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ECE-320, Quiz #2

Problems 1 and 2 refer to a system with poles at -2+j. -2-j. -4, -1+2j, -1-2j, and -20

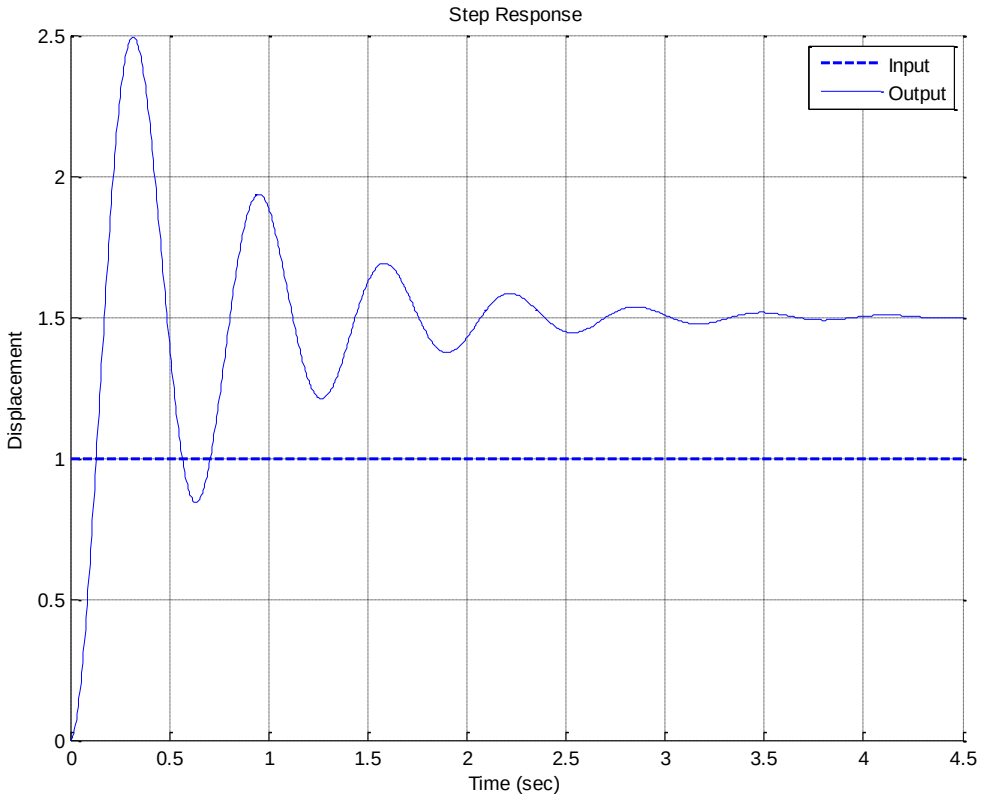
1) The best estimate of the **settling time** for this system is

a) 4 seconds b) 2 seconds c) 1 second d) 0.2 seconds

2) The **dominant pole(s)** of this system are

a) -2+j and -2-j b) -1+2j and -1-2j c) -4 d) -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) 0.5 b) -0.5 c) 1.5 d) -1.5 e) none of these

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

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

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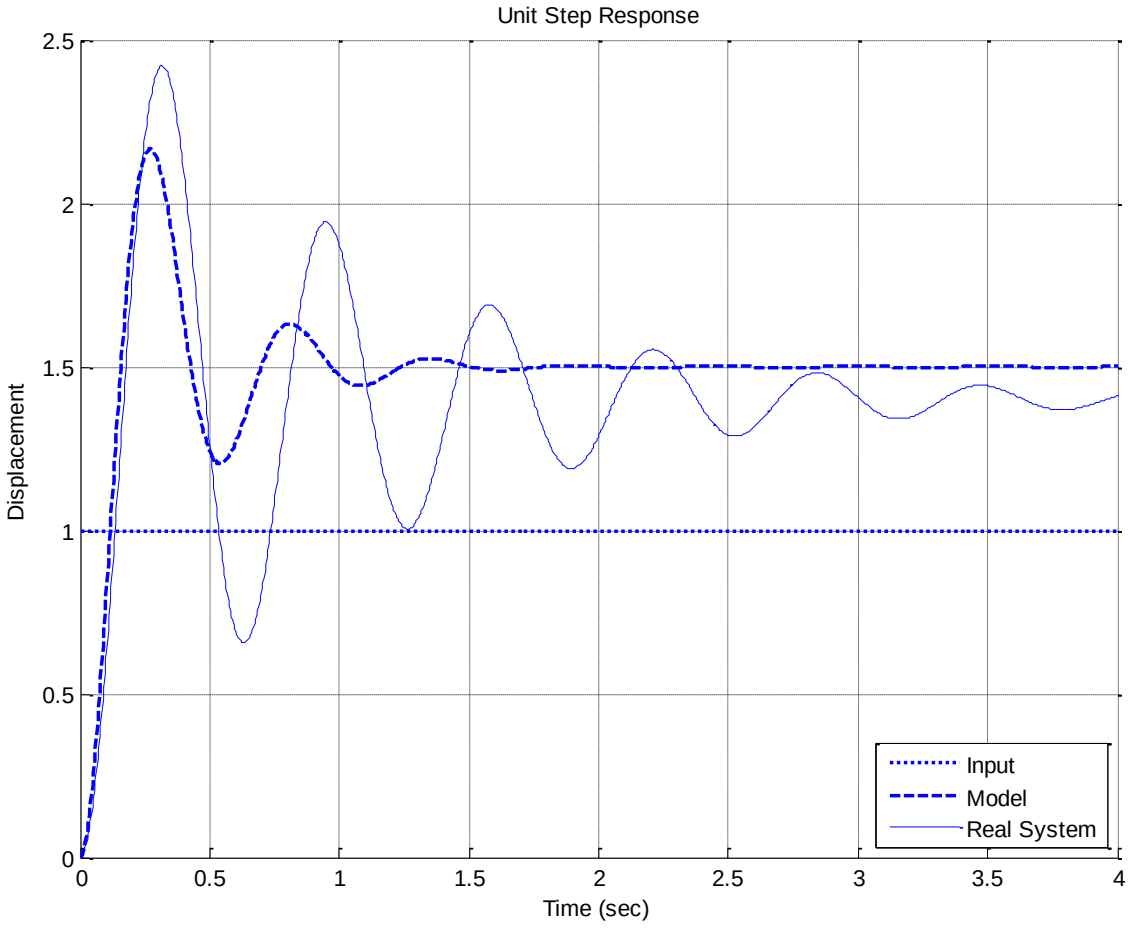
Problems 5-7 refer to the figure below, which shows the unit step response of a real 2nd order system and the unit step response of a second order model we are trying to match to the real system.



5) 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

6) 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

7) 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

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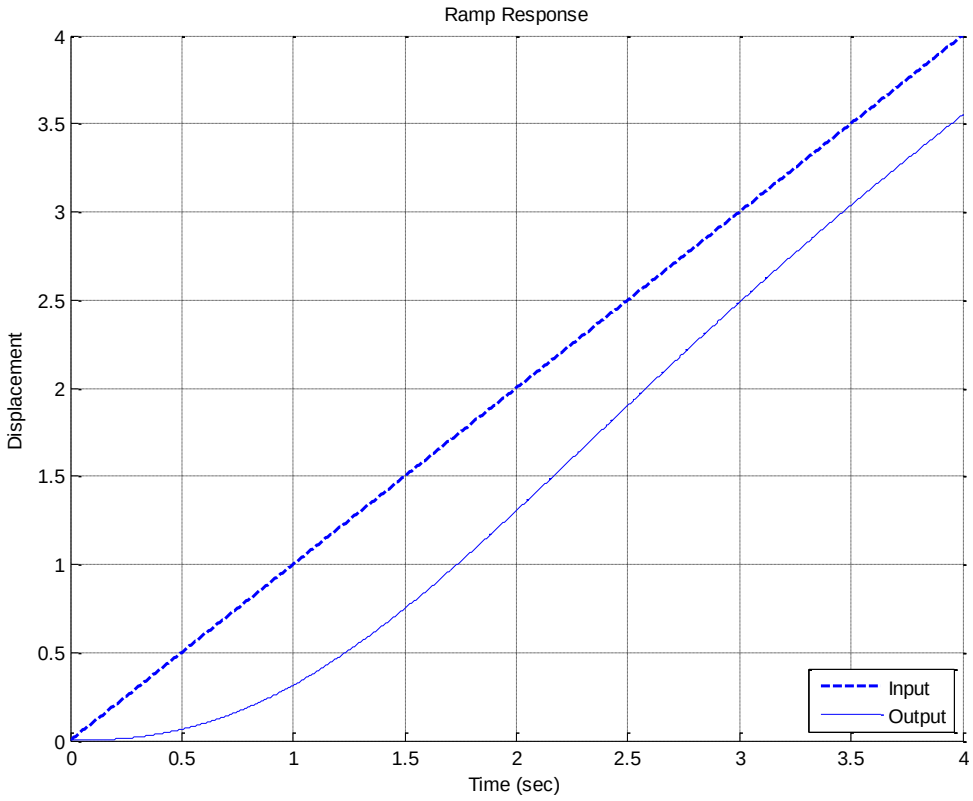
Problem 8 refers to the **unit ramp response** of a system, shown below:



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

a) 0.5 b) -0.5 c) 0.8 d) -0.8 e) 0.0

Problems 9 and 10 refer to the impulse responses of six different systems given below:

$$h_1(t) = [t + e^{-t}]u(t)$$
$$h_2(t) = e^{-2t}u(t)$$
$$h_3(t) = [2 + \sin(t)]u(t)$$
$$h_4(t) = [1 - t^3 e^{-0.1t}]u(t)$$
$$h_5(t) = [1 + t + e^{-t}]u(t)$$
$$h_6(t) = [te^{-t}\cos(5t) + e^{-2t}\sin(3t)]u(t)$$

9) The number of **stable systems** is a) 0 b) 1 c) 2 d) 3

10) The number of **unstable systems** is a) 0 b) 1 c) 2 d) 3

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11) 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

12) 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) ∞

13) Which of the following transfer functions represents a **stable** system?

$$G_a(s) = \frac{s-1}{s+1} \qquad G_b(s) = \frac{1}{s(s+1)} \qquad G_c(s) = \frac{s}{s^2-1}$$

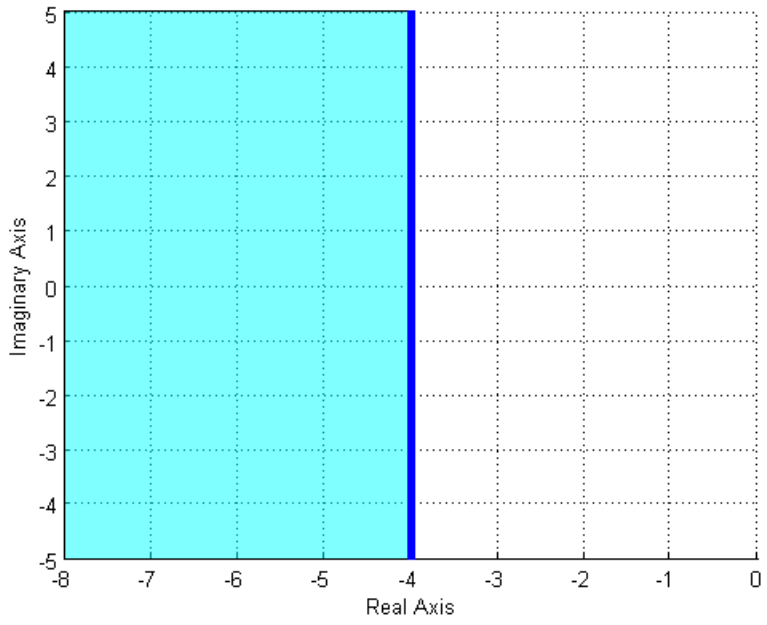
$$G_d(s) = \frac{s+1}{(s+1+j)(s+1-j)} \qquad G_e(s) = \frac{(s-1-j)(s-1+j)}{s} \qquad G_f(s) = \frac{(s-1-j)(s-1+j)}{(s+1-j)(s+1+j)}$$

a) all but G_c b) only G_a, G_b, and G_d c) only G_a, G_d, and G_f

d) only G_d and G_f e) only G_a and G_d

14) 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) $T_s \le 1$ b) $T_s \ge 1$ c) $T_s \ge 4$ d) $T_s \le 4$ e) none of these



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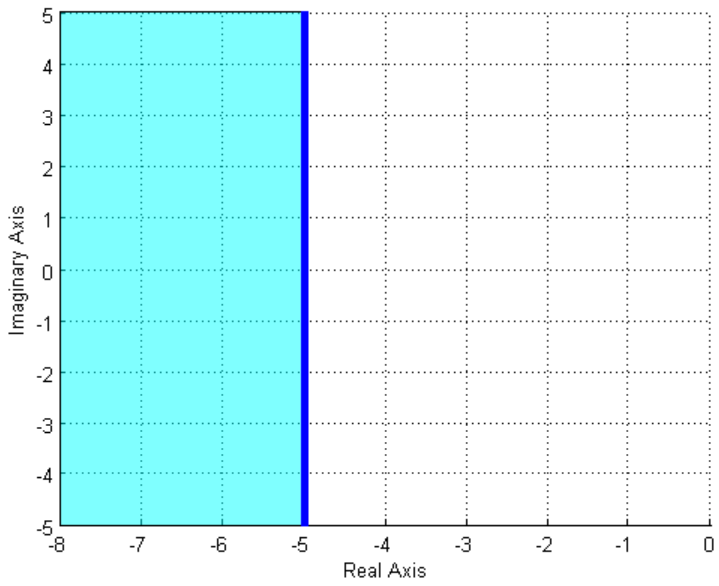
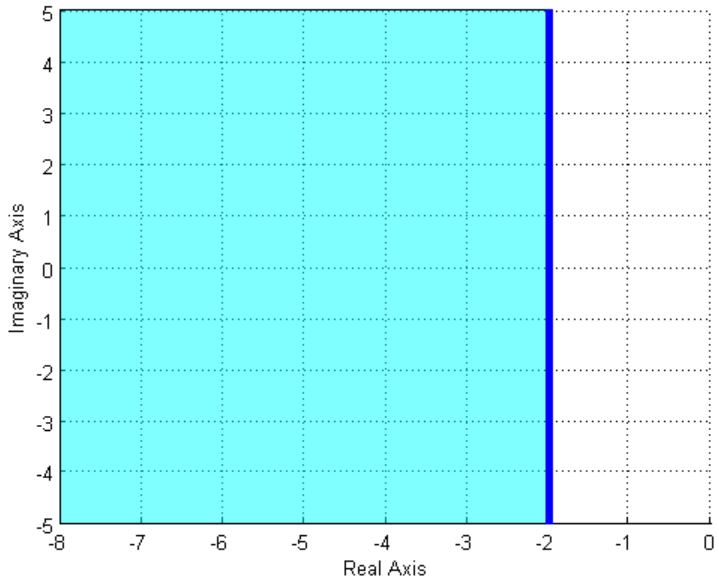
15) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller settling time** for our system?

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





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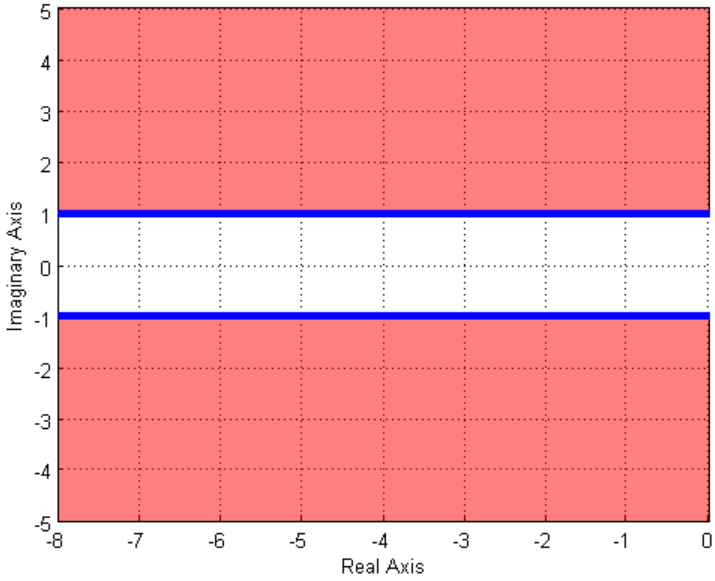
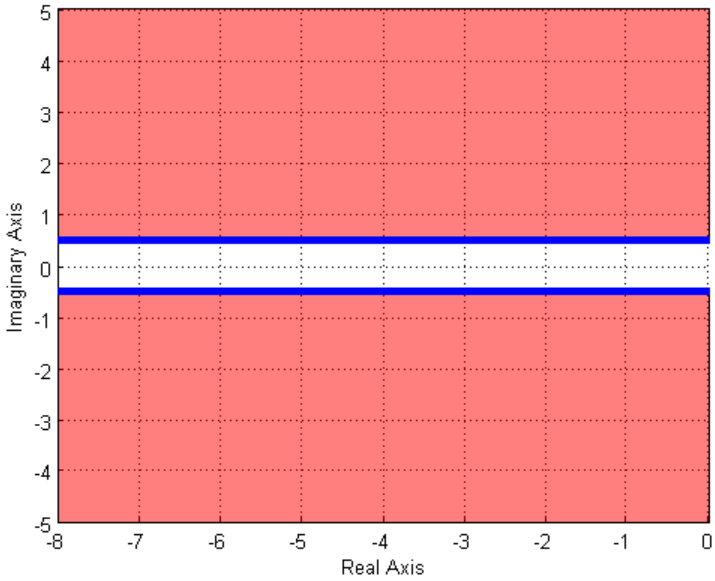
16) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller time to peak** for our system?

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





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17) 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