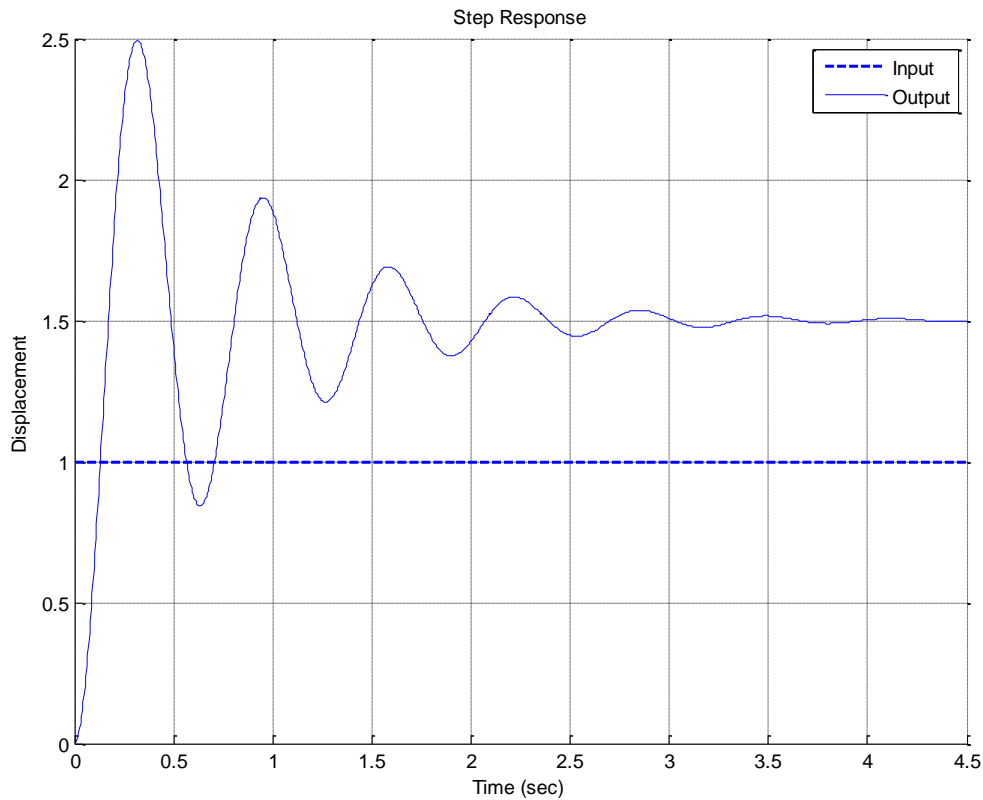


ECE-320, Quiz #2

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

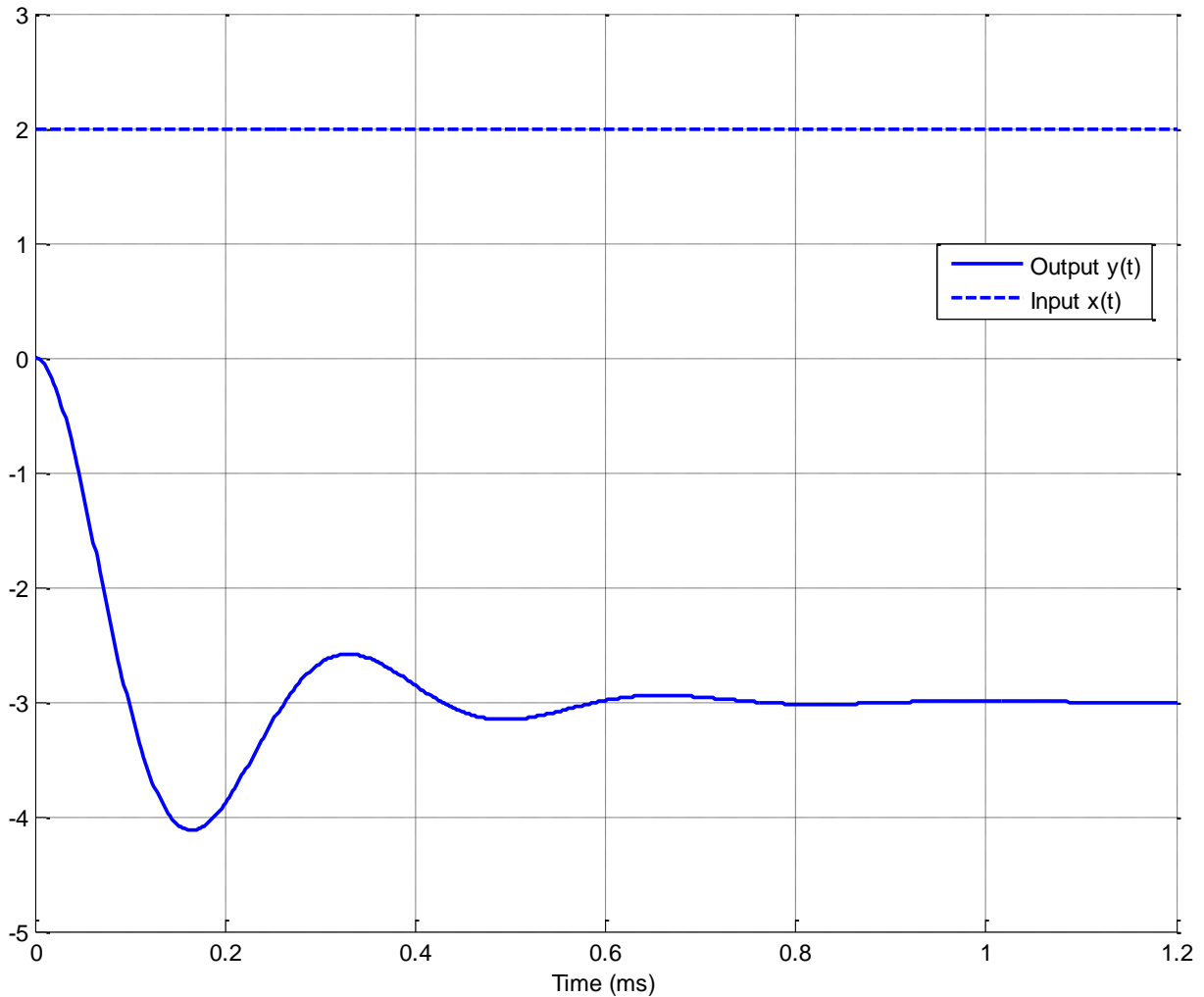
2) The best estimate of the steady state error for a **unit ramp input is**

- 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

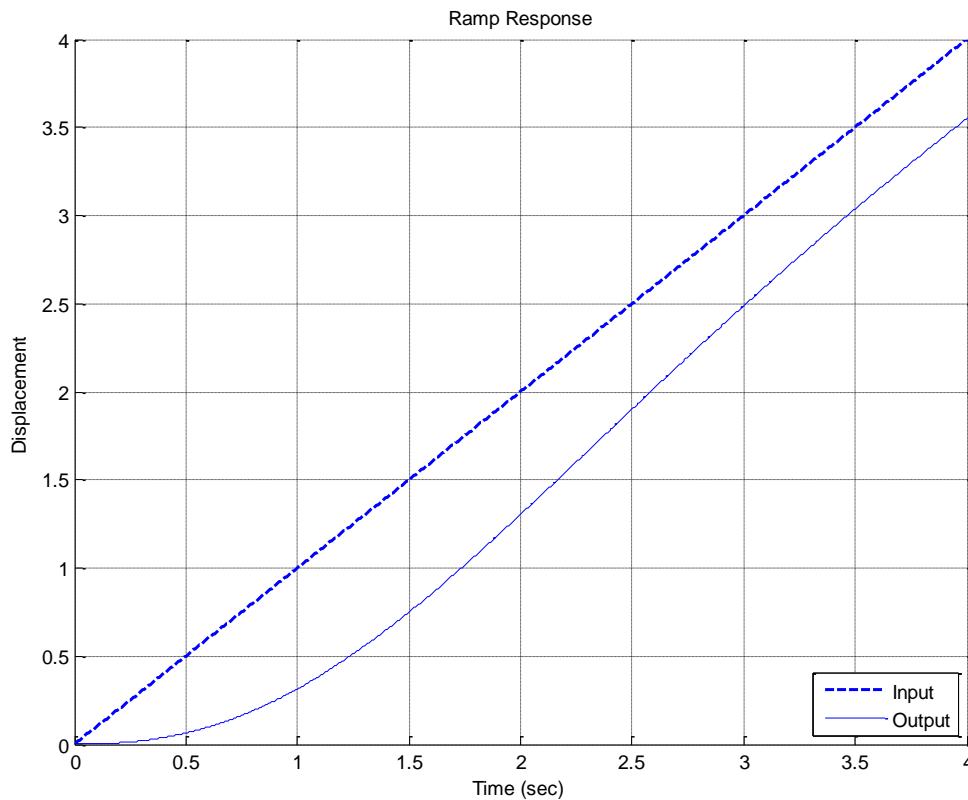
Problems 4 and 5 refer the following graph showing the response of a second order system to a step input.



- 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

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 $y(t) = -u(t) - t^4 e^{-t} u(t) + e^{-2t} u(t)$

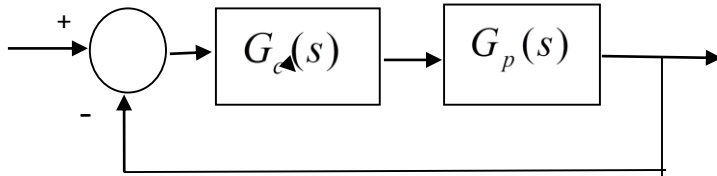
The steady state error for a unit step input for this system is best estimated as

- 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) ∞

10) For the following system



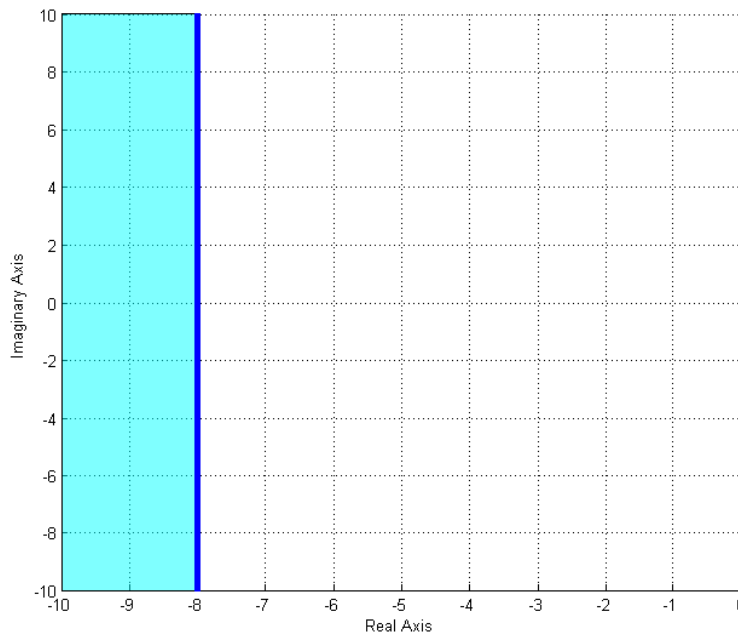
the pole of the controller $G_c(s)$ is at -15
 the poles of the plant $G_p(s)$ are at -1 and -2
 the poles of the closed loop system are at -7.1, -5.43 +3.98j, -5.43 -3.98j

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

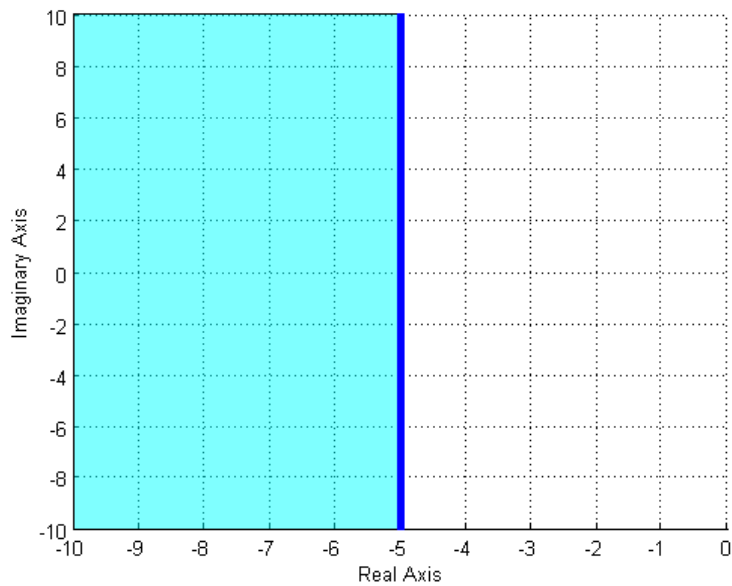
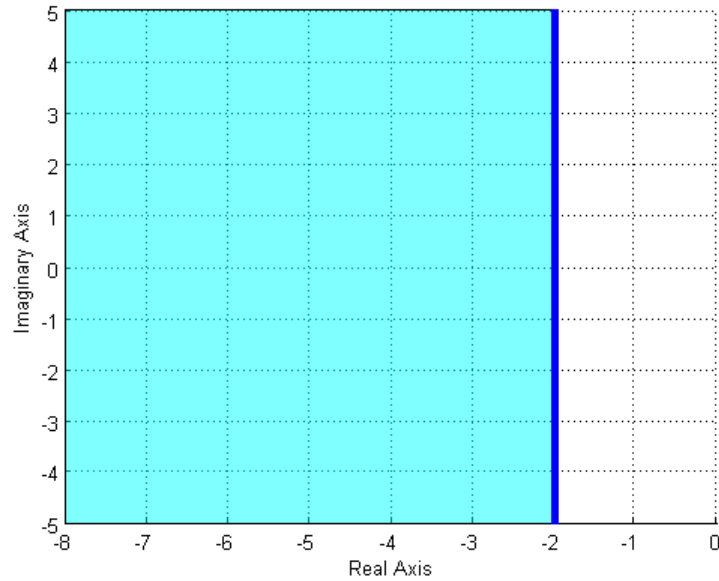
11) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

- a) $T_s \leq 0.5$ b) $T_s \geq 0.5$ c) $T_s \geq 8$ d) $T_s \leq 8$ e) none of these



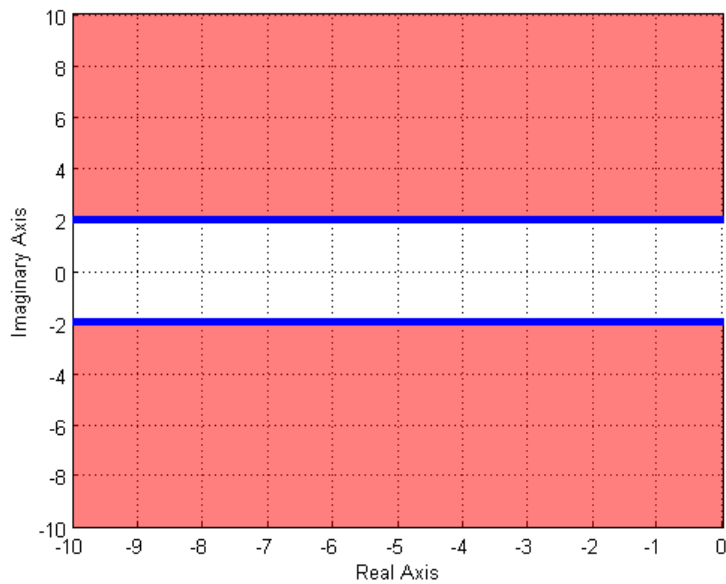
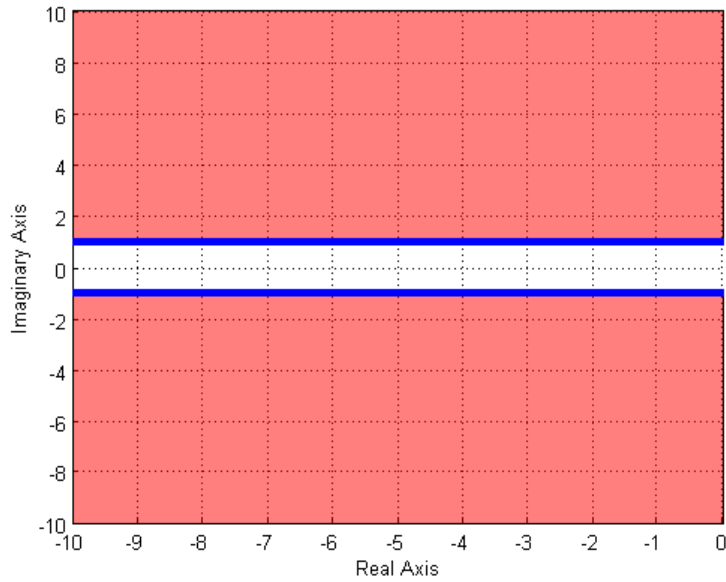
12) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller settling time** for our system?

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



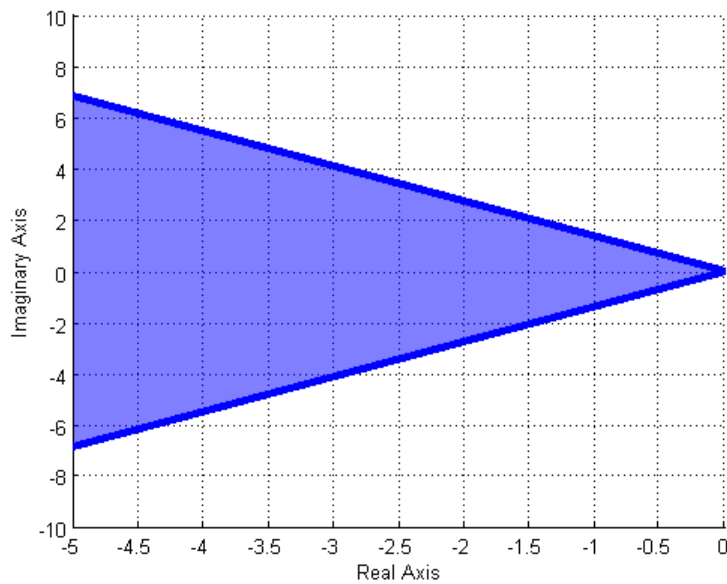
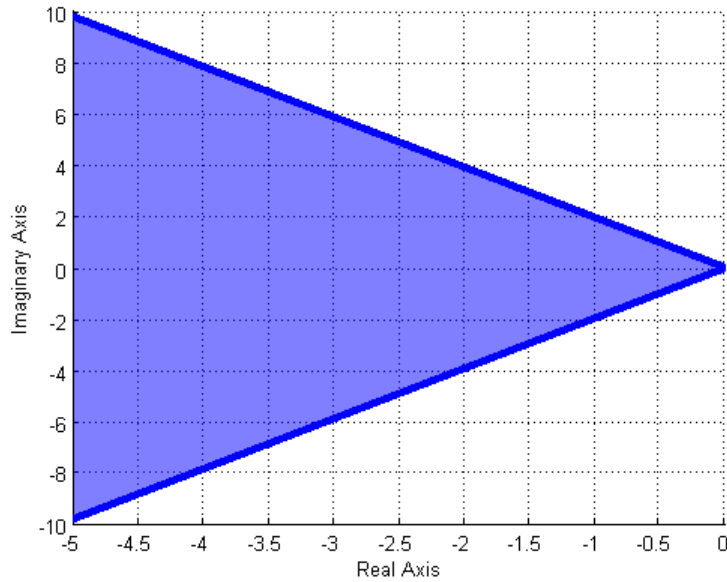
13) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller time to peak** for our system?

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

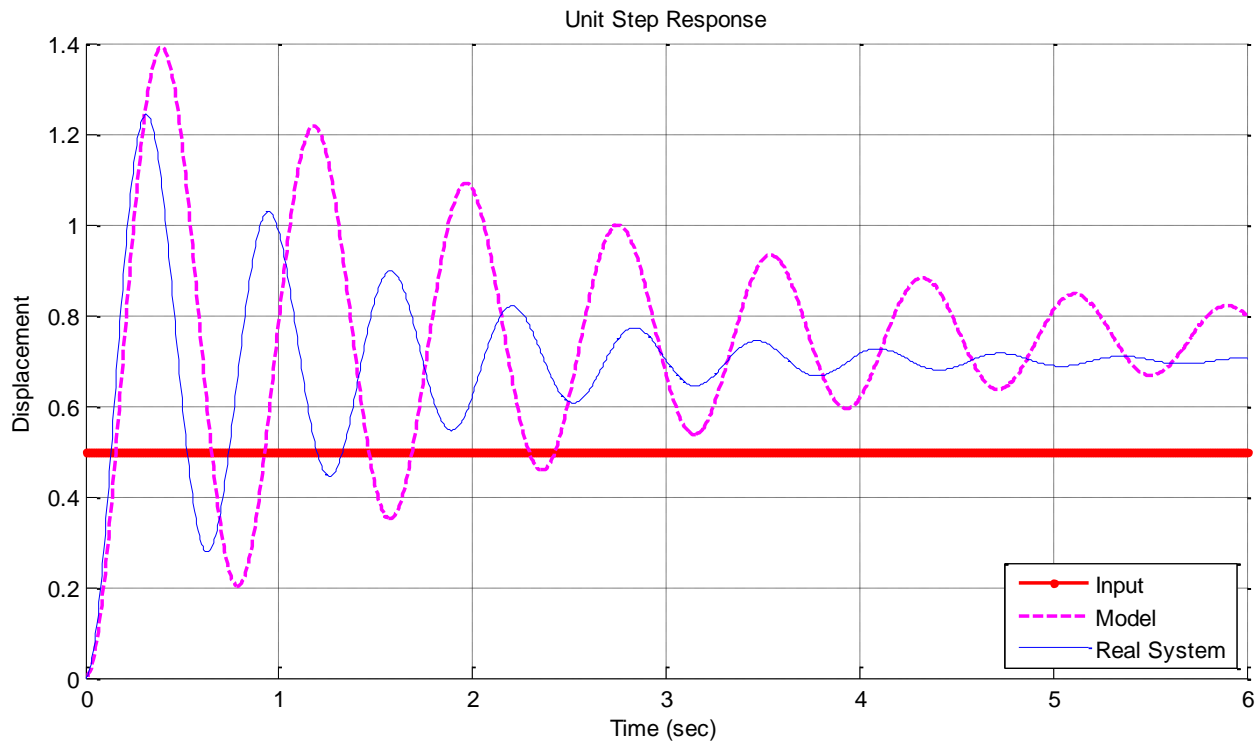


14) One of the shaded regions below shows the possible pole locations for a percent overshoot less than 10%, and the other shows the possible pole locations for a percent overshoot less than 20%. Which of the two graphs shows the possible pole locations for a percent overshoot less than 20%?

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

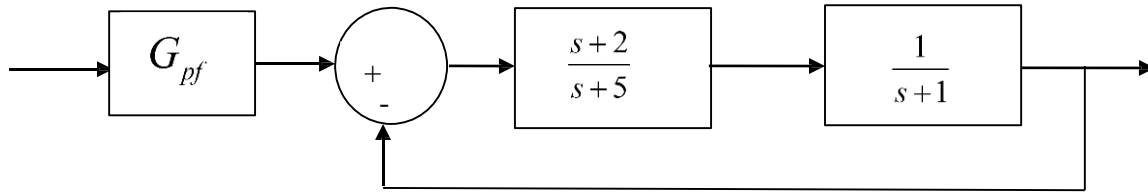


Problems 15-17 refer to the figure below, which shows the unit step response of a real 2nd order system and the unit step response of a second order model we are trying to match to the real system.



- 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

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

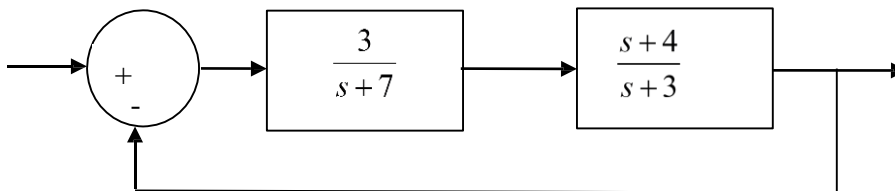
19) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit step is best approximated as

- 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) $7/5$

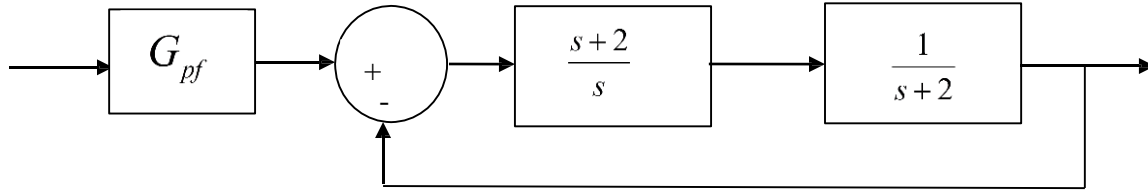
21) For the following system



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

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

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

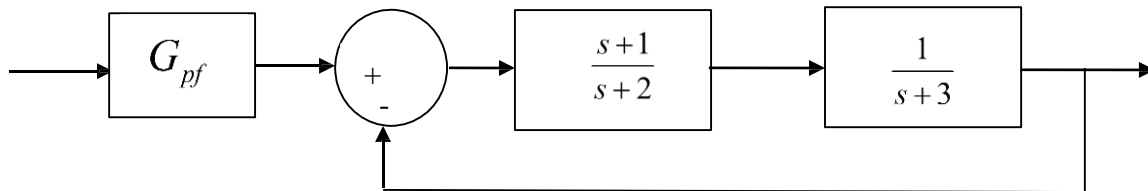
23) Assuming the prefilter G_{pf} is 1, the **steady state error** for a unit ramp input is best approximated as

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