

**Practice for Quiz 8**

These are sample problems similar to what you might find on the quiz. The quiz itself will be made up of only 2 questions.

Instructions: *Show all of your work. Answers without sufficient justification will receive little or no credit.*

1. Find the laplace transform for the following functions

(a)  $u(t - 5)e^t + u(t - 7) \sin(t)$ .

(b) The “staircase” function:

$$f(t) = \begin{cases} 1 & \text{if } 0 \leq t \leq 1, \\ 2 & \text{if } 1 \leq t < 2 \\ 3 & \text{if } 2 \leq t < 3 \\ \vdots & \\ n & \text{if } n - 1 \leq t < n \\ \vdots & \end{cases}$$

(c) The periodic function with period  $T = 2$  whose windowed version is given by

$$f_T(t) = \begin{cases} 1 & \text{if } 0 \leq t \leq 1, \\ -1 & \text{if } 1 \leq t < 2 \\ 0 & \text{otherwise} \end{cases}$$

2. Write the following systems of differential equations in normal form

(a)

$$\begin{aligned} \frac{dy}{dt} + 3 \cos(t)x &= e^t \\ \frac{dx}{dt} + y &= t^2 \end{aligned}$$

(b)

$$\frac{d^3y}{dt^3} + y = t + 1$$

(c)

$$\begin{aligned}\frac{d^2y}{dt^2} + 3 \cos(t)x &= e^t \\ \frac{dx}{dt} + \frac{dy}{dt} &= 0\end{aligned}$$

3. Solve the following systems of linear equations:

(a)

$$\begin{aligned}3x_1 + 5x_2 + x_3 &= 9 \\ 2x_1 - x_2 + 4x_3 &= 5 \\ x_1 + 7x_2 + 3x_3 &= 11.\end{aligned}$$

(b)

$$\begin{aligned}2x_1 + 4x_2 + x_3 &= 9 \\ x_1 - x_2 + 4x_3 &= 5 \\ x_1 - 7x_2 - 11x_3 &= 6.\end{aligned}$$