

QP Code : 3313

(3 Hours)

[Total Marks : 80

- N.B. : (1) Questions No.1 is compulsory.
 (2) Attempt any three questions from the remaining questions.
 (3) Solve every question in an order.

1. (a) Prove convolution property of Fourier Transform. 20
 (b) State and prove final value Theorem of Laplace Transform.
 (c) Prove shifting property of Z transform.
 (d) Determine energy and/or power of following signals.

$$(i) \quad x(n) = \left(\frac{3}{5}\right)^n u(n) - (4)^n u(-n-1)$$

$$(ii) \quad x(t) = 4e^{-2t} u(t)$$

2. (a) Obtain output $y(t) = x(t) * h(t)$ using graphical convolution. 10

$$x(t) = 1+t \quad \text{for } -1 \leq t \leq 0$$

$$= 1-t \quad \text{for } 0 \leq t \leq 1$$

$$h(t) = 1 \quad \text{for } 0 \leq t \leq 2$$

$$= 0 \quad \text{elsewhere}$$

- (b) Obtain $h(n)$ for all possible ROC conditions. Also plot the ROC comment 10
 on causality and stability at the system.

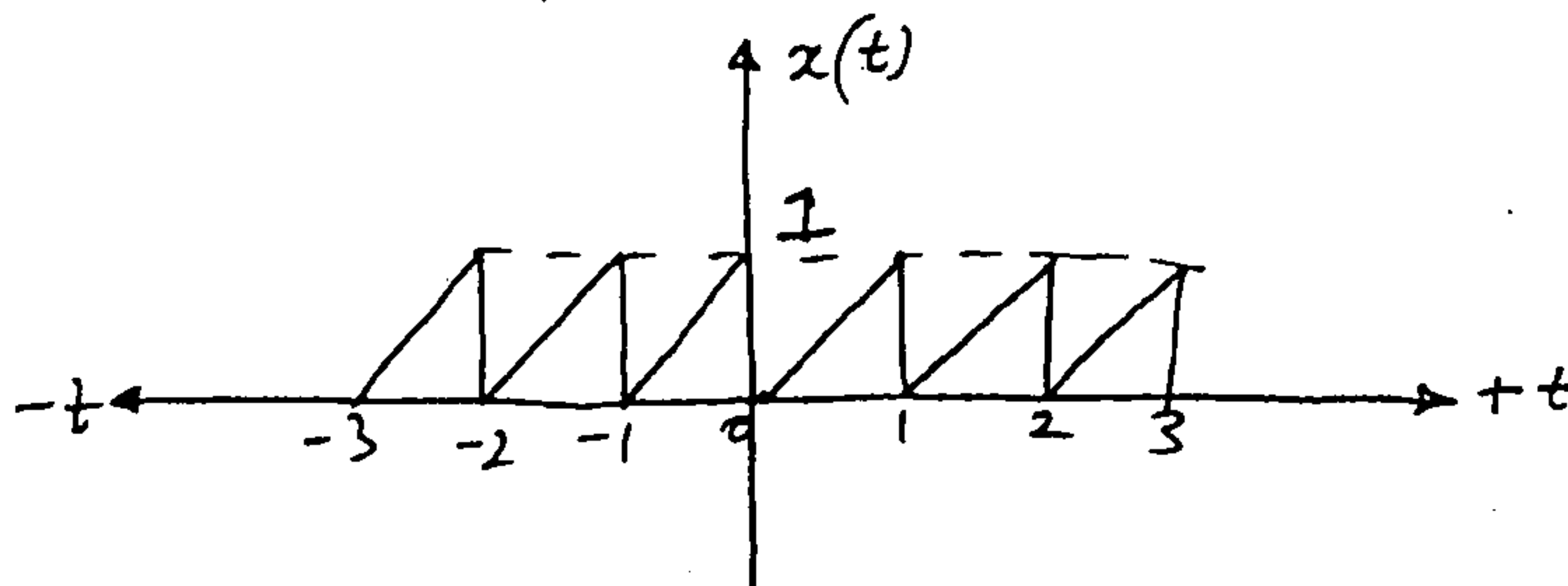
$$H(z) = \frac{4z(z^2 - 8z + 9)}{(z - \frac{1}{3})(z - 3)(z + 4)}$$

3. (a) A C.T. LTI system has 8

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{7dx(t)}{dt} - 3x(t)$$

- (i) Determine Transfer function.
 (ii) Obtain impulse response.
 (iii) Obtain unit Ramp response.

- (b) Plot the magnitude and phase spectrum of the periodic signal. Shown below. 8



TURN OVER

- (c) Obtain initial and final value 4

$$\text{if } X(z) = \frac{3z^2}{4z^2 - 5z + 1}$$

4. (a) If two subsystem are connected in cascade 8

$$h_1(n) = (0.9)^n u(n) - 0.5(0.9)^{n-1} u(n-1)$$

$$h_2(n) = (0.5)^n u(n) - (0.5)^{n-1} u(n-1)$$

Determine overall impulse response of the interconnected system.

- (b) Obtain z transform of the following signal using properties of z transform. 6

$$x(n) = \left(\frac{3}{4}\right)^{n-1} \sin\left(\frac{\pi}{6}n\right) u(n)$$

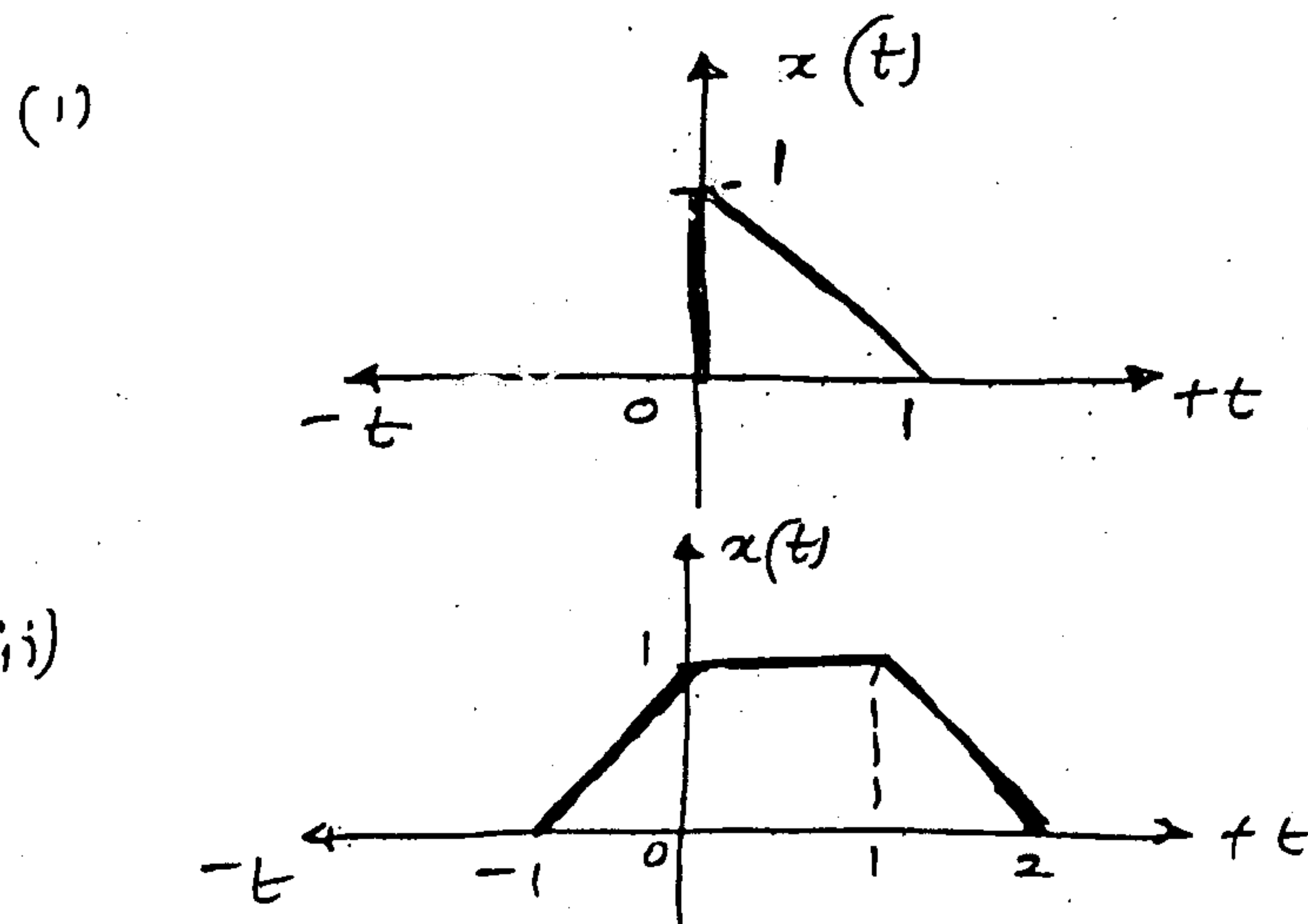
- (c) Prove Parsevals theorem of Fourier series. 6

5. (a) Obtain circular convolution of 5

$$x_1(n) = [3 \ 2 \ 1 \ 4]$$

$$x_2(n) = [5 \ 7 \ -8 \ 2]$$

- (b) Obtain Laplace Transform of following waveforms using its properties. 5



- (c) Obtain zero input response, zero state response and total response of a D. T. L. T. I. system. 10

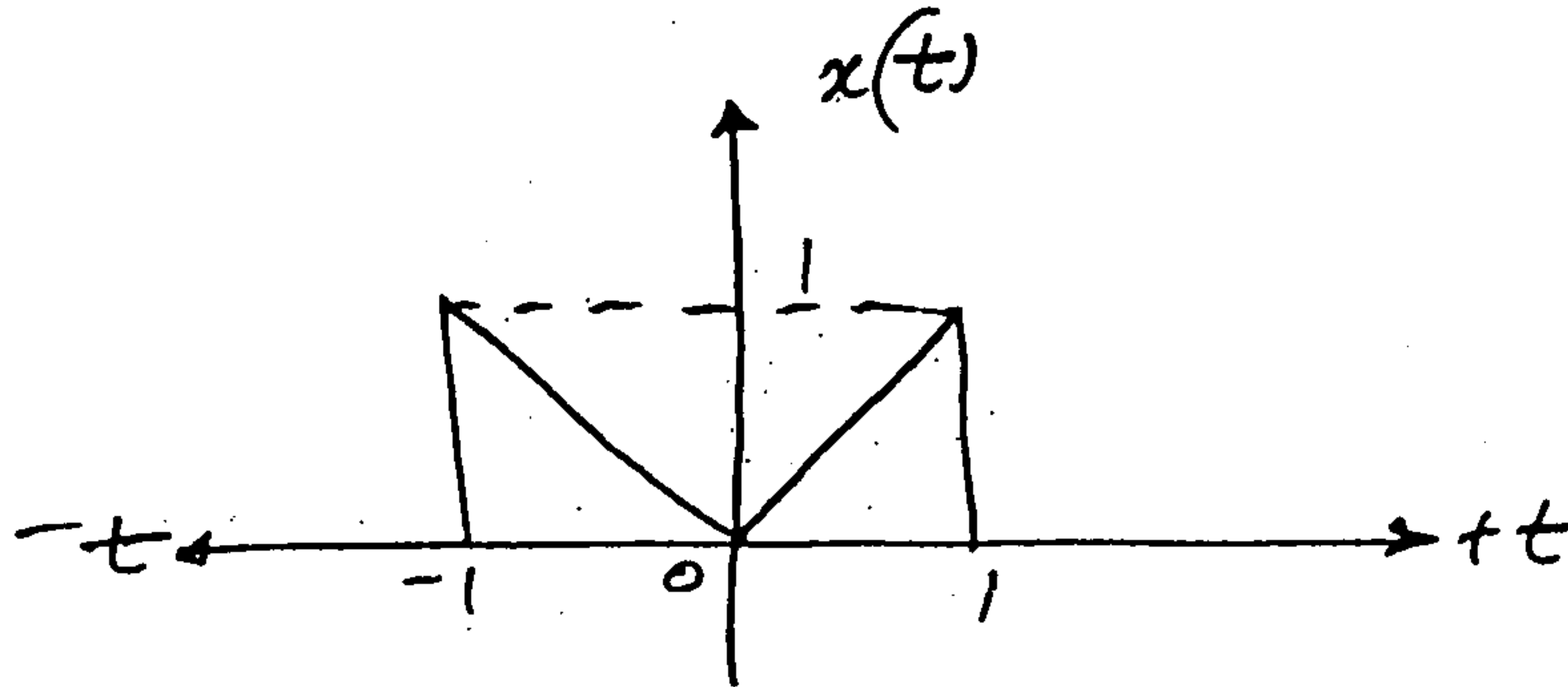
$$y(n) + 7y(n-1) + 12y(n-2) = 4x(n) - 11x(n-1)$$

If $y(-1) = 1$ $y(-2) = 2$ $x(-1) = 0$.

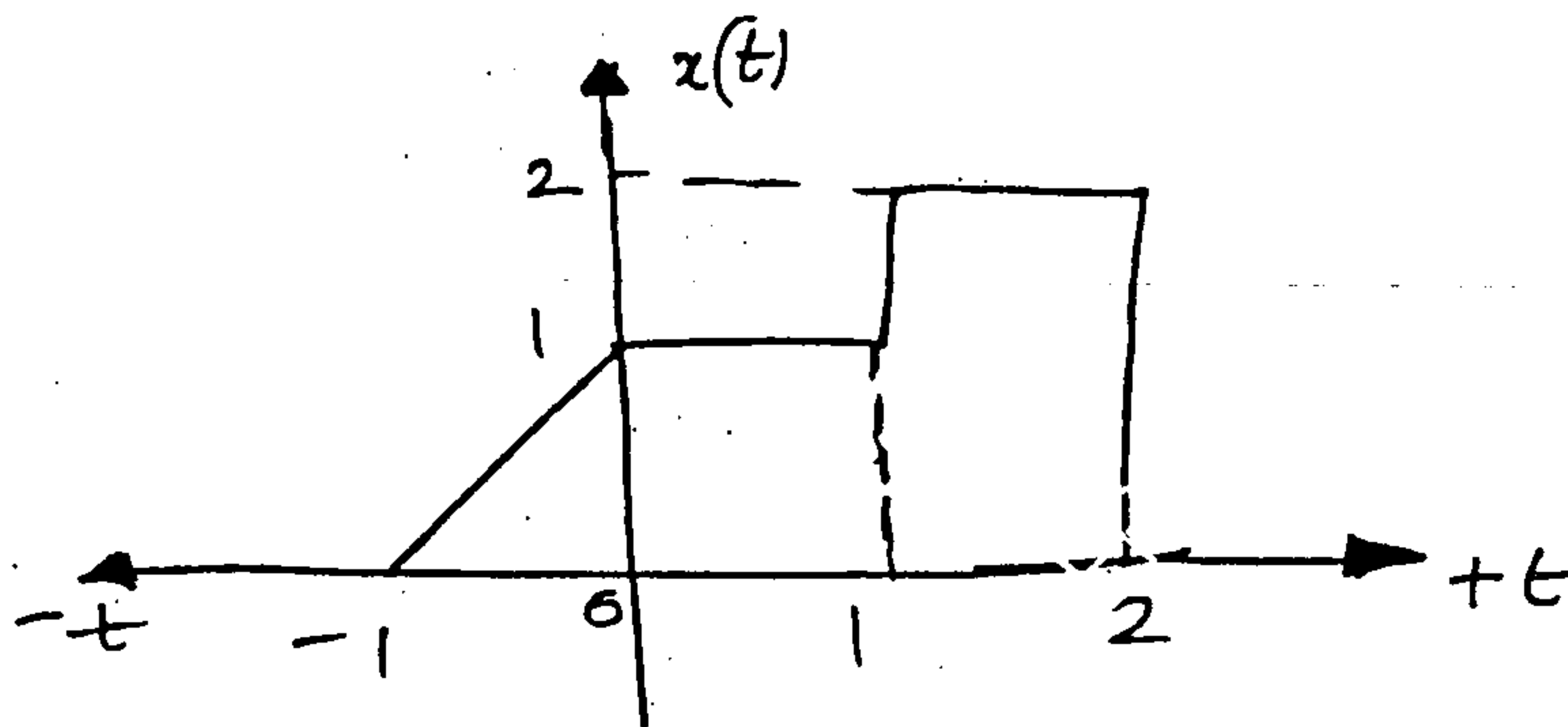
If input $x(n) = u(n) = \text{unit step signal}$

TURN OVER

6. (a) Obtain Fourier transform of the following signal. 6



- (b) Plot even and odd parts of following signals. 6



- (c) Obtain $h(t)$ for causal and stable system If 8

$$H(s) = \frac{s^2 - 3s + 11}{(s-i)(s+2)(s+3)}$$

Plot the ROC and pole's and zero's of the system.