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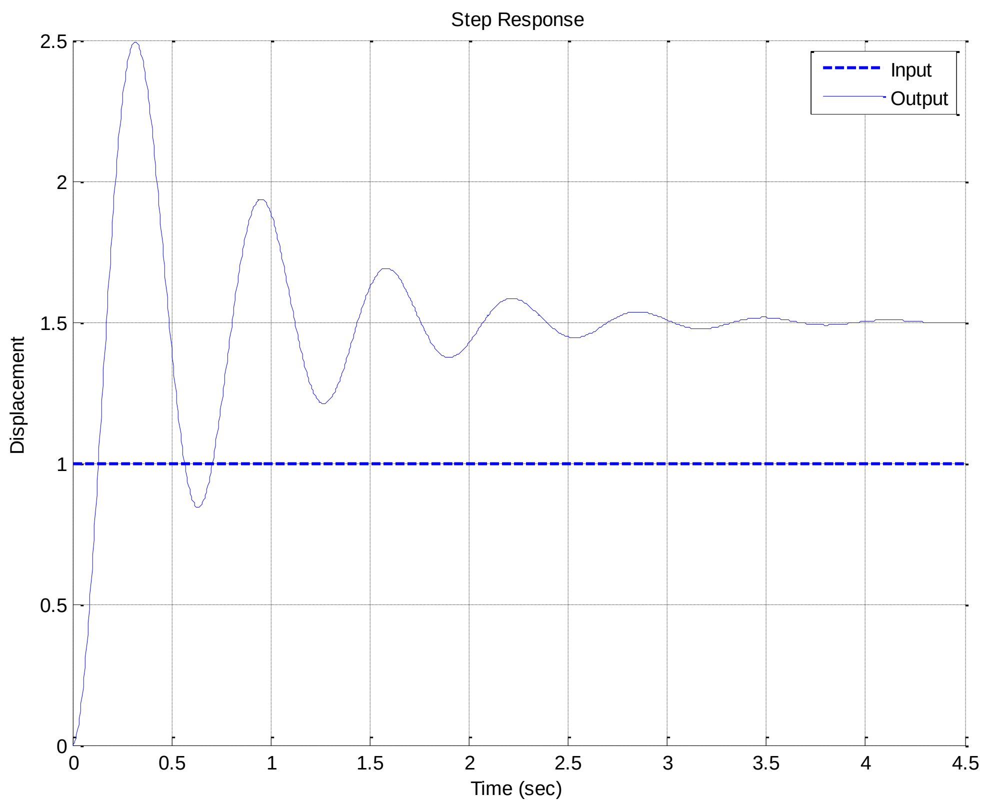
ECE-320, Quiz #2

Problems 1-3 refer to the **unit step response** of a system, shown below



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

a) 0.5 b) -0.5 c) 1.5 d) -1.5 e) none of these

2) The best estimate of the **steady state error** for a **unit ramp input** is

a) 0.0 b) 0.25 c) ∞ d) impossible to determine

3) The best estimate of the **percent overshoot** is

a) 200% b) 100% c) 67% d) 50% e) none of these

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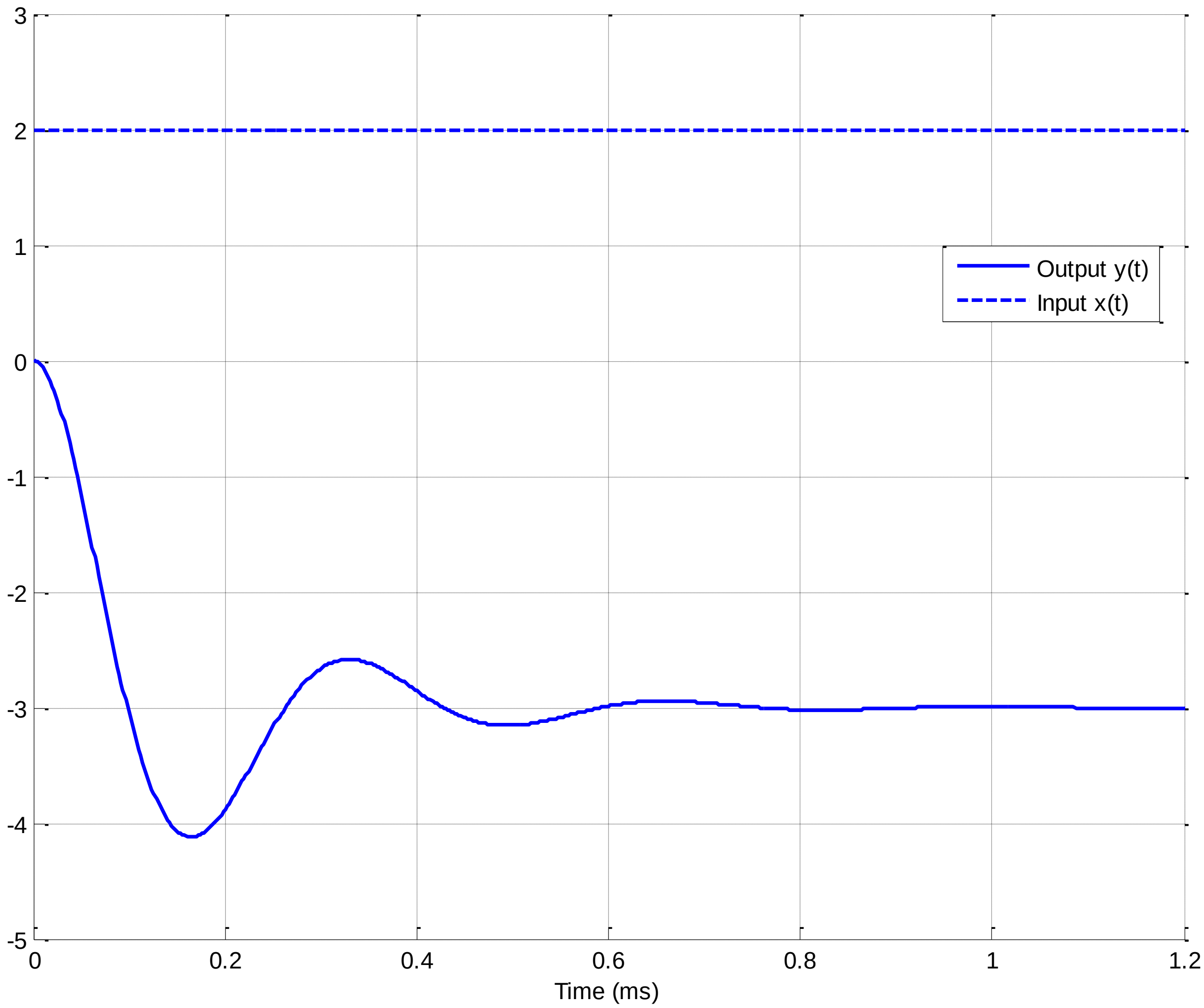
Problems 4 and 5 refer the following graph showing the response of a second order system to a step input.



4) The percent overshoot for this system is best estimated as

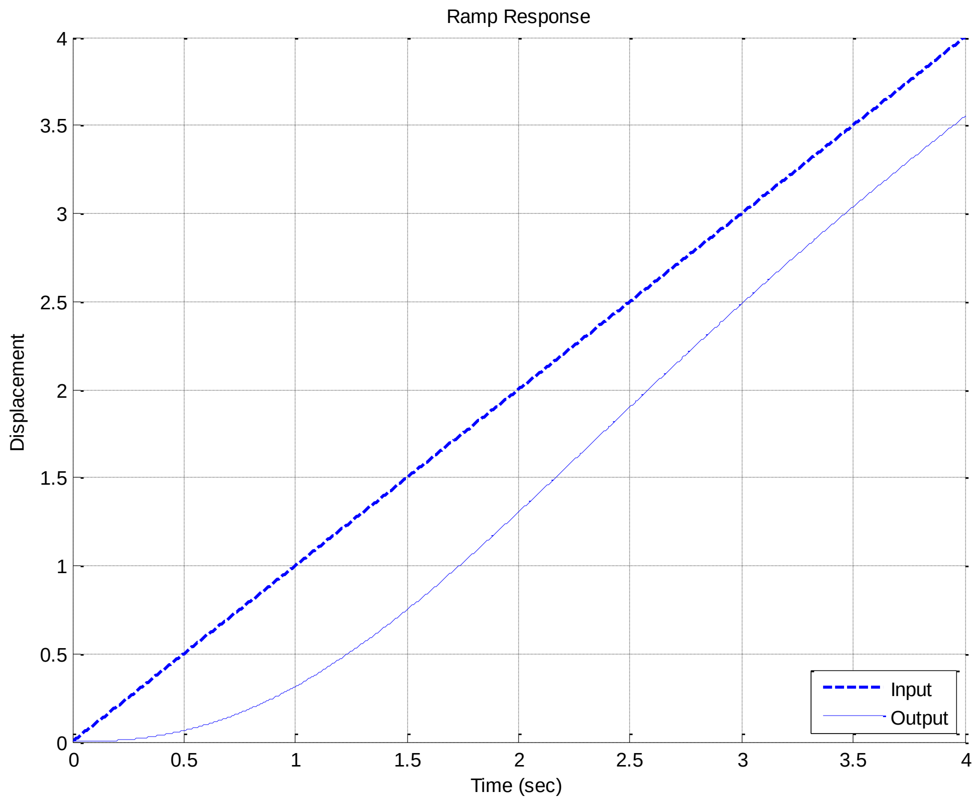
a) 400% b) -400 % c) 300% d) -300 % e) -33% f) 33%

5) The steady state error for this system is best estimated as

a) 5 b) -5 c) -3 d) -4

Name ________________________________ Mailbox ______________

Problems 6 and 7 refer to the **unit ramp response** of a system, shown below:



6) The best estimate of the **steady state error** is

a) 0.5 b) -0.5 c) 0.8 d) -0.8 e) 0.0 f) none of these

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

a) 1.0 b) 0.5 c) 0.0 d) ∞

8) The **unit step response** of a system is given by $y(t) = -u(t) - t^4 e^{-t} u(t) + e^{-2t} u(t)$

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

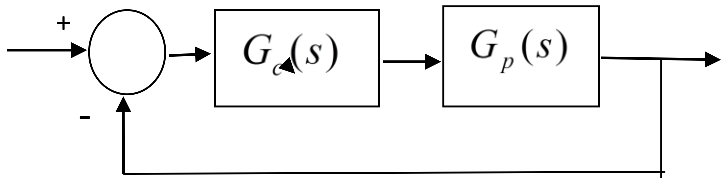
a) ∞ b) 0.5 c) 2.0 d) impossible to determine

9) The **unit ramp response** of a system is given by $y(t) = -2u(t) + tu(t) + e^{-t} u(t)$.

The best estimate of the **steady state error** is a) 0.5 b) 2.0 c) 1.0 d) ∞

Name ________________________________ Mailbox ______________

10) For the following system



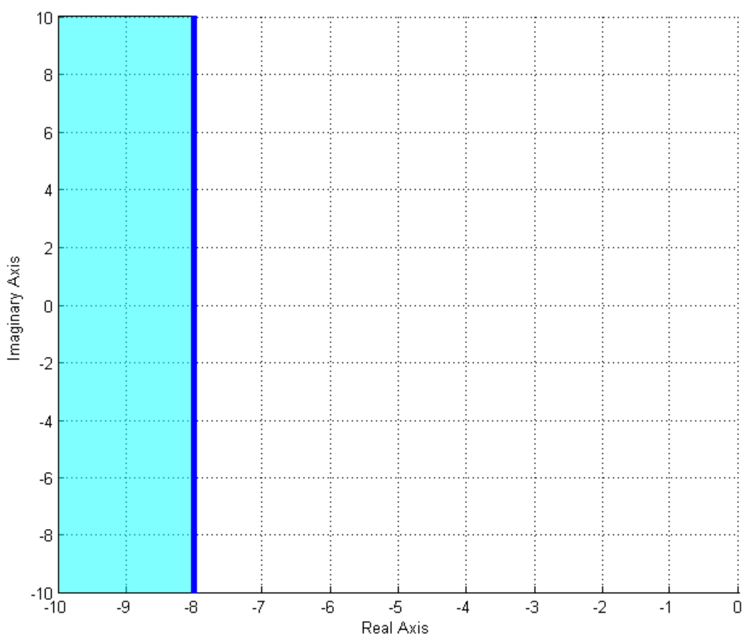
the pole of the controller $G_c(s)$ is at -15
the poles of the plant $G_p(s)$ are at -1 and -2
the poles of the closed loop system are at -7.1, -5.43 +3.98j, -5.43 -3.98j

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

a) 4 seconds b) $\frac{4}{15}$ seconds c) $\frac{4}{7.1}$ seconds d) $\frac{4}{5.43}$ seconds

11) 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?

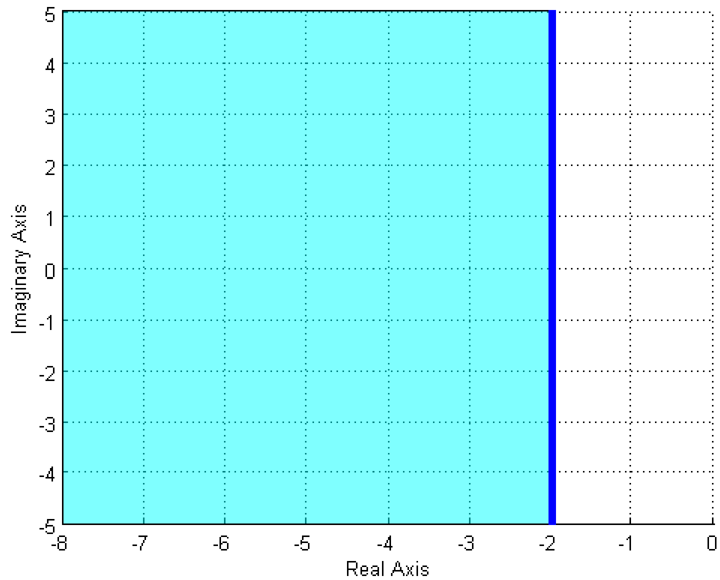
a) $T_s \le 0.5$ b) $T_s \ge 0.5$ c) $T_s \ge 8$ d) $T_s \le 8$ e) none of these

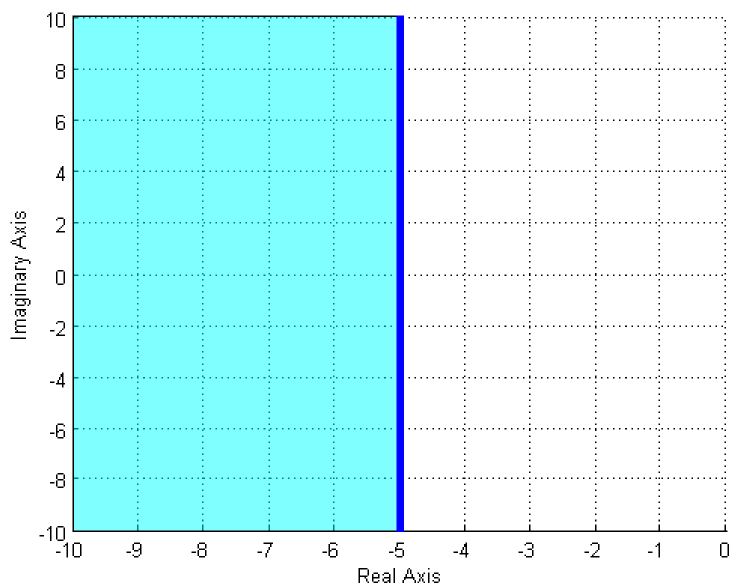


Name ________________________________ Mailbox ______________

12) 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

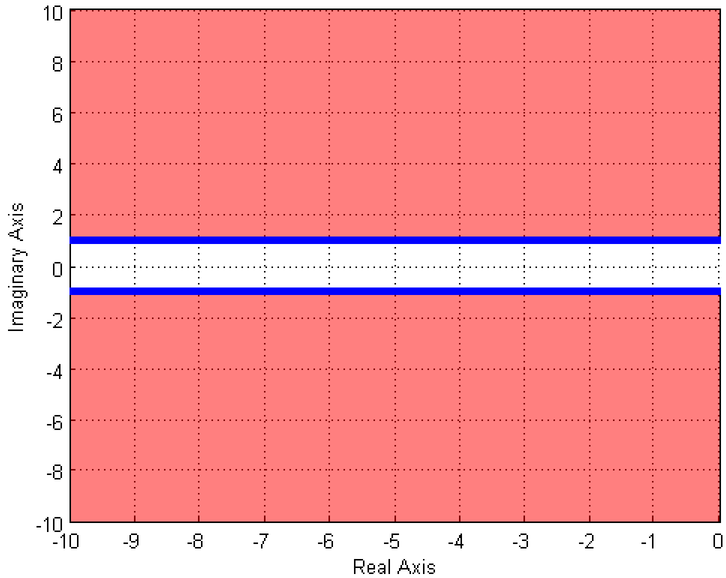


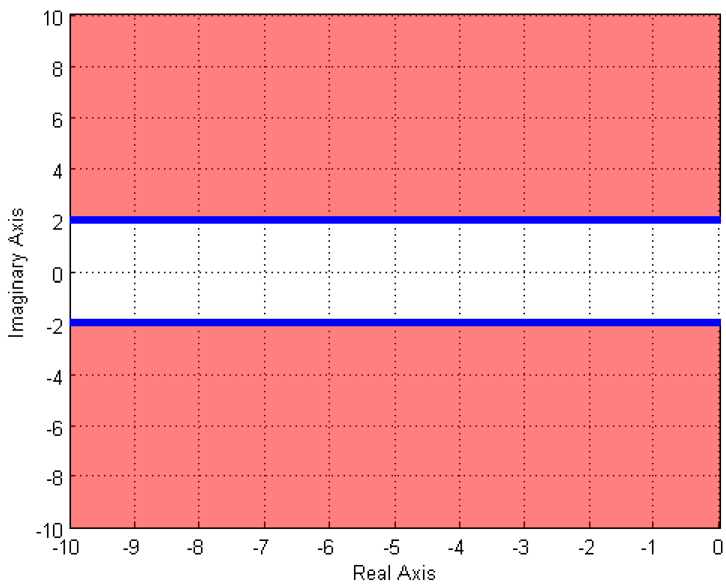


Name ________________________________ Mailbox ______________

13) 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





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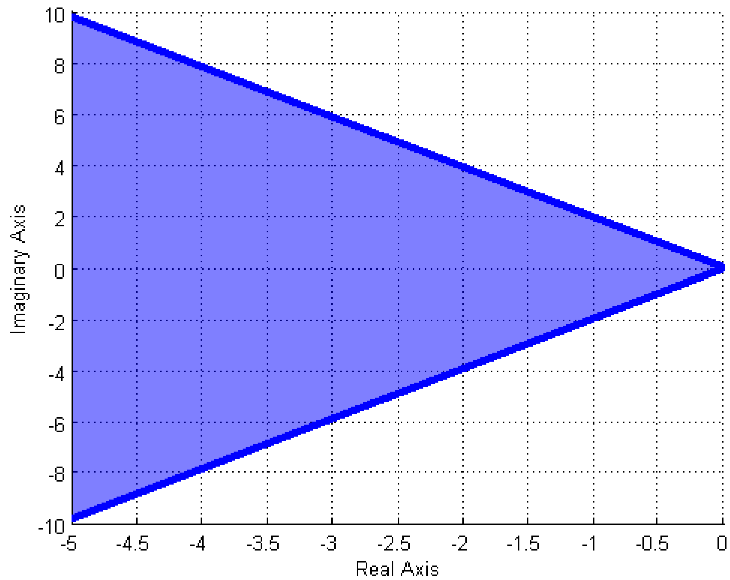
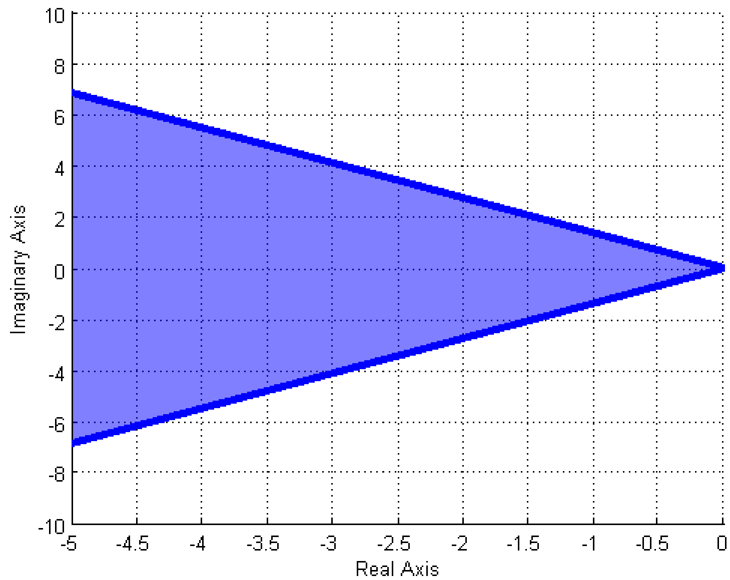
14) One of the shaded regions below shows the possible pole locations for a percent overshoot less than 10%, and the other shows the possible pole locations for a percent overshoot less than 20%. Which of the two graphs shows the possible pole locations for a percent overshoot less than 20%?

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





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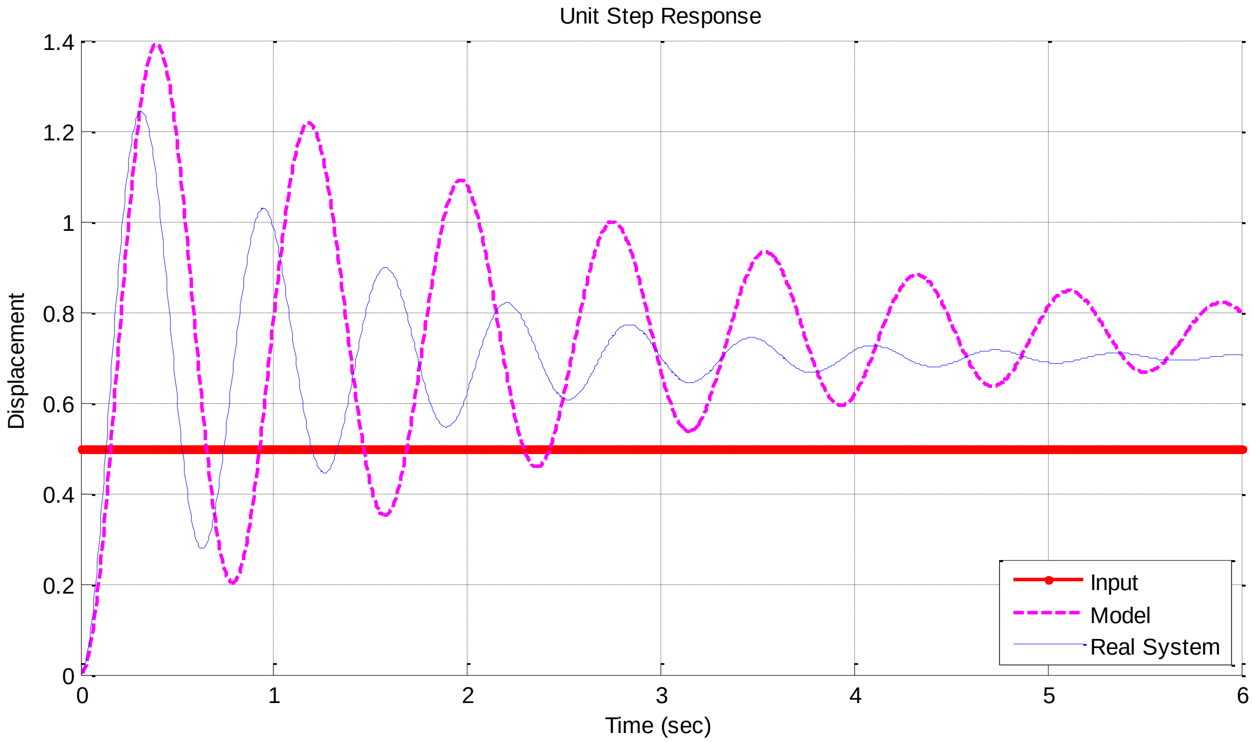
Problems 15-17 refer to the figure below, which shows the unit step response of a real 2nd order system and the unit step response of a second order model we are trying to match to the real system.



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

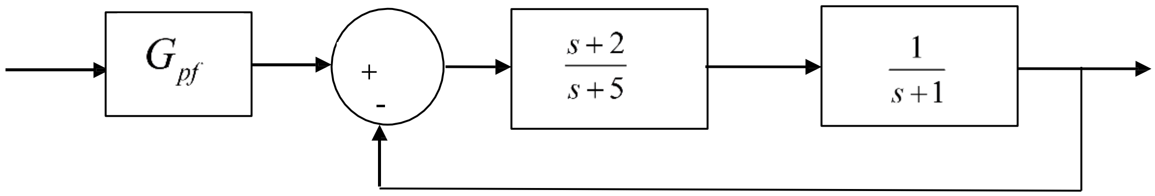
a) increased b) decreased c) left alone d) impossible to determine

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

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

Name ________________________________ Mailbox ______________

Problems 18-20 refer to the following system:



18) 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

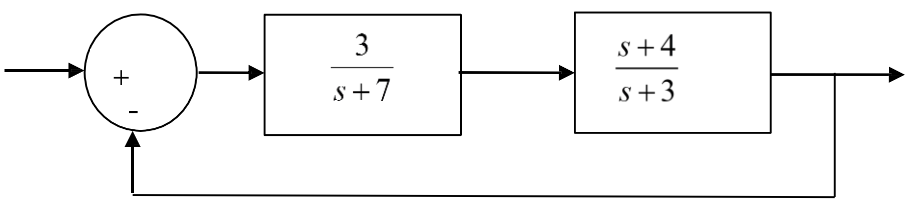
19) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit step is best approximated as

a) 1/3 b) 5/7 c) 3/5 d) 2/5

20) The value of the prefilter that produces a **steady state error** of zero is

a) 1 b) 7/2 c) 5/2 d) 7/5

21) For the following system

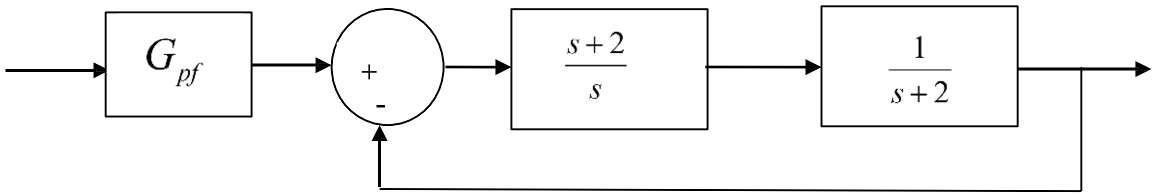


The dynamic prefilter which cancels the closed loop zeros and produces a zero steady state error for a unit step input is

a) $\dfrac{\frac{11}{8}}{s+4}$ b) $\dfrac{\frac{11}{2}}{s+4}$ c) $\dfrac{11}{s+4}$ d) $\dfrac{\frac{3}{2}}{s+4}$

Name ________________________________ Mailbox ______________

Problems 22-24 refer to the following system



22) 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

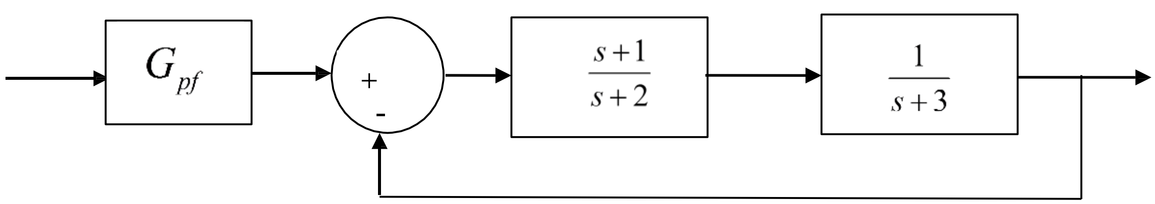
23) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit ramp input is best approximated as

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

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

a) ∞ b) 0 c) 1 d) 2/5

25) 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**, the prefilter should equal what?

26) Is $G_{pf}(s) = \dfrac{4}{(s-2)(s+3)}$ and acceptable prefilter for any system? A) Yes b) No