Section A
Roll - 49

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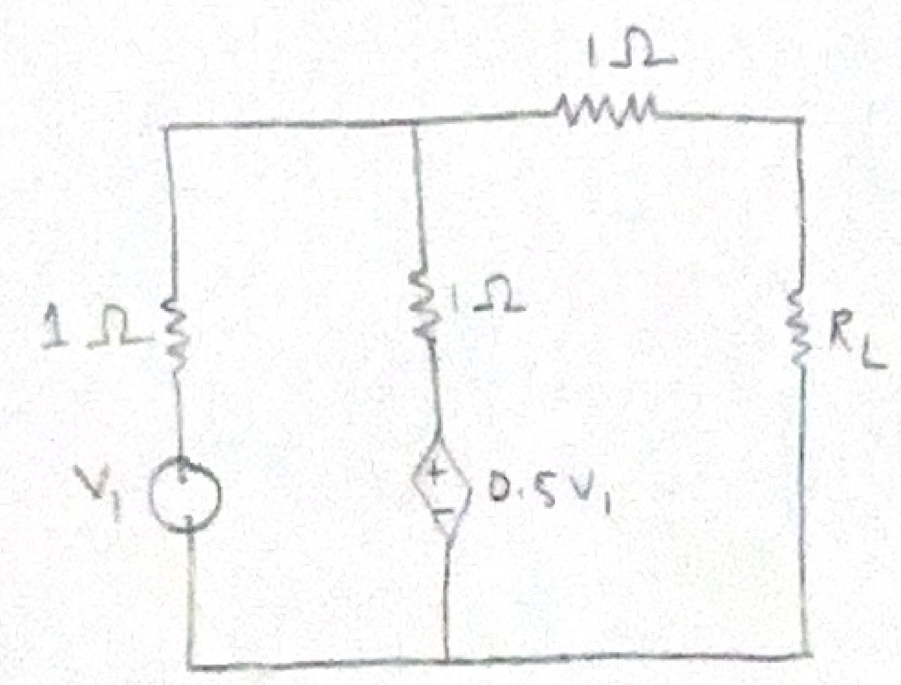
20.01.2022

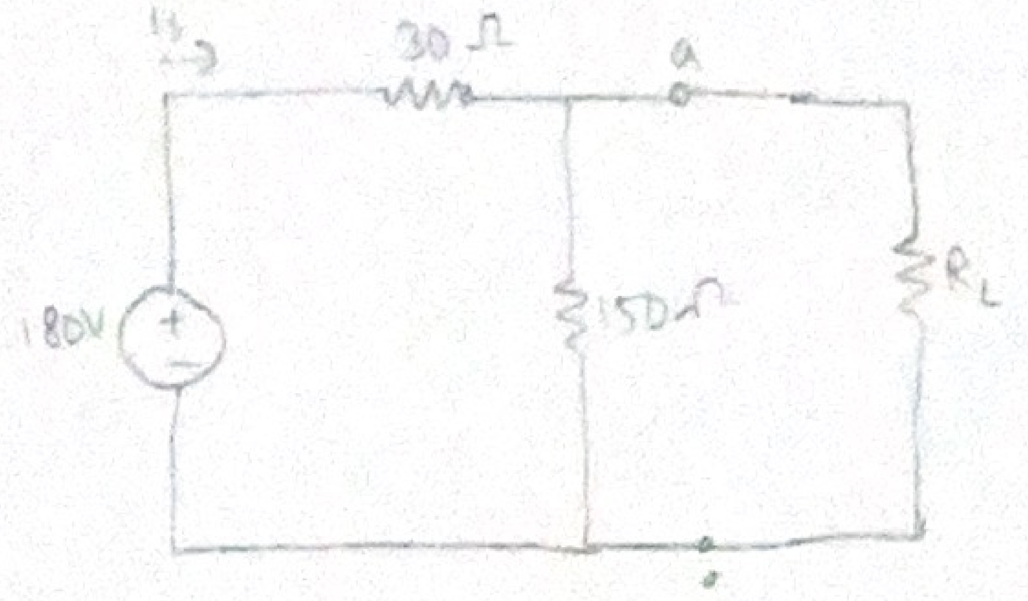
NETWORK ANALYSIS & SIGNALS (ICE 2154)

BTECH III SEMESTER (ETE) END SEM EXAM

1.

A





According to the MPT, the maximum power transfer to the load when the load resistance is equal to the source resistance of Thevenin resistance.

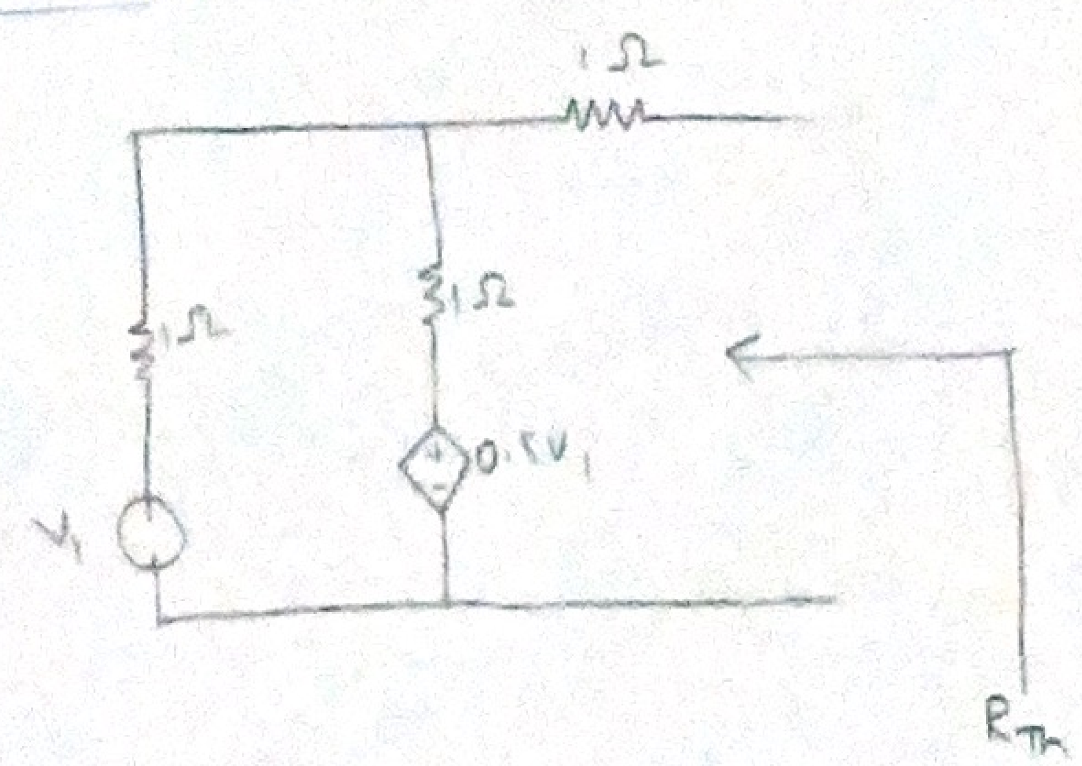
$R_L = R_{Th}$

R_L = load resistance

R_{Th} = Thevenin or source resistance

The maximum power transfer (P_{max}) = $V_{Th}^2 / 4R_{Th}$

Calculation



$R_{Th} = R_L$

$= \dfrac{2 \times 1}{0.5 V_1^2} =$

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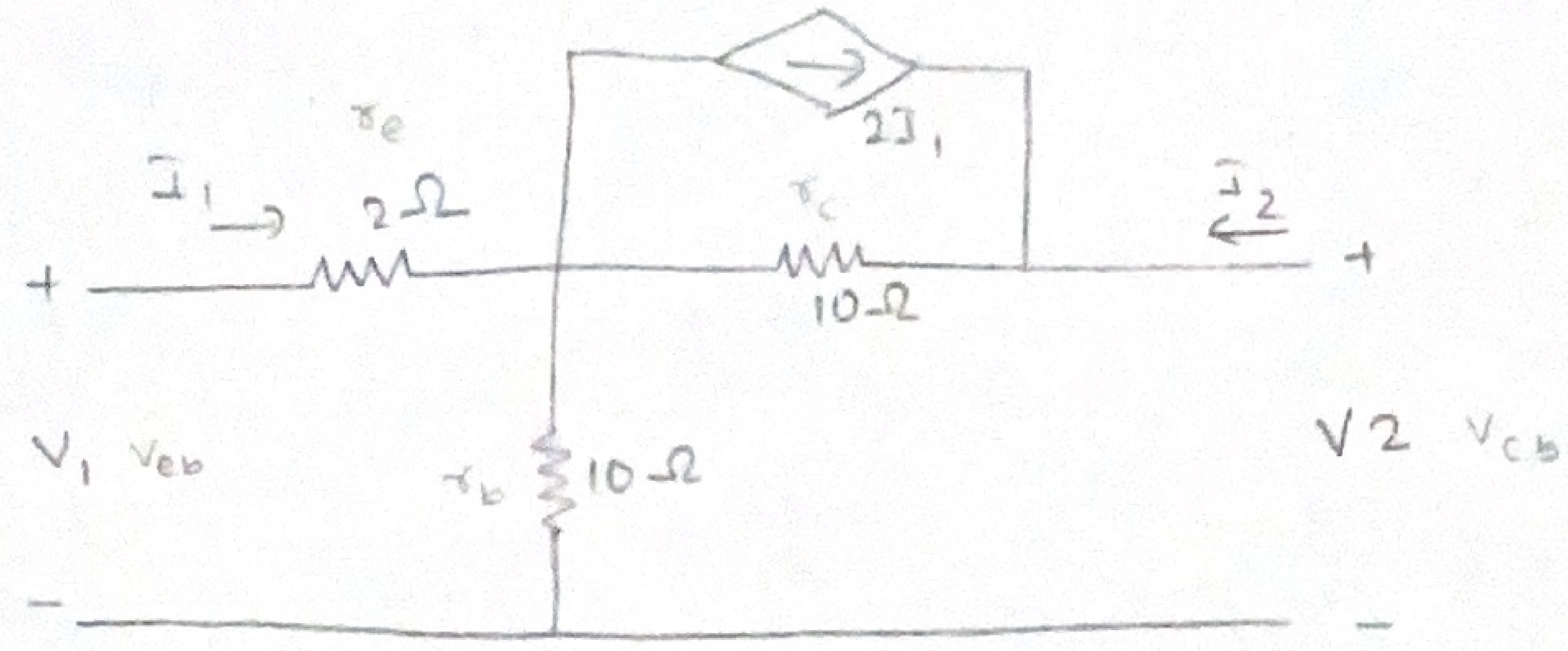
(2)

1.

(c)



Applying KVL to the loops,

$$V_1 = I_1 2 + 10(I_1 - I_2)$$

or $\quad V_1 = 2I_1 + 10I_1 - 10I_2$

$$= 12I_1 - 10I_2$$

And,

$$-V_2 = (I_2 - I_1)10 + (I_2 - 2I_1)10$$

or, $\quad -V_2 = 10I_2 - 10I_1 + 10I_2 - 20I_1$

or, $\quad -V_2 = 20I_2 - 30I_1$

or, $\quad V_2 = 30I_1 - 20I_2$

ie

$\therefore \quad V_1 = 12I_1 - 10I_2$

$\quad V_2 = 30I_1 - 20I_2$

i.e., $\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 12 & 10 \\ 30 & 20 \end{bmatrix} \begin{bmatrix} I_1 \\ -I_2 \end{bmatrix}$

$-I_2$ indicates the current at the output opposite to the assumed direction of I_2 of the original two port Z parameter representation.

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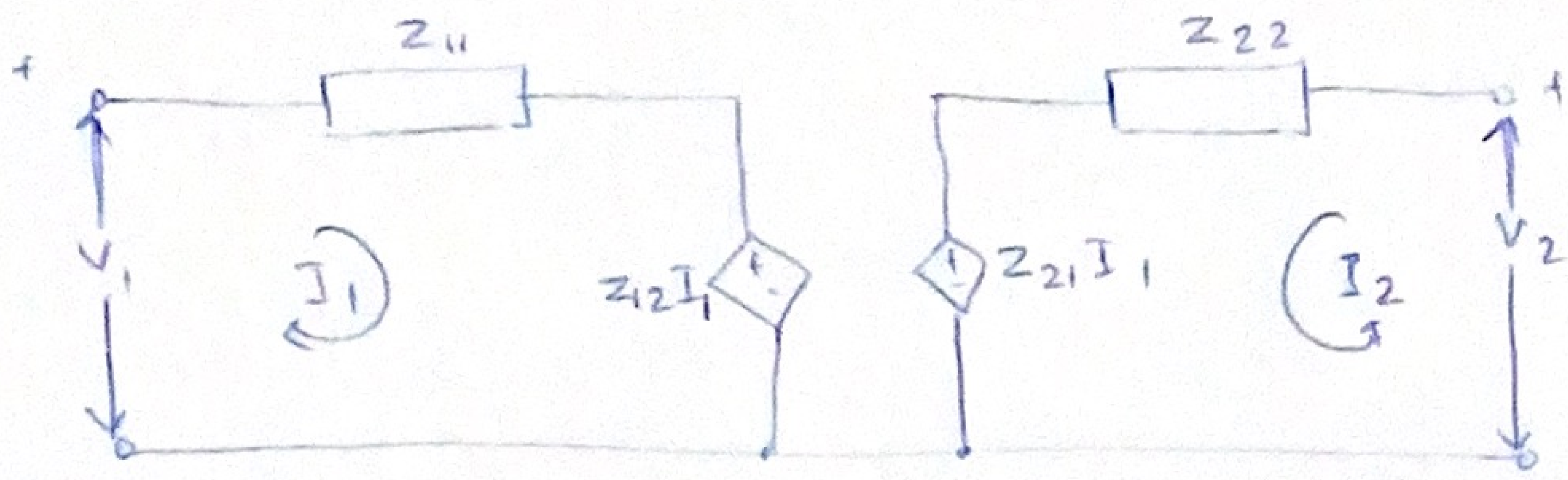
③

Comparing with the original Z-parameter representation,

$Z_{11} = 12$; $Z_{12} = 10$

$Z_{21} = 30$; $Z_{22} = 20$

$\therefore$ Z parameter equivalent of the circuit.



Thus,

$$Y_{11} = \frac{Z_{22}}{\Delta Z} , \quad Y_{12} = -\frac{Z_{12}}{\Delta Z}$$

$$Y_{21} = -\frac{Z_{21}}{\Delta Z} , \quad Y_{22} = \frac{Z_{11}}{\Delta Z}$$

Here, $\Delta Z = Z_{11} Z_{22} - Z_{12} Z_{21}$

$= 12 \times 20 - 10 \times 30$

$= 240 - 300$

$= -60$

$Y_{11} = \frac{20}{-60} = -\frac{1}{3}$, ~~Z_{22}~~

$Y_{12} = \frac{10}{60} = \frac{1}{6}$

$Y_{21} = \frac{30}{60} = \frac{1}{2}$

$Y_{22} = -\frac{20}{60} = -\frac{1}{3}$

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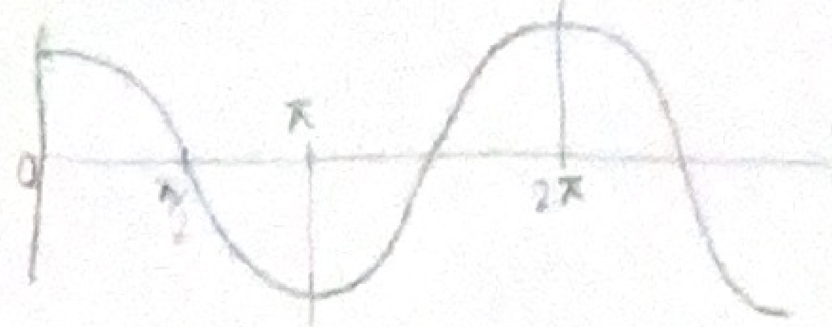
(4)

2.

(B)

(i) $x(t) = 1 + \cos(2\pi t) + \sin(3\pi t)$



$x(0) = 1 + \cos(0) + \sin(0)$

$= 1 + 1 + 0 \quad = 2$

$x(1) = 1 + \cos 2\pi + \sin 3\pi$

$= 1 + 1 + 0 \quad = 2$

$x(2) = 1 + \cos 4\pi + \sin 6\pi$

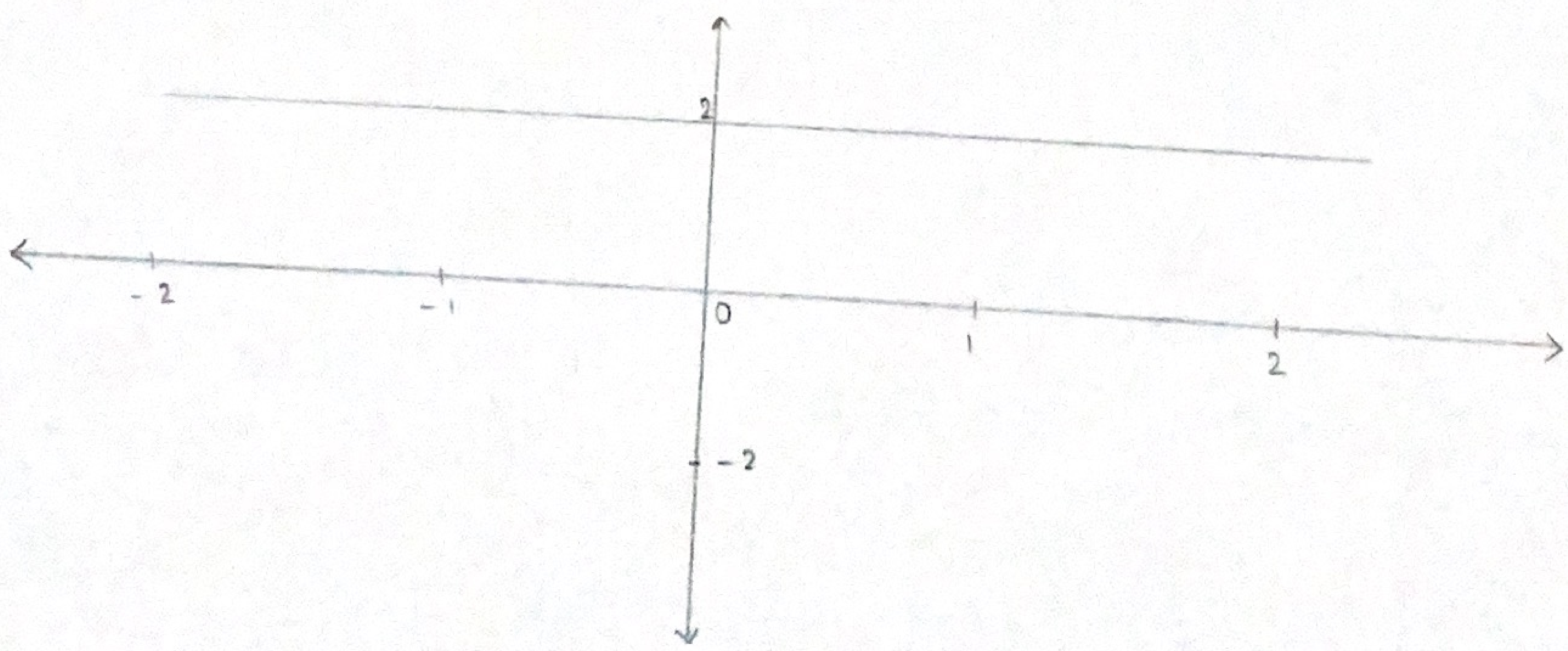
$= 1 + 1 + 0 = 2$

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

$= 1 + 1 - 0 \quad = 2$

$x(-2) = 1 + \cos(-4\pi) + \sin(-6\pi)$

$= 1 + 1 - 0 \quad = 2$



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(5)

2.

B.

(ii) $x(t) = e^{3t}u(-t)$

$x(0) = e^{0}u(0) = u(0)$

$x(1) = e^{3}u(-1)$

$= 20.08\,u(-1)$

$x(2) = e^{6}u(-2)$

$= 403.43\,u(-2)$

$x(-1) = e^{-3}u(1)$

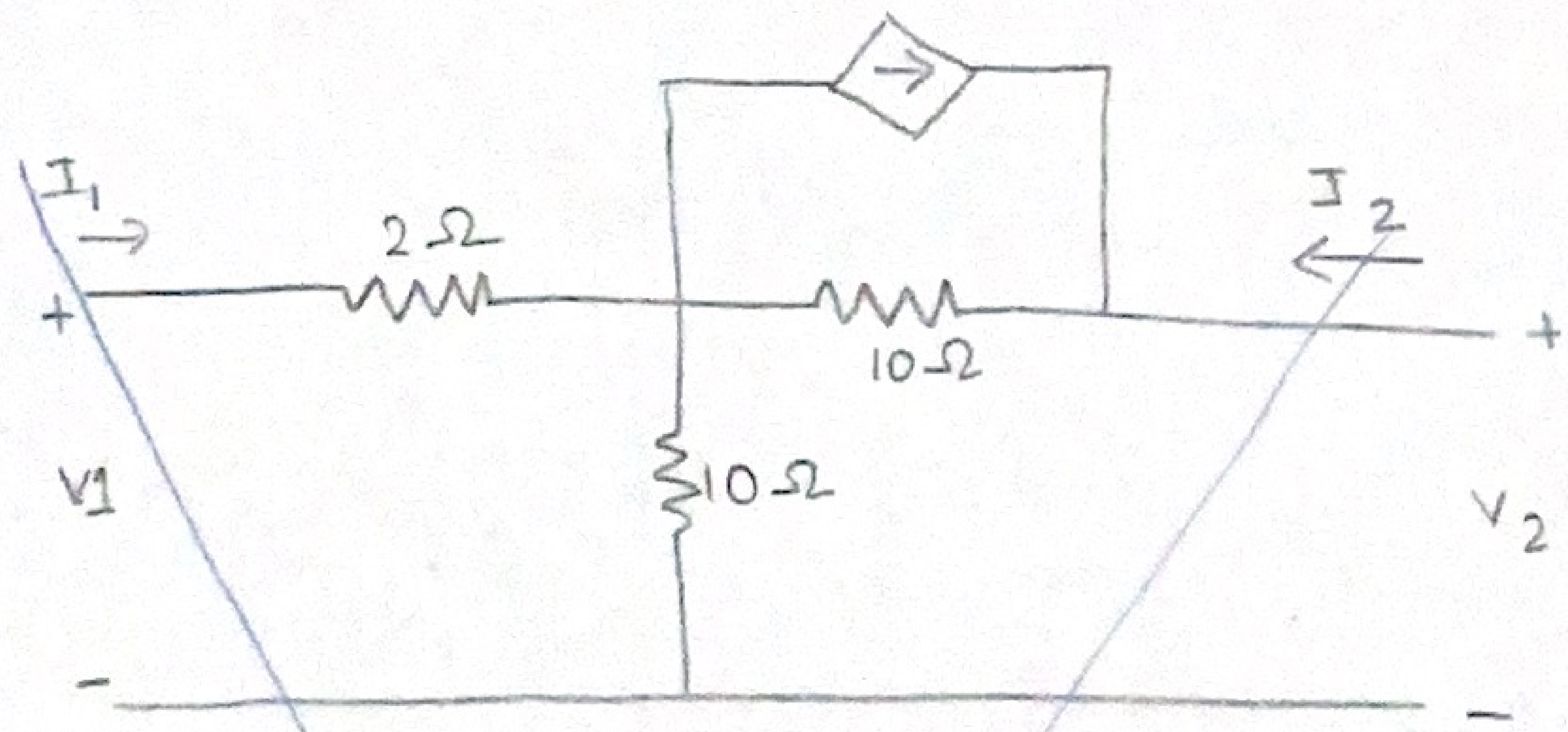
$= 0.05\,u(1)$

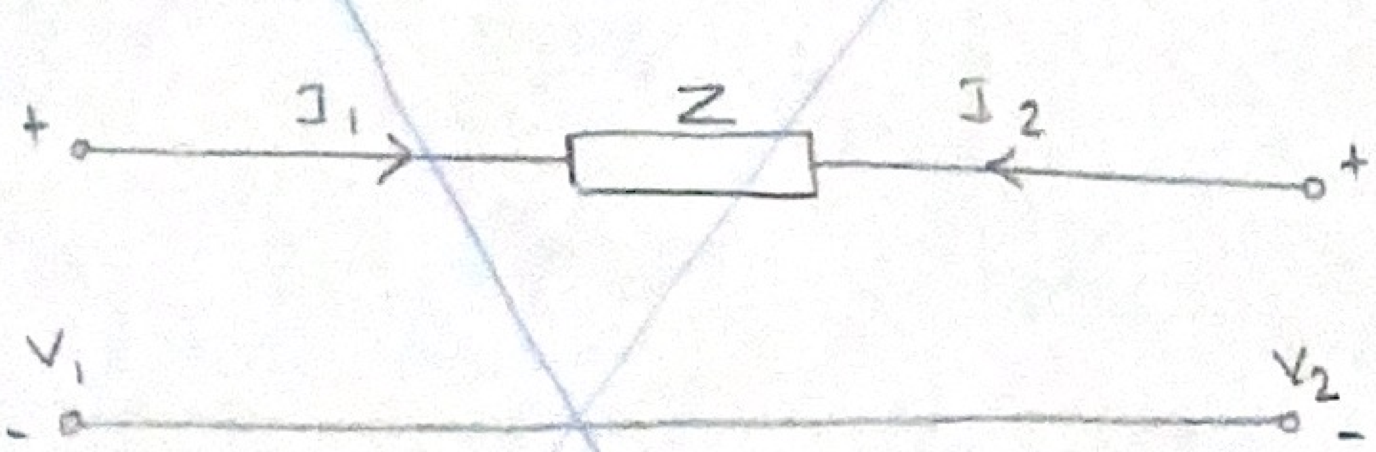
$x(-2) = e^{-6}u(2)$

$= 2.48 \times 10^{-3}\,u(2)$

Q.

(ii)





$$I_1 = \frac{V_1 - V_2}{Z}$$

$$I_1 = \frac{V_1}{Z} - \frac{V_2}{Z} \quad \text{---(i)}$$

$$I_2 = -\frac{1}{Z}V_1 + \frac{1}{Z}V_2 \quad \text{---(ii)}$$

$$|y| = \begin{bmatrix} \frac{1}{Z} & -\frac{1}{Z} \\ -\frac{1}{Z} & \frac{1}{Z} \end{bmatrix}$$