

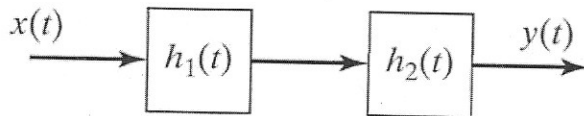
# solution

ECE103 Quiz 2 October 15, 2018

Name \_\_\_\_\_ Student ID No. \_\_\_\_\_

This quiz is to find outputs  $y(t)$  of systems characterized by their impulse responses  $h(t)$  for given inputs  $x(t)$  by convolution integral, i.e.,  $y(t) = x(t) * h(t)$ .

Consider the following system:



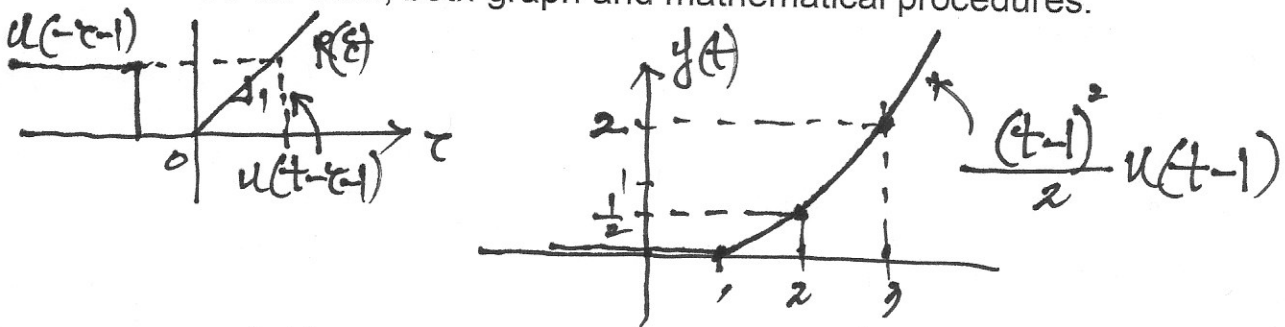
Here  $h_1(t)$  is "integration" over time domain,  $h_2(t)$  is "time delay" by 1 second.

- (4 points) Express  $y(t) = h(t)$  in mathematical form for  $x(t) = \delta(t)$ , impulse. (hint:  $h(t)$  can be expressed by a basic function such as  $\delta(t)$ ,  $u(t)$ ,  $R(t)$ ,  $\exp(t)$ , etc. or its modification.)

$$h(t) = u(t-1) \xrightarrow{\delta(t)} \int_0^t u(\tau) d\tau \xrightarrow{h_2} \int_0^{t-1} u(\tau) d\tau = y(t) = h(t)$$

- (6 points) Find  $y(t)$  for  $x(t) = R(t)$  by convolution  $x(t) * h(t)$ , where  $R(t) = 0$  for  $t < 0$  and  $t$  for  $t > 0$ .

Show all work, both graph and mathematical procedures.



$$y(t) = 0 \quad \text{for } t < 1$$

$$y(t) = \int_0^{t-1} \tau d\tau \quad \text{for } t \geq 1$$

$$= \frac{1}{2} (t-1)^2 u(t-1)$$

checking

$$H_1(x(t)) = \int_0^t \tau d\tau = \frac{1}{2} t^2 u(t)$$

$$H_2[H_1(x(t))] = \frac{1}{2} (t-1)^2 u(t-1)$$