ECE-205 Practice Quiz 10

(no Tables, Calculators, or Computers)

1) Assume $x(t) = 2\cos(3t)$ is the input to an LTI system with transfer function $H(j\omega) = 2e^{-j\omega}$. In steady state the output of this system will be

a) $y(t) = 4\cos(3t)e^{-j3}$ b) $y(t) = 4\cos(3t-3)$ c) $y(t) = 4\cos(3t-1)$ d) none of these

2) Assume $x(t) = 3\cos(2t-5)$ is the input to a system with transfer function

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

the output $y(t)$ in steady state will be

a) $y(t) = 6\cos(2t-5)$ b) $y(t) = 9\cos(2t-5)$

c) $y(t) = 9\cos(2t-5)e^{-j4}$ d) $y(t) = 9\cos(2t-9)$

3) Assume $x(t) = 2\cos(3t)$ is the input to system with transfer function $H(j\omega) = 2e^{-j\omega}$. In steady state the output of the system will be

a) $y(t) = 4\cos(3t)e^{-j\omega}$ b) $y(t) = 4\cos(3t)e^{-j3}$ c) $y(t) = 4\cos(3t-3)$

d) $y(t) = 4\cos(3t+3)$ e) none of these

4) Assume $x(t) = 2\cos(3t) + 4\cos(5t)$ is the input to a system with transfer function given by

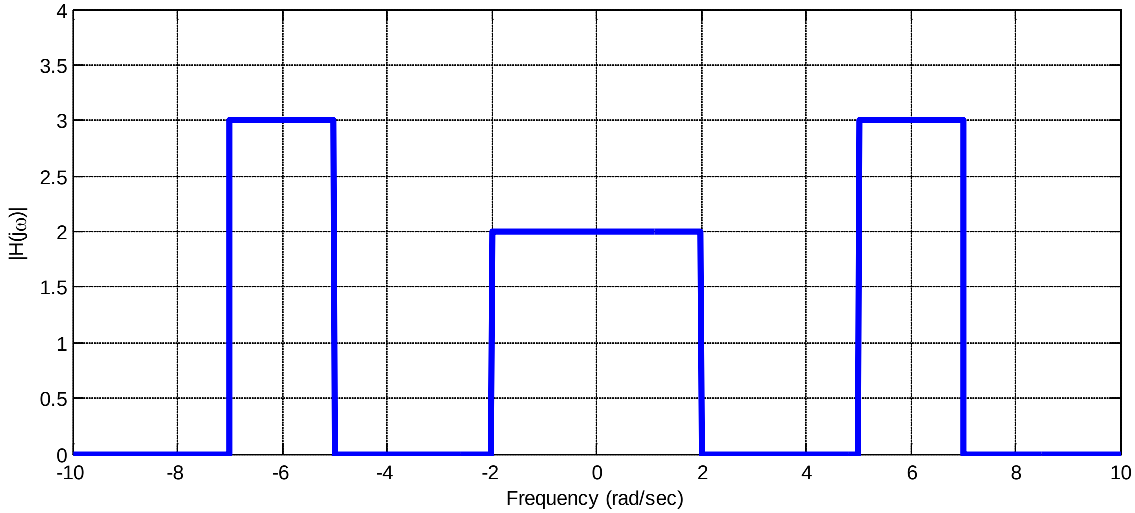
$$H(j\omega) = \begin{cases} 2 & 4 < |\omega| < 6 \\ 0 & else \end{cases}$$

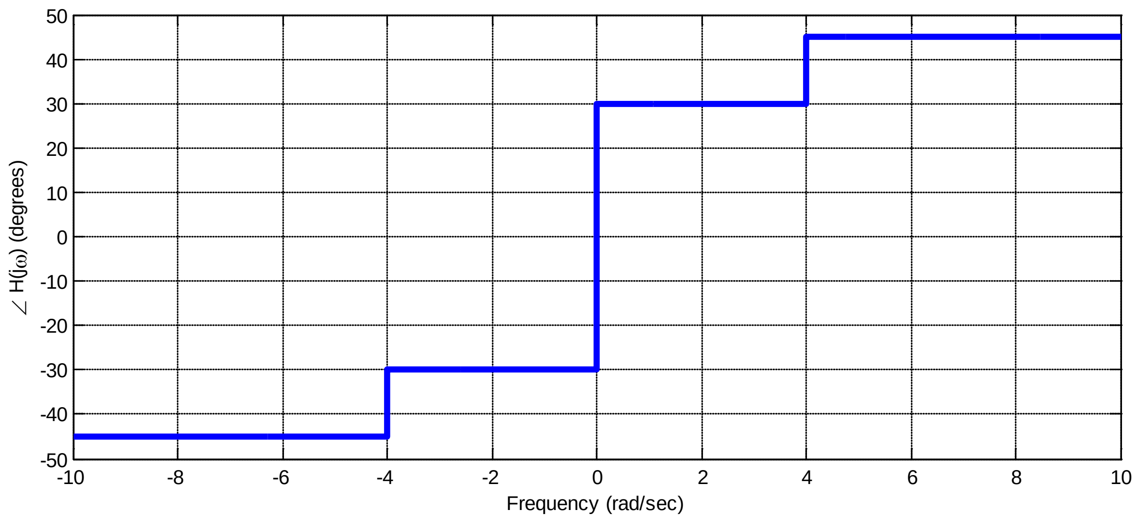
The output of the system in steady state will be

a) $y(t) = 4\cos(3t) + 8\cos(5t)$ b) $y(t) = 8\cos(5t)$

c) $y(t) = 4\cos(3t)$ d) none of these

5) Assume $x(t) = 2 + 3\cos(t) + 3\cos(4t) + 2\cos(6t)$ is the input to an LTI system with the transfer function shown graphically (magnitude and phase) below:





The steady state output of the system will be

a) 0 b) $y(t) = 2 + 3\cos(t) + 3\cos(4t) + 2\cos(6t)$ c) $y(t) = 4 + 6\cos(t) + 6\cos(6t)$

d) $y(t) = 4 + 6\cos(t + 30^0) + 6\cos(6t + 45^0)$ e) $y(t) = 2 + 6\cos(t + 30^0) + 6\cos(6t + 45^0)$

f) $y(t) = 4 + 3\cos(t + 30^0) + 2\cos(6t + 45^0) + 3\cos(t - 30^0) + 2\cos(6t - 45^0)$

g) $y(t) = 4 + 6\cos(t + 30^0) + 6\cos(6t + 45^0) + 6\cos(t - 30^0) + 6\cos(6t - 45^0)$

h) none of these

Problems 6 and 7 refer to a system whose frequency response is represented by the Bode plot below.

6) If the input to this system is $x(t) = 5\cos(10t + 45^o)$, then the steady state output is best estimated as

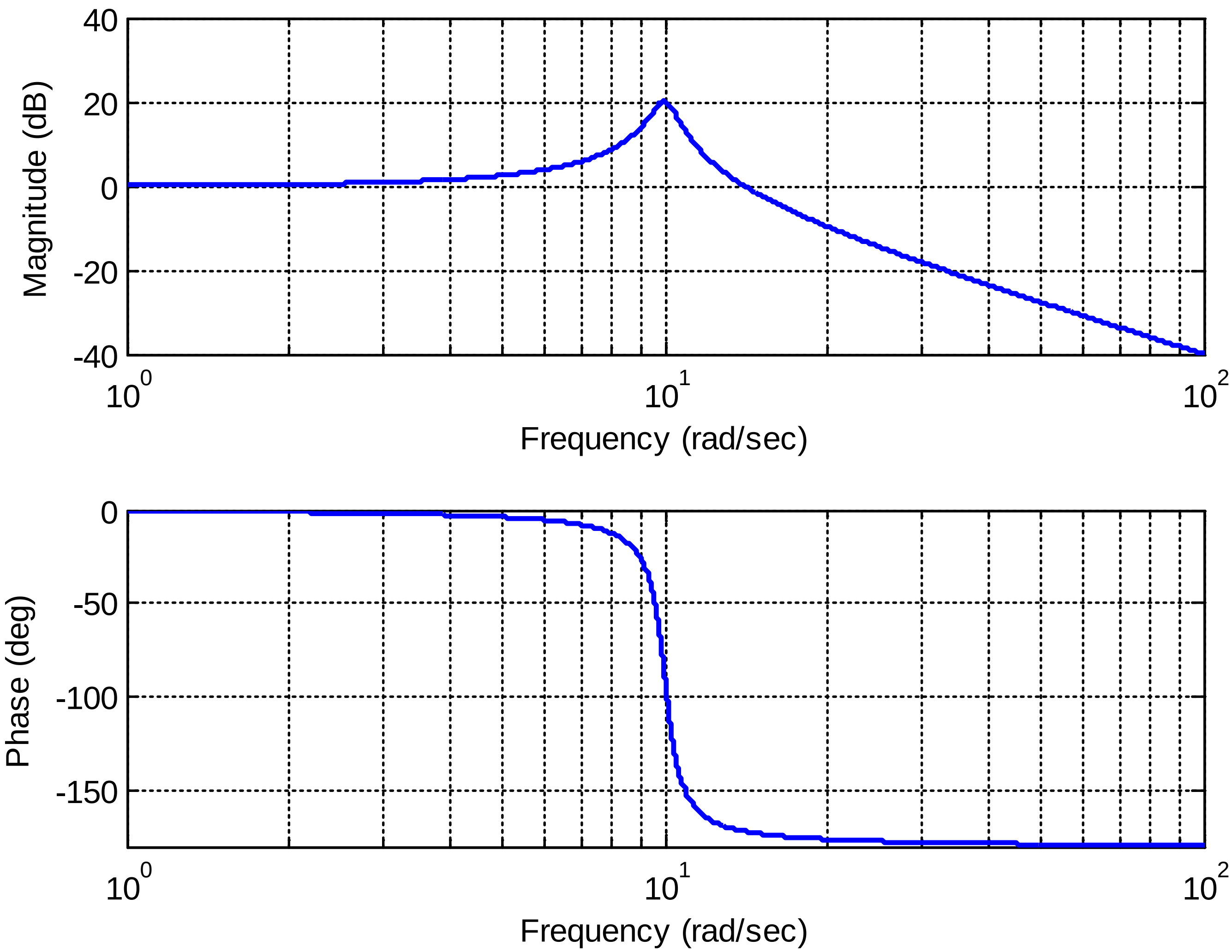
a) $y_{ss}(t) = 100\cos(10t - 55^o)$ b) $y_{ss}(t) = 50\cos(10t - 55^o)$

c) $y_{ss}(t) = 50\cos(10t - 100^o)$ d) $y_{ss}(t) = 100\cos(10t - 100^o)$

7) If the input to this system is $x(t) = 2\sin(30t + 90^o)$, then the steady state output is best estimated as

a) $x(t) = -40\sin(30t - 90^o)$ b) $x(t) = 40\sin(30t + 90^o)$

c) $x(t) = 0.2\sin(30t - 90^o)$ d) $x(t) = 0.2\sin(30t - 180^o)$



Problems 8 and 9 refer to a system whose frequency response is represented by the Bode plot below.

8) If the input to the system is $x(t) = 5\cos(100t + 30^o)$, then the steady state output is best estimated as

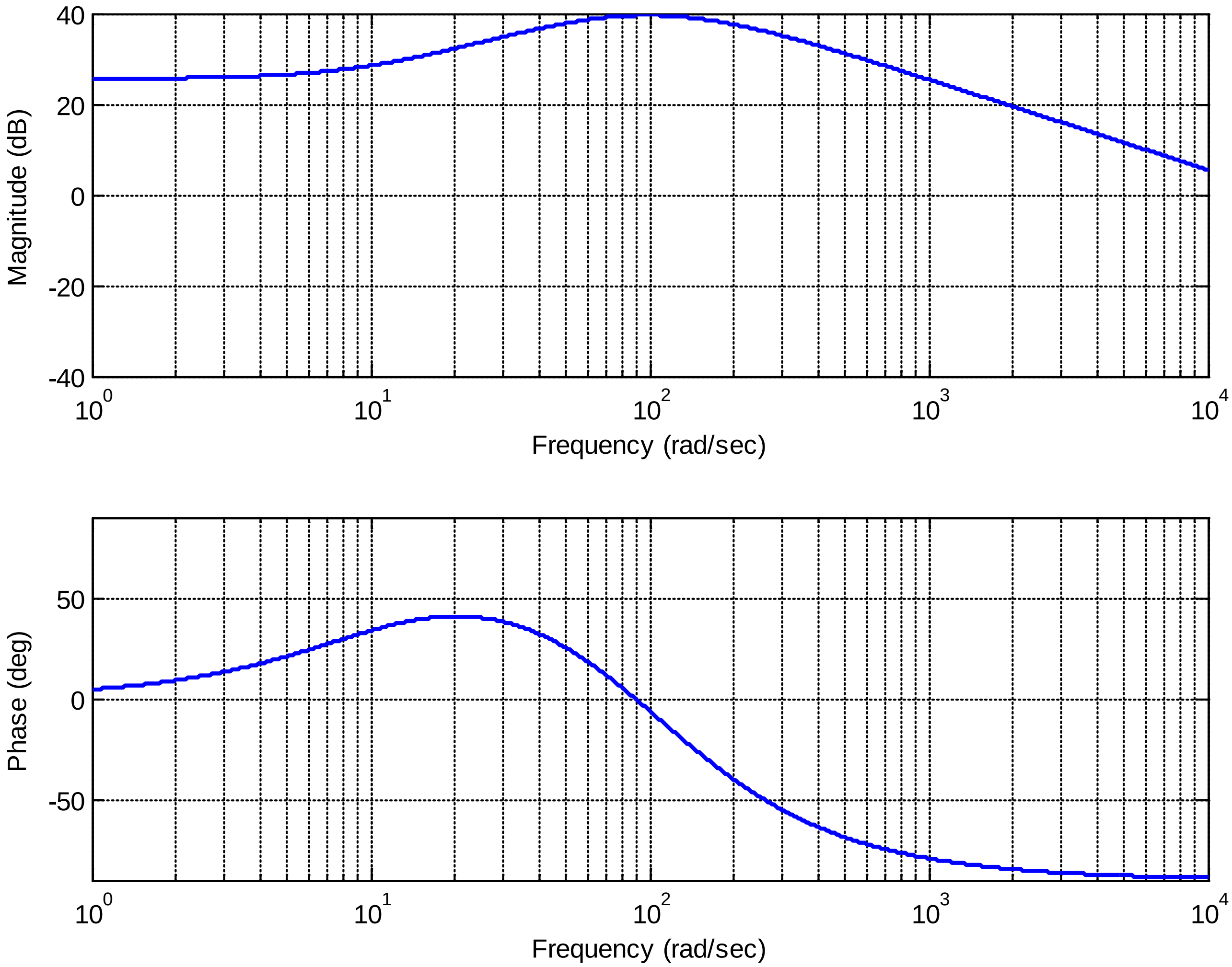
a) $y_{ss}(t) = 200\cos(100t + 30^o)$ b) $y_{ss}(t) = 500\cos(100t + 30^o)$

c) $y_{ss}(t) = 40\cos(100t + 0^o)$ d) $y_{ss}(t) = 40\cos(100t + 30^o)$

9) If the input to the system is $x(t) = 5\sin(2000t)$, then the steady state output is best estimated as

a) $y_{ss}(t) = 50\sin(2000t - 90^o)$ b) $y_{ss}(t) = 100\sin(2000t - 90^o)$

c) $y_{ss}(t) = 20\sin(2000t)$ d) $y_{ss}(t) = 20\sin(2000t - 90^o)$



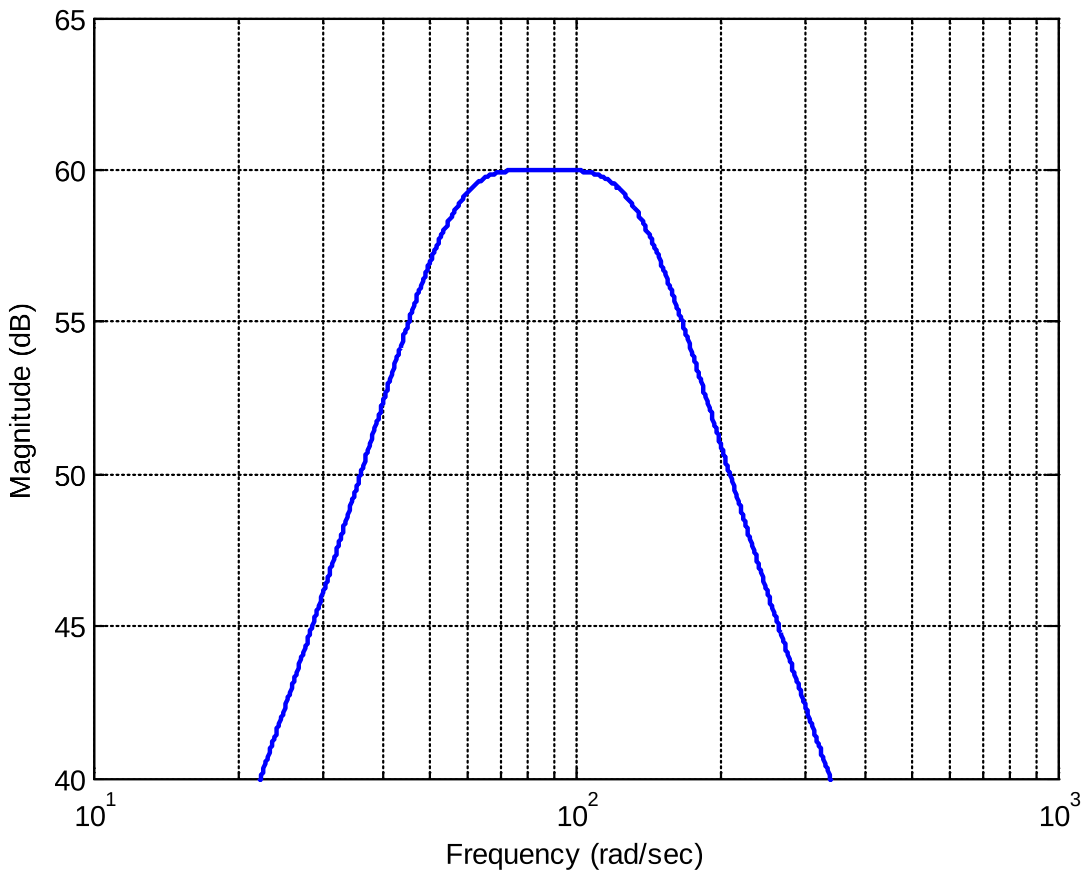
10) The **bandwidth** of the system $H(s)=\dfrac{10}{s+3}$ is a) 10 Hz b) 10 rad/sec c) 3 rad/sec d) 3 Hz

11) The **bandwidth** of the system $H(s)=\dfrac{1}{(s+2)(s+10)}$ is a) 2 rad/sec b) 2 Hz c) 10 rad/sec d) 10 Hz

12) The **bandwidth** of the system $H(s)=\dfrac{100}{(s+5)(s+10)(s+20)}$ is best estimated as

a) 5 rad/sec b) 10 rad/sec c) 20 rad/sec d) 20 Hz

Problems 13 sand 14 refer to a system whose magnitude of the frequency response is shown below.



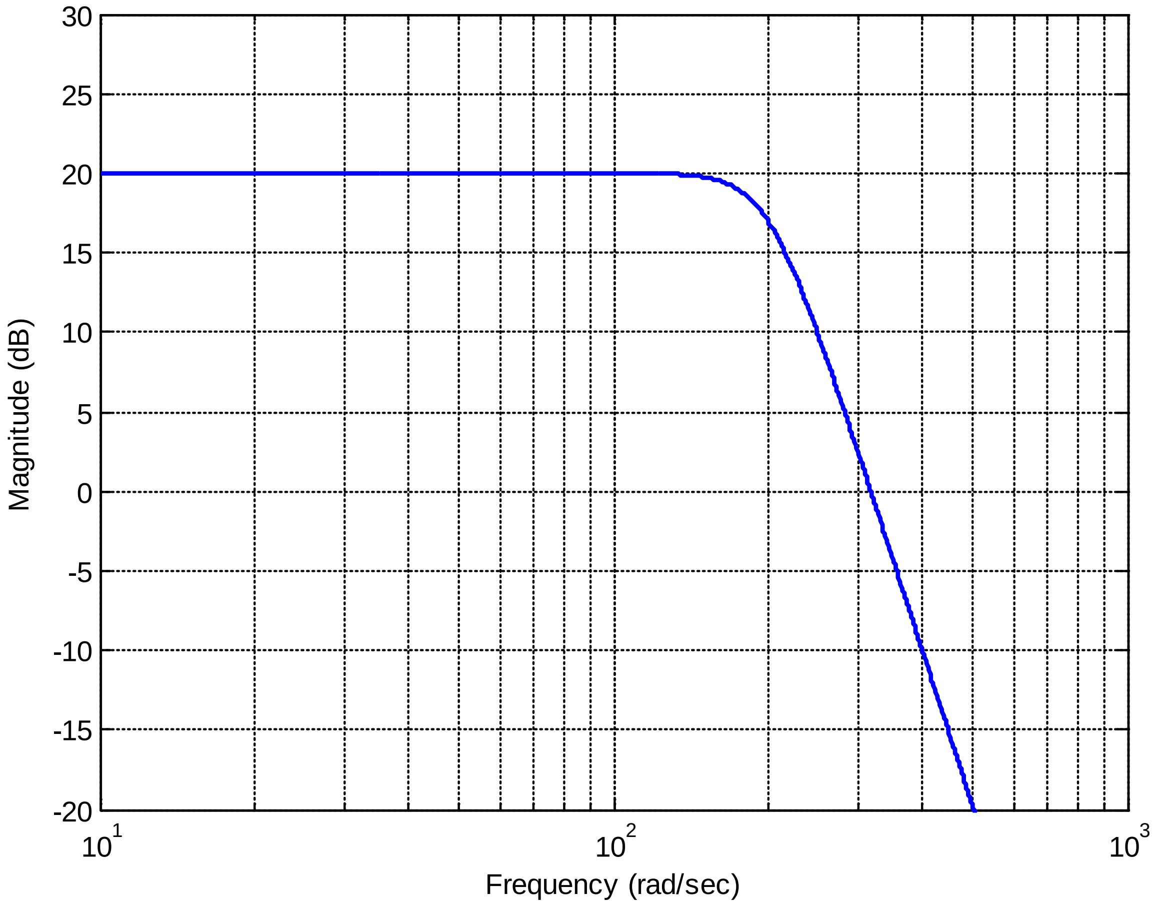
13) What type of filter does this represent?

a) lowpass b) highpass c) bandpass d) notch (band reject)

14) The bandwidth of this filter is best estimated as

a) 40 rad/sec b) 100 rad/sec c) 200 rad/sec d) 300 rad/sec

Problems 15 and 16 refer to a system whose magnitude of the frequency response is shown below.



15) What type of filter does this represent?

a) lowpass b) highpass c) bandpass d) notch (band reject)

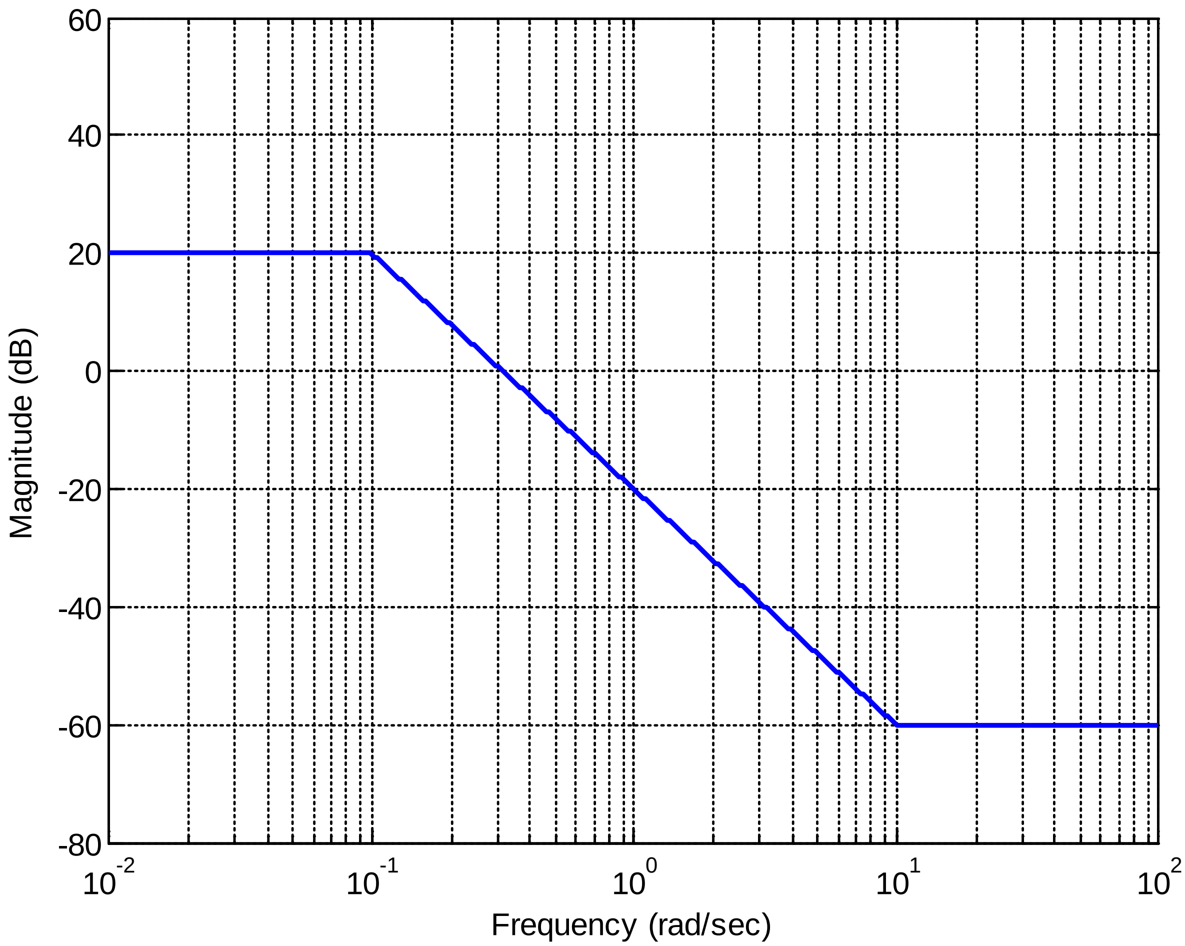
16) The bandwidth of this filter is best estimated as

a) 100 rad/sec b) 200 rad/sec c) 300 rad/sec d) 400 rad/sec

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) $H(s) = \dfrac{20\left(\frac{1}{10}s+1\right)}{10s+1}$ b) $H(s) = \dfrac{10\left(\frac{1}{10}s+1\right)}{10s+1}$

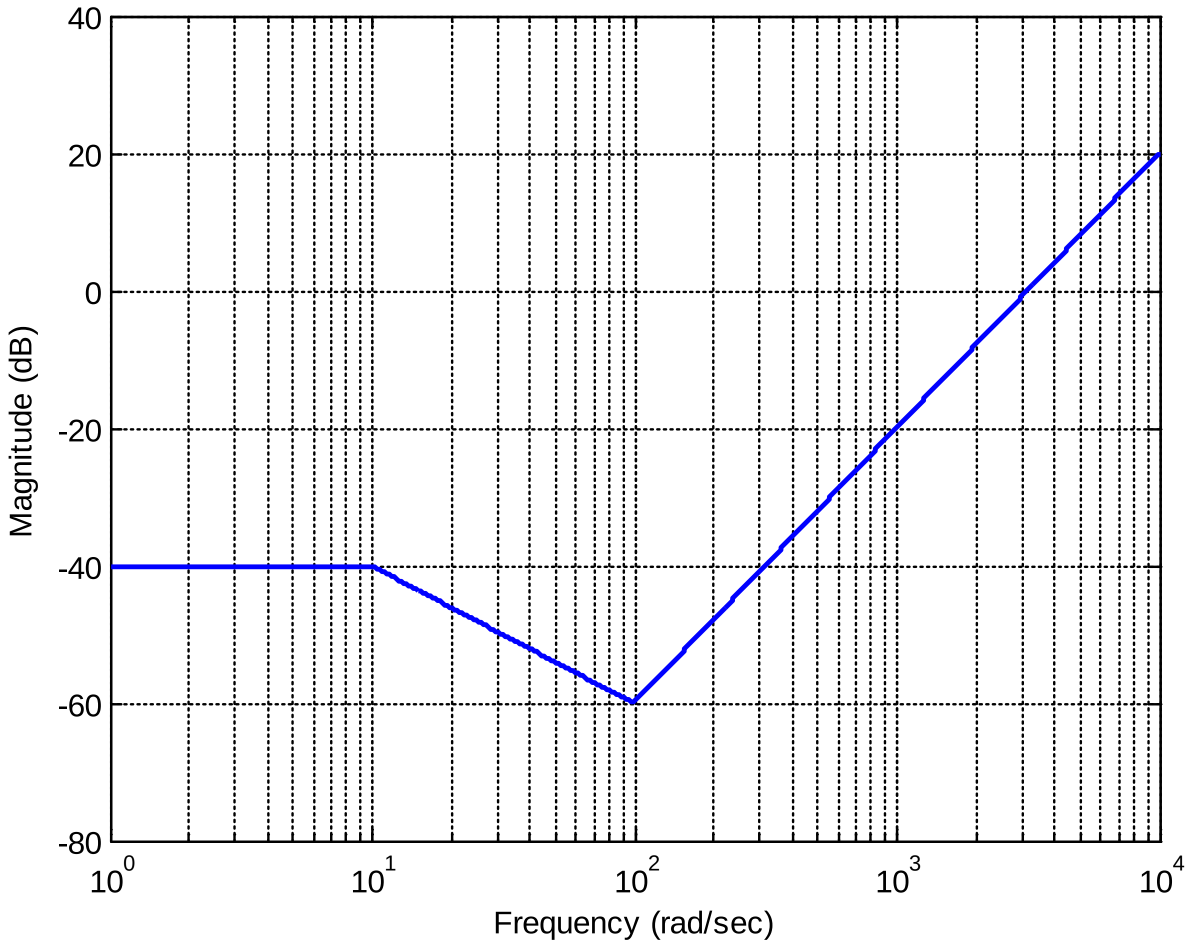
c) $H(s) = \dfrac{10\left(\frac{1}{10}s+1\right)}{(10s+1)^2}$ d) $H(s) = \dfrac{10\left(\frac{1}{10}s+1\right)^2}{(10s+1)^2}$



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

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



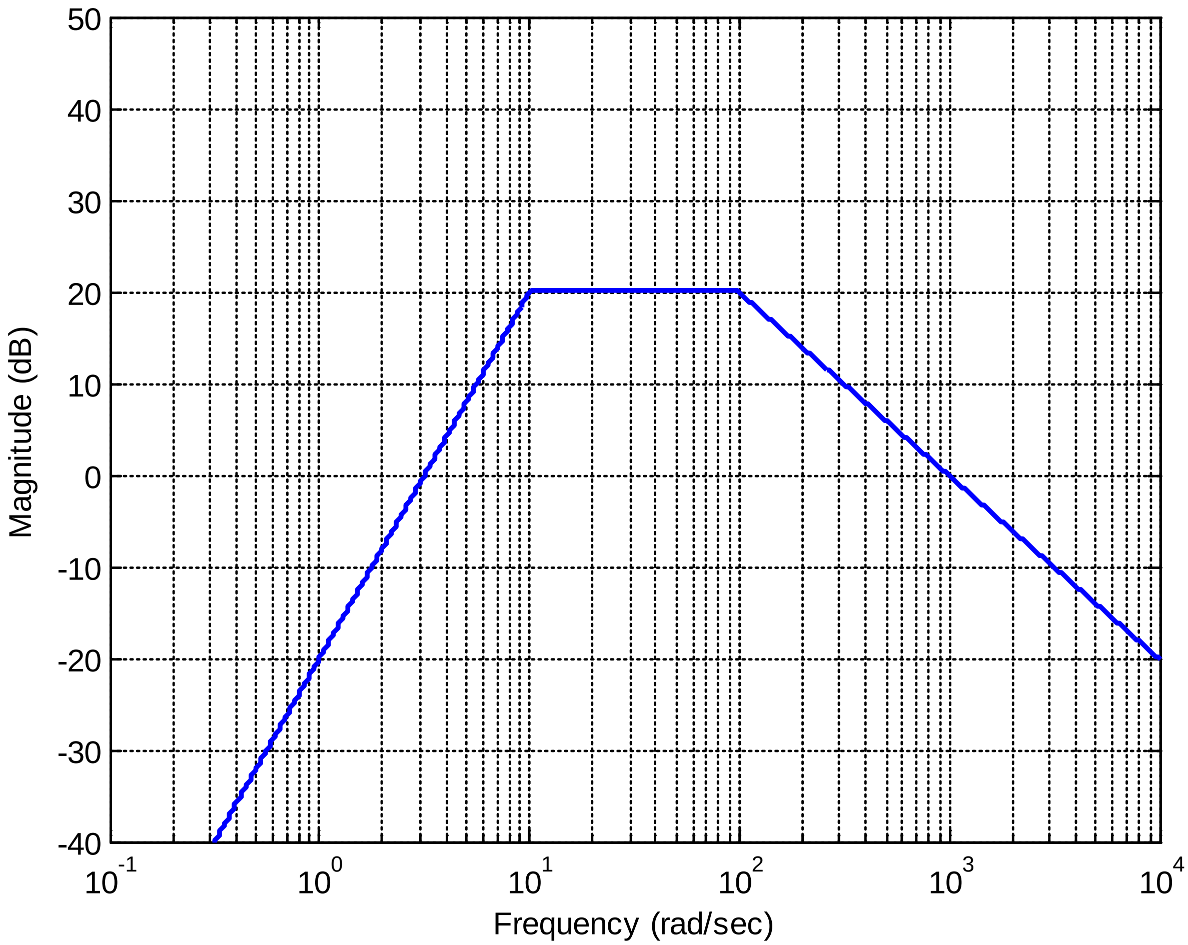
19) For the straight line approximation to the magnitude portion of a Bode plot shown below, the best estimate of the corresponding transfer function is

a) $H(s) = \dfrac{10s}{\left(\frac{1}{10}s+1\right)\left(\frac{1}{100}s+1\right)^2}$

b) $H(s) = \dfrac{10s^2}{\left(\frac{1}{10}s+1\right)^2\left(\frac{1}{100}s+1\right)}$

c) $H(s) = \dfrac{0.1s^2}{\left(\frac{1}{10}s+1\right)^2\left(\frac{1}{100}s+1\right)}$

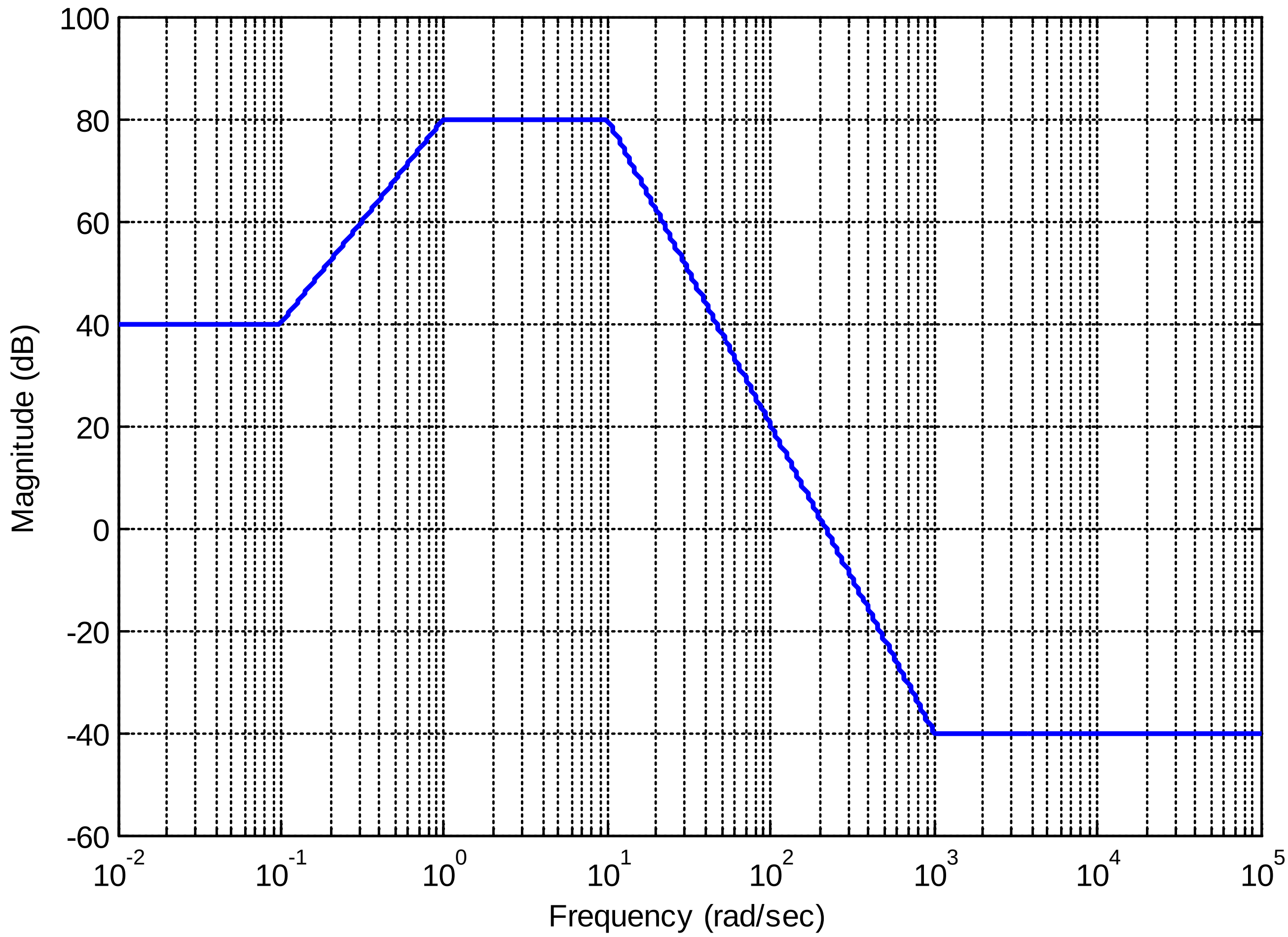
d) $H(s) = \dfrac{0.01s^2}{\left(\frac{1}{10}s+1\right)^2\left(\frac{1}{100}s+1\right)}$



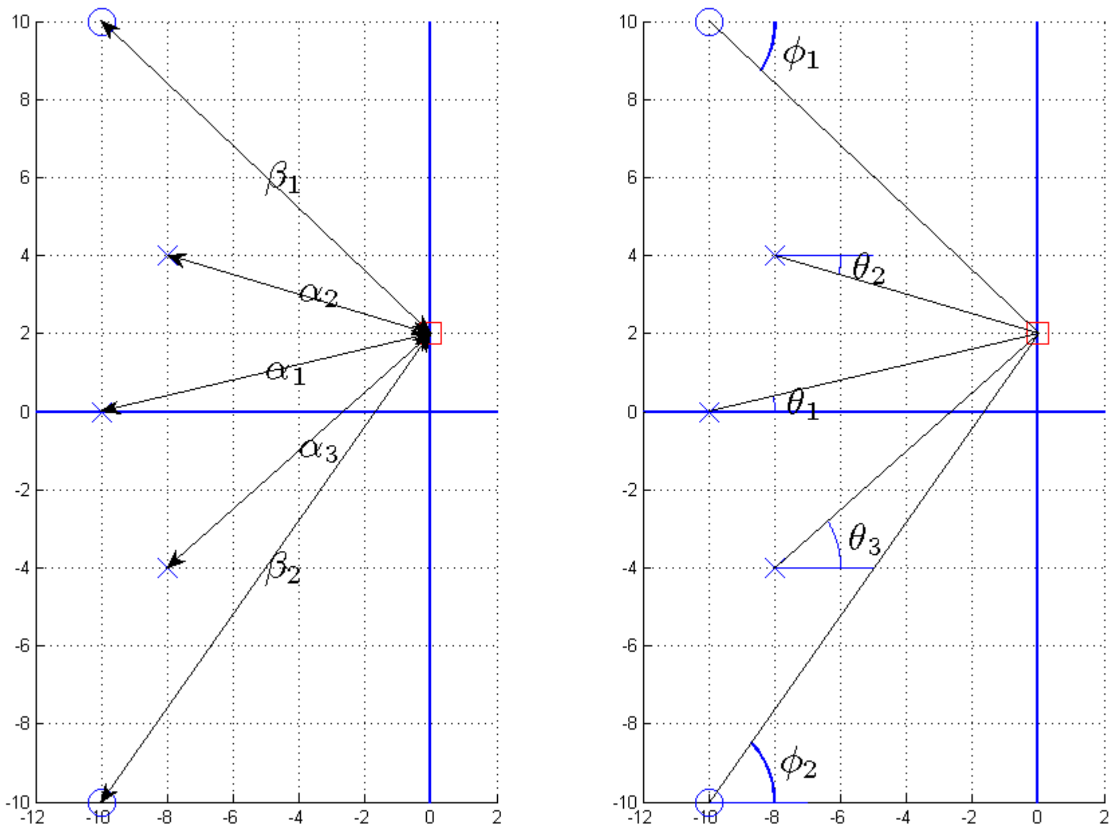
20) For the straight line approximation to the magnitude portion of a Bode plot shown below, the best estimate of the corresponding transfer function is

a) $H(s)=\dfrac{100(10s+1)\left(\frac{1}{1000}s+1\right)^3}{(s+1)\left(\frac{1}{10}s+1\right)^3}$ b) $H(s)=\dfrac{100(10s+1)\left(\frac{1}{1000}s+1\right)}{(s+1)\left(\frac{1}{10}s+1\right)}$

c) $H(s)=\dfrac{100(10s+1)^2\left(\frac{1}{1000}s+1\right)^3}{(s+1)^2\left(\frac{1}{10}s+1\right)^3}$ d) $H(s)=\dfrac{100(10s+1)^2\left(\frac{1}{1000}s+1\right)^2}{(s+1)^2\left(\frac{1}{10}s+1\right)^2}$



Problems 21 –25 refer to the following pole-zero diagram that is being used to compute the frequency response of a transfer function.



21) For this transfer function, the frequency response is computed as

a) $H(j\omega_0) = \dfrac{\alpha_1\alpha_2\alpha_3}{\beta_1\beta_2}\angle(\theta_1+\theta_2+\theta_3-\phi_1-\phi_2)$ b) $H(j\omega_0) = \dfrac{\beta_1\beta_2}{\alpha_1\alpha_2\alpha_3}\angle(\theta_1+\theta_2+\theta_3-\phi_1-\phi_2)$

c) $H(j\omega_0) = \dfrac{\beta_1\beta_2}{\alpha_1\alpha_2\alpha_3}\angle(\phi_1+\phi_2-\theta_1-\theta_2-\theta_3)$ d) $H(j\omega_0) = \dfrac{\alpha_1\alpha_2\alpha_3}{\beta_1\beta_2}\angle(\phi_1+\phi_2-\theta_1-\theta_2-\theta_3)$

22) β_2 is equal to a) $\sqrt{10^2+12^2}$ b) $\sqrt{10^2+10^2}$ c) $\sqrt{10^2+8^2}$ d) none of these

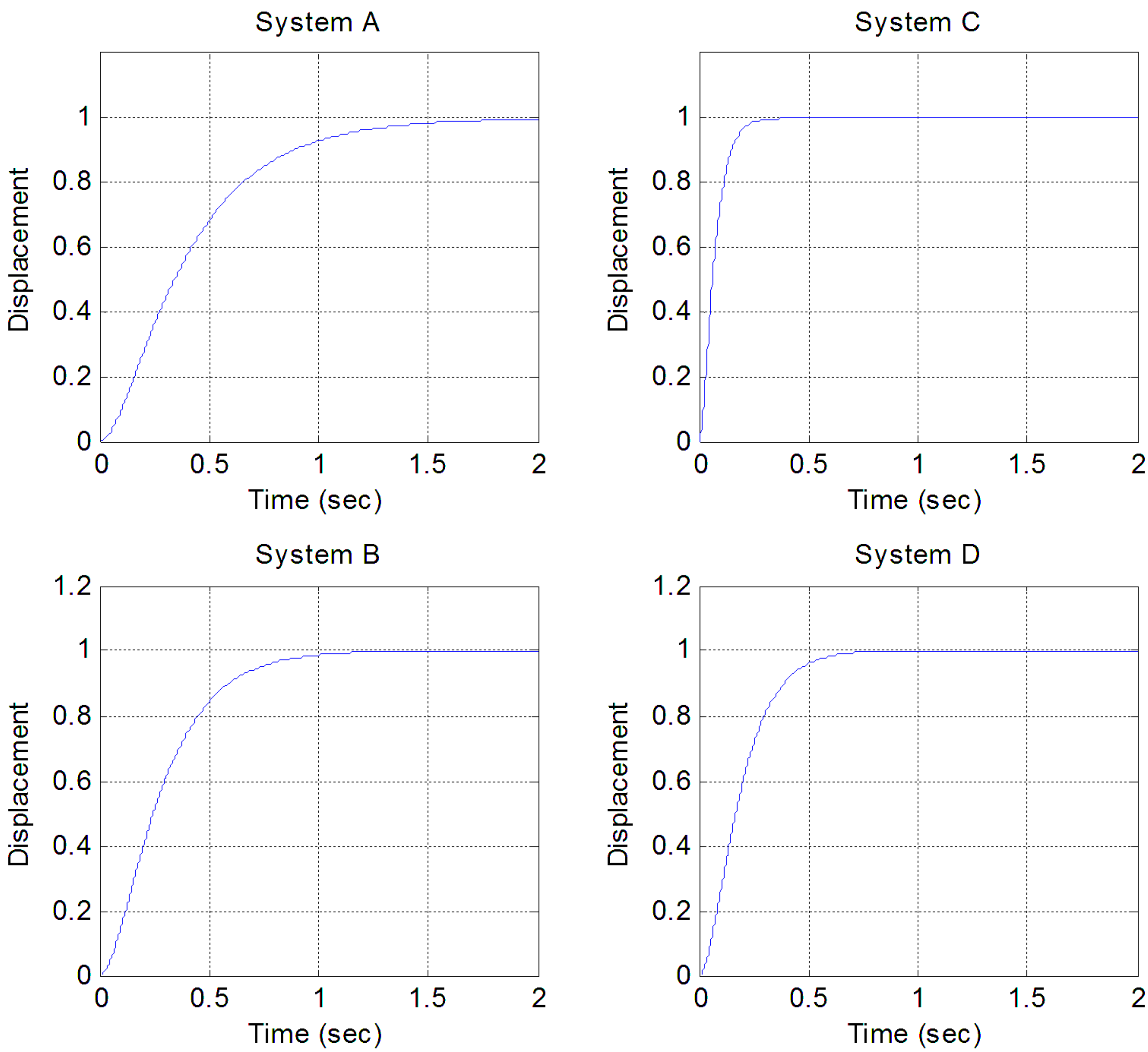
23) α_2 is equal to a) $\sqrt{8^2+6^2}$ b) $\sqrt{8^2+4^2}$ c) $\sqrt{8^2+2^2}$ d) none of these

24) θ_3 is equal to a) $\tan^{-1}\left(\dfrac{6}{8}\right)$ b) $\tan^{-1}\left(\dfrac{6}{-8}\right)$ c) $\tan^{-1}\left(\dfrac{2}{-8}\right)$ d) none of these

25) ϕ_1 is equal to a) $\tan^{-1}\left(\dfrac{8}{10}\right)$ b) $\tan^{-1}\left(\dfrac{-8}{10}\right)$ c) $\tan^{-1}\left(\dfrac{-8}{-10}\right)$ d) none of thes

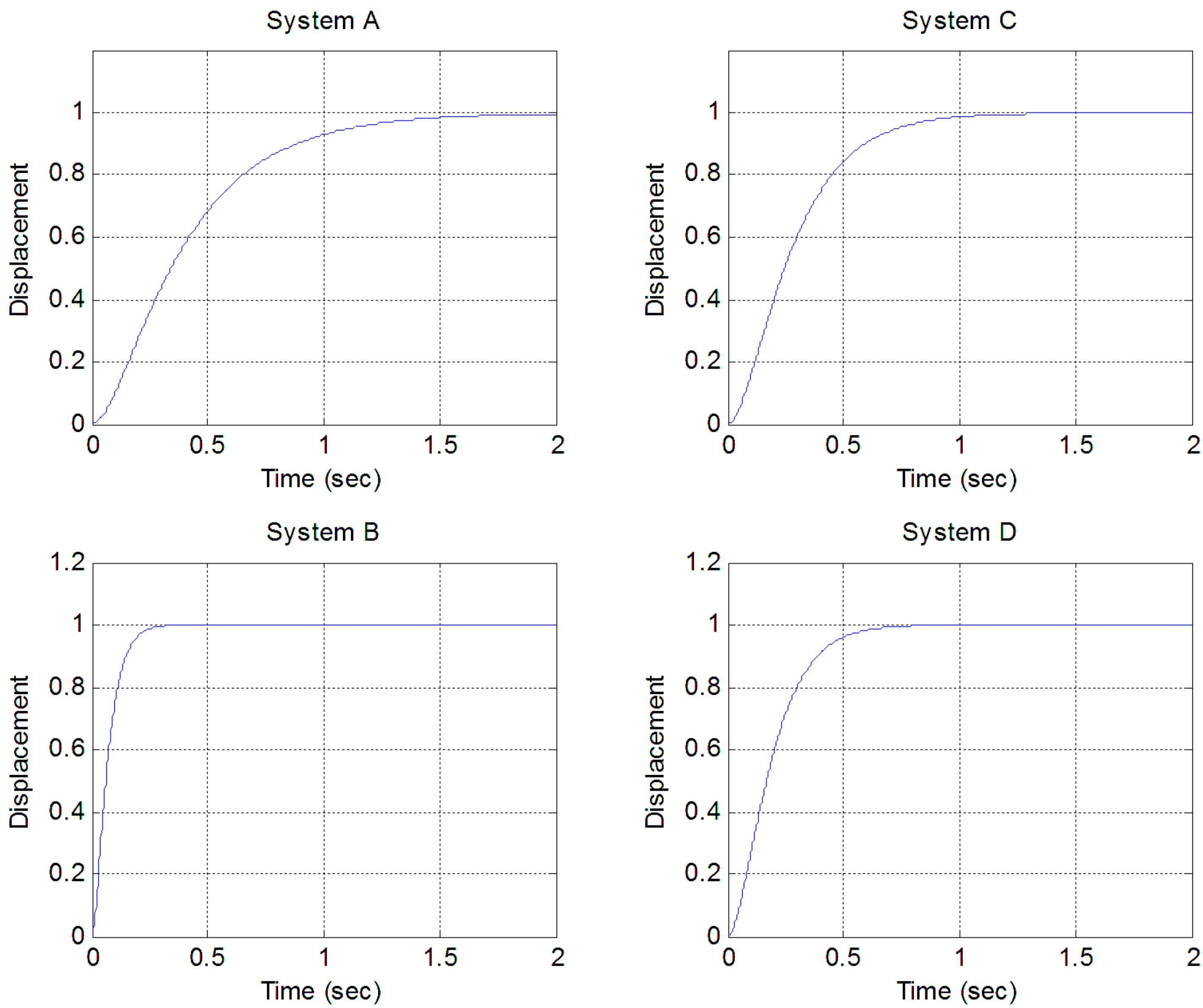
26) The unit step responses of four systems with real poles is shown below. Which system will have the **largest bandwidth**?

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



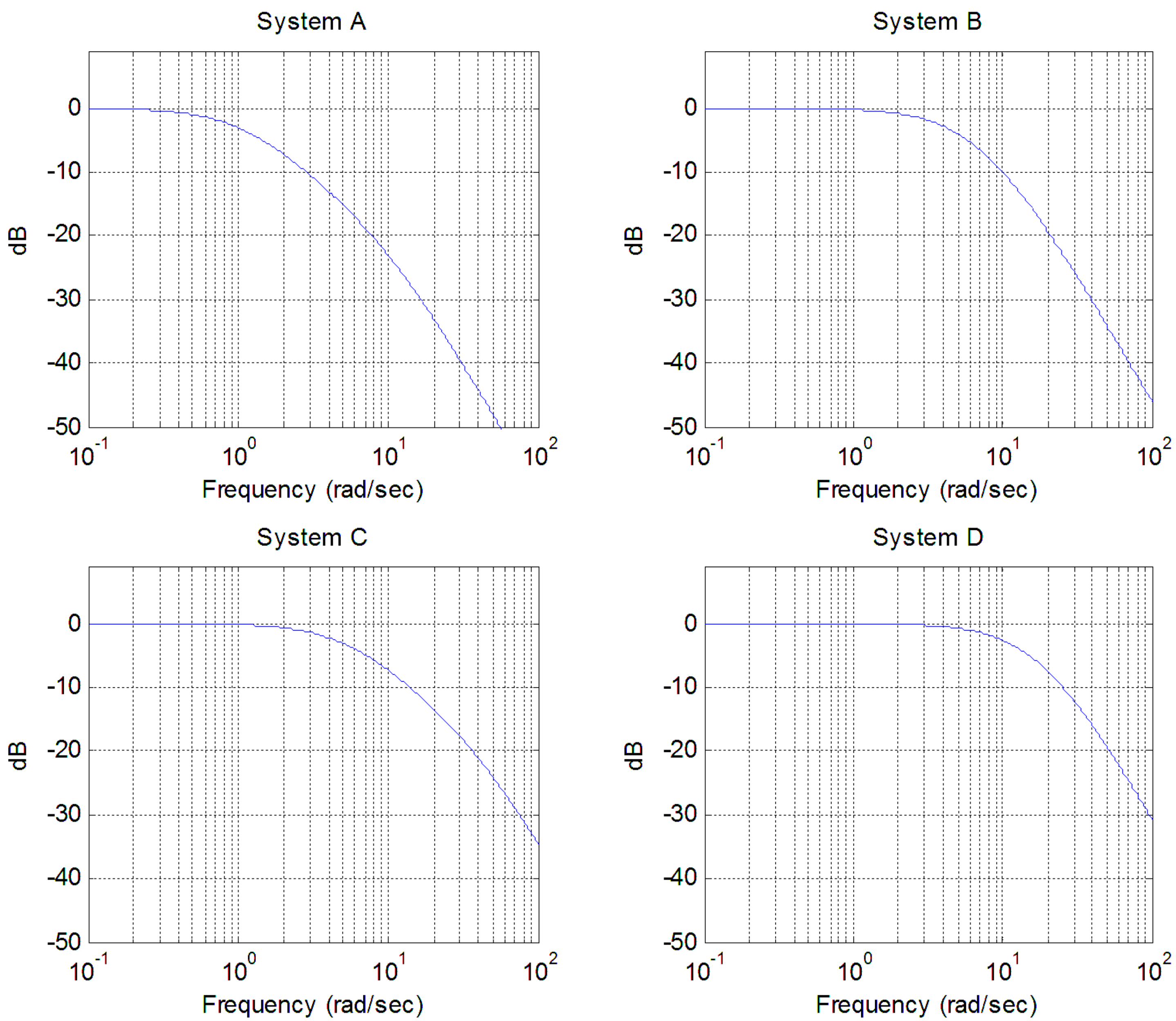
27) The **unit step responses** of four systems with real poles is shown below. Which system will have the **largest bandwidth**?

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



28) 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



Answers: 1-b, 2-d, 3-c, 4-b, 5-d, 6-b, 7-c, 8-b, 9-a, 10-c, 11-a, 12-a, 13-c, 14-b, 15-a, 16-b, 17-d, 18-c, 19-c, 20-c, 21-c, 22-a, 23-c, 24-a, 25-b, 26-c, 27-b, 28-d