



Bonjour! Obtenez  
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*University of Portland*  
*School of Engineering*

**EE 262-Signals & Systems-3 cr. hrs.**  
**Spring 2015**

**Midterm Exam # 2**

(Prepared by Professor A. S. Inan)

(Friday, April 10, 2015)

(Closed Book Exam, 3 formula sheets allowed.)

(Total Time: 55 mins.)

(Any 5 of 10 problems in-class, other 5 take-home!)

**Name:** \_\_\_\_\_ 😊

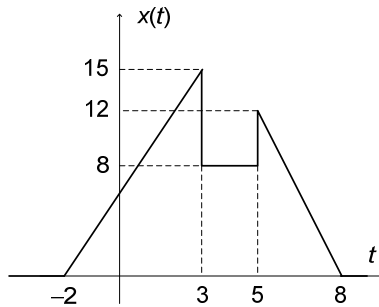
**Signature:** \_\_\_\_\_ 😊

(1)(10 points) **Unilateral Laplace transform.** Find the unilateral Laplace transform of the signal given by

$$x(t) = 2tu(t-1) * 6e^{-t}u(t-2)$$

(Note that this is a convolution problem. Provide your answer in its simplest form.)

(2)(10 points) **Unilateral Laplace transform.** Find the unilateral Laplace transform of the signal  $x(t)$  as shown.



(3)(10 points) **Inverse Laplace transform.** Find the inverse Laplace transform of the signal given by

$$X(s) = 5e^{-3(s-2)} \frac{d}{ds} \left( \frac{4}{(s+1)^2} \right)$$

(4)(10 points) **Inverse Laplace transform.** Find the inverse Laplace transform of the signal given by

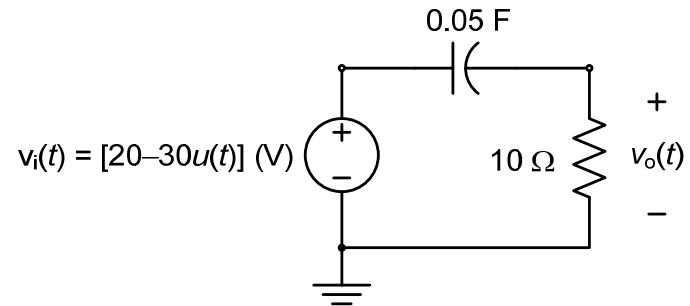
$$X(s) = \frac{2s^2 + 18s + 9}{s^2 + 6s + 18}$$

(5)(10 points) **Unilateral Laplace transform.** Given  $x(t) \leftrightarrow X(s)$  unilateral Laplace transform pair and given the signal  $y(t)$  to be  $y(t) = 2e^{-2t+2}x\left(\frac{t}{2} - 2\right)$ , express  $Y(s)$  in terms of  $X(s)$ .

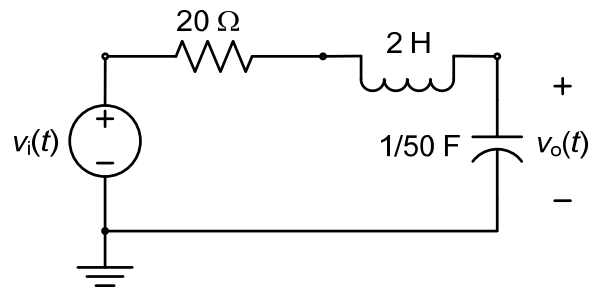
(6)(10 points) **Initial and final values.** Determine the initial and final values of  $x(t)$  if the unilateral Laplace transform of  $x(t)$  is given by

$$X(s) = \frac{9s^2 + 20s + 16}{s^3 + 4s^2 + 4s}$$

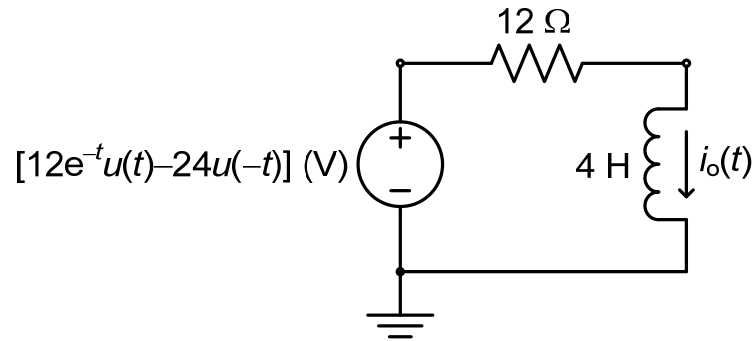
- (7)(10 points) **Application of Laplace transform to electric circuits.**  
 For the electric circuit shown, use Laplace transform to find the output voltage signal  $v_o(t)$  for  $t > 0$ .



- (8)(10 points) **Transfer function and impulse response.** Find the transfer function and the impulse response of the electric circuit shown.



- (9)(10 points) **Application of Laplace transform to electric circuits.**  
 For the electric circuit shown, use Laplace transform to find the current signal  $i_o(t)$  for  $t \geq 0$ .



- (10) (10 points) **Applications of Laplace transform to solve differential equations.** Determine the response  $y(t)$  for  $t \geq 0$  of the differential equation with the specified input signal and the initial conditions:

$$\frac{d^2 y(t)}{dt^2} + 4 \frac{dy(t)}{dt} = 4x(t), \quad x(t) = e^{-2t}u(t), \quad y(0^-) = 4, \quad \left. \frac{dy(t)}{dt} \right|_{t=0^-} = 0$$