Practice Quiz 5

(no calculators allowed)

For problems 1 and 2, assume $z = \frac{e^{-j\omega_0 t}}{3+2j}$,

1) The **magnitude** of z, $|z|$, is equal to

a) $\frac{1}{\sqrt{5}}$ b) $\frac{1}{\sqrt{13}}$ c) $\frac{e^{-j\omega_0 t}}{\sqrt{5}}$ d) $\frac{e^{-j\omega_0 t}}{\sqrt{13}}$ e) none of these

2) The **complex conjugate** of z, z^*, is equal to

a) $z^* = \frac{e^{-j\omega_0 t}}{3-2j}$ b) $z^* = \frac{e^{+j\omega_0 t}}{3+2j}$ c) $z^* = \frac{e^{+j\omega_0 t}}{3-2j}$ d) none of these

For problems 3 and 4, assume we know $z = 10\angle 45^0$

3) The **magnitude** of the conjugate of z, $|z^*|$, is equal to

a) 10 b) -10 c) 5 d) -5 e) none of these

4) The **phase** of the conjugate of z, $\angle z^*$, is equal to

a) 45^0 b) -45^0 c) 0^0 d) none of these

5) Are the functions $v_1(t) = 1$ and $v_2(t) = t$ **orthogonal** over the interval $[0,1]$?

a) Yes b) No

6) Are the functions $v_1(t) = 1$ and $v_2(t) = t$ **orthogonal** over the interval $[-1,1]$?

a) Yes b) No

7) Are the functions $v_1(t) = e^{jk\omega_o t}$ and $v_2(t) = e^{jm\omega_o t}$ where $k \neq m$, k and m are integers, and $\omega_o T_o = 2\pi$, orthogonal over the interval $[0, T_o]$?

a) Yes b) No

8) Using Euler's identity, we can write $\cos(\omega t)$ as

a) $\dfrac{e^{j\omega t}+e^{-j\omega t}}{2}$ b) $\dfrac{e^{j\omega t}-e^{-j\omega t}}{2}$ c) $\dfrac{e^{j\omega t}+e^{-j\omega t}}{2j}$ d) $\dfrac{e^{j\omega t}-e^{-j\omega t}}{2j}$

9) Using Euler's identity, we can write $\sin(\omega t)$ as

a) $\dfrac{e^{j\omega t}+e^{-j\omega t}}{2}$ b) $\dfrac{e^{j\omega t}-e^{-j\omega t}}{2}$ c) $\dfrac{e^{j\omega t}+e^{-j\omega t}}{2j}$ d) $\dfrac{e^{j\omega t}-e^{-j\omega t}}{2j}$

For problems 10 and 11, assume we have an LTI system with impulse response $h(t)=e^{-t}u(t+1)$

10) Is the system **causal**? a) yes b) no

11) Is the system **BIBO** stable? a) yes b) no

12) 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

Problems 13-15 refer to a system with transfer function $H(s)=\dfrac{10}{s+3}$. Assume the input to this system is $x(t)=2\cos(3t+30^o)$

13) In steady state, the **magnitude** of the output will be

a) $\dfrac{20}{3}$ b) $\dfrac{20}{\sqrt{18}}$ c) $\dfrac{20}{\sqrt{8}}$ d) $\dfrac{20}{6}$

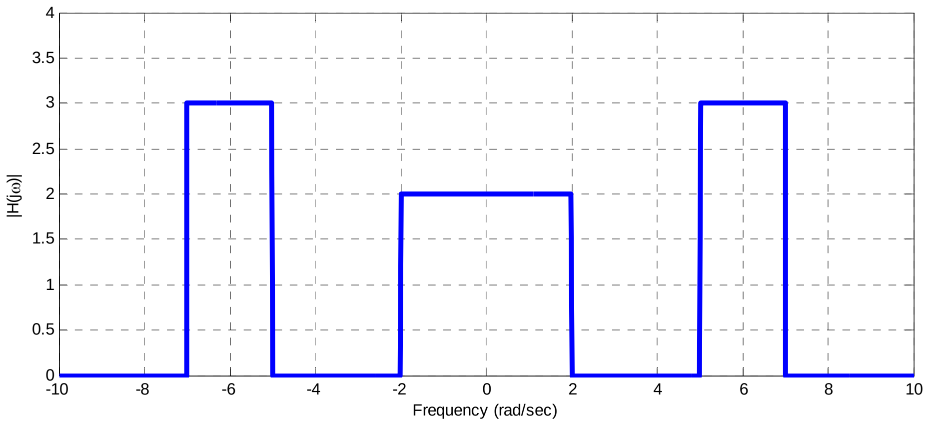
14) In steady state, the **phase** of the output will be

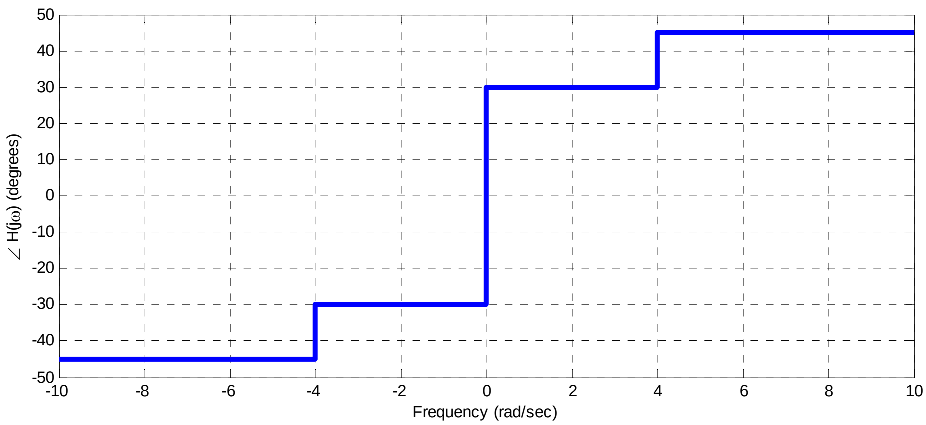
a) 30^o b) 45^o c) -15^o d) -45^o

15) The **bandwidth** (-3 dB point) of the system is

a) 10 Hz b) 10 radians/sec c) 3 radians/sec d) 3 Hz

16) 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

17) 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) $y(t) = 9\cos(2t - 9)$

18) 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

19) Assume $x(t) = 2\cos(t) + 5\sin(2t) + 6\sin(3t)$ is the input to a system with transfer function $H(j\omega) = 3\Pi\left(\frac{\omega}{5}\right)$. In steady state the output of the system will be

a) $y(t) = \left[2\cos(t) + 5\sin(2t) + 6\sin(3t)\right]\left[3\text{rect}\left(\frac{\omega}{5}\right)\right]$
b) $y(t) = 6\cos(t) + 15\sin(2t) + 18\sin(3t)$
c) $y(t) = 6\cos(t) + 15\sin(2t)$
d) none of these

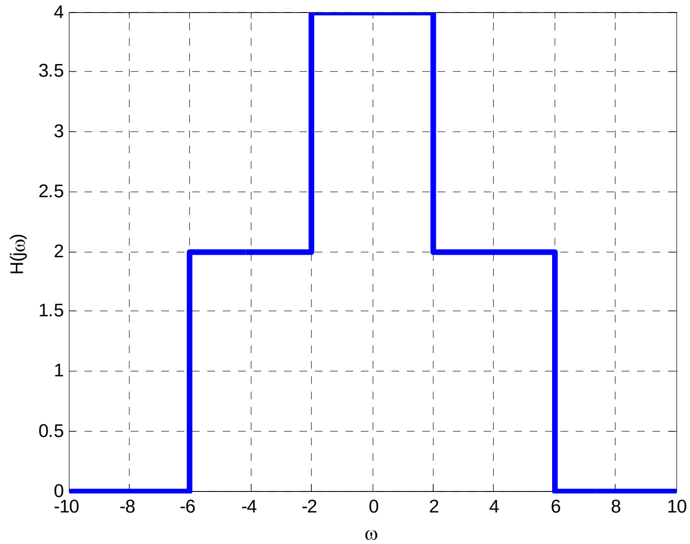
20) Assume $x(t) = 2\cos(3t) + 4\cos(5t)$ is the input to a system with transfer function given by

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

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

21) Assume $x(t) = \cos(t) + \cos(5t) + \cos(9t)$ is the input to a system with transfer function given below:



The output of this system in steady state will be

a) $y(t) = 4\cos(t) + 4\cos(5t)$ b) $y(t) = 4\cos(t) + 2\cos(5t) + \cos(9t)$
c) $y(t) = 4\cos(t) + 2\cos(5t)$ d) none of these

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