Quiz 1
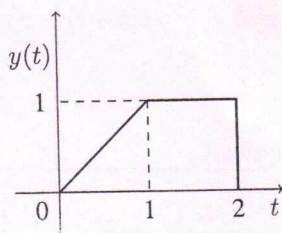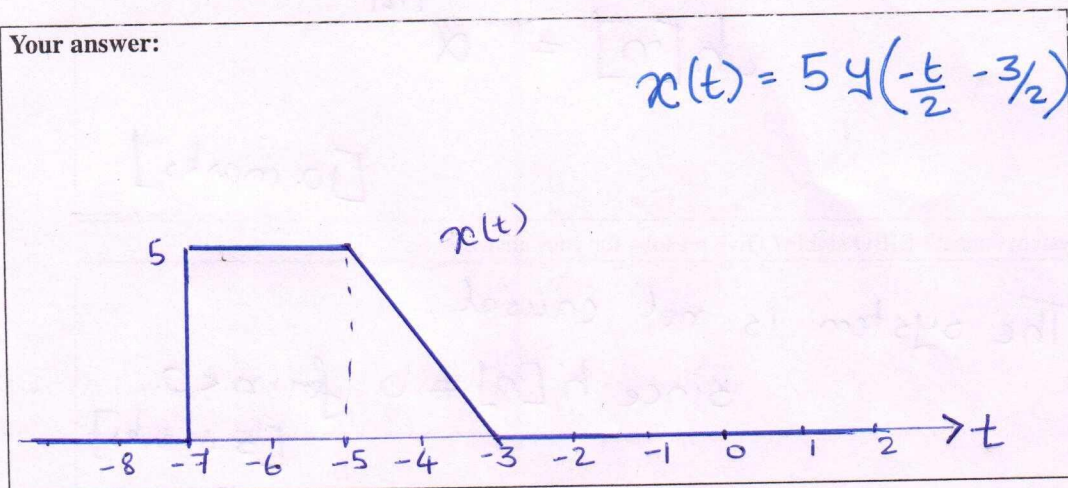
Be sure to write your name **and** *roll number above. Write only your* **final** *answers in the space provided after each question. A seperate sheet is provided to you for rough work.*

1. [**10 marks**] Consider the signal $y(t) = (1/5)x(-2t - 3)$ shown below. Determine and carefully sketch the original signal $x(t)$.

Your answer:

$$x(t) = 5\, y\left(-\frac{t}{2} - \frac{3}{2}\right)$$

2. [**10 marks**] Consider three continuous time systems S_1, S_2, and S_3. The responses of these systems to the input signal $\cos(\omega_o t)$ is given below.

$$\cos(\omega_o t) \xrightarrow{S_1} 5t \sin(\omega_o t)$$

$$\cos(\omega_o t) \xrightarrow{S_2} 3 \sin(\omega_o t + 1)$$

$$\cos(\omega_o t) \xrightarrow{S_3} e^{-t} \cos(\omega_o t)$$

Given the above information, which of the systems S_1, S_2, and S_3 are definitely **not** LTI?

Your answer:

S_1, S_3 NOT LTI

$\left[5 \text{ marks each}\right]$

3. [**20 marks**] Consider the discrete-time LTI system described by the following input-output relation.

$$y[n] = x[n] + \sum_{i=1}^{\infty}(x[n+i] + x[n-i])\alpha^i,$$

where $\alpha \in (0,1)$.

(a) What is the impulse response for this system?

$$h[n] = \alpha^{|n|}$$

$\left[10 \text{ marks}\right]$

(b) Is the system causal? BIBO stable? Give reasons for your answers.

The system is not causal, since $h[n] \neq 0$ for $n < 0$.

$\left[5 \text{ marks}\right]$

The system is stable, since

$$\sum_{-\infty}^{\infty}|h[n]| = \frac{1+\alpha}{1-\alpha} < \infty$$

$\left[5 \text{ marks}\right]$