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: _____

EECS 206 Exam 1, 2003-2-6
DO NOT TURN THIS PAGE OVER UNTIL TOLD TO BEGIN!

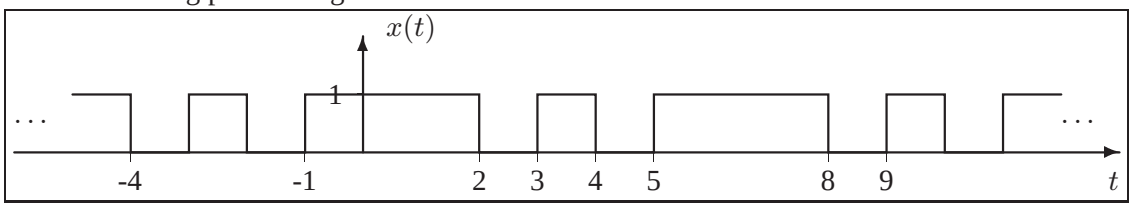
- This is a 120 minute exam.
- It is closed book, closed notes, closed computer.
- You may use one 8.5x11" piece of paper, both sides, and a calculator.
- There are 11 problems. The questions are not necessarily in order of increasing difficulty.
- This exam has 5 pages. Make sure your copy is complete.
- Continuing to write *anything* after the ending time is announced will be considered an honor code violation.

Fill out your name etc. above now, and do not wait until the end to circle your answers!

- Clearly circle the letter(s) for your answers **in this table.** Any letter(s) that you circle on subsequent pages do not count.
  We recommend that you show your work on subsequent pages just in case we need to see it.
  There are no intentional "none of the above" answers on this exam, but there is always the slim possibility of a typographical error. If you are confident that the correct answer is "none of the above" in any problem, then make a clear mark in this table and show your work clearly near that problem.
  Some problems may have multiple possible answers (as indicated), and some partial credit may be awarded for some of these problems. (Each incorrect answer "cancels" a correct answer in such problems.)
  For problems with only a single answer, no partial credit will be given.

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

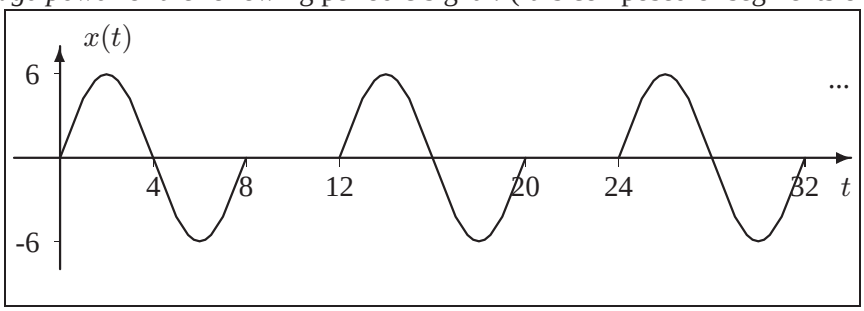
1. (9 points)
Let $x(t)$ be the following periodic signal.



Determine the *average value* of $x(t)$.

a) 1/2 b) 2/3 c) 3/4 d) 4/5 e) 5/6 f) 1

2. (9 points)
Determine the *average power* of the following periodic signal. (It is composed of segments of sinusoids.)



a) 0 b) 6 c) 12 d) 18 e) 24 f) 36

3. (9 points)
Define $x[n]$ to be the following discrete-time signal:

$$x[n] = \cos\left(\frac{4\pi}{5}n + \pi/3\right) - \pi \sin\left(\frac{\pi}{8}n\right).$$

Determine the *fundamental frequency* of the following signal:

$$y[n] = 7x[4n+1].$$

a) 16 b) 8 c) 1/5 d) 1/10 e) 1/16 f) 1/20

4. (9 points)
Consider the following signal.

$$x(t) = 3\cos\left(\frac{\pi}{2}t + 2\right) - 7\cos\left(\frac{\pi}{3}t - \pi/4\right) + 4\sin\left(\frac{\pi}{2}t\right).$$

Determine which of the following values are *periods* of $x(t)$. **Circle *all* that apply in the answer table.**
a) 2 b) 4 c) 6 d) 12 e) 18 f) 24

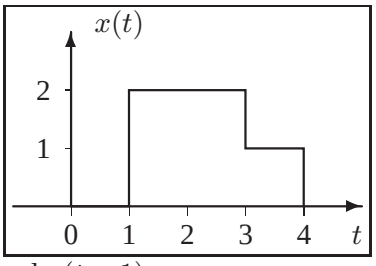
5. (9 points)
A signal $x(t)$ has an RMS value of 4.
Determine the RMS value of the signal $y(t) = x(4t)$.
a) 1 b) 2 c) 4 d) 8 e) 16 f) 32

6. (9 points)
Determine the average power of the following signal:

$$x(t) = 4 + 6\cos(\pi t - \pi/2) + 4\cos(\pi t + \pi/2).$$

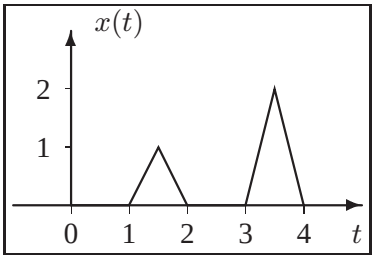
a) 18 b) 20 c) 36 d) 42 e) 66 f) 68

7. (9 points)
Let $x(t)$ be the following signal.



Determine the correlation between $x(t)$ and $x(t-1)$.
a) 1 b) 2 c) 3 d) 4 e) 5 f) 6

8. (9 points)
Let $x(t)$ be the following signal.



Determine which of the following possible values for t_0 are ones for which $x(t)$ and $x(t-t_0)$ are *uncorrelated* signals. **Circle *all* that apply in the answer table.**
a) $t_0 = -2$ b) $t_0 = -1$ c) $t_0 = 0$ d) $t_0 = 1$ e) $t_0 = 2$ f) $t_0 = 3$

9. (9 points)
The correlation between two signals $x_1(t)$ and $y_1(t)$ is known to be $C(x_1, y_1) = 16$.
Let $x_2(t) = x_1(2t)$ and $y_2(t) = y_1(2t)$ and determine $C(x_2, y_2)$.
a) 0 b) 4 c) 8 d) 16 e) 32 f) 64

10. (9 points)
Determine a value for ϕ that satisfies the following equality (for some value of B):

$$B\cos(\pi t + \phi) = 2\cos(\pi t + \pi/6) + 2\sin(\pi t) - 5\cos(\pi t - \pi/6).$$

a) $\pi/6$ b) $\pi/2$ c) $\pi/3$ d) $2\pi/3$ e) $3\pi/4$ f) $5\pi/6$

11. (10 points)
The signal $x(t)$ has energy = 10 and support $[2, 7]$. The signal $y(t)$ has average power = 5 and support $[2, 7]$.
In addition, it is known that $C(x, y) = 10$.
Determine $\mathrm{MS}(x + y)$.
a) 10 b) 11 c) 12 d) 13 e) 14 f) 15

end