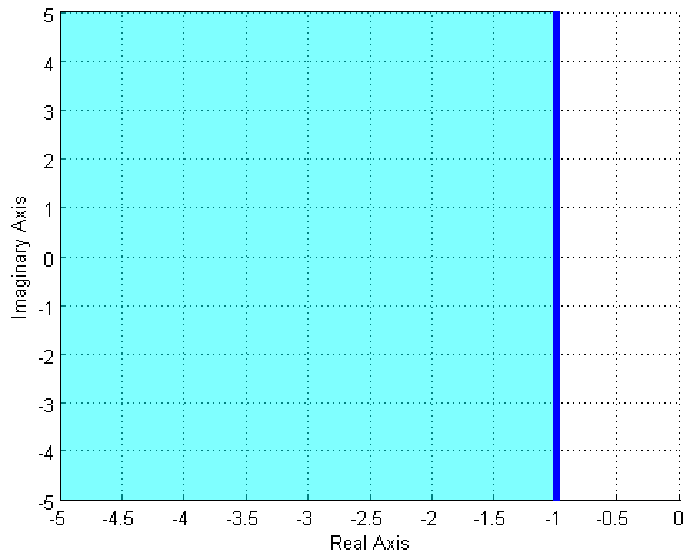
the pole of the controller $G_c(s)$ is at -15
the poles of the plant $G_p(s)$ are at -1 and -2
the poles of the closed loop system are at -7.1, -5.43 +3.98j, -5.43 -3.98j

The best estimate of the settling time of the closed loop system is

a) 4 seconds b) 4/15 seconds c) 4/7.1 seconds d) 4/5.r3 seconds

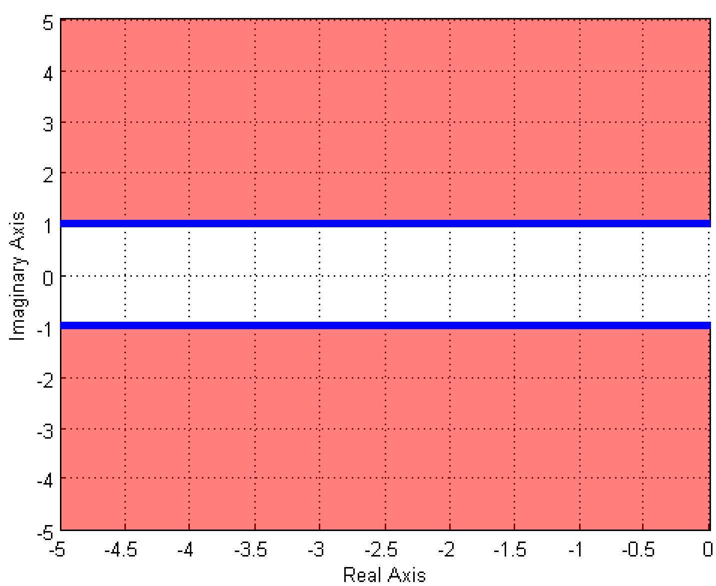
19) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

a) $T_s \leq 1$ b) $T_s \geq 1$ c) $T_s \geq 4$ d) $T_s \leq 4$ e) none of these



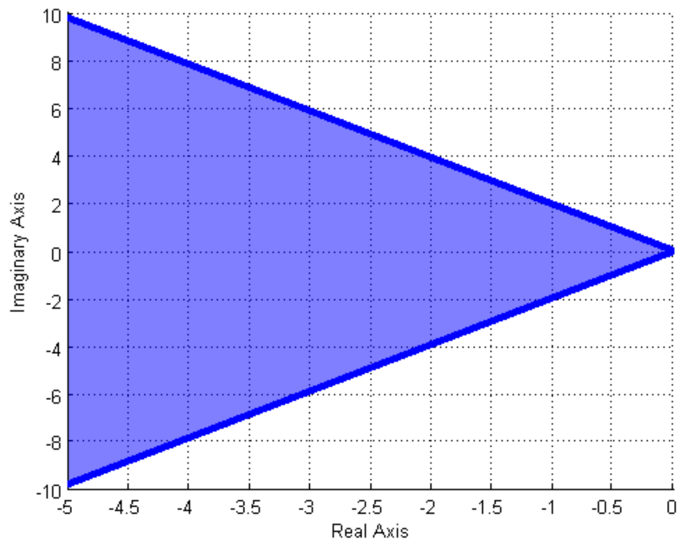
20) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

a) $T_p \leq 1$ b) $T_p \geq 1$ c) $T_p \geq \pi$ d) $T_p \leq \pi$ e) none of these



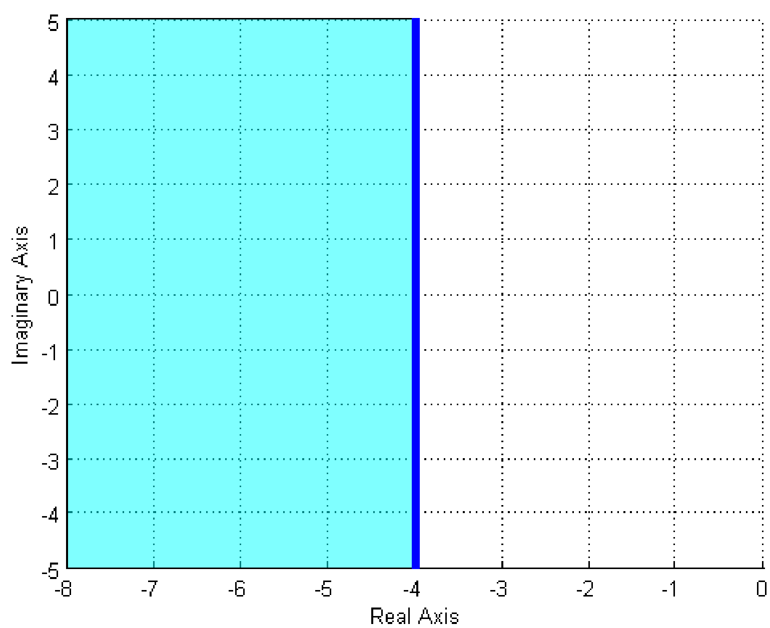
21) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

a) $PO \geq 20\%$ b) $PO \leq 20\%$



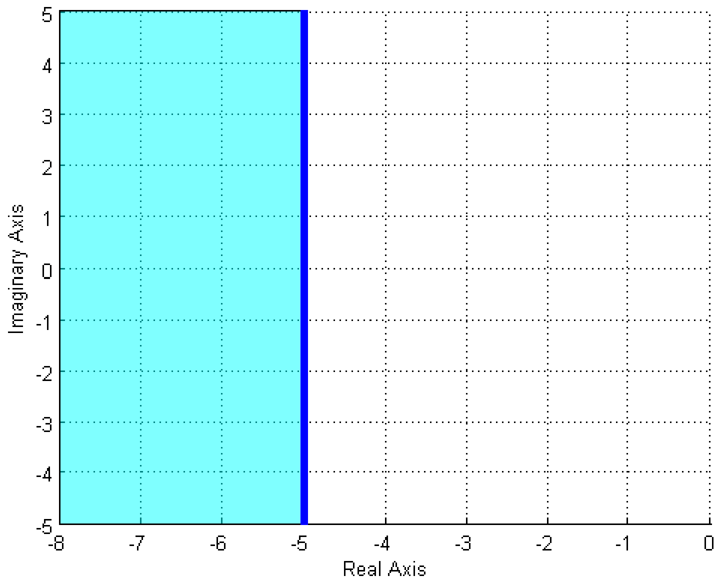
22) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

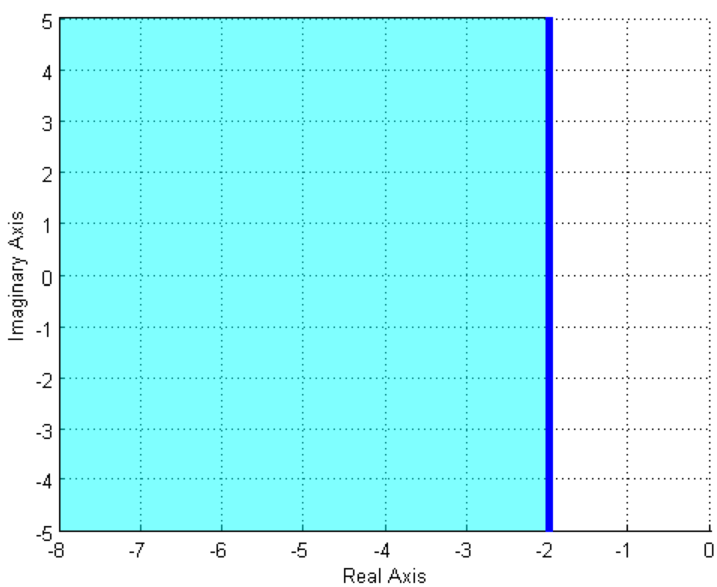
a) $T_s \leq 1$ b) $T_s \geq 1$ c) $T_s \geq 4$ d) $T_s \leq 4$ e) none of these



23) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller settling time** for our system?

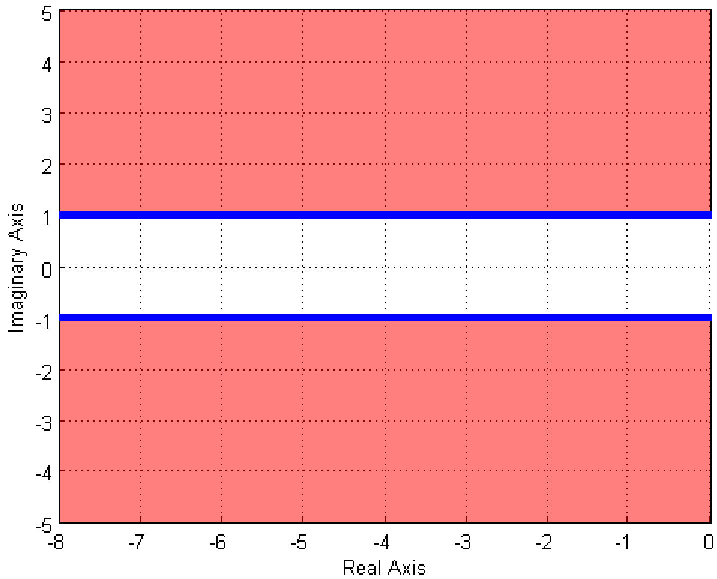
a) the region in the top figure b) the region in the bottom figure

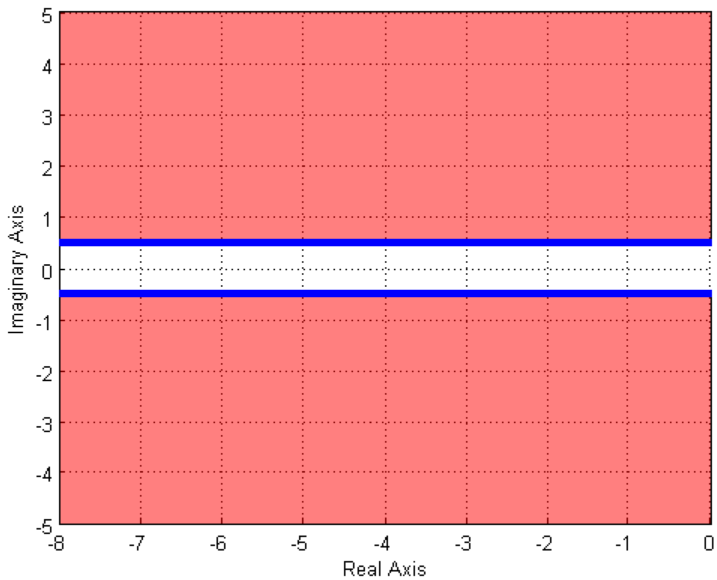




24) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller time to peak** for our system?

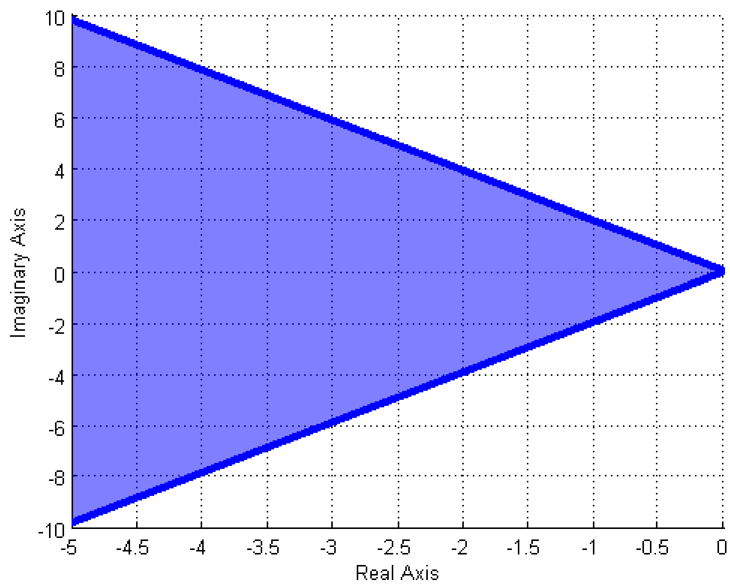
a) the region in the top figure b) the region in the bottom figure

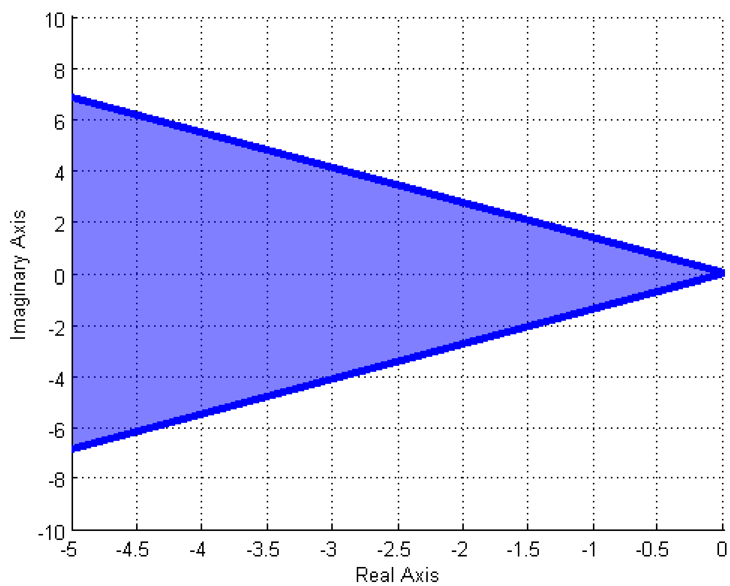




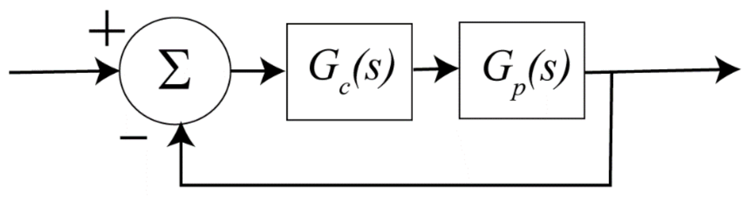
25) One of the shaded regions below shows the possible pole locations for a percent overshoot less than 10%, and the other shows the possible pole locations for a percent overshoot less than 20%. Which of the two graphs shows the possible pole locations for a percent overshoot less than 20%?

a) the region in the top figure b) the region in the bottom figure





Problems 26-28 refer to the following system, where $G_p(s) = \frac{2}{s+3}$ and $G_c(s) = k$



26) For this system, the position error constant, K_p, is

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

27) The steady state error for a unit step input is

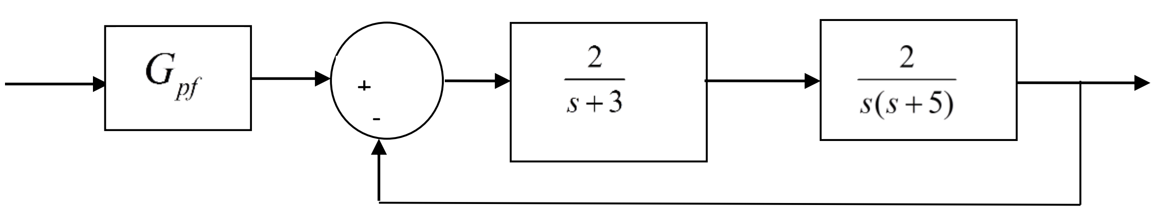
a) $e_{ss} = 0$ b) $e_{ss} = \frac{1}{k}$ c) $e_{ss} = \frac{1}{1+k}$ d) $e_{ss} = \frac{3}{k}$ e) $e_{ss} = \frac{3}{3+k}$ f) $e_{ss} = \frac{3}{2k}$ g) none of these

28) The (2%) settling time for this system is

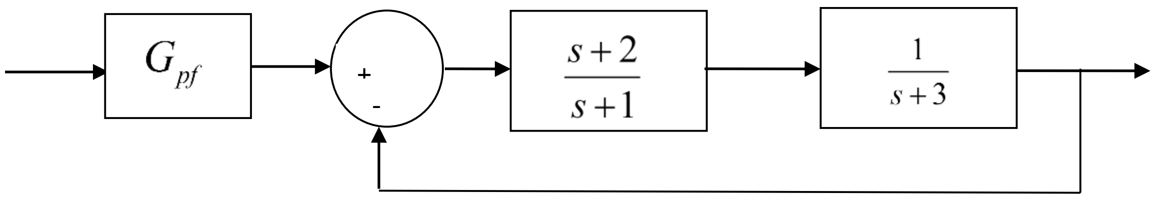
a) $T_s = \frac{4}{1+2k}$ b) $T_s = \frac{4}{3+2k}$ c) $T_s = \frac{4}{2+3k}$ d) none of these

29) 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 30-32 refer to the following system:



30) 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

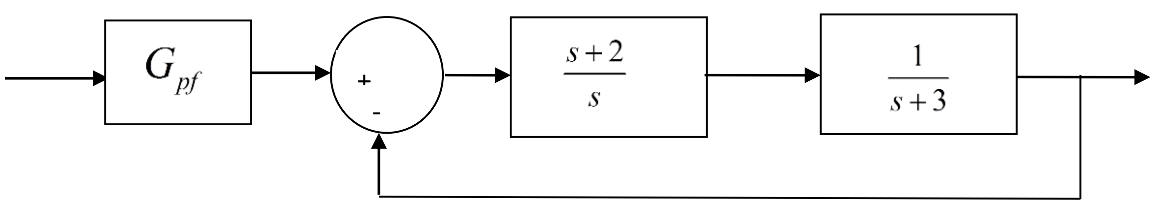
31) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit step is best approximated as

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

32) 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 33-35 refer to the following system



33) 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

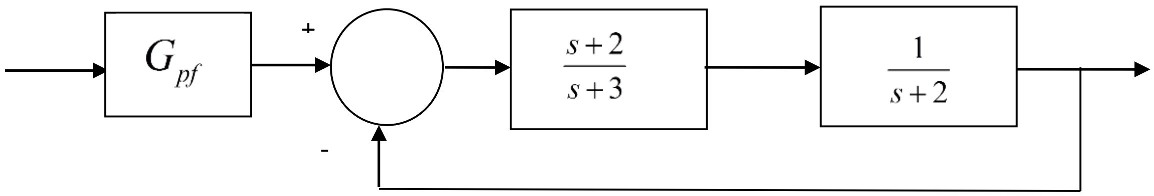
34) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit ramp input is best approximated as

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

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

a) ∞ b) 0 c) 3/5 d) 2/5

Problems 36- 38 refer to the following system:



36) 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

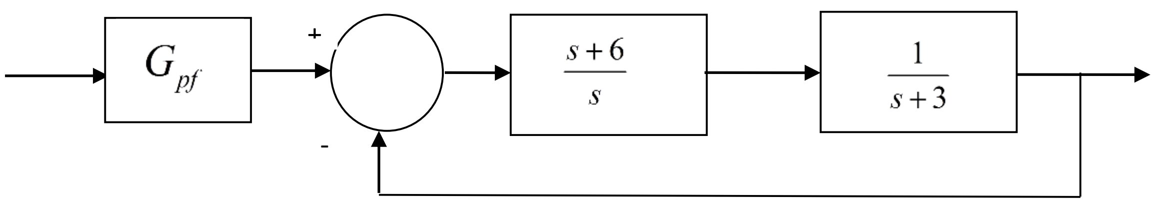
37) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit step is best approximated as

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

38) 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 39-41 refer to the following system



39) 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

40) 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

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

a) ∞ b) 0 c) 3/5 d) 2

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