

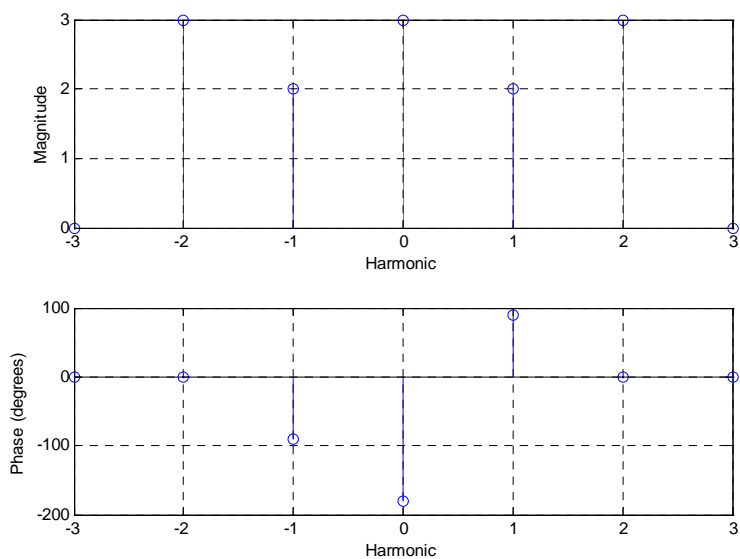
## Practice Quiz 7

(no calculators allowed)

1) Assume  $x(t)$  is a periodic function with Fourier series representation  $x(t) = \sum c_k^x e^{jk\omega_0 t}$ .  $x(t)$  is the input to an LTI system with output  $y(t) = 3\dot{x}(t-2)$ . The Fourier series coefficients  $c_k^y$  are related to the  $c_k^x$  in which of the following ways

- a)  $c_k^y = 3jk\omega_0 e^{+jk\omega_0 2} c_k^x$       b)  $c_k^y = -3jk\omega_0 e^{-jk\omega_0 2} c_k^x$   
 c)  $c_k^y = 3jk\omega_0 e^{-jk\omega_0 2} c_k^x$       d)  $c_k^y = -3jk\omega_0 e^{+jk\omega_0 2} c_k^x$

Problems 2-5 refer to the following spectrum plot for a signal  $x(t)$  with fundamental frequency  $\omega_0 = 2$ . All angles are multiples of 90 degrees.



2) What is the average value of  $x(t)$ ?    a) 13    b)  $\frac{13}{7}$     c)  $\frac{13}{5}$     d) 3    e) -3

3) What is the average power in  $x(t)$ ?    a) 13    b)  $\frac{13}{7}$     c) 35    d) 3

4) If  $x(t)$  is the input to a system with transfer function

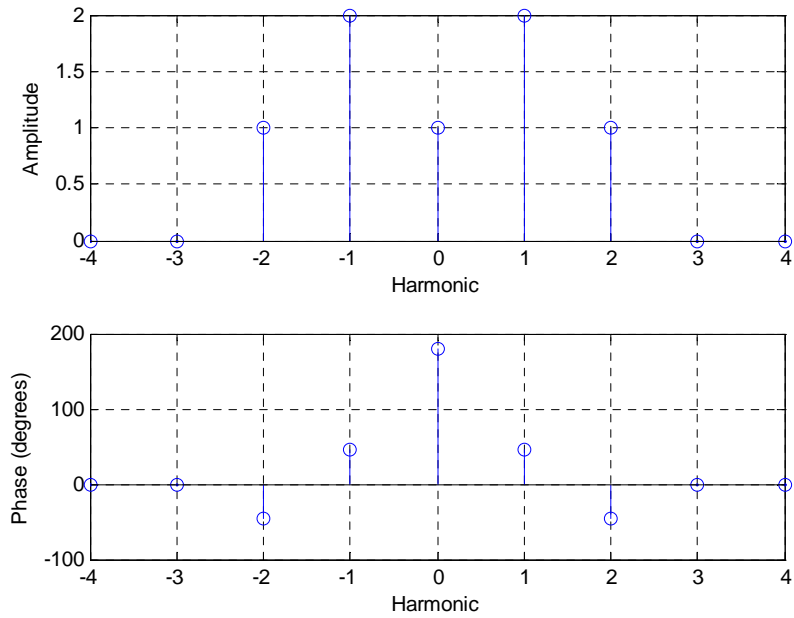
$$H(\omega) = \begin{cases} 2 & 1 < |\omega| < 3 \\ 0 & \text{else} \end{cases}$$

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

a)  $12 \cos(2t)$     b)  $4 \cos(2t + 90^\circ)$     c)  $8 \cos(t + 90^\circ)$     d)  $8 \cos(2t + 90^\circ)$     e)  $6 \cos(2t)$

5) The average power in  $y(t)$  is                      a) 4    b) 8    c) 16    d) 32

Problems 6-8 refer to the following plot (all angles are multiples of 45 degrees)



6) Is this a valid spectrum plot for a real valued function  $x(t)$ ? a) Yes b) No

7) Assuming the magnitude portion of the spectrum is correct, what is the average power in  $x(t)$ ?

a) 4 b) 7 c) 11 d) 12

8) Assuming the plot is a valid spectrum plot for a real valued function  $x(t)$ , the average value of  $x(t)$  is

a) 1 b) 2 c)  $\frac{7}{4}$  d) -1

Problems 9-13 refer to the following Fourier series representation of a periodic signal

$$x(t) = 2 + \sum_{k=-\infty}^{k=\infty} \frac{2}{2 + jk} e^{\frac{jkt}{2}}$$

9) The average value of  $x(t)$  is

- a) 1   b) 2   c) 3   d) 4

10) The average power in the DC component of  $x(t)$  is

- a) 1   b) 2   c) 4   d) 8   e) 9   f) 18

11) If  $x(t)$  is the input to a system with transfer function

$$H(\omega) = \begin{cases} 2 & |\omega| < 0.4 \\ 0 & \text{else} \end{cases}$$

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

- a) 0   b) 3   c) 6   d)  $1.79 \cos(0.5t - 26.6^\circ)$    e)  $6 + 3.58 \cos(0.5t - 26.6^\circ)$

12) If  $x(t)$  is the input to a system with transfer function

$$H(\omega) = \begin{cases} 2 & |\omega| > 0.4 \\ 0 & \text{else} \end{cases}$$

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

- a)  $2x(t)$    b)  $2x(t) - 3$    c)  $2x(t) - 6$    d) none of these

13) If  $x(t)$  is the input to a system with transfer function

$$H(\omega) = \begin{cases} 0 & 0.4 < |\omega| < 0.6 \\ 2 & \text{else} \end{cases}$$

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

- a)  $1.79 \cos(0.5t - 26.6^\circ)$    b)  $3.58 \cos(0.5t - 26.6^\circ)$   
c)  $2x(t) - 1.79 \cos(0.5t - 26.6^\circ)$    d)  $2x(t) - 3.58 \cos(0.5t - 26.6^\circ)$

For problems 14 and 15, assume  $x(t) = 1 + 3\sin(2t + 45^\circ)$

**14)** The average value of  $x(t)$  is

- a) 0    b) 1    c) 2    d) 4

**15)** The average power in  $x(t)$  is

- a) 1    b)  $\frac{13}{4}$     c) 5.5    d) 19

Problems 16 and 17 refer to the periodic function  $x(t)$  defined over one period  $T_0 = 3$  as  $x(t) = t$   $0 \leq t < 3$  which has the Fourier series representation

$$x(t) = \frac{3}{2} + \sum_{k \neq 0} \frac{3j}{k2\pi} e^{jk\frac{2\pi}{3}t}$$

**16)** The average power in  $x(t)$  is

- a) 0    b)  $\frac{3}{2}$     c)  $\frac{9}{4}$     d) 3    e)  $\frac{9}{2}$

**17)** If this signal is the input to a transfer function  $H(j\omega) = 0.5e^{-j0.25\omega}$ , the steady state output will be

- a)  $0.5(t - 0.25)$     b)  $0.5te^{-j0.25\omega}$     c)  $0.5(t + 0.25)$     d) none of these

Answers: 1) c    2) e    3) c    4) d    5) d

6) b    7) c    8) d

9) c    10) e    11) c    12) c    13) d

14) b    15) c    16) d    17) a