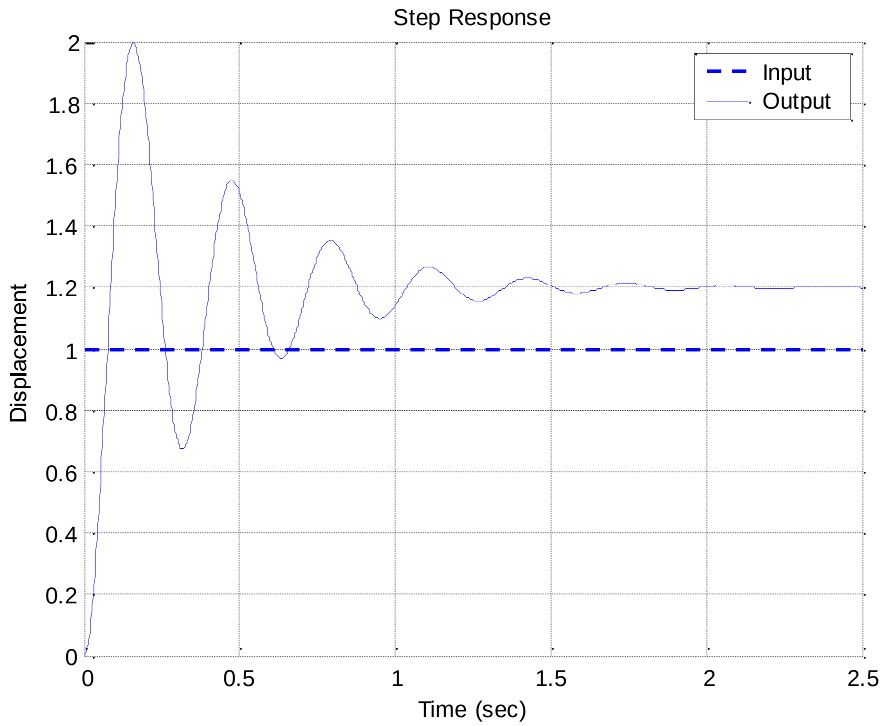
ECE-320, Practice Quiz #2

Problems 1and 2 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) 0.2 b) -0.2 c) 1.0 d) -0.0

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

3) 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

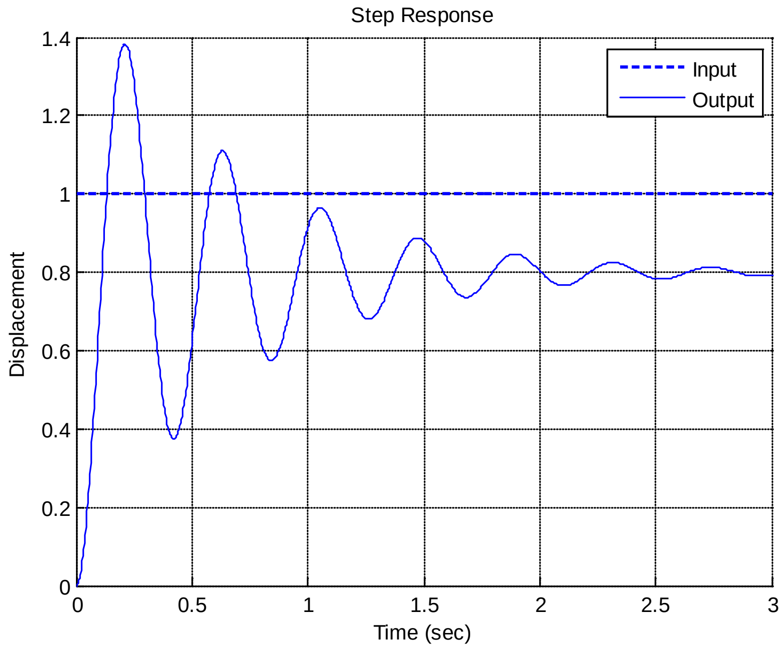
a) ∞ b) 0.5 c) 2.0 d) -0.5 e) impossible to determine

4) 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 5 and 6 refer to the **unit step response** of a system, shown below

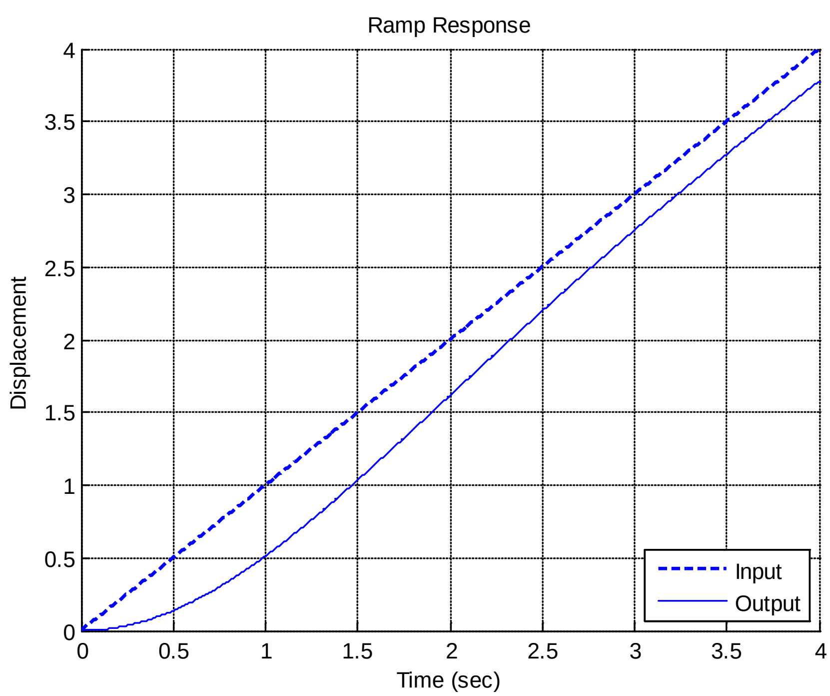


5) The best estimate of the **steady state error** for a **unit step input** is

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

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

7) 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

8) 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

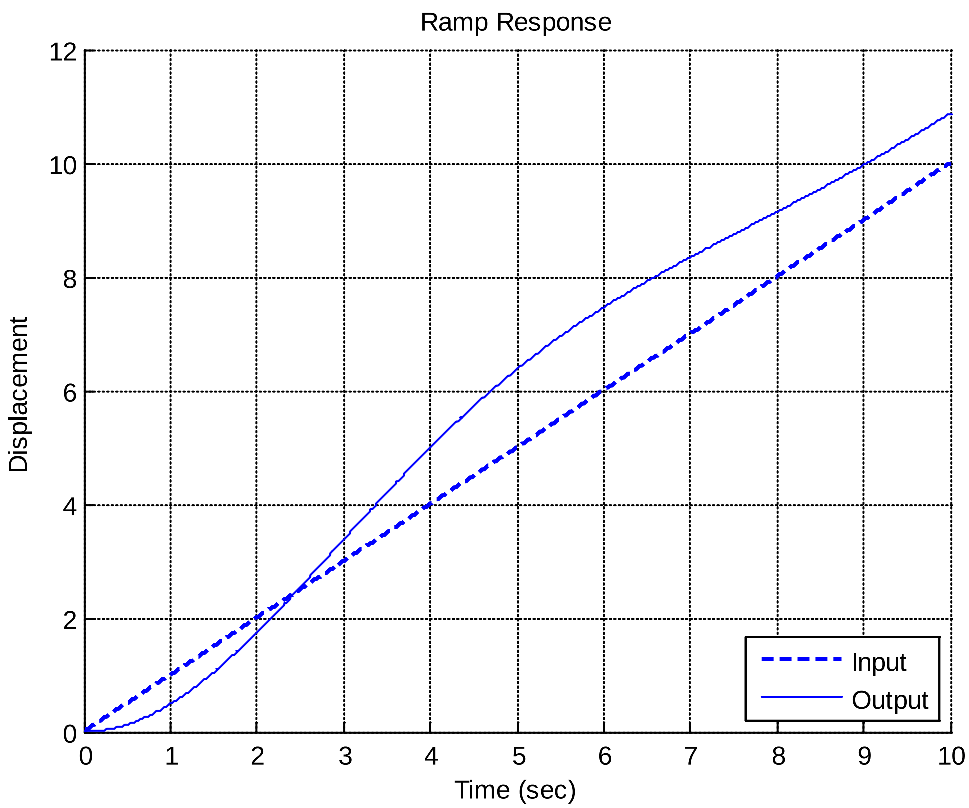
a) 0.5 b) 2.0 c) 1.0 d) ∞ e) -0.5

9) The **unit ramp response** of a system is given b $y(t) = -0.5u(t) - 2tu(t) + e^{-t}u(t)$.

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

a) 0.5 b) 2.0 c) 1.0 d) ∞

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

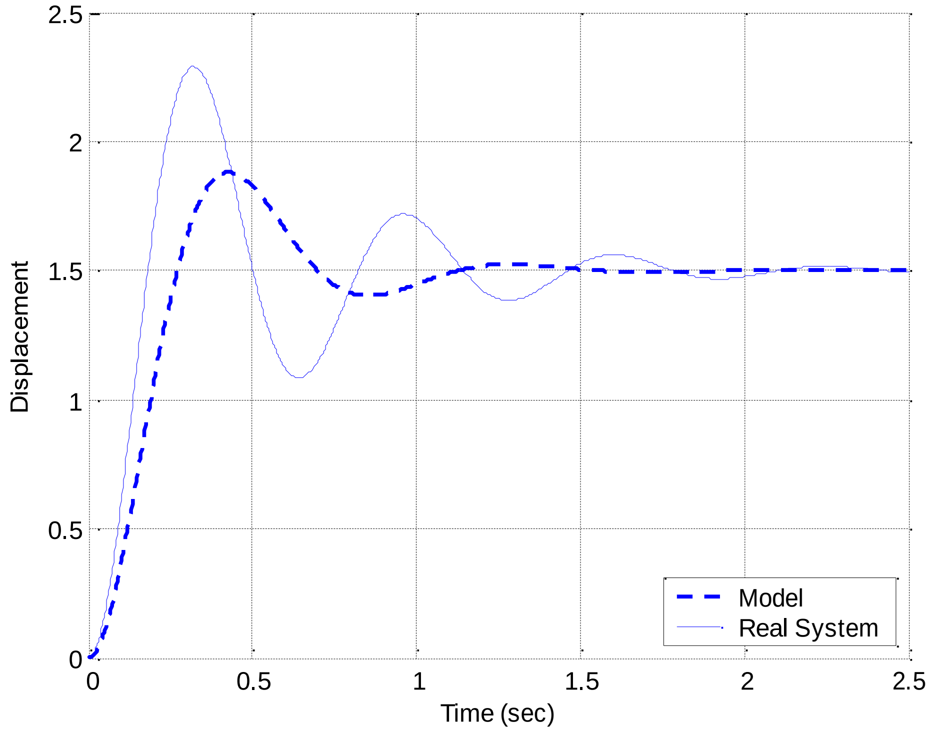
Problems 11 and 12 refer to a system with poles at -2+5j. -2-5j. -10+j, -10-j, and -20

11) 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

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

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.



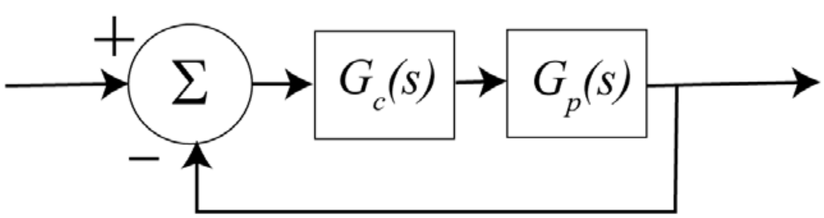
13) In order to make the model better match the real system, the ***damping ratio*** of the ***model*** should be

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

15) For the following system

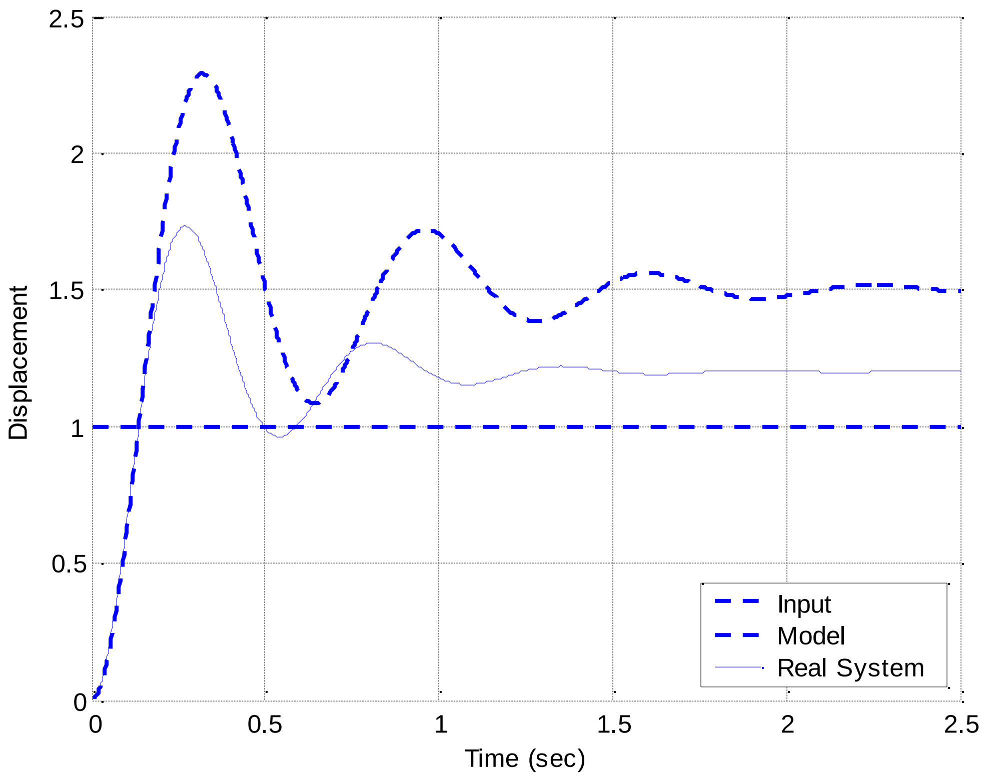


the pole of the controller $G_c(s)$ is at -15
the poles of the plant $G_p(s)$ are at -1 and -2
the poles of the closed loop system are at -7.1, -5.43 +3.98j, -5.43 -3.98j

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

Problems 16-18 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.



16) 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

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

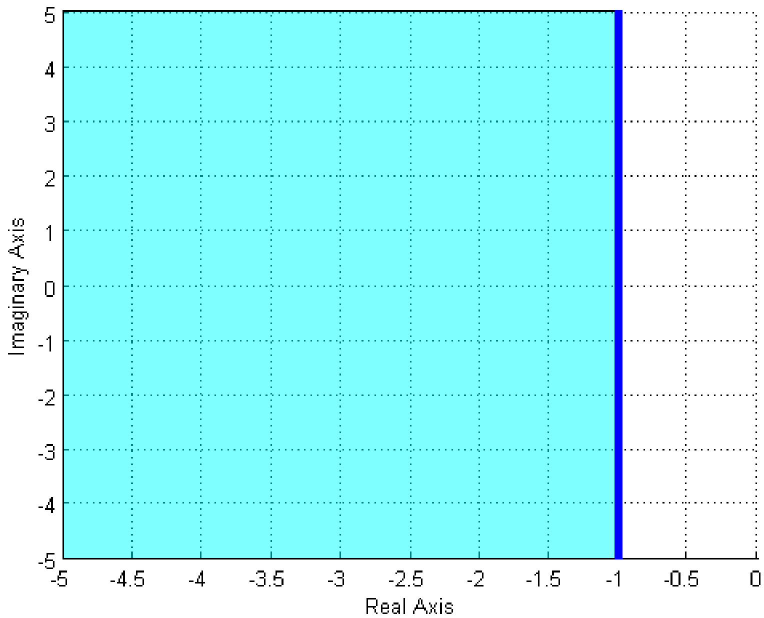
a) increased b) decreased c) left alone d) impossible to determine

18) 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

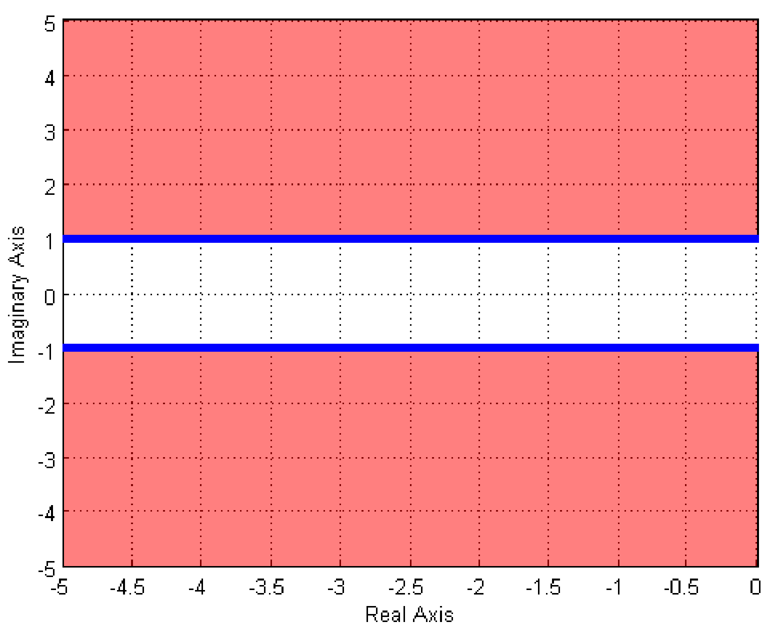
19) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

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



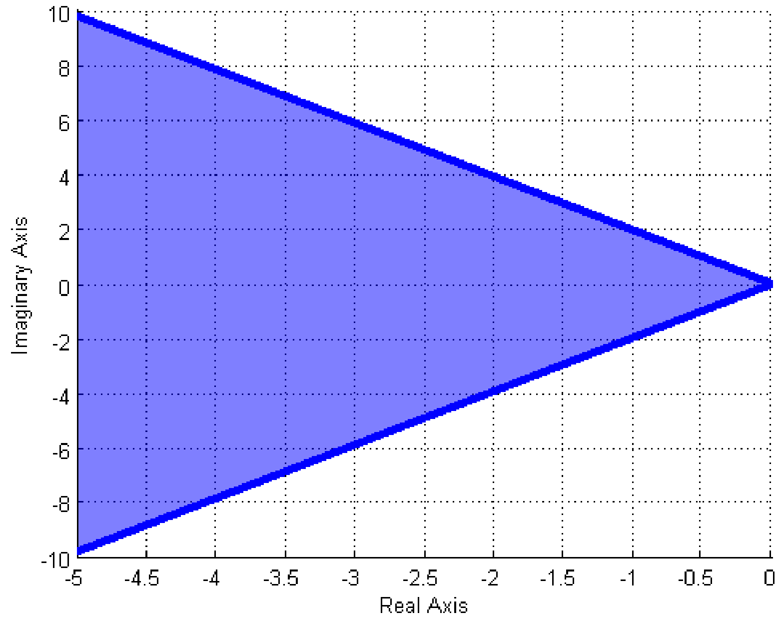
20) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

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



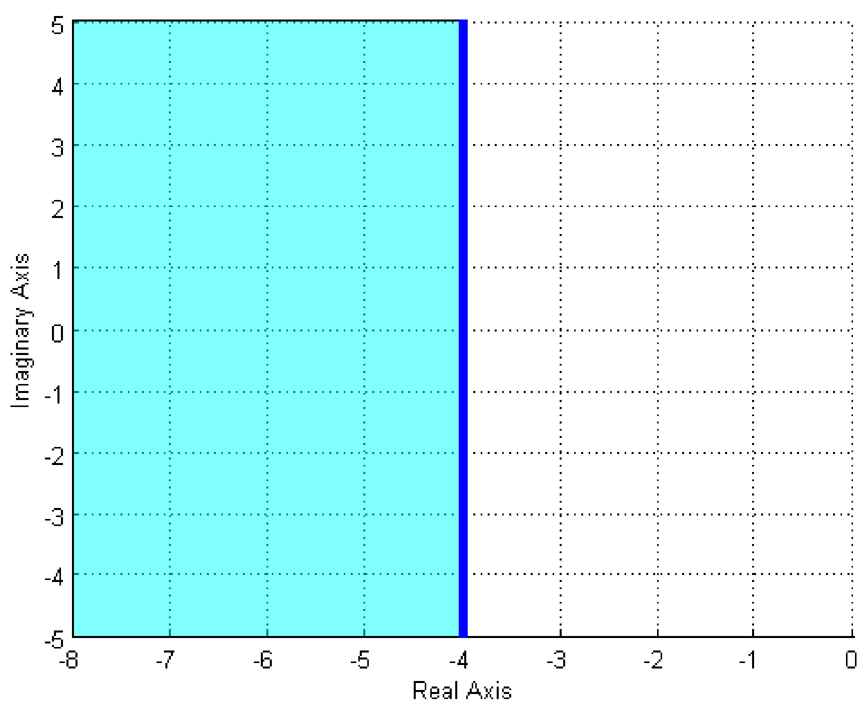
21) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

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



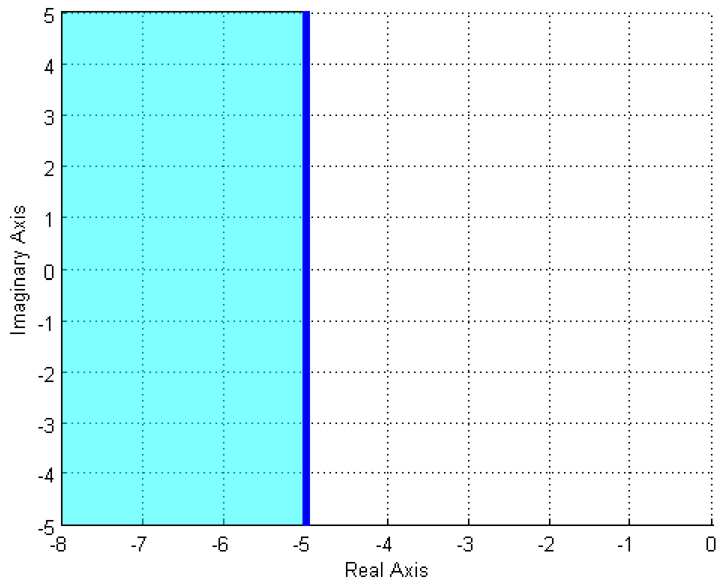
22) The (dark) shaded area in the s-plane figure below shows the possible pole location for an ideal second order system that meets which of the following constraints?

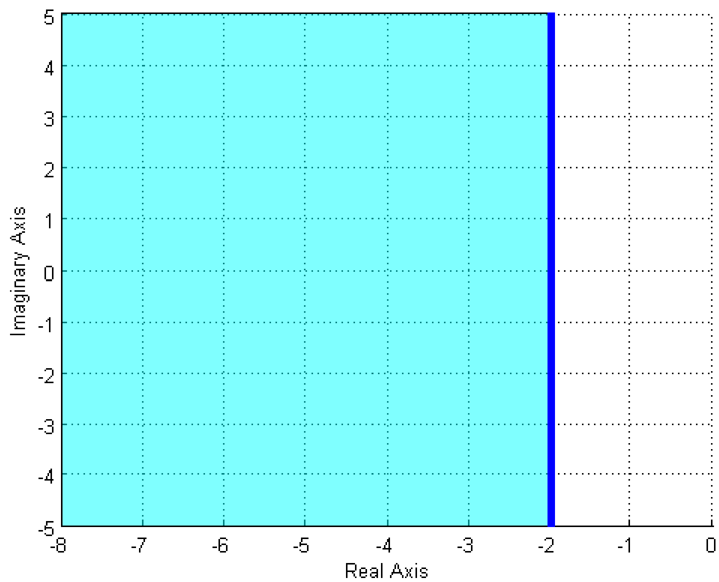
a) $T_s \leq 1$ b) $T_s \geq 1$ c) $T_s \geq 4$ d) $T_s \leq 4$ e) none of these



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?

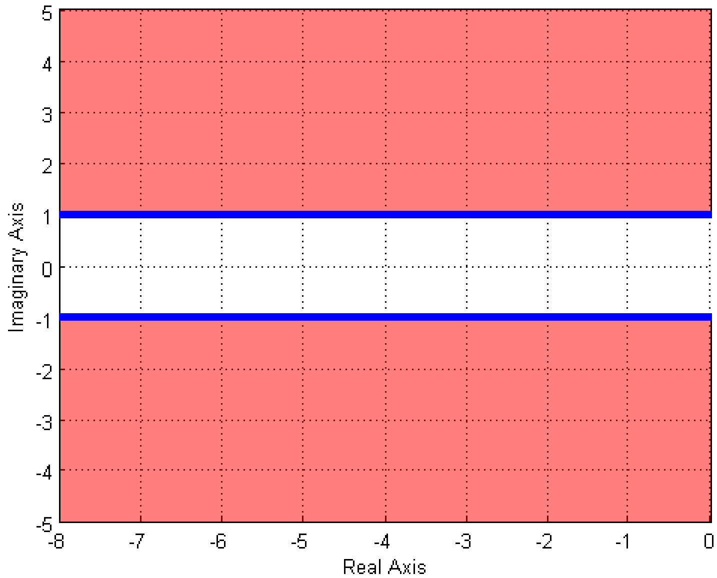
a) the region in the top figure b) the region in the bottom figure

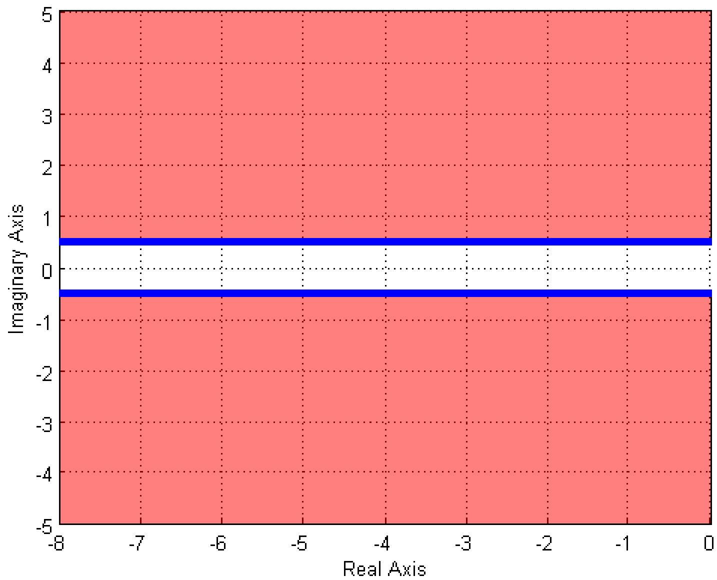




24) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller time to peak** for our system?

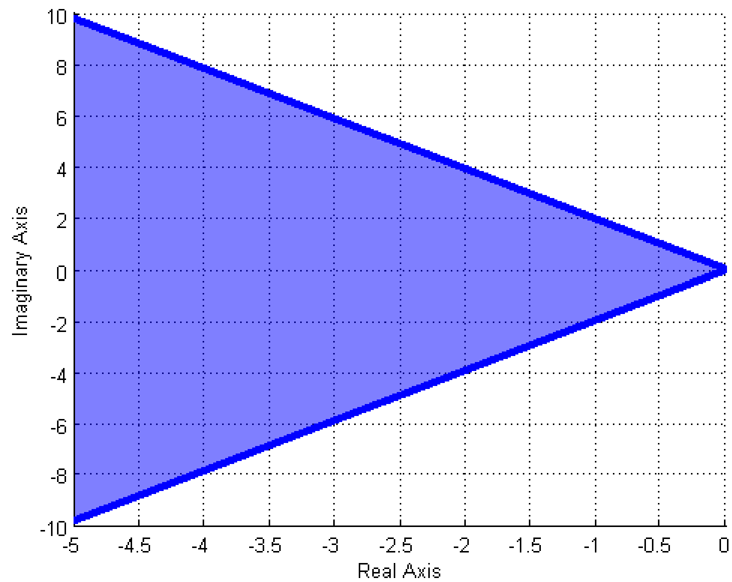
a) the region in the top figure b) the region in the bottom figure

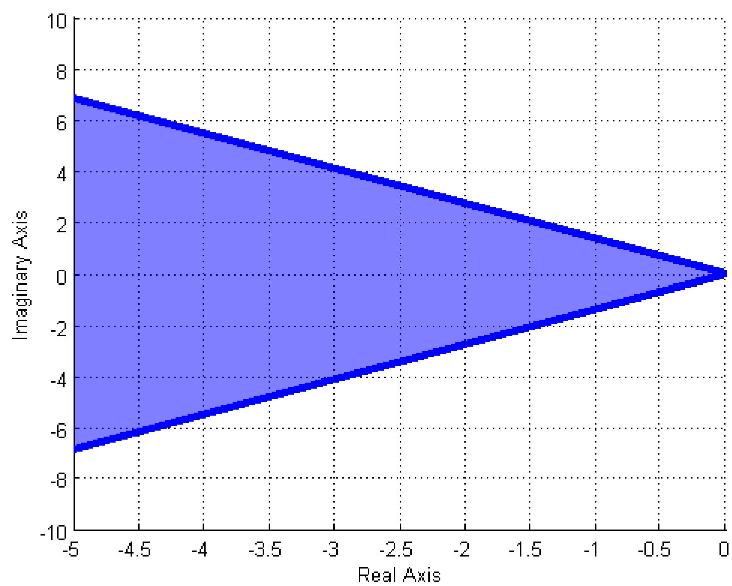




25) One of the shaded regions below shows the possible pole locations for a percent overshoot less than 10%, and the other shows the possible pole locations for a percent overshoot less than 20%. Which of the two graphs shows the possible pole locations for a percent overshoot less than 20%?

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





ccc

Answers: 1-b, 2-c, 3-a, 4-b, 5-a, 6-a, 7-a, 8-a, 9-d, 10-b, 11-a, 12-a, 13-b, 14-a, 15-d, 16-a, 17-a, 18-b, 19-d, 20-d 21-b, 22-a, 23-a, 24-a, 25-a