

## Signals and Systems ECE 202 Test 2 Solution

1. (a)  $\text{rect}(x/d)$   
(b)  $\exp(j6\pi t)$
2. The Fourier Series coefficients are given by

$$2 \int_0^d \sin(2\pi kt) dt = -2 \frac{\cos(2\pi kt)}{2\pi k} \Big|_0^d = \frac{1 - \cos(2\pi kd)}{\pi k}$$

3. (a) Let  $h(t) = K \exp(-t/\tau)u(t)$

$$\tau \frac{dh(t)}{dt} + h(t) = \delta(t)$$

$$-K \exp(-t/\tau)u(t) + K\delta(t) + K \exp(-t/\tau)u(t) = \delta(t)$$

so  $h(t) = \exp(-t/\tau)u(t)$

- (b) Let

$$h(t) = K_1 \exp(-t/\tau)u(t) + K_2\delta(t)$$

Substitute into differential equation

$$\tau \frac{dh(t)}{dt} + h(t) = \tau\delta'(t)$$

$$-K_1 \exp(-t\tau)u(t) + K_1\tau\delta(t) + K_2\tau\delta'(t) + K_1 \exp(-t/\tau)u(t) + K_2\delta(t) = \tau\delta'(t)$$

from which we conclude

$$h(t) = \delta(t) - \frac{1}{\tau} \exp(-t/\tau)u(t)$$