

**ECE-205 Quiz #10**

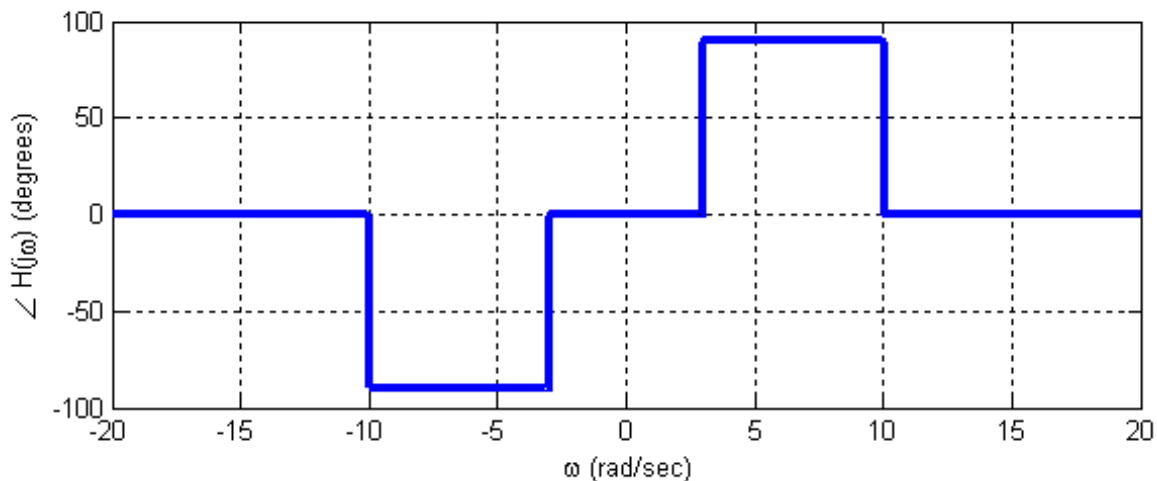
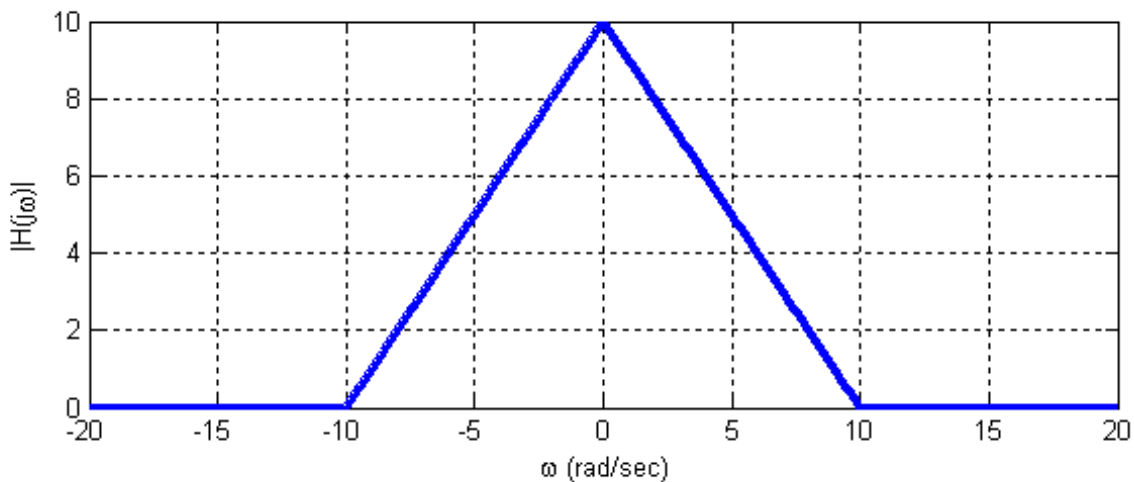
1) Assume  $x(t) = 3 + 2 \cos(2t - 3)$  is the input to an LTI system with transfer function

$$H(j\omega) = \begin{cases} 2e^{-j\omega} & |\omega| < 3 \\ 3e^{-j2\omega} & |\omega| \geq 3 \end{cases}$$

The **steady state output** will be

- a)  $y(t) = 6 + 4 \cos(2t - 5)$     b)  $y(t) = 4 \cos(2t - 5)$     c)  $y(t) = [3 + 2 \cos(2t - 3)][2e^{-j\omega}]$   
 d)  $y(t) = 6 + 4 \cos(2t - 3)e^{-j^2}$     e)  $y(t) = 3 + 4 \cos(2t - 5)$     f) none of these

2) Assume  $x(t) = 2 + \sin(5t) + 3 \cos(8t + 30^\circ)$  is the input to an LTI system with transfer function shown below

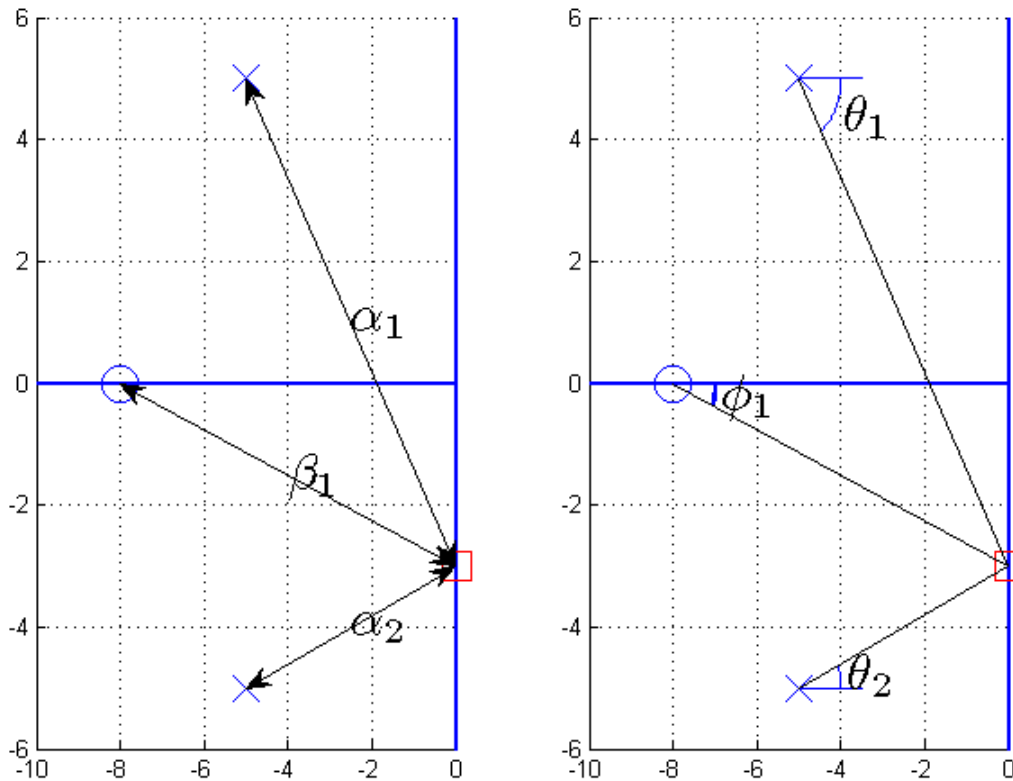


The **steady state output** of this system will be

- a)  $y(t) = 20 + 5 \sin(5t + 90^\circ) + 6 \cos(8t + 90^\circ)$     b)  $y(t) = 2 + 5 \sin(5t + 90^\circ) + 6 \cos(8t + 90^\circ)$   
 c)  $y(t) = 20 + 5 \sin(5t + 90^\circ) + 6 \cos(8t + 120^\circ)$     d)  $y(t) = 10 + 5 \sin(5t + 90^\circ) + 6 \cos(8t + 120^\circ)$   
 e) none of these

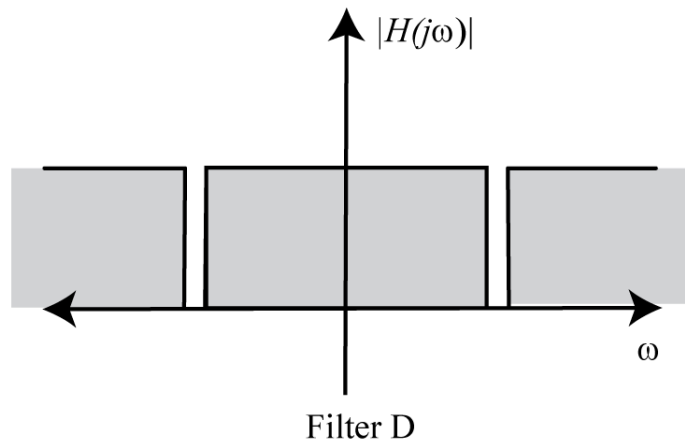
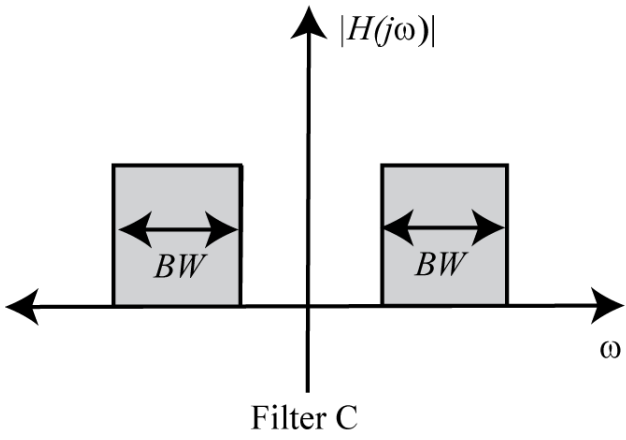
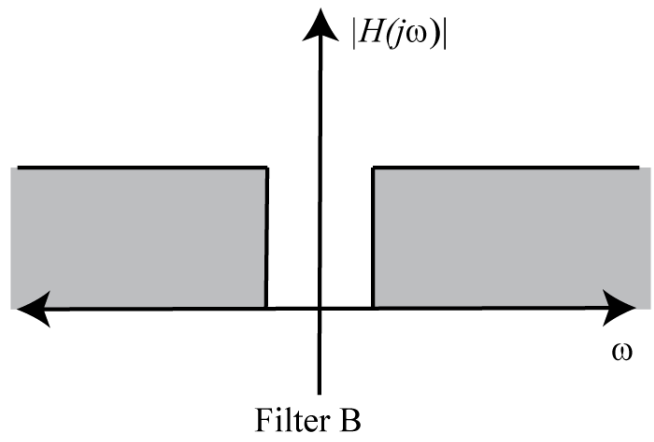
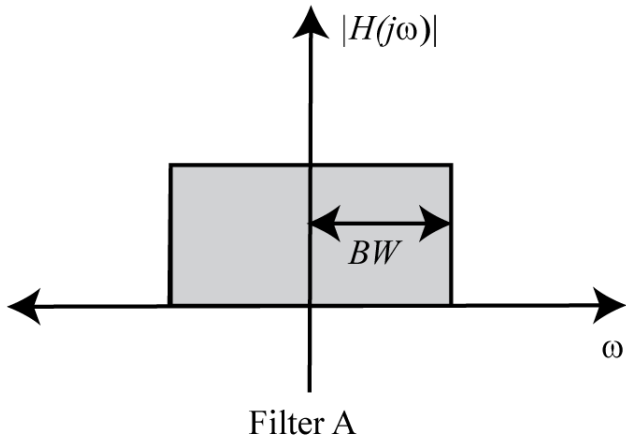
- 3) The **bandwidth** of the LTI system with transfer function  $H(s) = \frac{10}{2s+3}$  is  
 a) 3 rad/sec b) 3 Hz c) 2 rad/sec d) 0.5 Hz e) 1.5 rad/sec f) 1.5 Hz

Problems 4 –7 refer to the following pole-zero diagram that is being used to compute the frequency response of a transfer function.



- 4) For this transfer function, the frequency response is computed as  
 a)  $H(j\omega_0) = \frac{\alpha_1\alpha_2}{\beta_1} \angle(\theta_1 + \theta_2 - \phi_1)$     b)  $H(j\omega_0) = \frac{\beta_1}{\alpha_1\alpha_2} \angle(\theta_1 + \theta_2 - \phi_1)$   
 c)  $H(j\omega_0) = \frac{\beta_1}{\alpha_1\alpha_2} \angle(\phi_1 - \theta_1 - \theta_2)$     d)  $H(j\omega_0) = \frac{\alpha_1\alpha_2}{\beta_1} \angle(\phi_1 - \theta_1 - \theta_2)$
- 5)  $\beta_1$  is equal to    a)  $\sqrt{8^2 + 5^2}$     b)  $\sqrt{8^2 - 5^2}$     c) 3    d) none of these
- 6)  $\alpha_2$  is equal to    a)  $\sqrt{5^2 + 3^2}$     b)  $\sqrt{5^2 - 3^2}$     c)  $\sqrt{5^2 + 2^2}$     d) none of these
- 7)  $\theta_1$  is equal to    a)  $\tan^{-1}\left(\frac{-8}{-5}\right)$     b)  $\tan^{-1}\left(\frac{-8}{5}\right)$     c)  $\tan^{-1}\left(\frac{-3}{-8}\right)$     d) none of these

Problems 8-11 refer the representations of ideal filters shown below:



- 8) Which of these represents a **notch/bandstop** filter? A B C D
- 9) Which of these represents a **highpass** filter ? A B C D
- 10) Which of these represents a **lowpass** filter? A B C D
- 11) Which of these represents a **bandpass** filter? A B C D

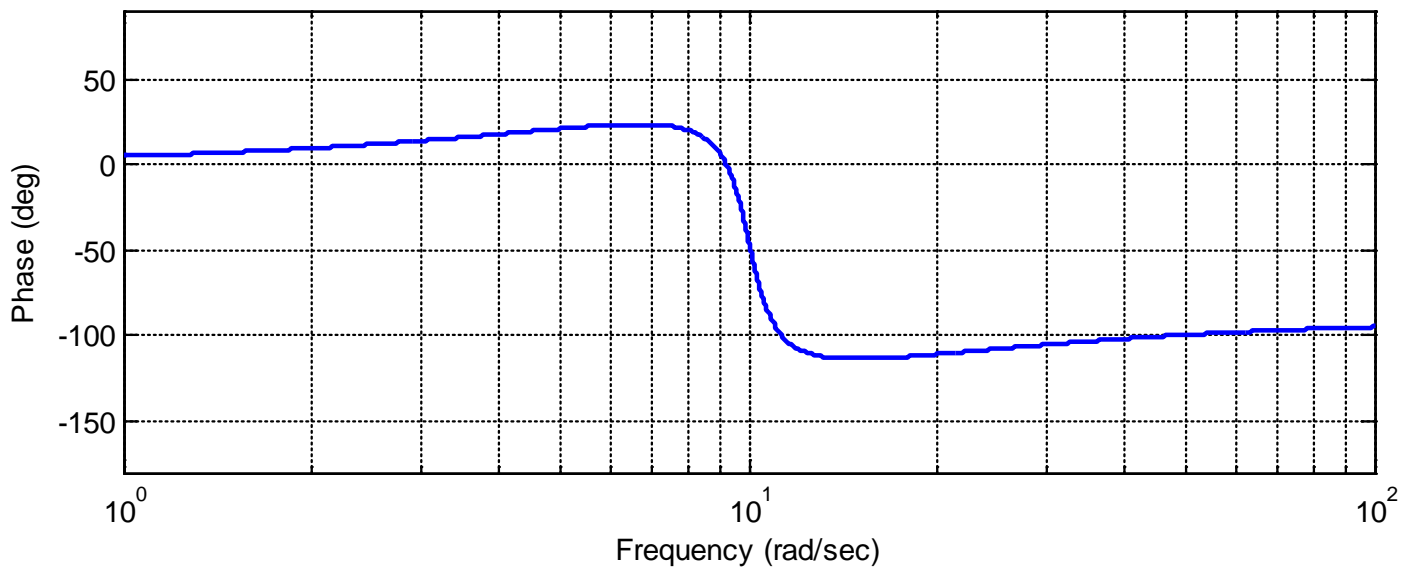
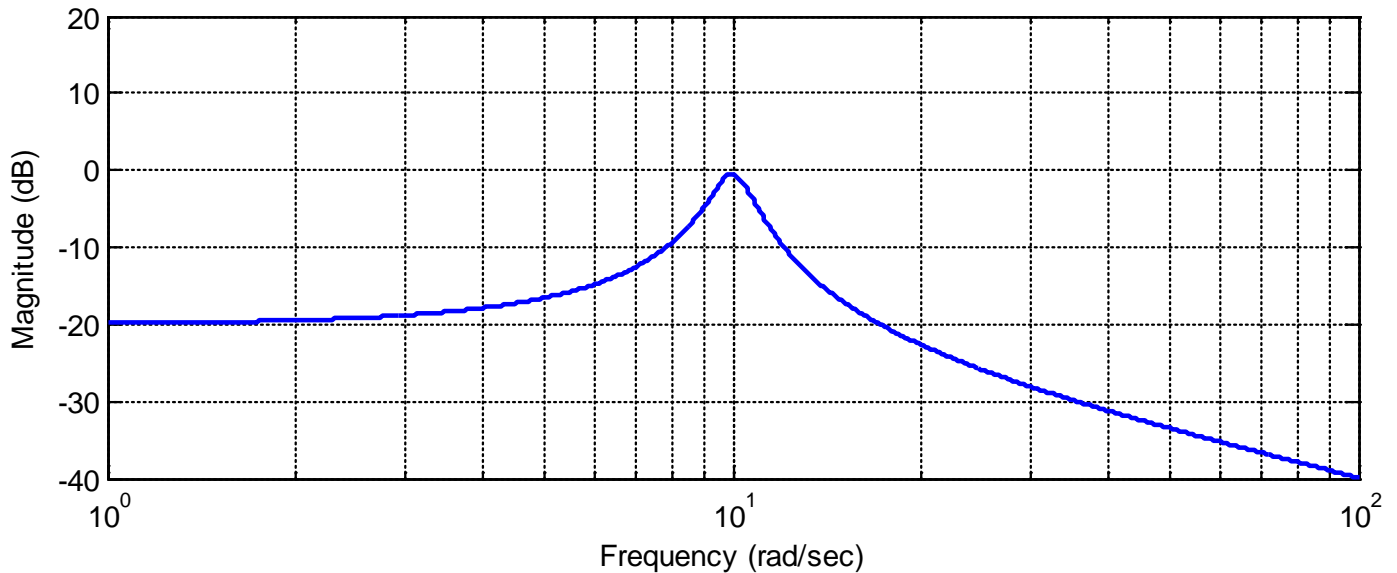
Problems 12 and 13 refer to a system whose frequency response is represented by the Bode plot below.

**12)** If the input to the system is  $x(t) = 5 \cos(10t + 30^\circ)$ , then the steady state output is best estimated as

- a)  $y_{ss}(t) = 0$                       b)  $y_{ss}(t) = 5 \cos(10t + 30^\circ)$   
c)  $y_{ss}(t) = 5 \cos(10t - 20^\circ)$       d)  $y_{ss}(t) = 5 \cos(10t - 50^\circ)$

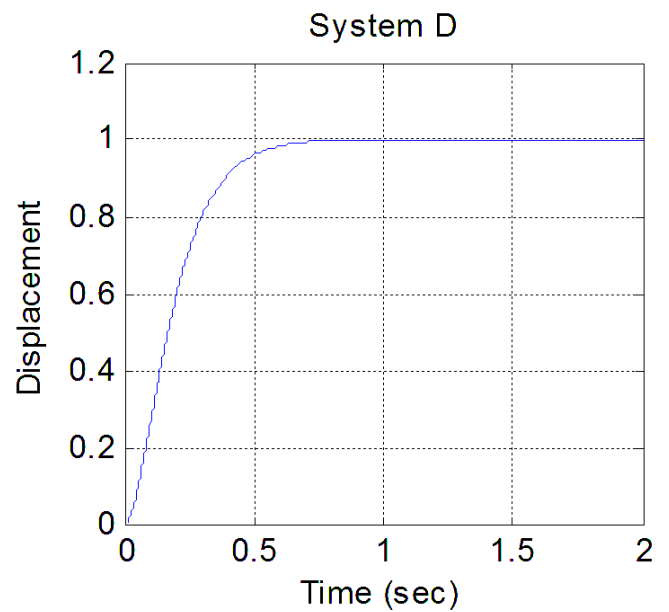
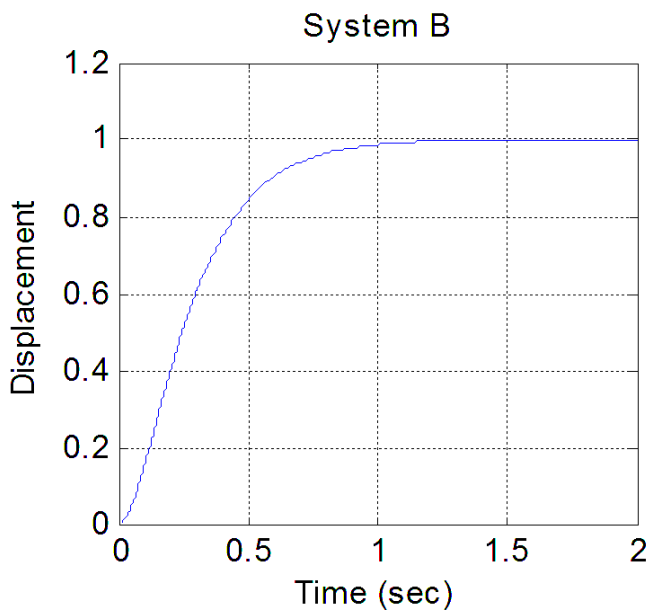
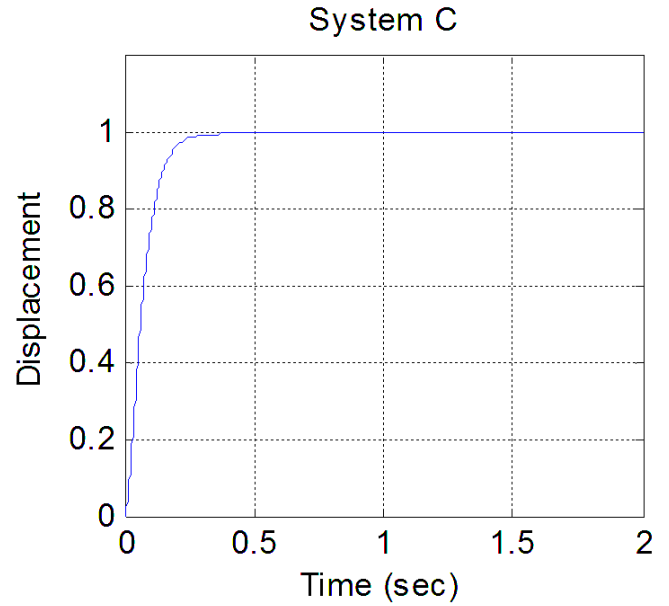
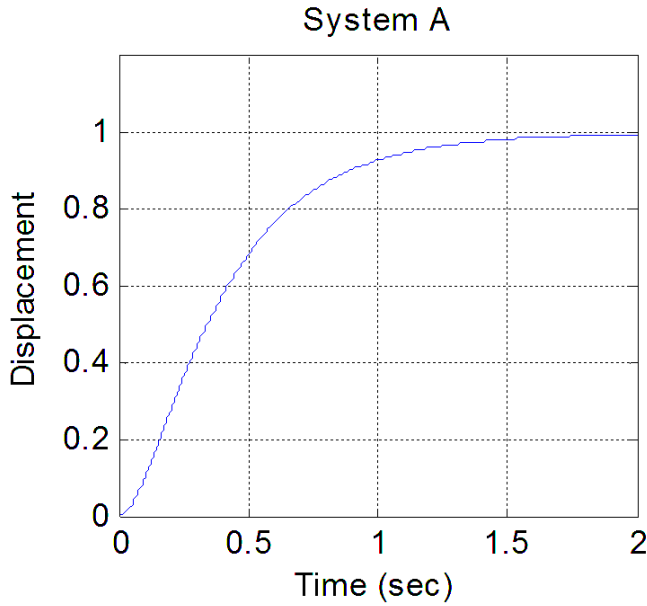
**13)** If the input to the system is  $x(t) = 50 \sin(100t)$ , then the steady state output is best estimated as

- a)  $y_{ss}(t) = -2000 \sin(100t - 100^\circ)$     b)  $y_{ss}(t) = 0.5 \sin(100t - 100^\circ)$   
c)  $y_{ss}(t) = 2000 \sin(100t - 100^\circ)$     d)  $y_{ss}(t) = 5 \sin(100t - 100^\circ)$



14) The unit step responses of four systems with real poles is shown below. Which system will have the **largest bandwidth**?

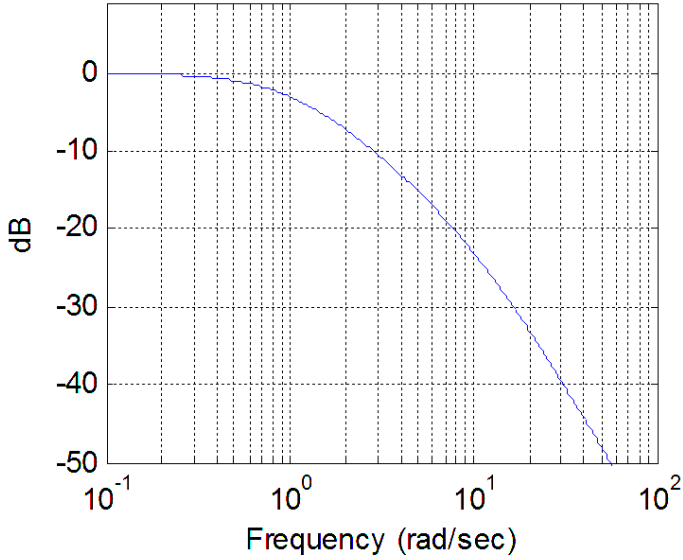
- a) System A   b) System B   c) System C   d) System D



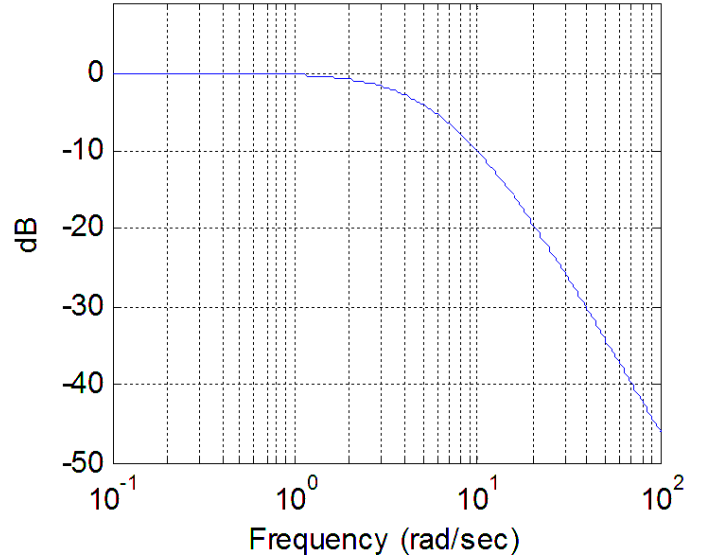
15) The magnitude of the frequency response of four systems with real poles is shown below. Which system will have the smallest **settling time**?

- a) System A   b) System B   c) System C   d) System D

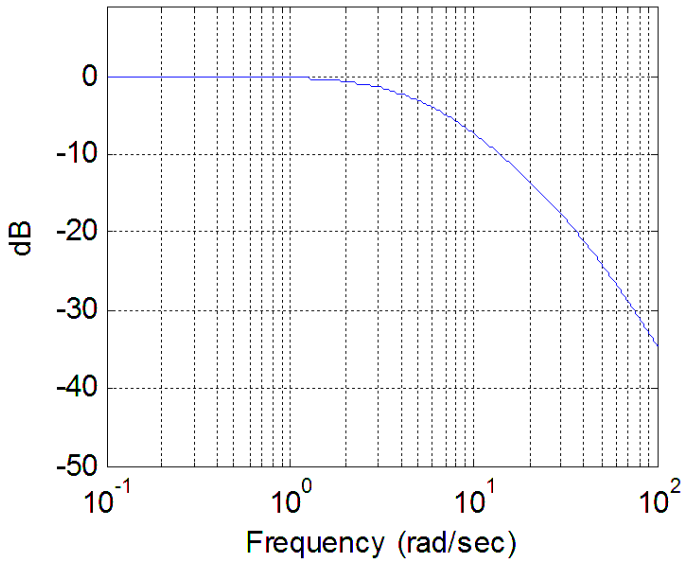
System A



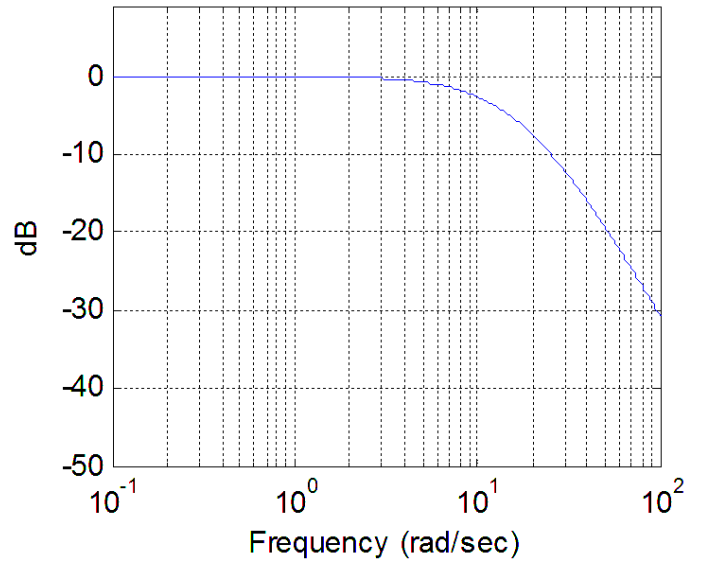
System B



System C

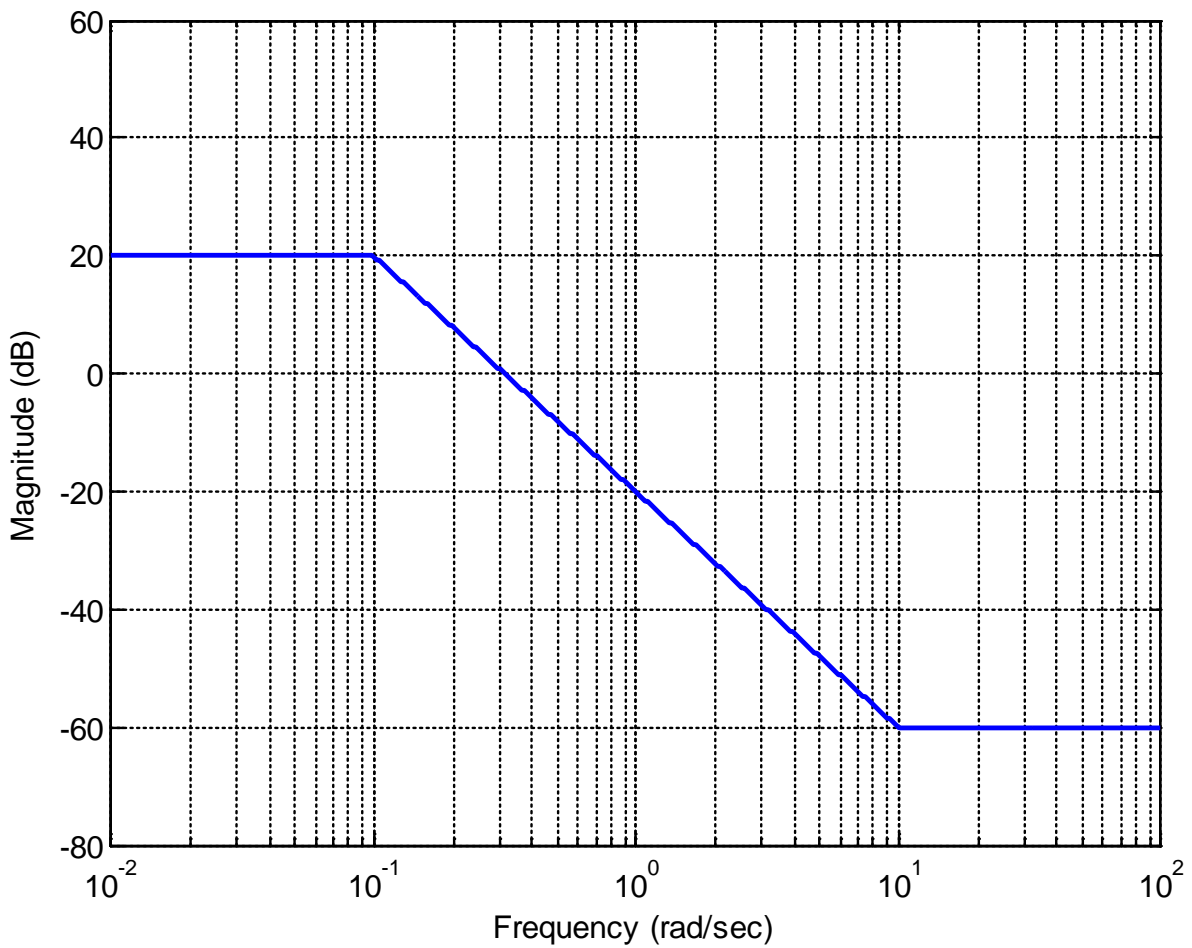


System D



16) For the straight line approximation to the magnitude portion of a Bode plot shown below, the best estimate of the corresponding transfer function is

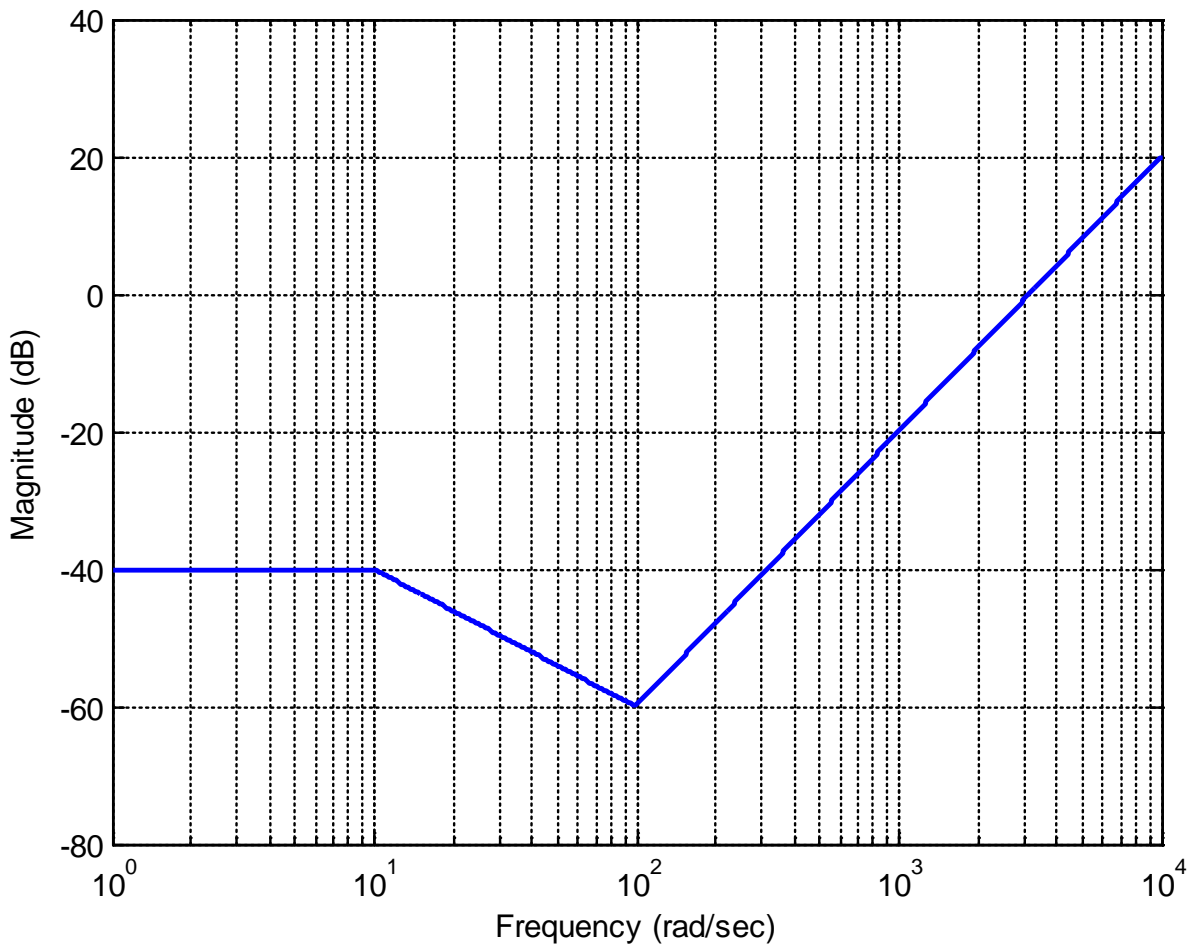
- a)  $H(s) = \frac{20\left(\frac{1}{10}s+1\right)}{10s+1}$       b)  $H(s) = \frac{10\left(\frac{1}{10}s+1\right)}{10s+1}$   
 c)  $H(s) = \frac{10\left(\frac{1}{10}s+1\right)}{(10s+1)^2}$       d)  $H(s) = \frac{10\left(\frac{1}{10}s+1\right)^2}{(10s+1)^2}$



17) For the straight line approximation to the magnitude portion of a Bode plot shown below, the best estimate of the corresponding transfer function is

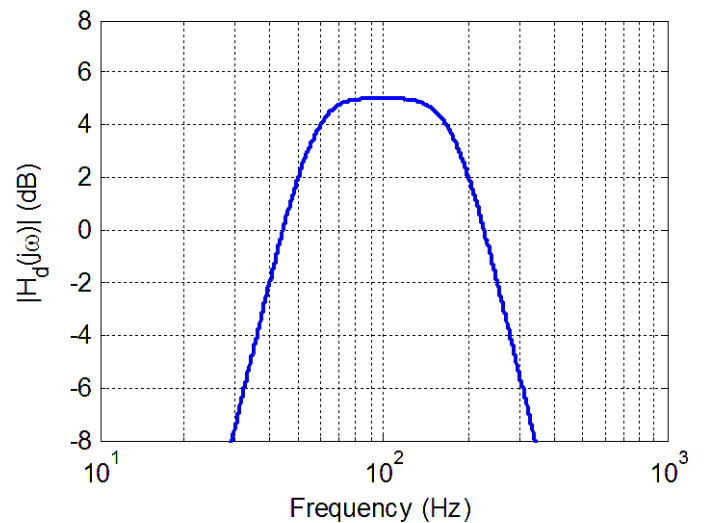
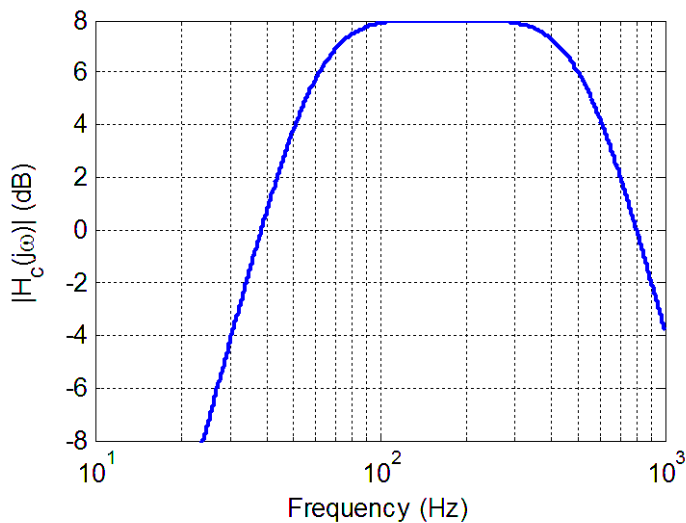
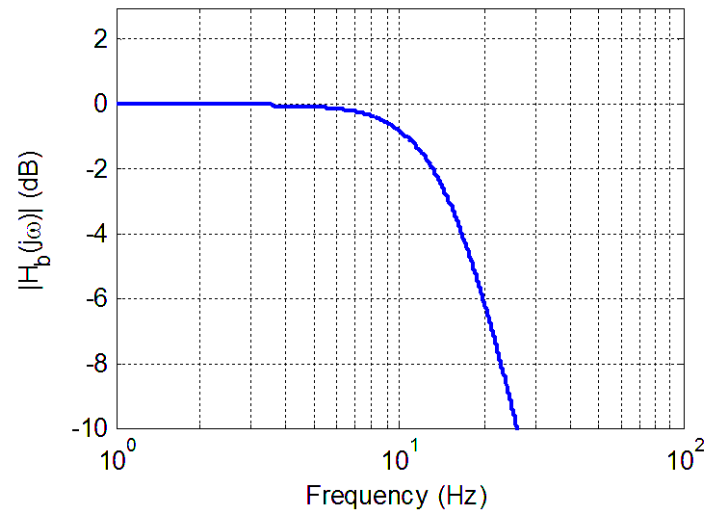
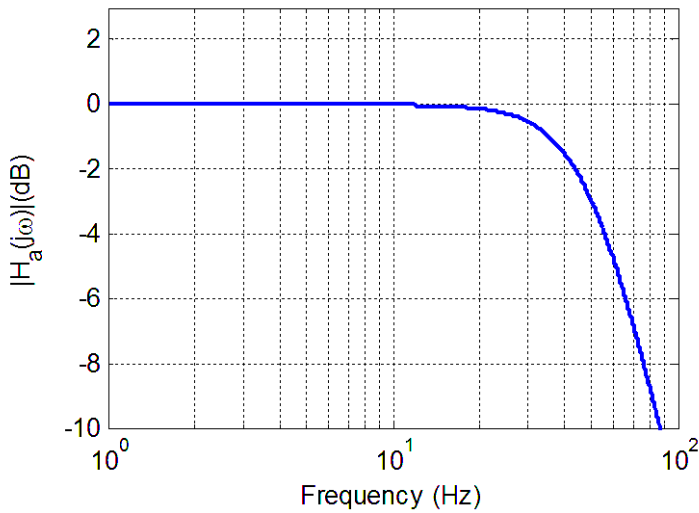
a)  $H(s) = \frac{0.01 \left( \frac{1}{100} s + 1 \right)^2}{\left( \frac{1}{10} s + 1 \right)}$       b)  $H(s) = \frac{-40 \left( \frac{1}{100} s + 1 \right)^2}{\left( \frac{1}{10} s + 1 \right)}$

c)  $H(s) = \frac{0.01 \left( \frac{1}{100} s + 1 \right)^3}{\left( \frac{1}{10} s + 1 \right)}$       d)  $H(s) = \frac{0.01 \left( \frac{1}{100} s + 1 \right)^3}{\left( \frac{1}{10} s + 1 \right)^2}$





Problems 18-23 refer to four systems, whose magnitude portion of their Bode plot is shown below.



- 18) The cutoff frequency for system A is best estimated as a) 10 Hz b) 20 Hz c) 30 Hz d) 50 Hz e) 70 Hz f) 90 Hz
- 19) The cutoff frequency for system B is best estimated as a) 6 Hz b) 8 Hz c) 10 Hz d) 15 Hz e) 20 Hz f) 25 Hz
- 20) The bandwidth of system A is best estimated as a) 10 Hz b) 20 Hz c) 30 Hz d) 50 Hz e) 70 Hz f) 90 Hz
- 21) The bandwidth of system B is best estimated as a) 6 Hz b) 8 Hz c) 10 Hz d) 15 Hz e) 20 Hz f) 25 Hz
- 22) The bandwidth of system C is best estimated as a) 300 Hz b) 440 Hz c) 500 Hz d) 760 Hz e) 920 Hz
- 23) The bandwidth of system D is best estimates as a) 80 Hz b) 120 Hz c) 150 Hz d) 200 Hz e) 250 Hz