

*University ☺ of P ☺ r t l a n d*  
*Sch ☺ o o l ☺ of Engineering*

**EE 262-Signals & Systems-3 cr. hrs.**

**Spring 2015**

**Midterm Exam # 1**

(Prepared by Professor A. S. Inan)

(Monday, February 23, 2015)

(Closed Book Exam, One formula sheet allowed.)

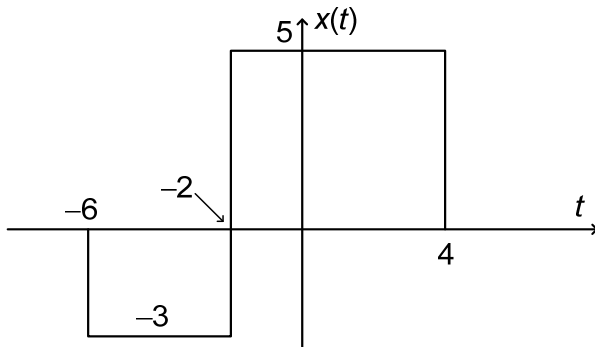
(Total Time: 55 mins.)

**Name:** \_\_\_\_\_ ☺

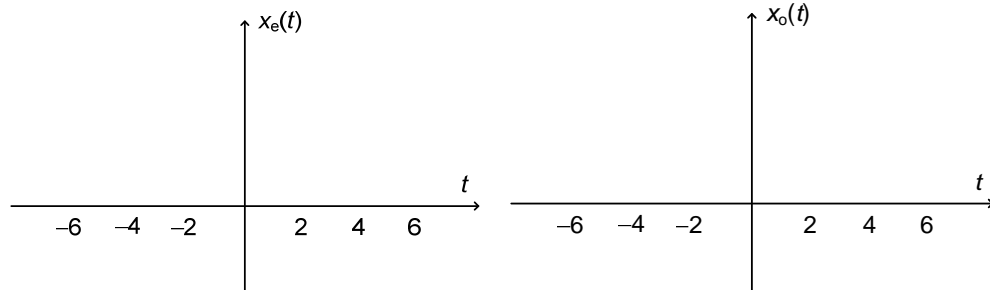
**Signature:** \_\_\_\_\_ ☺

(Any 6 problems in-class, the other 6 problems take-home due this Wednesday, February 25, 2015)

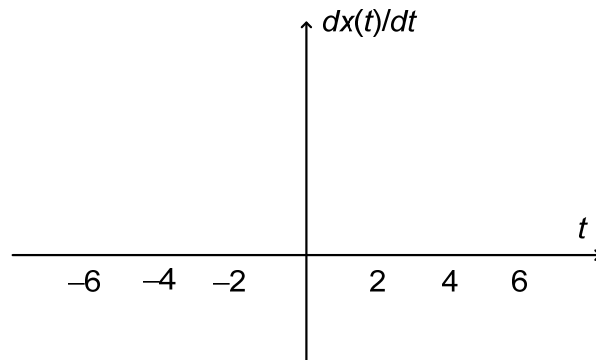
(1) (Total: 20 points) **Signals.** Consider a continuous-time signal,  $x(t)$ , as shown.



(a) (10 points) **Even and odd parts.** Sketch the even and odd parts of  $x(t)$ . Provide all the pertinent values on your sketch.

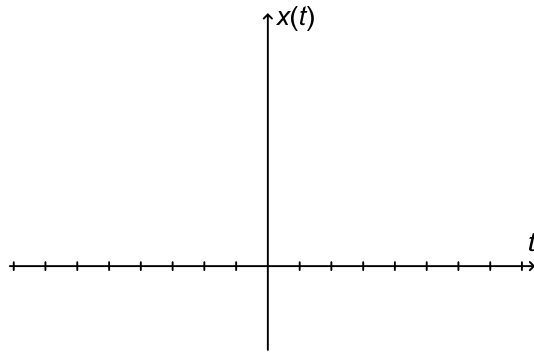


(b) (10 points) **Derivative of a signal.** Find the complete mathematical expression for the function  $y(t) = dx(t)/dt$  and sketch  $y(t)$  versus  $t$ . Provide all the pertinent values on your sketch.



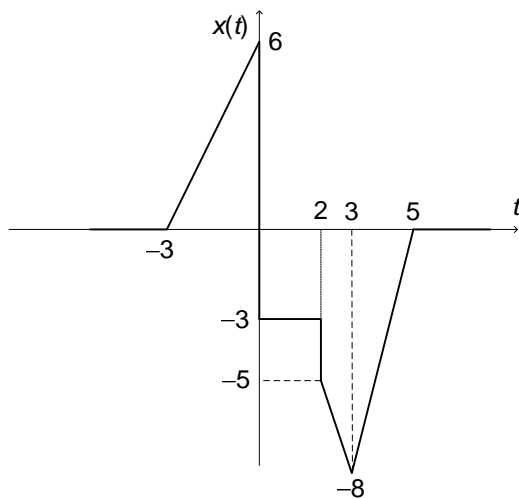
- (2) (10 points) **Rectangular pulse signal.** Sketch the rectangular pulse signal given by

$$x(t) = 7\text{rect}\left(\frac{2t-3}{6}\right) - 5\text{rect}\left(\frac{t-1}{8}\right)$$

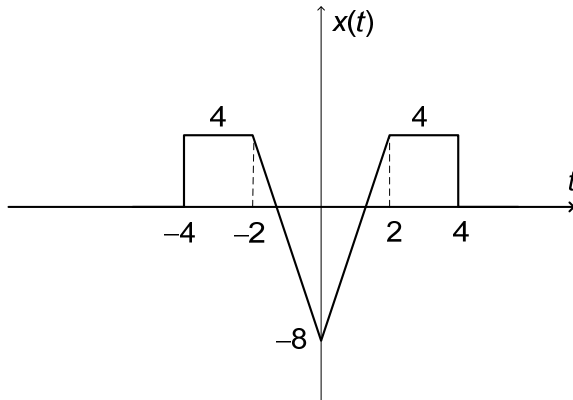


- (3) (10 points) **Period of a signal.** Determine the period of the signal given by  $x(t) = 10\cos(4\pi t - 5\pi/6) - 9\sin(8\pi t/3 + 2\pi/7)$ .

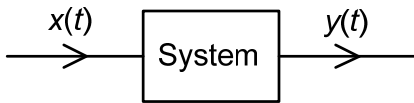
- (4) (10 points) **Singularity functions.** Express the signal  $x(t)$  sketched below in terms of singularity functions.



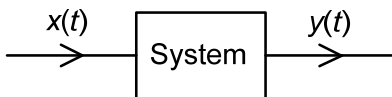
- (5) (10 points) **Energy of a signal.** Determine the total energy of the signal  $x(t)$  shown below.



- (6) (10 points) **Causal system?** The input-output relationship of the system shown below is described as  $y(t) = 4e^{t+2}x(3t-1)$ . Is this system causal? (Provide a meaningful justification.)

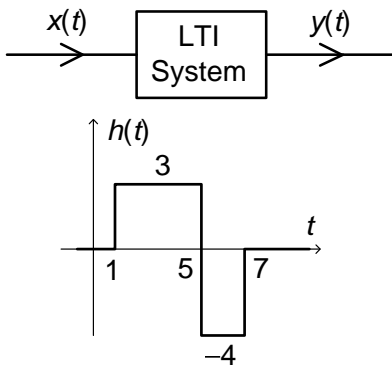


- (7) (10 points) **Linear system?** The input-output relationship of the system shown below is described as  $y(t) = 2x(t) - 3x(t-1)$ . Is this system linear? (Provide a meaningful justification.)

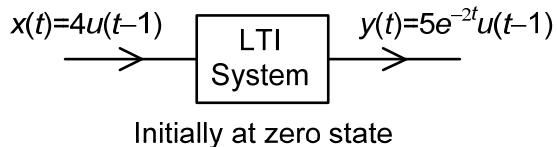


- (8) (10 points) **Time-invariant system?** The input-output relationship of the system shown below is described as  $y(t) = 3\cos[2tx(t-1)]$ . Is this system time invariant? (Provide a meaningful justification.)

- (9) (10 points) **LTI system.** The impulse response of an LTI system is given as shown. Find and sketch the unit-step response of this system.



- (10) (10 points) **LTI system.** The zero-state response of an LTI system excited by  $x(t) = 4u(t-1)$  is given by  $y(t) = 5e^{-2t}u(t-1)$ . If an input signal given by  $x(t) = 3u(t) - 4\delta(t-2)$  is applied to this system, what will be the output signal  $y(t)$ ?



- (11) (10 points) **LTI system.** The impulse response of an LTI system is given by  $h(t) = 7\delta(t+5) - 6u(t-1) + 4u(t-3) + 2u(t-8)$ . Determine whether this system is (a) causal or non-causal; and (b) BIBO stable or unstable. (Show your work.)



$$h(t) = 7\delta(t+5) - 6u(t-1) + 4u(t-3) + 2u(t-8)$$

- (12) (10 points) **Impulse response.** Find the impulse response of the following circuit shown.

