EEE235F Class Test

15 April 2005

Name:

Student number:

Information

- The test is closed-book.
- This test has *five* questions, totalling 50 marks.
- Answer *all* the questions.
- You have 45 minutes.

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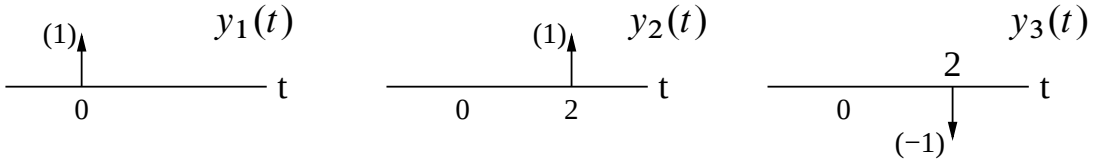
1. (10 marks) Are the following signals periodic? If so, what is the fundamental period and frequency?

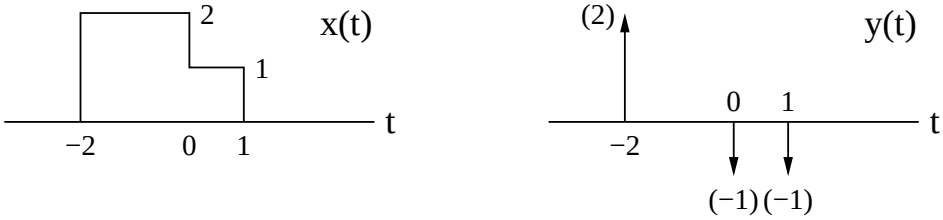
   (a) $x(t) = \cos(\frac{\pi}{3}t) + 3\sin(\frac{\pi}{4}t)$

   (b) $x(t) = e^{j(\frac{\pi}{2}t-1)}$.

2. (10 marks) Suppose $y_1(t)$, $y_2(t)$ and $y_3(t)$ are as shown below:



If $x(t)$ and $y(t)$ are



then sketch

(a) $x(t) * y_1(t)$

(b) $x(t) * y_2(t)$

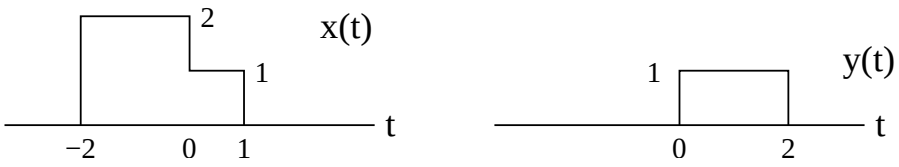
(c) $x(t) * y_3(t)$

(d) $y(t) * y_1(t)$

(e) $y(t) * y_2(t)$

(f) $y(t) * y_3(t)$.

3. (10 marks) Use the derivative property of convolution to find $w(t) = x(t) * y(t)$, where



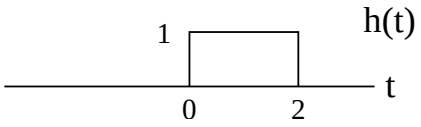
4. (10 marks) Consider a continuous-time LTI system described by

$$y(t) = T\{x(t)\} = \frac{1}{T}\int_{t-T/2}^{t+T/2} x(\tau)d\tau.$$

(a) Find and sketch the impulse response $h(t)$ of the system.

(b) Is the system causal?

5. (10 marks) Suppose a LTI system has impulse response



(a) What is the response of the system to the complex signal

$$x_1(t) = e^{j\omega t}$$

for some fixed ω?

(b) Hence, by writing $\cos(x)$ in terms of complex exponentials, find the response of the system to

$$x_2(t) = \cos(\omega t).$$

Note that in this case the result should be *real valued*, so some simplification may be necessary.