<table>
<tr><td rowspan="2">CMR
INSTITUTE OF
TECHNOLOGY</td><td colspan="9"></td><td rowspan="2"></td></tr>
<tr><td colspan="9">USN | | | | | | | | | | |</td></tr>
<tr><td colspan="11">Internal Assesment Test I –Nov 2021</td></tr>
<tr><td>Sub:</td><td colspan="7">Signals and Systems</td><td>Code:</td><td colspan="2">18EE54</td></tr>
<tr><td>Date:</td><td>12/11/2021</td><td>Duration:</td><td>90 mins</td><td>Max Marks:</td><td>50</td><td>Sem:</td><td>V</td><td>Section</td><td colspan="2">EEE (A &B)</td></tr>
<tr><td colspan="11">Note: Answer any fiveFULL Questions
Sketch neat figures wherever necessary. Answer to the point. Good luck!</td></tr>
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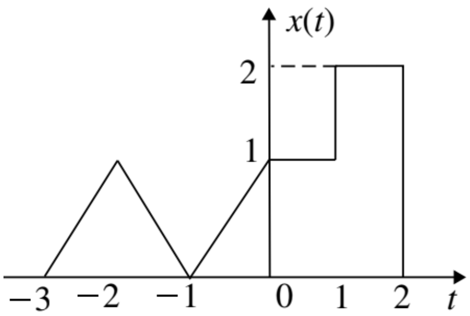
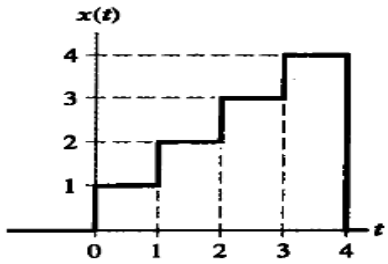
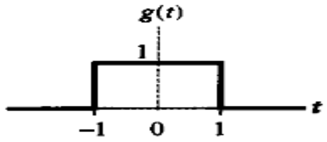
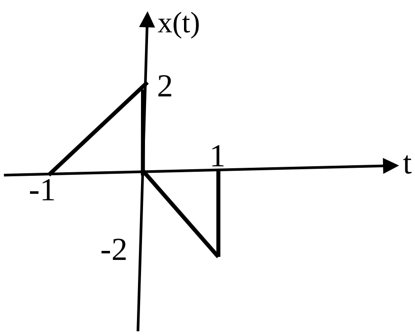
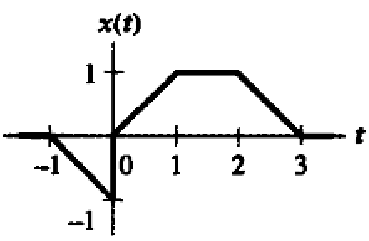
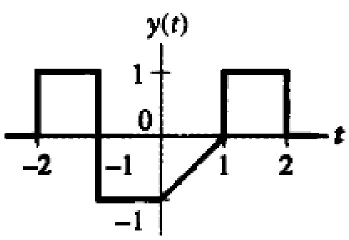
<table>
<tr><th></th><th></th><th></th><th colspan="2">OBE</th></tr>
<tr><th></th><th></th><th>Marks</th><th>CO</th><th>RBT</th></tr>
<tr><td>1</td><td>Check whether the following signals are periodic or not. If periodic, find fundamental time period and fundamental angular frequency.
(a) $x(t)=\sin\left(2\pi t+\frac{\pi}{6}\right)+\cos\left(3\pi t+\frac{\pi}{2}\right)+e^{\left(j\pi t+\frac{\pi}{3}\right)}$
(b) $x[n]=\sin\left(\frac{n\pi}{8}+\frac{\pi}{2}\right)+\cos\left(\frac{n\pi}{3}+\frac{\pi}{3}\right)+6\,e^{-\frac{jn\pi}{7}}$</td><td>[10 M]</td><td>CO1</td><td>L3</td></tr>
<tr><td>2 (a)</td><td>Define Signal and System.</td><td>[2 M]</td><td>CO1</td><td>L1</td></tr>
<tr><td>2 (b)</td><td>Sketch the following signal for the given x(t) shown in figure
$(i)\ y(t)=x(-2t+3)$ $(ii)\ x\left(-3\left(t+\frac{3}{4}\right)\right)$

</td><td>[8 M]</td><td>CO1</td><td>L3</td></tr>
<tr><td>3</td><td>Evaluate the following expressions
$(a)\int_{0}^{2\pi} t\sin t\ \delta\left(\frac{\pi}{3}-t\right)dt$ $(b)\int_{-8}^{2} e^{t-4}\delta(2t+8)dt$
$(c)\int_{0}^{\infty}\cos t\, u(t+1)\ \delta(t)dt$ $(d)\sum_{n=0}^{2}2^{n}\ \delta(2n-2)$
$(e)\sum_{n=0}^{3}e^{4-2n}\ \delta(4-2n)$</td><td>[10 M]</td><td>CO1</td><td>L3</td></tr>
<tr><td>4</td><td>Given the signal $x[n]=[6-n]\big[u[n]-u[n-6]\big]$, Draw the following signals
$(a) x[2n]$ $(b) x\left[\frac{n}{2}\right]$ $(c)\ x[1-2n]$</td><td>[10 M]</td><td>CO1</td><td>L3</td></tr>
<tr><td>5 (a)</td><td>Write the classification of signals</td><td>[2 M]</td><td>CO1</td><td>L1</td></tr>
<tr><td>5 (b)</td><td>Draw the following signals
$(i)\ x(t)=u(t+2)-2\,u(t)+u(t-2)$
$(ii)\ x(t)=r(t+1)-r(t)-r(t-1)$
$(iii)\ x[n]=u(n+3)-u(n-2)$</td><td>[8 M]</td><td>CO1</td><td>L2</td></tr>
</table>

6 (a)	Distinguish between (i) Deterministic and Non-Deterministic signal (ii) Periodic and Non-periodic Signal	[4 M]	CO1	L1
6 (b)	A staircase like signal x(t) that may be viewed as the superposition of four rectangular pulses. Express x(t) in terms of g(t).   	[6 M]	CO1	L3
7 (a)	Find the Even and Odd components of each of the following signals $(i)\ x(t) = (1 + t^2 + t^3) \cos t$ $(ii) x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ $(iii)\ x(t) = 1 + t\ \cos t + t^2 \sin t + t^3 \sin t \cos t$	[6 M]	CO1	L3
7 (b)	Draw the even and odd components of the following signal.  	[4 M]	CO1	L3
8 (a)	Find the expression of x(t), If $\frac{dx(t)}{dt} = 2u(t+2) + \delta(t) + 4\ \delta(t-1) + u\ (t-2)$	[2 M]	CO1	L2
8 (b)	Sketch the following signals $(i)\ x(t)\ y(2-t)$ $(ii)\ x(t-1)\ y(-t)$   	[8 M]	CO1	L3

CI CCI HOD

IAT-1 Solution

1 (a) Given Signal,

$$x(t) = \sin\left(2\pi t + \frac{\pi}{6}\right) + \cos\left(3\pi t + \frac{\pi}{2}\right) + e^{(j\pi t + \pi/3)}$$

Step 1 :- angular frequencies of $x(t)$,

$\omega_1 = 2\pi$, $\omega_2 = 3\pi$, $\omega_3 = \pi$

$2\pi f_1 = 2\pi$ $\quad$ $2\pi f_2 = 3\pi$ $\quad$ $2\pi f_3 = \pi$

$f_1 = 1$ $\quad$ $f_2 = \frac{3}{2}$ $\quad$ $f_3 = \frac{1}{2}$

step 2 :- individual time periods,

$T_1 = \frac{1}{f_1} = 1$ $\quad$ $T_2 = \frac{1}{f_2} = \frac{2}{3}$, $T_3 = \frac{1}{f_3} = 2.$ — 1 Mark

step 3 :- Ratio's ,

$$\frac{T_1}{T_2} = \frac{1}{(2/3)} = 1 \times \frac{3}{2} = \frac{3}{2}$$

$$\frac{T_1}{T_3} = \frac{1}{2} = \frac{1}{2}.$$ — 1 Mark

step 4 :- The ratio's are rational numbers: Therefore,

$x(t)$ Signal is periodic Signal. — 1 Mark

step 5 :- LCM of $(2,2) = 2.$

step 6 :- fundamental time period $T_0 = LCM \times T_1$ — 1 Mark

$T_0 = 2 \times 1 = 2$ sec.

$f_0 = \frac{1}{T_0} = \frac{1}{2} = 0.5$ Hz. — 1 Mark

$\omega_0 = 2\pi f_0 = 2\pi \times \frac{1}{2} = \pi$ rad/sec.

5 Marks

1 (b) Given Signal,

$$x[n] = \sin\left(\frac{n\pi}{8} + \frac{\pi}{2}\right) + \cos\left(\frac{n\pi}{3} + \frac{\pi}{3}\right) + 6e^{-\frac{jn\pi}{7}}$$

step 1 :- Individual angular frequencies,

$$\omega_1 = \frac{\pi}{8}, \quad \omega_2 = \frac{\pi}{3}, \quad \omega_3 = \frac{\pi}{7}$$

$$2\pi f_1 = \frac{\pi}{8} \qquad 2\pi f_2 = \frac{\pi}{3} \qquad 2\pi f_3 = \frac{\pi}{7}$$

$$f_1 = \frac{\pi}{8} \times \frac{1}{2\pi} \qquad f_2 = \frac{\pi}{3} \times \frac{1}{2\pi} \qquad f_3 = \frac{1}{14}$$

$$f_1 = \frac{1}{16} \qquad f_2 = \frac{1}{6}$$

step 2 :- Individual time periods,

$$N_1 = \frac{2\pi}{\omega_1} m_1 \qquad N_2 = \frac{2\pi}{\omega_2} m_2 \qquad N_3 = \frac{2\pi}{\omega_3} m_3$$

$$N_1 = \frac{2\pi}{(\pi/8)} m_1 \qquad N_2 = \frac{2\pi}{(\pi/3)} m_2 \qquad N_3 = \frac{2\pi}{(\pi/7)} m_3$$

$$N_1 = 16 m_1 \qquad N_2 = 6 m_2 \qquad N_3 = 14 m_3$$

$$\boxed{N_1 = 16, \ m_1 = 1} \qquad \boxed{N_2 = 6, \ m_2 = 1} \qquad \boxed{N_3 = 14, \ m_3 = 1}$$

— 1 Mark

step 3 :- Individual time periods, $N_1 = 16$, $N_2 = 6$, $N_3 = 14$ are rational numbers. So the given Signal is Periodic Signal. — 1 Mark

step 4 :- find the ratios,

$$\frac{N_1}{N_2} = \frac{16}{6} = \frac{8}{3}$$

$$\frac{N_1}{N_3} = \frac{16}{14} = \frac{8}{7}$$

— 1 Mark

step 5 :- LCM of $(3, 7) = 21$.

Step 6:- fundamental time period,

$N_0 = LCM \times N_1$

$N_0 = 21 \times 16$

$N_0 = 336$ sec. — 1 Mark

fundamental angular frequency,

$\omega_0 = \frac{2\pi}{N_0} = \frac{2\pi}{336}$

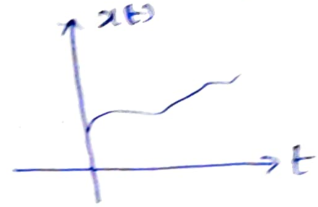
$\omega_0 = \frac{\pi}{168}$ rad/sec. — 1 Mark

5 Marks.

2 (a) **Signal** :- → It is representation of physical quantity which varies with respect to time (or) independent variable. — 1 Mark

→ It is a single valued function.

→ It carries information.

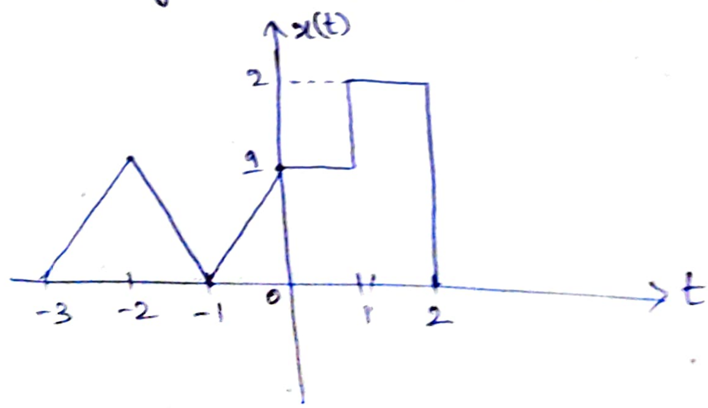


System :- System is a device, or combination of devices, which can operate on signals and produces corresponding responses. — 1 Mark

2 Marks.

2 (b) Sketch the following signal

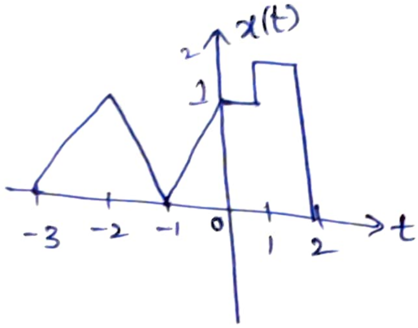
(i) $y(t) = x(-2t+3)$ (ii) $x\left(-3\left(t+\frac{3}{4}\right)\right)$.



(i) Step 1:-

(i) Draw $x(-2t+3)$

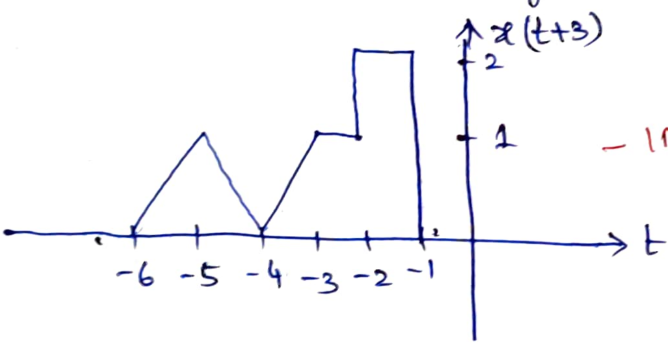
Step 1 :- Draw $x(t)$



— Mark

Step 2 :- Draw $x(t+3)$

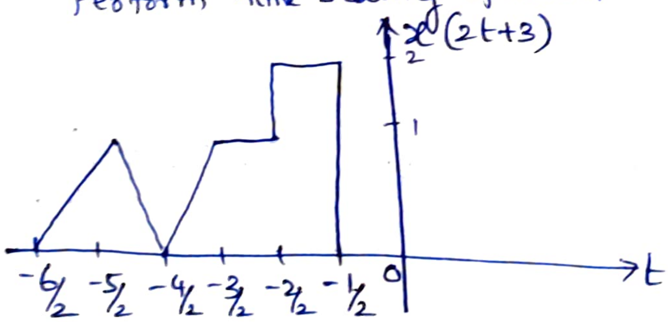
Perform time shifting operation.



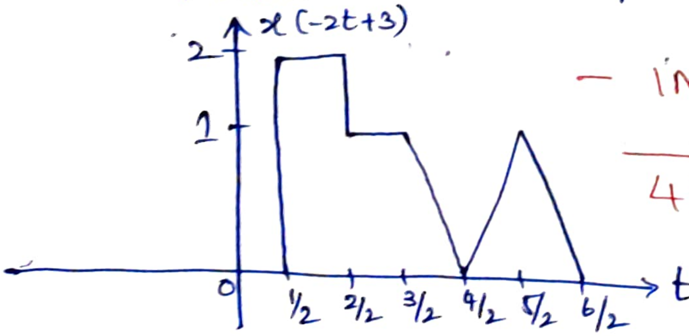
— 1 Mark

Step 3 :- Draw $x(2t+3)$ — 1 Mark

Perform time Scaling operation.



Step 4 :- Draw $x(-2t+3)$, Perform time reversal operation.

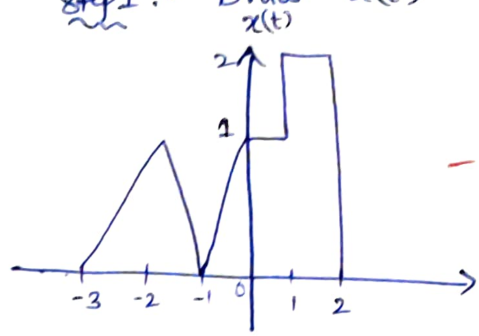


— 1 Mark

4 Marks.

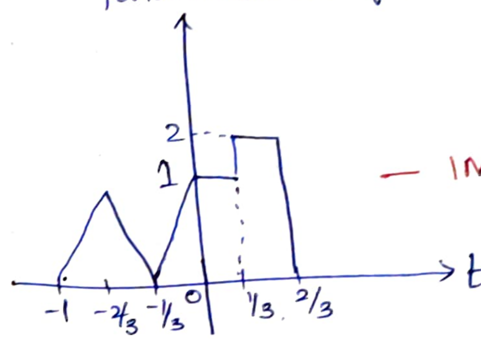
(ii) Draw $x(-3(t+3/4))$

Step 1 :- Draw $x(t)$



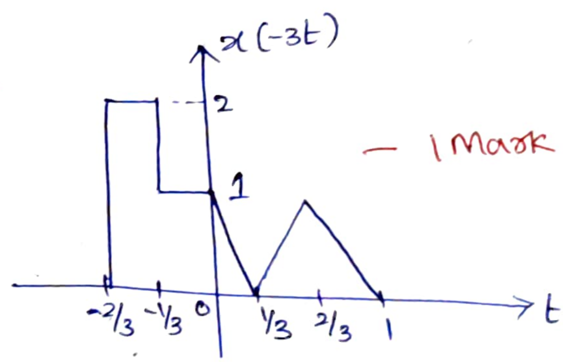
— 1 Mark

Step 2 :- Draw $x(3t)$
Perform time scaling operation.



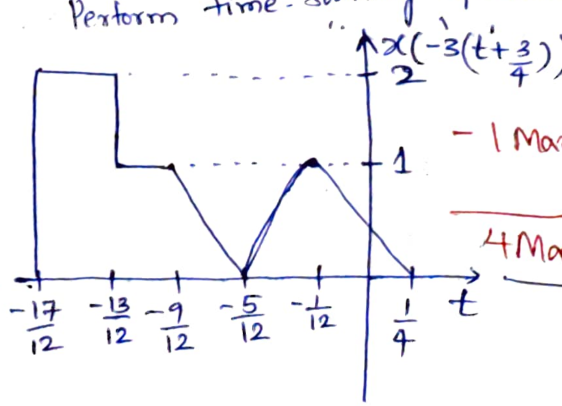
— 1 Mark

Step 3 :- Draw $x(-3t)$
Perform time reversal operation.



— 1 Mark

Step 4 :- Draw $x(-3(t+3/4))$
Perform time shifting operation.



— 1 Mark

4 Marks

③ ⓐ $\int_0^{2\pi} t \sin t \; \delta\left(\frac{\pi}{3}-t\right) dt$

using even property,

$\delta\left(\frac{\pi}{3}-t\right) = \delta\left(t-\frac{\pi}{3}\right)$ — 1 Mark

$\int_0^{2\pi} t \sin t \; \delta\left(t-\frac{\pi}{3}\right)$

$= t \sin t \Big|_{t=\frac{\pi}{3}}$.

$= \frac{\pi}{3} \sin\left(\frac{\pi}{3}\right) = \frac{\pi}{3} \cdot \frac{\sqrt{3}}{2}$

$= \frac{\pi}{2\sqrt{3}}$. — 1 Mark

— 2 Marks

ⓑ $\int_{-8}^{2} e^{t-4} \; \delta(2t+8)$

using time scaling property,

$\delta(2t+8) = \delta(2(t+4))$

$= \frac{1}{2}\delta(t+4)$. — 1M

$\int_{-8}^{2} e^{t-4} \left(\frac{1}{2}\right) \delta(t+4)$

$= \frac{1}{2} e^{t-4} \Big|_{t=-4}$

$= \frac{1}{2} e^{-4-4} = \frac{1}{2} e^{-8}$ — 1M

$= \frac{1}{2e^{8}} = 1.677 \times 10^{-4}$

2 M

⑤

ⓒ $\int_0^{\infty} \cos t \; u(t+1) \; \delta(t) \, dt$.

$= \cos t \; u(t+1) \Big|_{t=0}$ — 1M

$= \cos 0 \; u(0+1)$

$= 1 \; u(1)$

$= \underline{1}$. — 1M

2 M

ⓓ $\sum_{n=0}^{2} 2^n \delta(2n-2)$

using time scaling property,

$\delta(2n-2) = \delta(2(n-1))$

$= \delta(n-1)$. — 1M

$\sum_{n=0}^{2} 2^n \delta(n-1)$

$= 2^n \Big|_{n=1}$

$= \underline{2}$ — 1M

2M

ⓔ $\sum_{n=0}^{3} e^{4-2n} \delta(4-2n)$

using even property, — 1M

$\delta(4-2n) = \delta(2n-4)$

using time scaling property,

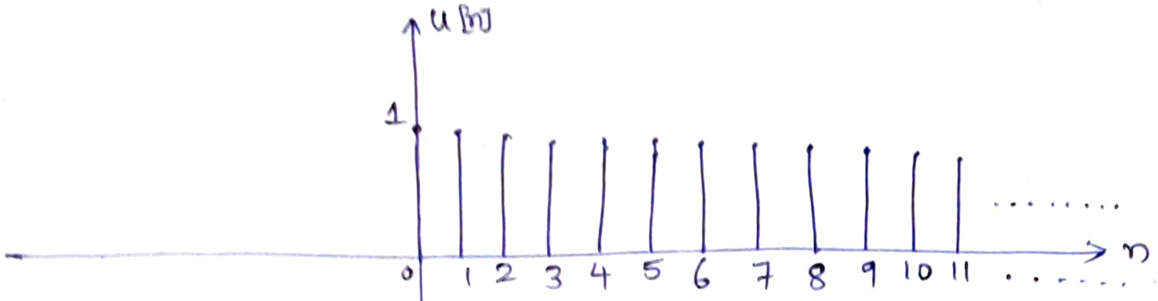
$\delta(2n-4) = \delta(2(n-2))$

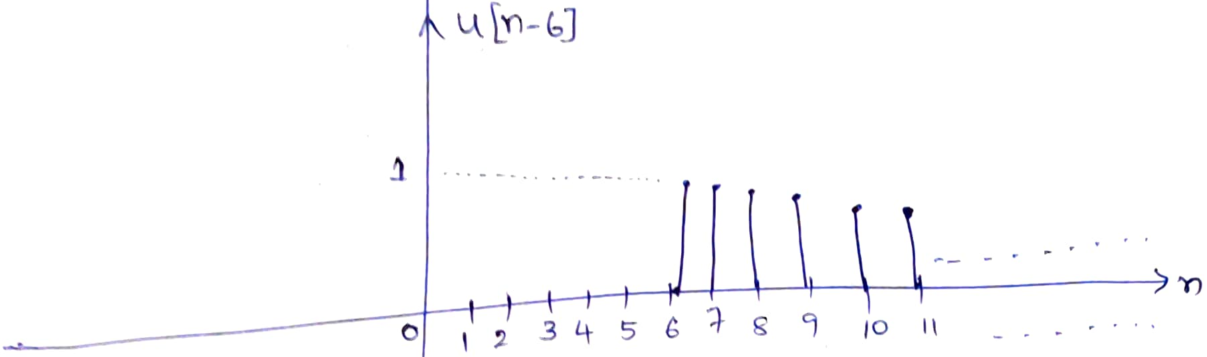
$= \delta(n-2)$ — 1M

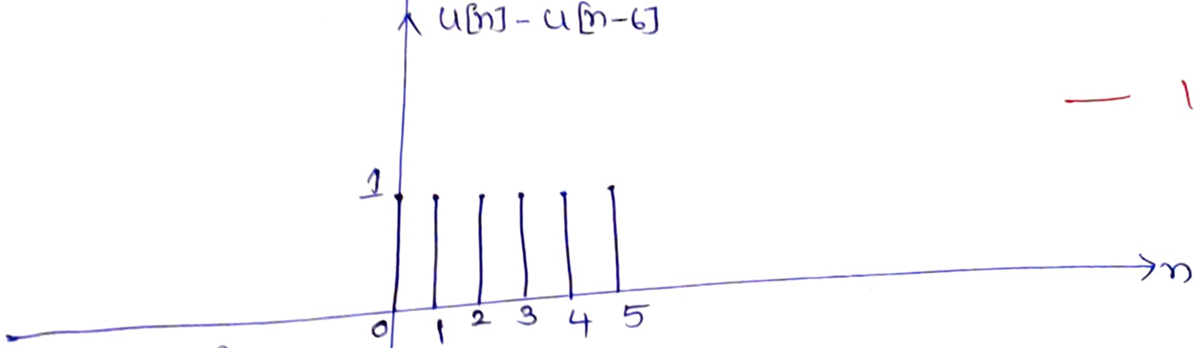
$= e^{4-2n}\Big|_{n=2} = e^{4-4} = \underline{1}$

2M

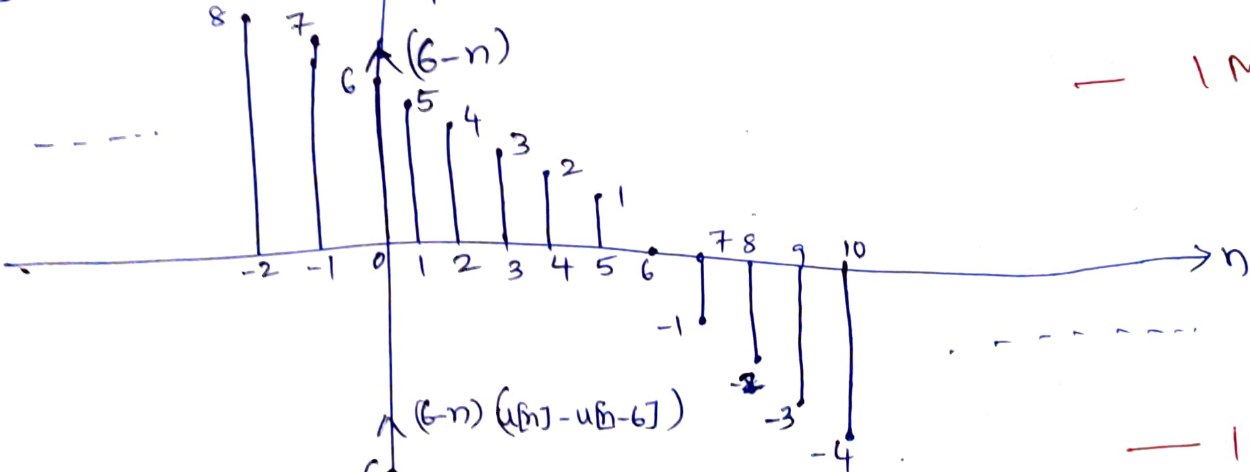
4 Given signal $x[n] = [6-n] (u[n] - u[n-6])$ 6



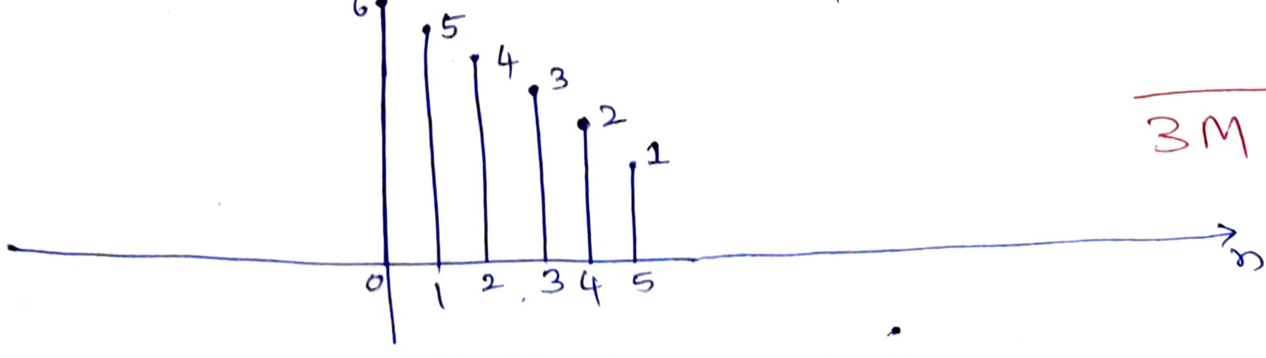




— 1M



— 1M

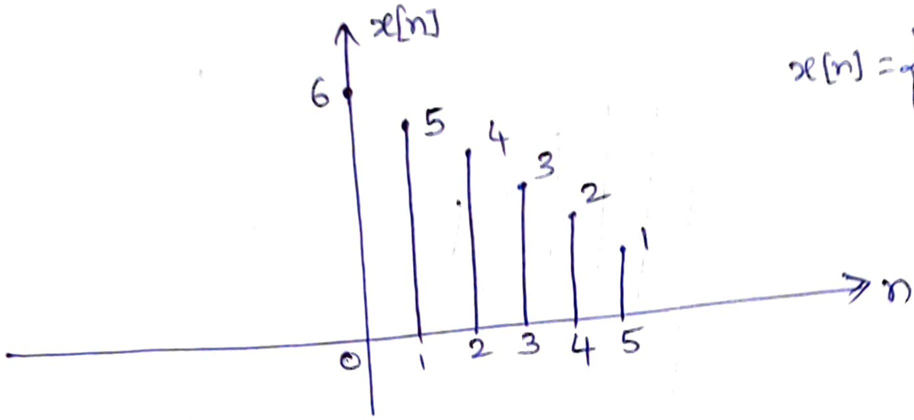


— 1M

3M

(a) Draw $x[2n]$.

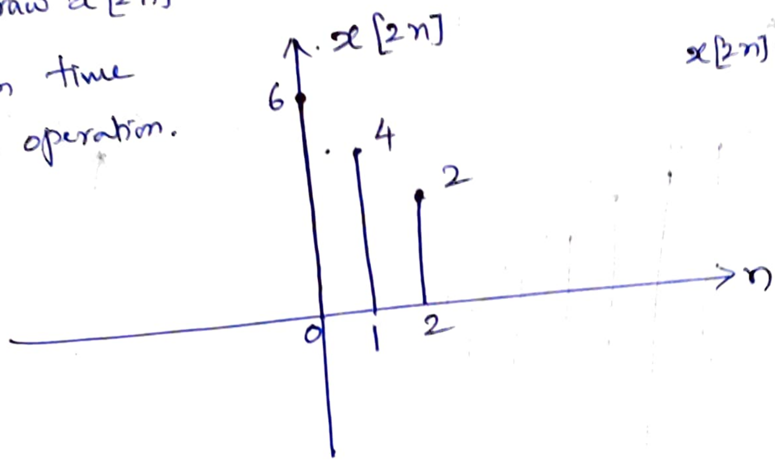
Step 1 :- Draw $x[n] = [6-n]\,(u[n]-u[n-6])$



$x[n] = \{ \underset{\uparrow}{6}, 5, 4, 3, 2, 1 \}$.

Step 2 :- Draw $x[2n]$

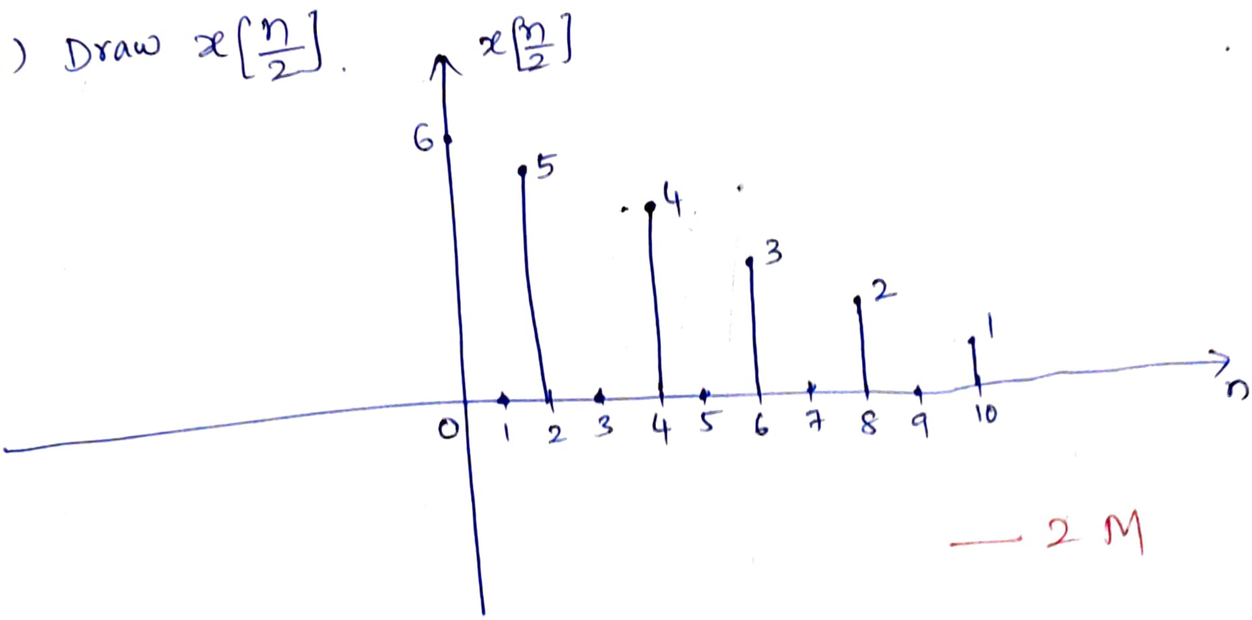
Perform time Scaling operation.



$x[2n] = \{ \underset{\uparrow}{6}, 4, 2 \}$

— 2 M

(b) Draw $x\left[\frac{n}{2}\right]$.

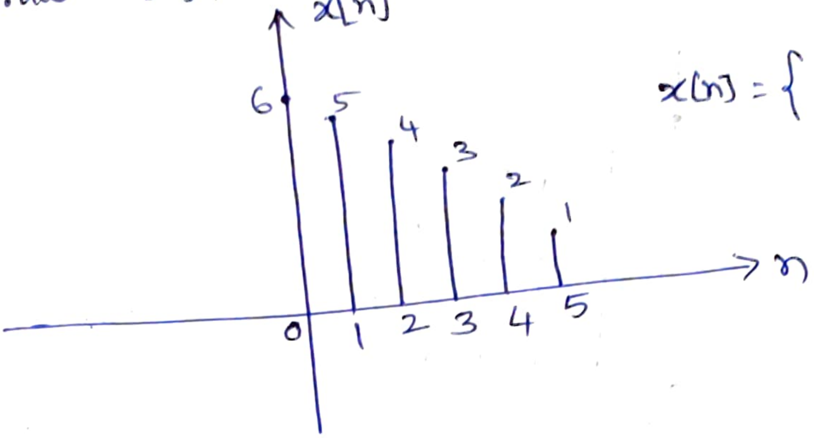


— 2 M

$x\left[\frac{n}{2}\right] = \{ \underset{\uparrow}{6}, 0, 5, 0, 4, 0, 3, 0, 2, 0, 1 \}$.

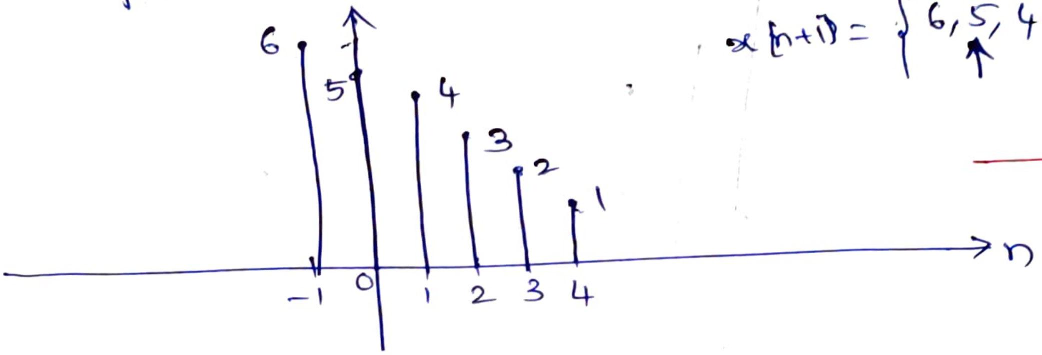
(c) Draw $x[1-2n] = x[-2n+1]$

Step 1 :- Draw $x[n]$.



$x[n] = \{ \underset{\uparrow}{6}, 5, 4, 3, 2, 1 \}$.

Step 2 :- Draw ~~x[2-n]~~ $x[n+1]$.
Perform time shifting operation.

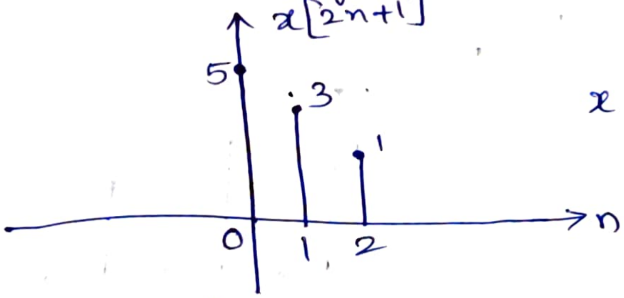


$x[n+1] = \{ 6, \underset{\uparrow}{5}, 4, 3, 2, 1 \}$

— 1M

Step 3 :- Draw $x[2n+1]$
Perform time Scaling operation.

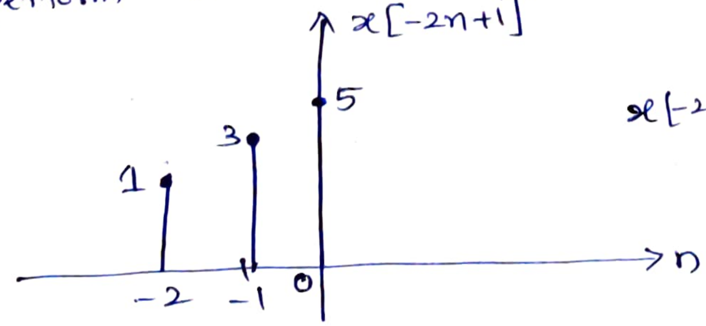
— 1M



$x[n+1] = \{ \underset{\uparrow}{5}, 3, 1 \}$

Step 4 :- Draw $x[-2n+1]$
perform time reversal operation.

— 1M



$x[-2n+1] = \{ 1, 3, \underset{\uparrow}{5} \}$

10M

5 (a) Classification of Signals.

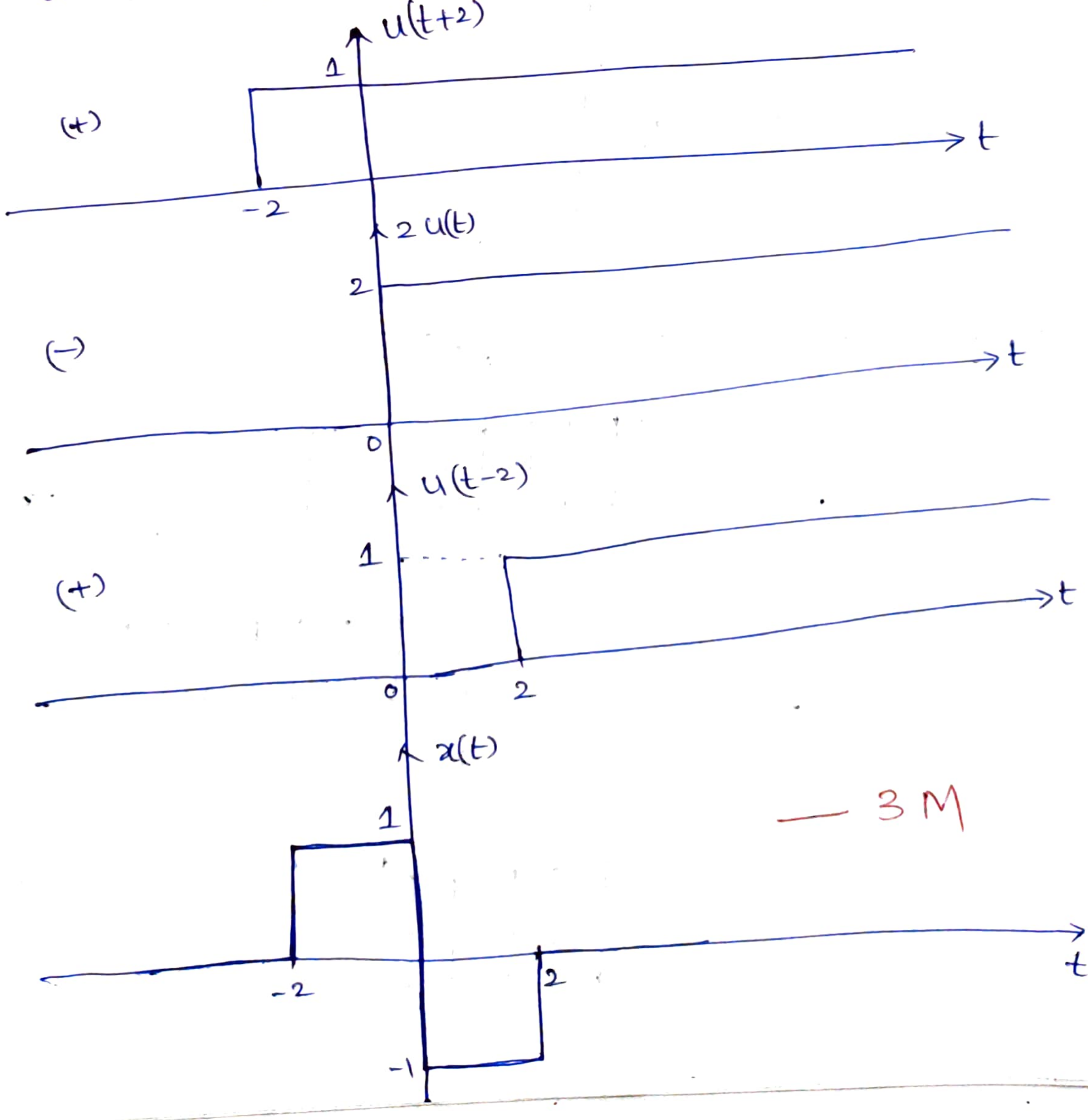
The Signals can be classified as follows,

The signals can be classified as continuous time signal and discrete time signal.

1. Continuous time Signal and discrete time Signal.
2. deterministic and Non-deterministic (Random) Signal.
3. Even and odd Signal.
4. Periodic and Non-periodic Signal
5. Real and Imaginary Signal.
6. Power and Energy Signal. — 2 M

(b) Draw the following Signals.

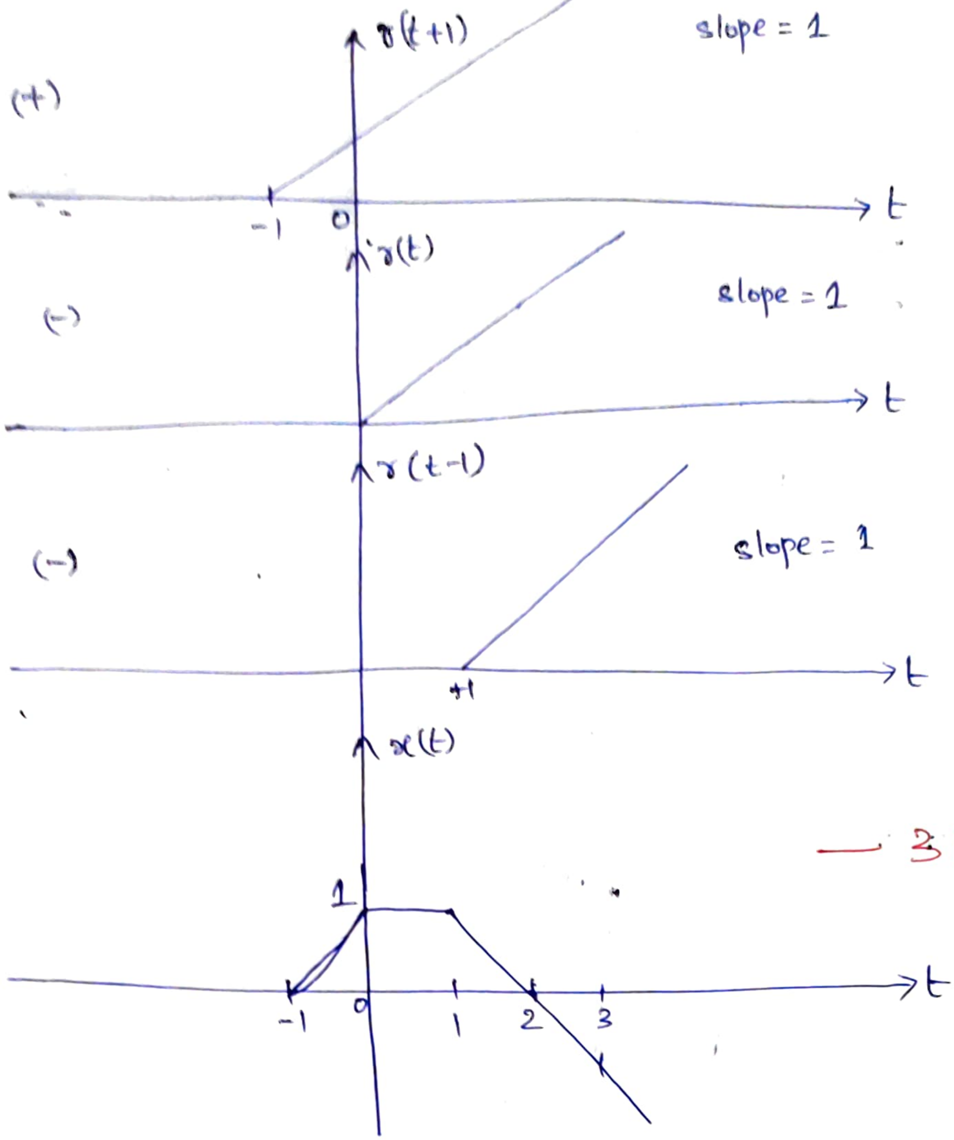
(i) $x(t) = u(t+2) - 2u(t) + u(t-2)$



— 3 M

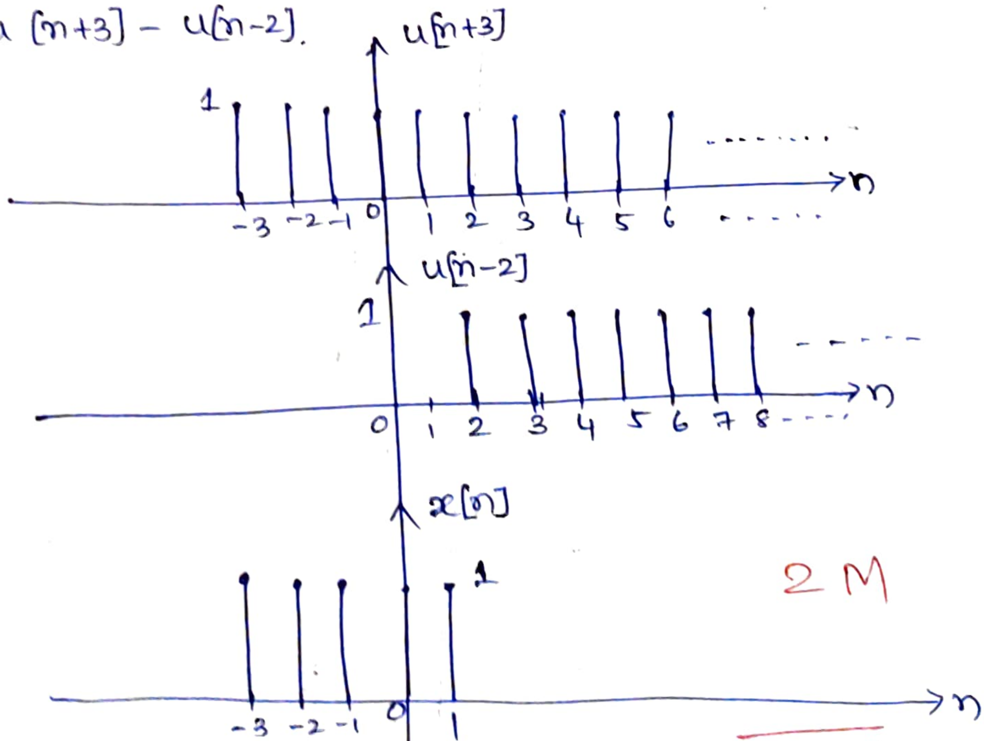
(ii) $x(t) = r(t+1) - r(t) - r(t-1)$

10



— 3M

(iii) $x[n] = u[n+3] - u[n-2]$.



2M

10M

⑥ Distinguish between the following signals. (ii)

(i)

Deterministic Signal	Non-deterministic Signal.
→ The amplitude of the signal can be determined at any given instant of time.	→ Amplitude can't be determined at any given time ~~using mathematical equation~~
→ Mathematical formula can be expressed.	→ Expressed in terms of probabilistic model. but not mathematical equation.
→ doesn't contain uncertainty	→ Signal contains uncertainty.
→ More Accurate & Amplitude can be calculated more accurately.	→ Amplitude can be predicted with less accuracy.
Ex: $A\sin(\omega t+\phi)$ $A\cos(\omega_0 t+\phi)$	→ Ex:- No. of vehicles in traffic, ~~whether~~ weather conditions.

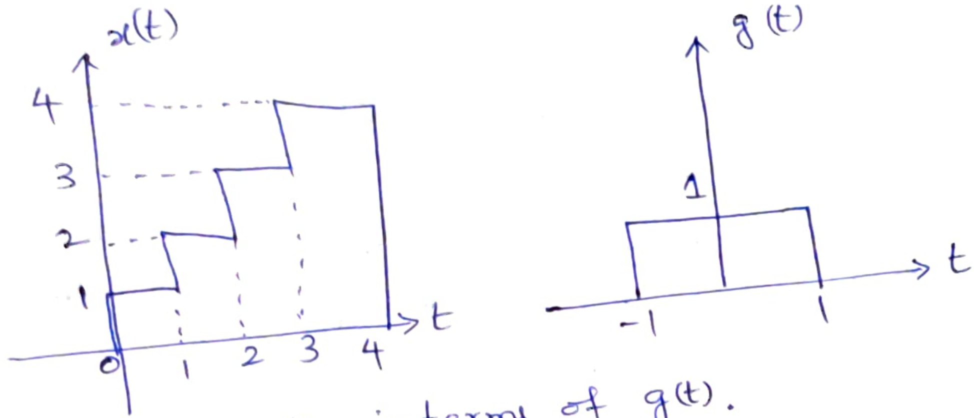
— 2 M

(ii)

Periodic Signal	Non-Periodic Signal.
→ periodic signal should exist from $-\infty$ to ∞.	→ This signal exist from finite time duration.
→ The signal will repeat at finite time duration. $x(t+T) = x(t)$.	→ This signal will not repeat (or) signal will repeat at "∞" (infinity).
→ Periodic signals are deterministic signals.	→ These are random signals.
→ Can be represented with mathematical equation.	→ Cannot be represented by any mathematical formula.
EX:- $A\sin(\omega_0 t+\phi)$, $A\cos(\omega_0 t+\phi)$	→ Ex:- Signals ~~at~~ propagated by FM radio stations.

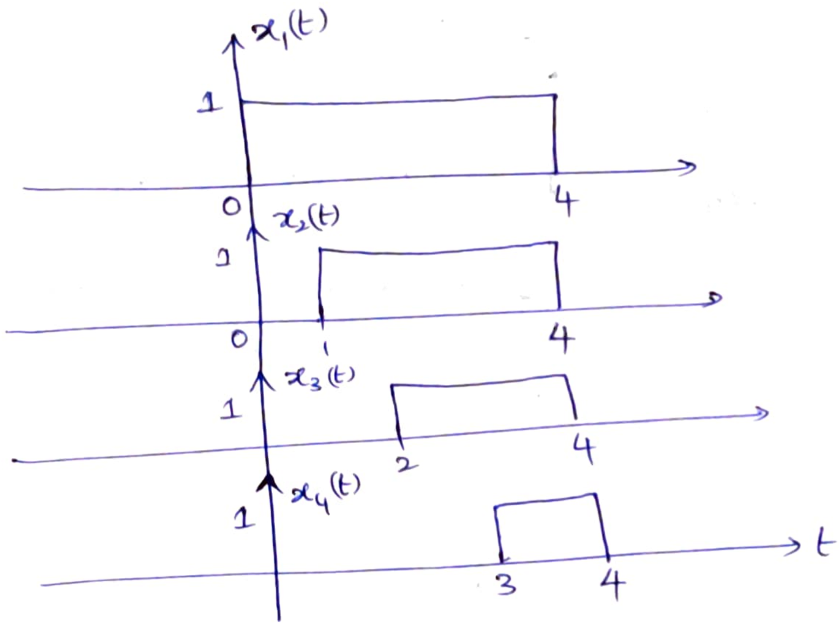
— 2 M

6 (b)

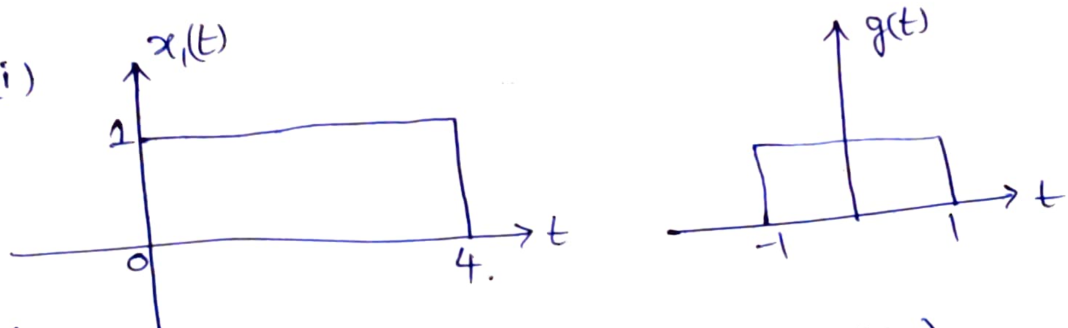


Express $x(t)$ interms of $g(t)$.

Sol:- $x(t)$ Can be drawn as.



(i)

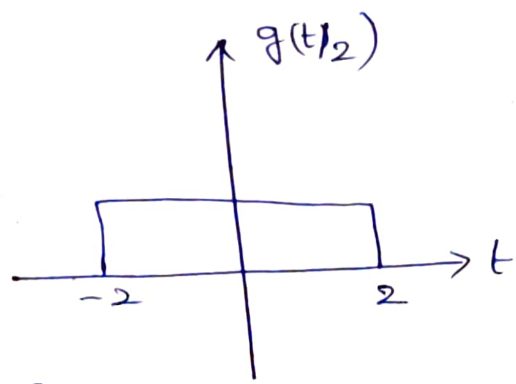


Step 1 :-

duration of $x(t) = 4$

duration of $g(t) = 2$

multiply time axis of $g(t) = 2$



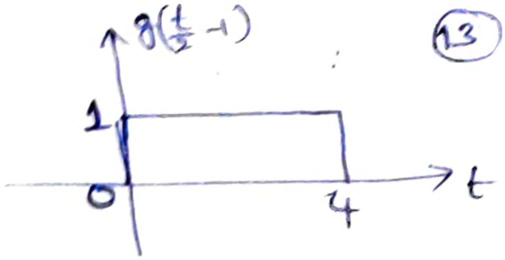
Step 2 :-

shift the $g(t/2)$ Signal,

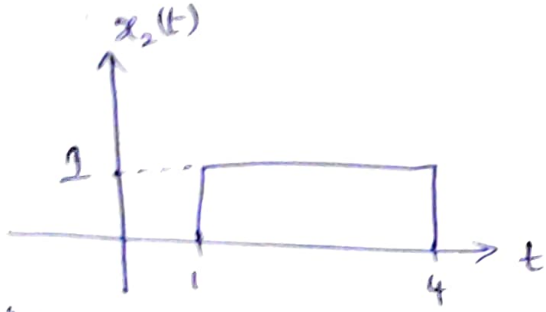
$-2 + t = 0 \Rightarrow t - 2 = 0.$

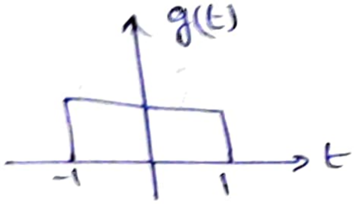
Replace "t" by "t-2".

$$x_1(t) = g\left(\frac{t-2}{2}\right) = g\left(\frac{t}{2}-1\right)$$ — 1M



(ii)





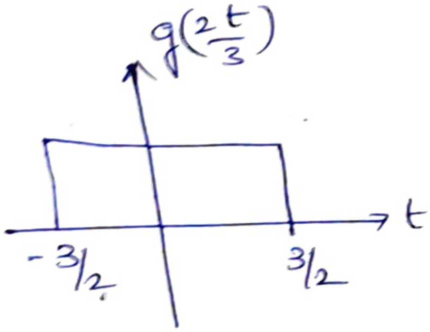
Step 1:-

duration of $x_2(t) = 3$

duration of $g(t) = 2$

multiply time axis of $g(t) = 3/2$.

$\therefore$ Draw $g\left(\frac{2t}{3}\right)$.



Step 2:- Shift the Signal

$$-\frac{3}{2}+t = 1$$

$$t-\frac{3}{2}-1=0$$

$$t-\frac{5}{2}=0.$$

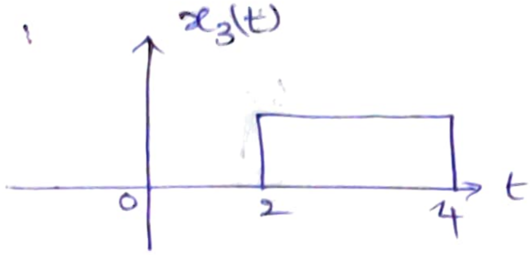
Replace "t" by "$t-\frac{5}{2}$" in $g\left(\frac{2t}{3}\right)$

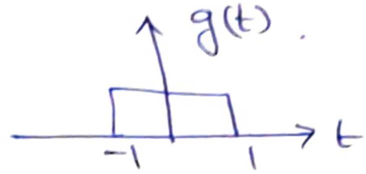
$\therefore$ Draw $g\left(\frac{2}{3}\left(t-\frac{5}{2}\right)\right)$

$$x_2(t) = g\left(\frac{2}{3}\left(t-\frac{5}{2}\right)\right) = g\left(\frac{2t}{3}-\frac{5}{2}\times\frac{2}{3}\right)$$

$$= g\left(\frac{2t}{3}-\frac{5}{3}\right).$$

$$x_2(t) = g\left(\frac{2t}{3}-\frac{5}{3}\right)$$ — 2M





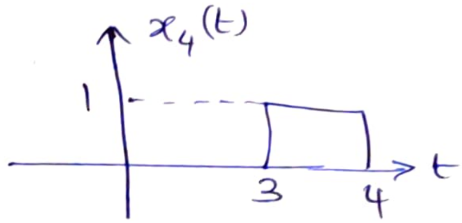
duration of $x_3(t) = 2$
duration of $g(t) = 2$

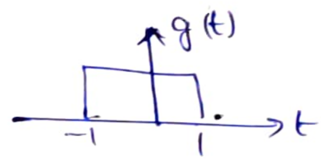
shift the signal, $-1 + t = 2$
$t - 1 - 2 = 0$
$t - 3$.

Replace "t" by "t-3" in g(t) signal.

$$x_3(t) = g(t-3).$$ — 1M.

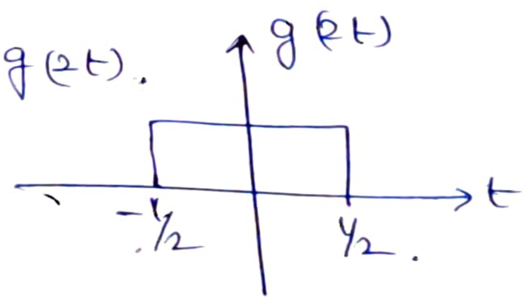
Draw $x_4(t)$





duration of $x_4(t) = 1$
duration of $g(t) = 2$

Multiply time axis by (1/2), then draw g(2t).



Shift the signal,
$-\frac{1}{2} + t = 3$
$t - \frac{1}{2} + 3 = 0$.
$t - 7/2 = 0$.

Replace "t" by "$t - 7/2$" in g(2t),

$$x_4(t) = g\left(2\left(t - 7/2\right)\right)$$

$$= g(2t-7) \quad \text{— 1M}$$

$$\therefore \quad x(t) = x_1(t) + x_2(t) + x_3(t) + x_4(t)$$

$$x(t) = g\left(\frac{t}{2}-1\right) + g\left(\frac{2t}{3}-\frac{5}{3}\right) + g(t-3) + g(2t-7) \quad \text{— 1M}$$

10M

7 a (i) $x(t) = (1+t^2+t^3)\cos t$

$$x(t) = \cos t + t^2\cos t + t^3\cos t \quad \text{— (1)}$$

$$x(-t) = \cos(-t) + (-t)^2\cos(-t) + (-t)^3\cos(-t)$$

$$x(-t) = \cos t + t^2\cos t - t^3\cos t \quad \text{— (2)}$$

from eq (1) & (2),

$$x_e(t) = \frac{1}{2}\left[x(t) + x(-t)\right]$$

$$x_e(t) = \frac{1}{2}\left[\cos t + t^2\cos t + \cancel{t^3\cos t} + \cos t + t^2\cos t - \cancel{t^3\cos t}\right]$$

$$x_e(t) = \frac{1}{\cancel{2}}\left[\cancel{2}(\cos t + t^2\cos t)\right]$$

$$\boxed{x_e(t) = \cos t + t^2\cos t = (1+t^2)\cos t.} \quad \text{— 1M}$$

$$x_o(t) = \frac{1}{2}\left[x(t) - x(-t)\right]$$

$$= \frac{1}{2}\left[\cancel{\cos t} + \cancel{t^2\cos t} + t^3\cos t - \cancel{\cos t} - \cancel{t^2\cos t} + t^3\cos t\right]$$

$$= \frac{1}{\cancel{2}}\left(\cancel{2}t^3\cos t\right) \quad \text{— 1M}$$

$$\boxed{x_o(t) = t^3\cos t}$$

(ii) $x(t) = 1 + t + 3t^2 + 5t^3 + 9t^4$ — (1)

$x(-t) = 1 + (-t) + 3(-t)^2 + 5(-t)^3 + 9(-t)^4$

$x(-t) = 1 - t + 3t^2 - 5t^3 + 9t^4$ — (2)

$x_e(t) = \frac{1}{2}\left[x(t) + x(-t)\right]$

$x_e(t) = \frac{1}{2}\left[1 + \cancel{t} + 3t^2 + \cancel{5t^3} + 9t^4 + 1 - \cancel{t} + 3t^2 - \cancel{5t^3} + 9t^4\right]$

$x_e(t) = \frac{1}{2}\left[2 + 6t^2 + 18t^4\right]$

$x_e(t) = \frac{1}{\cancel{2}}\left[\cancel{2}(1 + 3t^2 + 9t^4)\right]$

$\boxed{\therefore\ x_e(t) = 1 + 3t^2 + 9t^4}$ ← 1M

$x_o(t) = \frac{1}{2}\left[x(t) - x(-t)\right]$

$x_o(t) = \frac{1}{2}\left[\cancel{1} + t + \cancel{3t^2} + 5t^3 + \cancel{9t^4} - \cancel{1} + t - \cancel{3t^2} + 5t^3 - \cancel{9t^4}\right]$

$= \frac{1}{\cancel{2}}\left[\cancel{2}(t + 5t^3)\right]$

$\boxed{x_o(t) = t + 5t^3}$ ← 1M

(iii) $x(t) = 1 + t\cos t + t^2 \sin t + t^3 \sin t \cos t$ —— ①

(17)

$x(-t) = 1 + (-t)\cos(-t) + (-t)^2 \sin(-t) + (-t)^3 \sin(-t)\cos(-t)$

$x(-t) = 1 - t\cos t - t^2 \sin t + t^3 \sin t \cos t$ —— ②

$x_e(t) = \frac{1}{2}[x(t) + x(-t)]$

$= \frac{1}{2}[1 + \cancel{t\cos t} + \cancel{t^2 \sin t} + t^3 \sin t \cos t + 1 - \cancel{t\cos t} - \cancel{t^2 \sin t} + t^3 \sin t \cos t]$

$= \frac{1}{\cancel{2}}[\cancel{2}(1 + t^3 \sin t \cos t)]$

$\boxed{x_e(t) = 1 + t^3 \sin t \cos t}$ —— 1M

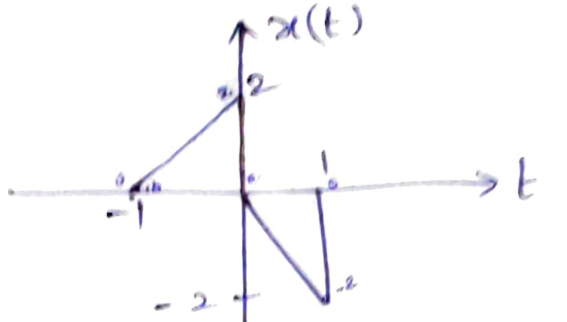
$x_o(t) = \frac{1}{2}[x(t) - x(-t)]$

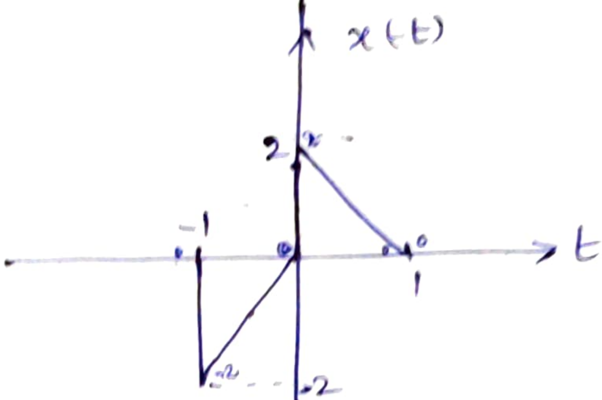
$= \frac{1}{2}[\cancel{1} + t\cos t + t^2 \sin t + \cancel{t^3 \sin t \cos t} - \cancel{1} + t\cos t + t^2 \sin t - \cancel{t^3 \sin t \cos t}]$

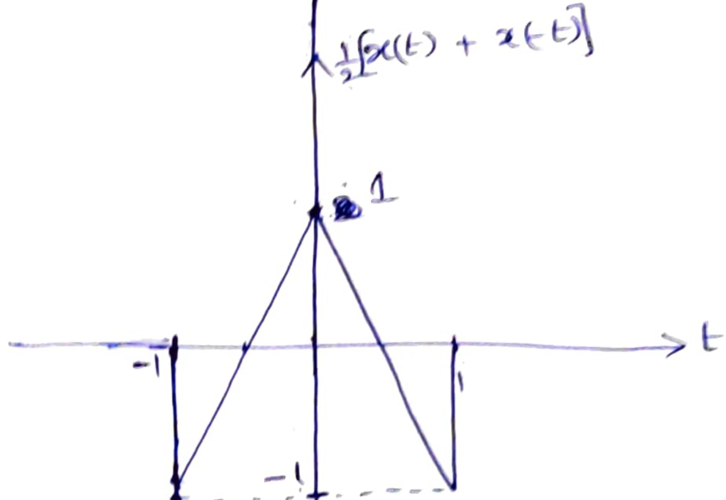
$= \frac{1}{\cancel{2}}[\cancel{2}(t\cos t + t^2 \sin t)]$

$\boxed{x_o(t) = t\cos t + t^2 \sin t}$ —— 1M

7 (b)

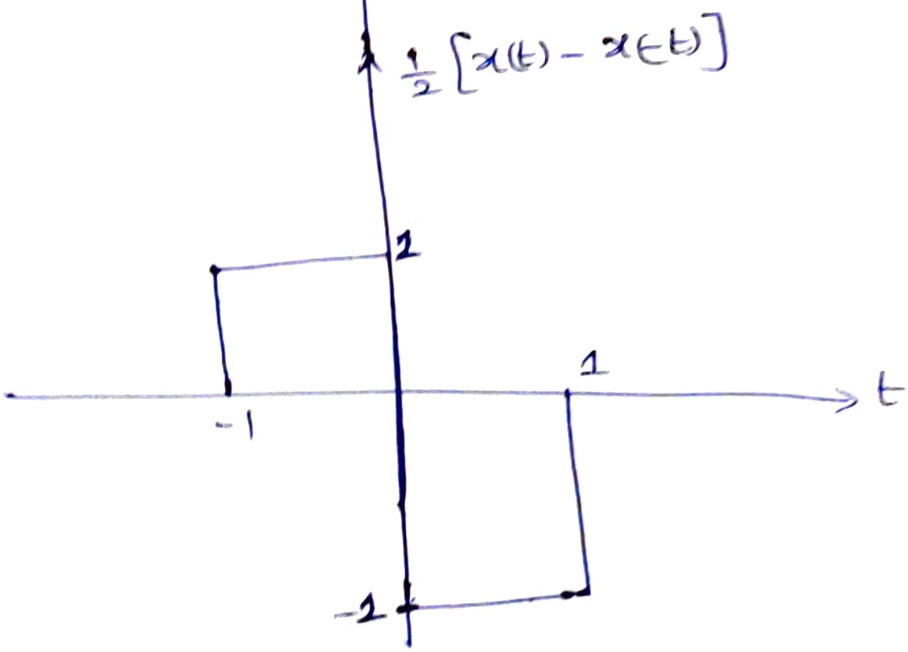






— 2 M

⇒ Even component



— 2 M

⇒ odd component.

10 Marks.

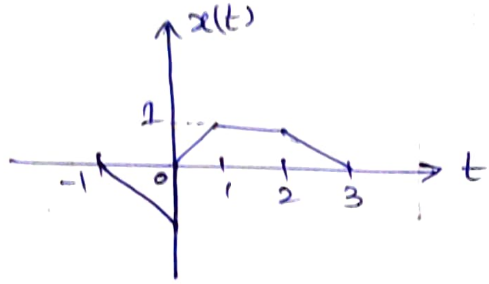
8 (a) $\frac{d\,x(t)}{dt} = 2\,u(t+2) + \delta(t) + 4\,\delta(t-1) + u(t-2)$

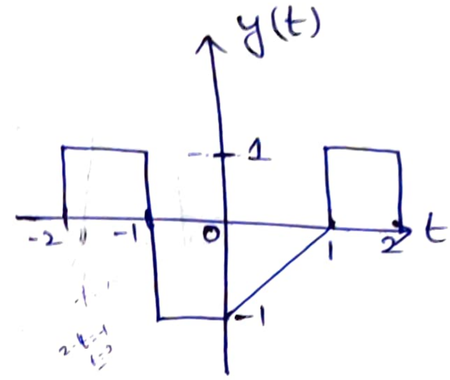
Integrate Both Sides, $\boxed{\int u(t)\,dt = r(t), \quad \int \delta(t)\,dt = u(t)}$

$\therefore \quad x(t) = 2\,r(t+2) + u(t) + 4\,u(t-1) + r(t-2)$. — 2 M

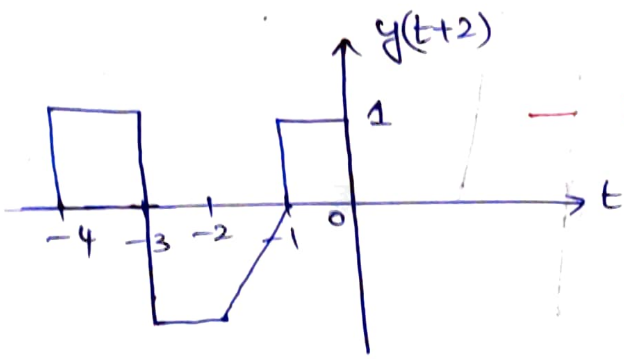
8 (b)

(i)

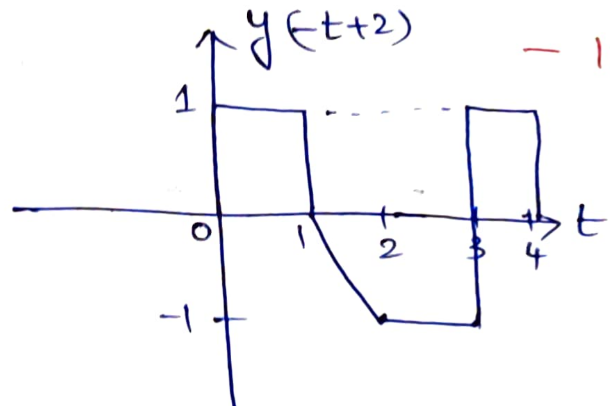




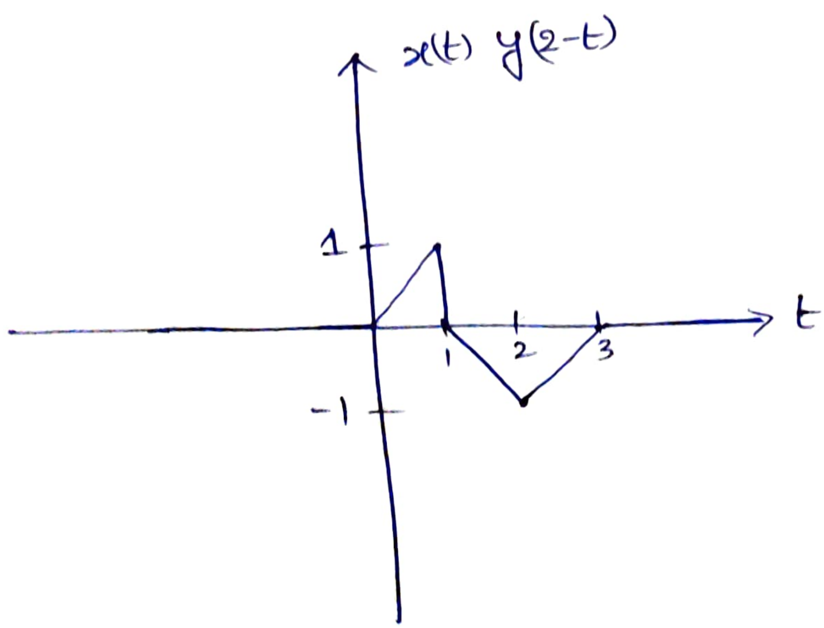
Draw $y(2-t) = y(-t+2)$



— 1M

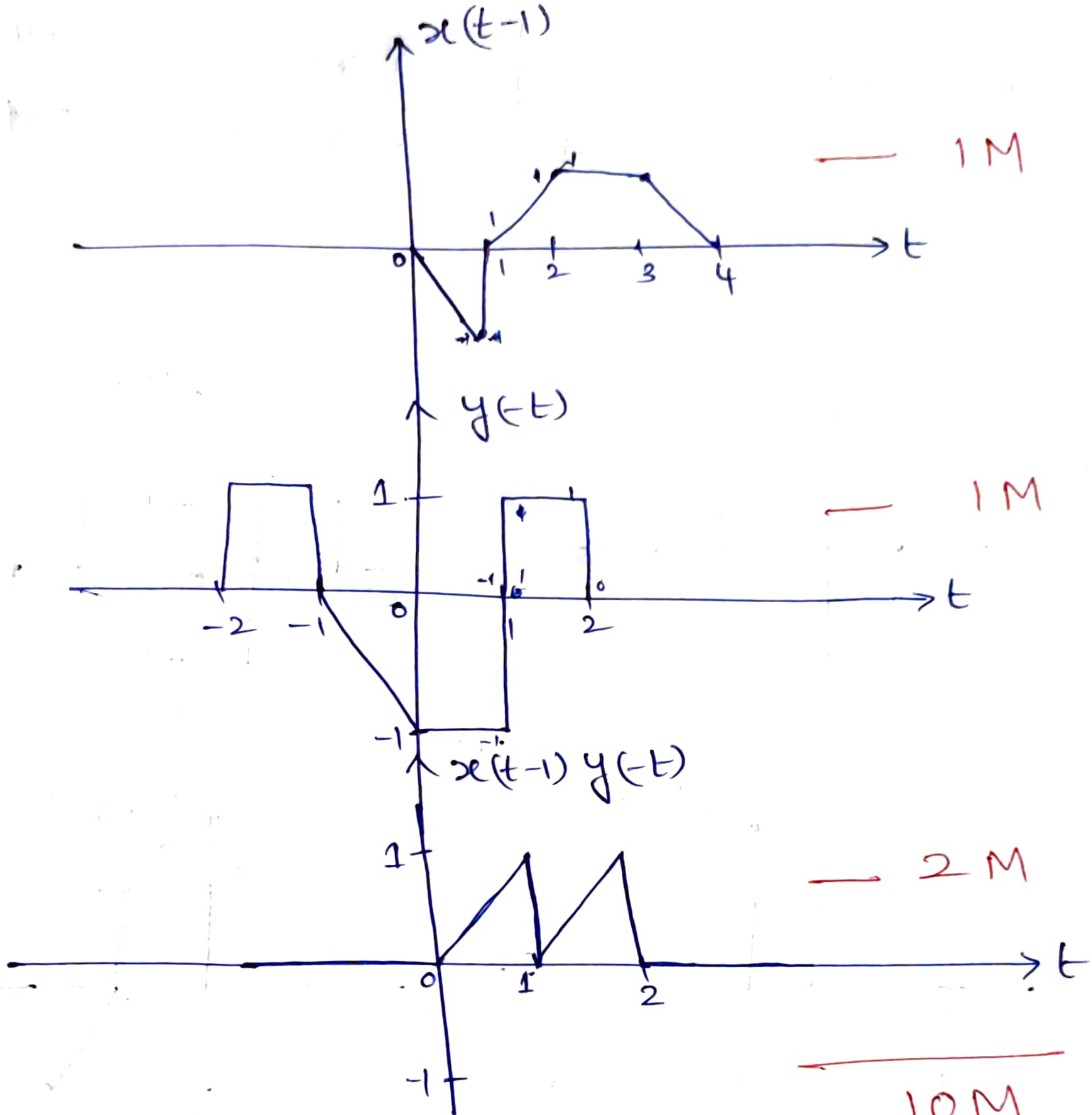


— 1M



— 2 M

8 b (ii) $x(t-1)\,y(-t)$.



— 1 M

— 1 M

— 2 M

10 M