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Quiz #8

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

3) How many terms will there be in the partial fraction expansion of $H(s)=\frac{(s+1)^2}{s^2(s+2)^2}$?

a) 2 b) 3 c) 4 d) 6

4) How many terms will there be in the partial fraction expansion of $H(s)=\frac{s}{(s^2+1)(s+2)}$?

a) 0 b) 1 c) 2 d) 3

5) An impulse response $h(t)$ is composed of the terms $1, e^{-t}, te^{-t}$

A possible corresponding transfer function (for some constant value *A*) is

a) $H(s)=\frac{A}{s(s+1)}$ b) $H(s)=\frac{A}{s^2(s+1)}$

c) $H(s)=\frac{As}{(s+1)}$ d) $H(s)=\frac{A}{s(s+1)^2}$

Problems 6 and 7 refer to the following transfer function

$$H(s)=\frac{2s+1}{(s+2)^2+1}$$

6) For this transfer function, the corresponding impulse response $h(t)$ is composed of which terms?

a) $e^{-t}\cos(2t), e^{-t}\sin(2t)$ b) $e^{-2t}\cos(t), e^{-2t}\sin(t)$

c) $e^{-t}\cos(4t), e^{-t}\sin(4t)$ d) $e^{-4t}\cos(t), e^{-4t}\sin(t)$

7) The **poles** of the transfer function are

a) $2 \pm j$ b) $-2 \pm j$

c) $-1 \pm 2j$ d) $-1 \pm 4j$

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Problems 8 and 9 refer to the impulse responses of six different systems given below:

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

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

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

10) 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

11) For the transfer function

$$H(s) = \frac{1}{s^2(s+2)}$$

the corresponding impulse response $h(t)$ is composed of which terms?

a) $t^2 e^{-2t}$ b) t and te^{-2t} c) $1, t, te^{-2t}$
d) t^2, e^{-2t} e) none of these

12) The Laplace transform of $x(t) = u(t) - u(t-2)$ is

a) $X(s) = 1 - e^{-2s}$ b) $X(s) = 1 - e^{+2s}$ c) $X(s) = \frac{1}{s} - \frac{e^{-2s}}{s}$ d) none of these

13) The Laplace transform of $x(t) = te^{-3t}u(t)$ is

a) $X(s) = \frac{1}{s}\frac{1}{s+3}$ b) $X(s) = \frac{1}{s+3}$ c) $X(s) = \frac{1}{(s+3)^2}$ d) $X(s) = \frac{2}{(s+3)^2}$

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14) The Laplace transform of $x(t) = (t-2)u(t-2)$ is

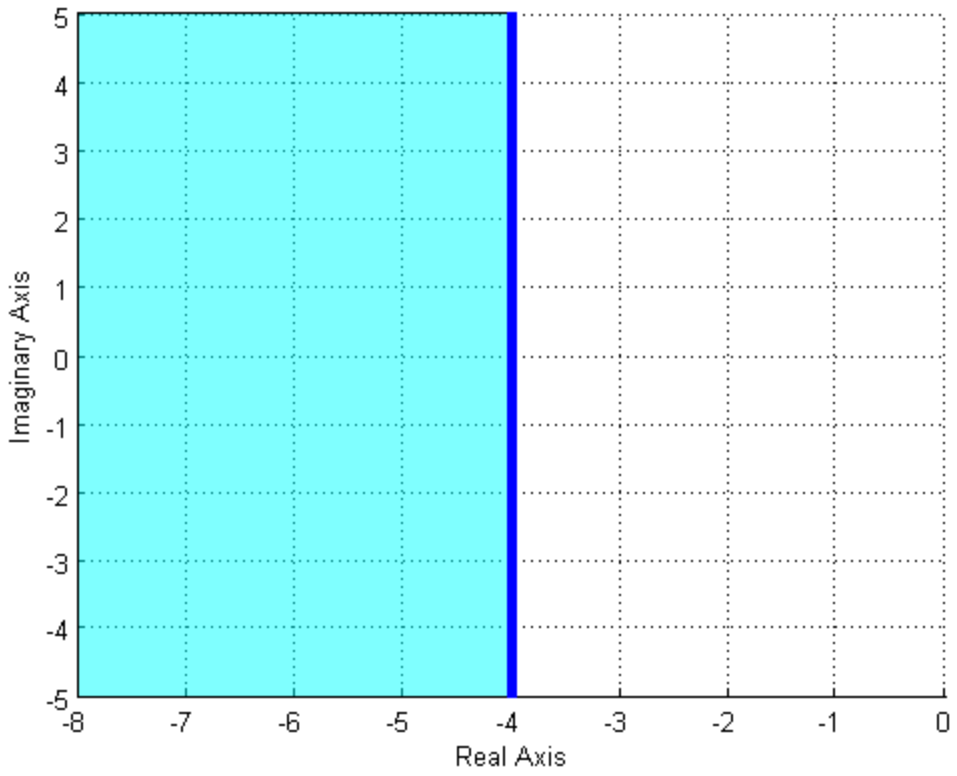
a) $X(s) = \frac{1}{s-2}$ b) $X(s) = \frac{e^{-2s}}{s^2}$ c) $X(s) = \frac{e^{-2s}}{s-2}$ d) none of these

For the following three problems, the following relationship may be useful

$$T_p = \frac{\pi}{\omega_d}, T_s = \frac{4}{\sigma}, \theta = cos^{-1}(\zeta)$$

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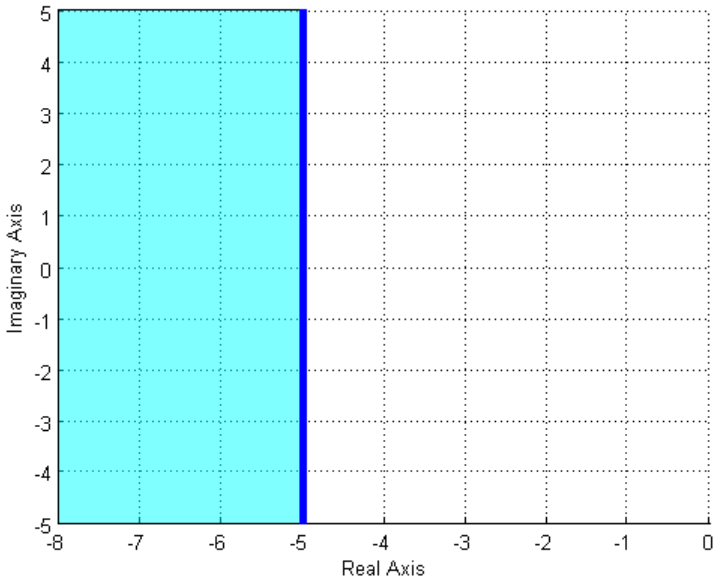
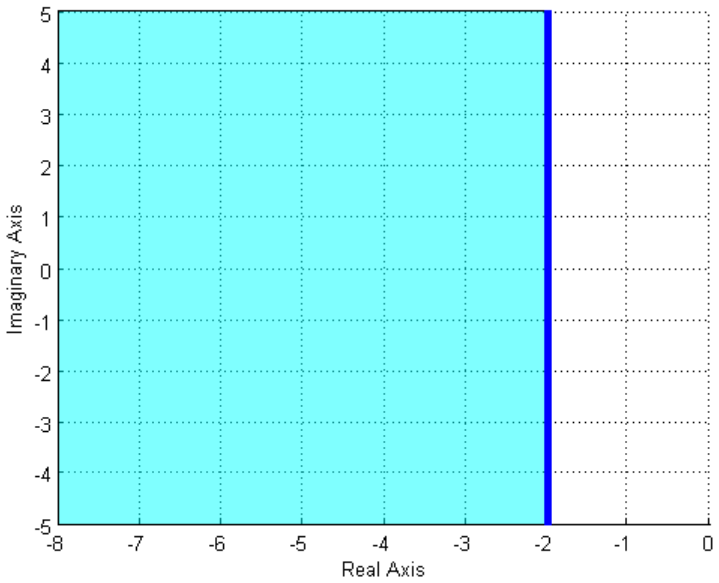
16) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller settling time** for our system?

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





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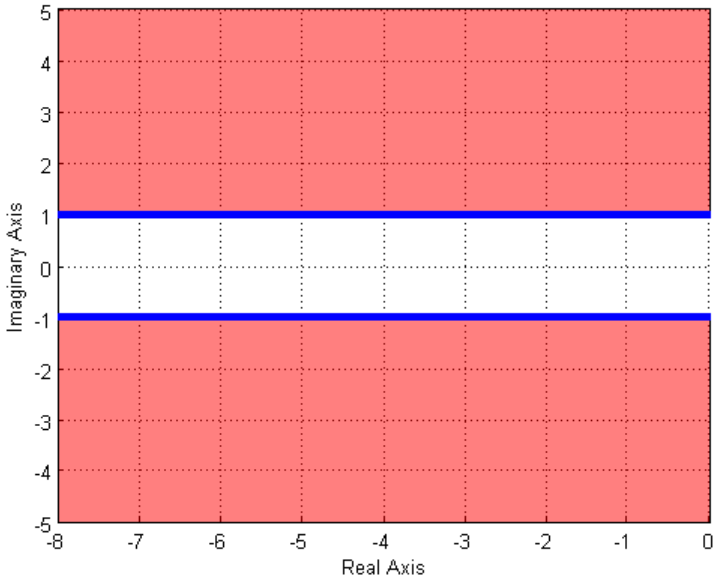
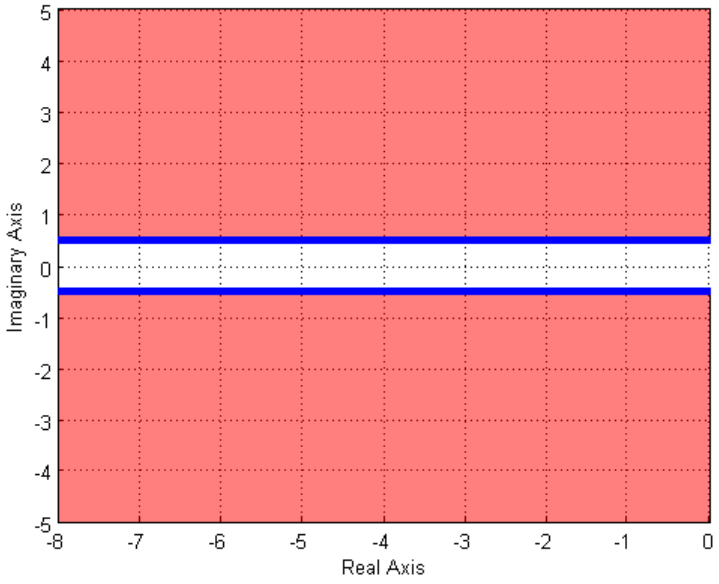
17) Assuming we are allowed to place our poles only in the (dark) shaded areas, which of the following two shaded regions will in general result in a **smaller time to peak** for our system?

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





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18) 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