Name: _____

ID Number: _____

Lab section: _____

Lecture section: _____

*I have neither given nor received aid on this examination, nor have I concealed any violation of the Honor Code.*

Signature: _____

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EECS 206 Exam 1, 2002-10-3
DO NOT TURN THIS PAGE OVER UNTIL TOLD TO BEGIN!

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- This is a 90 minute exam.

- It is closed book, closed notes, closed computer.

- You may use one 8.5x11" piece of paper, both sides, and a calculator.

- Read the questions carefully. They are multiple choice, so there is no partial credit.

- There are 10 problems. The questions are not necessarily in order of increasing difficulty.

- This exam has 5 pages. Make sure your copy is complete.

- Continuing to write *anything* after the ending time is announced will be considered an honor code violation. *Fill out your name etc. above now.*

- For each problem, clearly circle the letter for your answer in this table.

| 1.  | a | b | c | d | e | f | g |
|-----|---|---|---|---|---|---|---|
| 2.  | a | b | c | d | e | f | g |
| 3.  | a | b | c | d | e | f | g |
| 4.  | a | b | c | d | e | f | g |
| 5.  | a | b | c | d | e | f | g |
| 6.  | a | b | c | d | e | f | g |
| 7.  | a | b | c | d | e | f | g |
| 8.  | a | b | c | d | e | f | g |
| 9.  | a | b | c | d | e | f | g |
| 10. | a | b | c | d | e | f | g |

## 1.
Determine the RMS value of the following signal over the support $\{-2 \le t \le 6\}$:

$$x(t) = \begin{cases} 2, & |t| \le 2, \\ -4, & 4 \le t \le 6 \\ 0, & \text{otherwise.} \end{cases}$$

a) 0    b) 1    c) $\sqrt{2}$    d) 2    e) $\sqrt{6}$    f) $\sqrt{8}$    g) none of these

## 2.
Determine the *fundamental period* of the following signal:

$$x(t) = 3\cos(t+2) + 4\sin(t-2) + 6\cos(t+3) - 7\sin(t).$$

a) 0    b) $\frac{1}{2\pi}$    c) 1    d) 2    e) $\pi$    f) $2\pi$    g) none of these

## 3.
Determine the *fundamental frequency* of the following signal:

$$x(t) = 4\cos(\pi t) + 5\sin(6\pi t).$$

a) 0    b) 1/6    c) 1/3    d) 1/2    e) 2/3    f) 2    g) none of these

4.
Consider the signal
$$x(t) = 3\cos(2\pi t - \pi/4).$$

Determine the *fundamental period* of the signal $y(t) = 4x(2(t - 3))$.

a) 0        b) 1/6        c) 1/3        d) 1/2        e) 2/3        f) 2        g) none of these

5.

A signal $x(t)$ has the following characteristics:

| duration | 5 |
|---|---|
| energy | 20 |
| average value | 2 |
| mean-squared value | 4 |

Determine the mean-squared value of the signal

$$y(t) = 3x(t) - 2.$$

a) 16        b) 24        c) 32        d) 48        e) 64        f) insufficient information        g) none of these

6.
Determine the correlation between the following two signals. *Examine the limits carefully!*

- $x[n] = \begin{cases} (1/4)^n, & n \geq 0 \\ 0, & \text{otherwise}, \end{cases}$

- $y[n] = \begin{cases} (4/3)^n, & n \leq 0 \\ 0, & \text{otherwise}. \end{cases}$

a) 0        b) 2/3        c) 1        d) 3/2        e) 2        f) 3        g) none of these

## 7.

The following Matlab code segment would compute and display which one of the following signal characteristics?

```
T = 2;
n = 10:1:40;
x = sqrt(7)+sin(2*pi*n/5);
disp(sum(x.^2))
```

a) the average value of $x[n]$  b) the energy of $x[n]$  c) the mean-squared value of $x[n]$
d) the period of $x[n]$  e) the RMS value of $x[n]$  f) the duration of $x[n]$
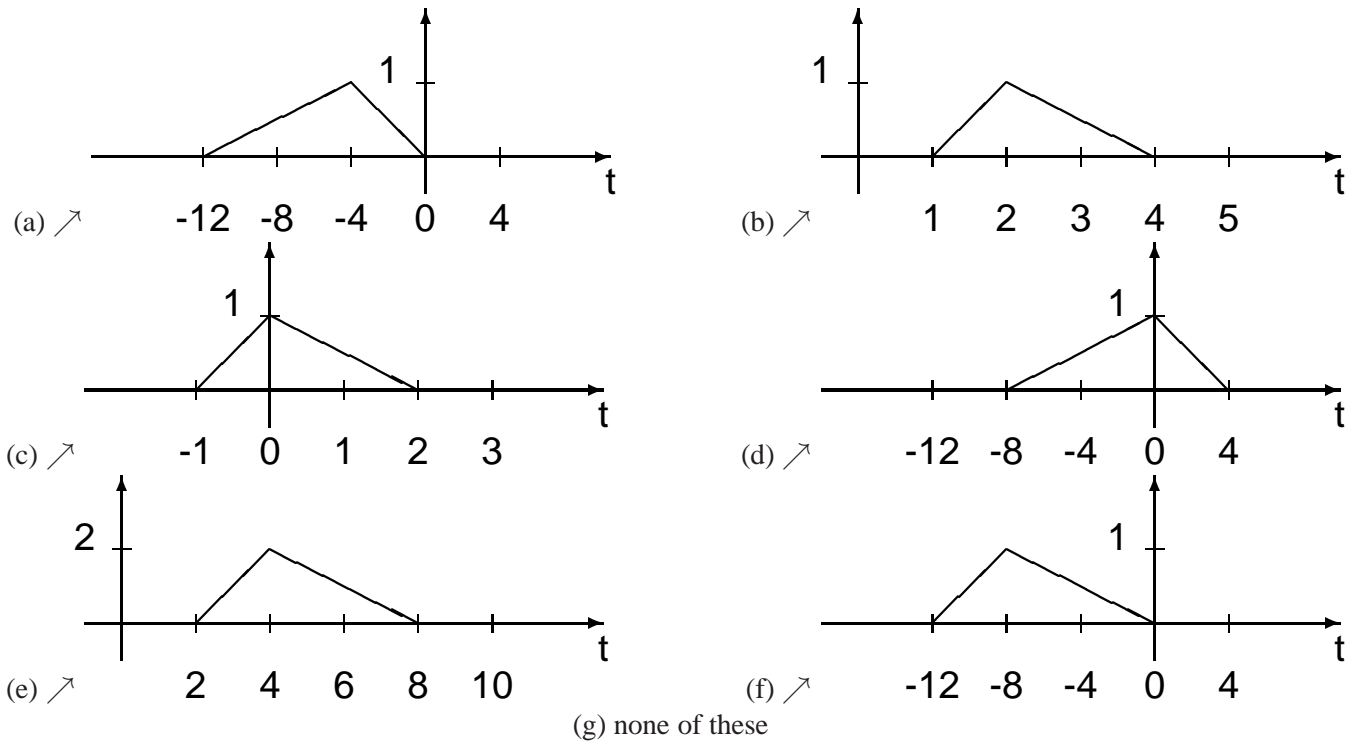g) none of these

## 8.

Consider the signal

$$x(t) = \begin{cases} t - 2, & 2 \le t \le 4 \\ 4 - t/2, & 4 \le t \le 8 \\ 0, & \text{otherwise.} \end{cases}$$
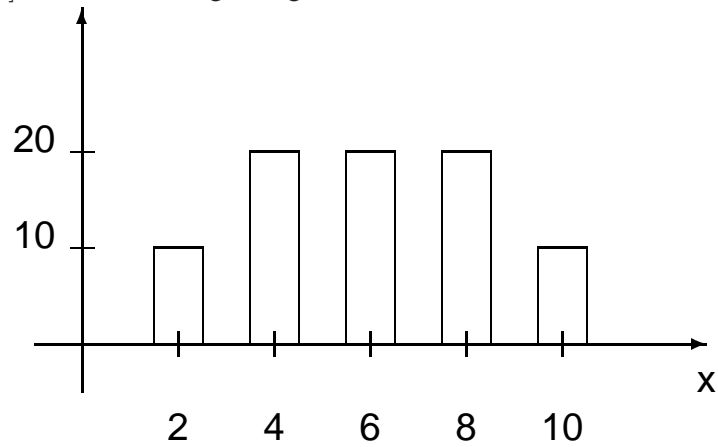
Determine which of the following figures corresponds to the following signal:

$$y(t) = \frac{1}{2}x(2 - t/2).$$



(a) ↗  -12 -8 -4 0 4

(b) ↗  1 2 3 4 5

(c) ↗  -1 0 1 2 3

(d) ↗  -12 -8 -4 0 4

(e) ↗  2 4 6 8 10

(f) ↗  -12 -8 -4 0 4

(g) none of these

9.

A discrete-time signal $x[n]$ has the following histogram.



Determine the average value of the signal $y(n)$ defined by $y(n) = 5(x[n] - 1)$.

a) 5     b) 45     c) 50     d) 55     e) 90     f) insufficient information     g) none of these

10.

Determine (in radians) the value of $\phi$ in the following equality

$$3\cos(4t - \pi/2) + \mathrm{Re}\left(2e^{j\,(4t+\pi/2)}\right) = A\cos(4t + \phi).$$

a) $-\pi/2$     b) 0     c) $\pi/2$     d) $\pi$     e) $3\pi/2$     f) insufficient information     g) none of these

end