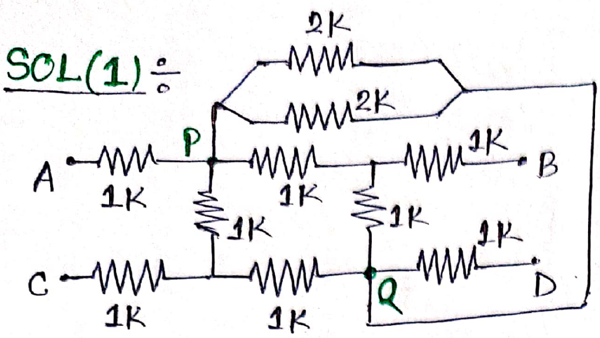
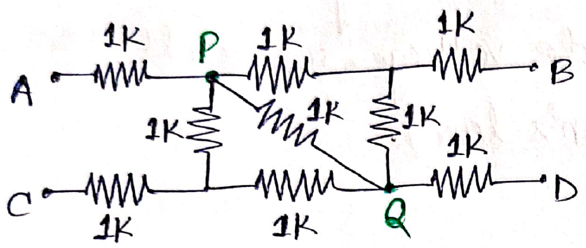
ASSIGNMENT – 1 SOLUTION

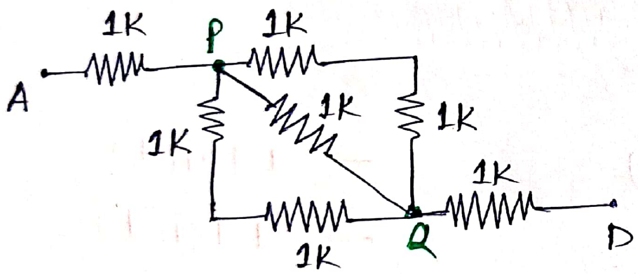
SOL(1):–

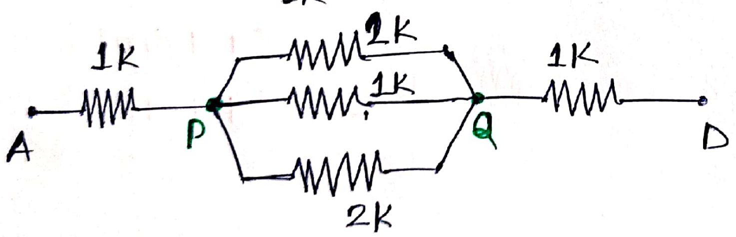




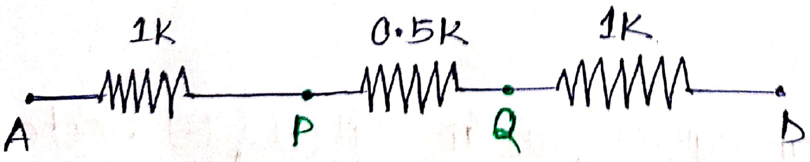
— (1 Point)

We have to determine the equivalent resistance b/w A & D, hence–

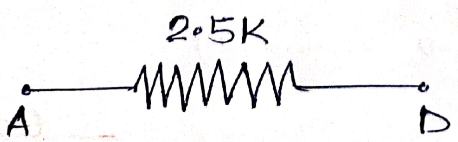




— (1 Point)



— (1 Point)



$\therefore R_{AD} = 2.5K\,\Omega$ — (1 Point)

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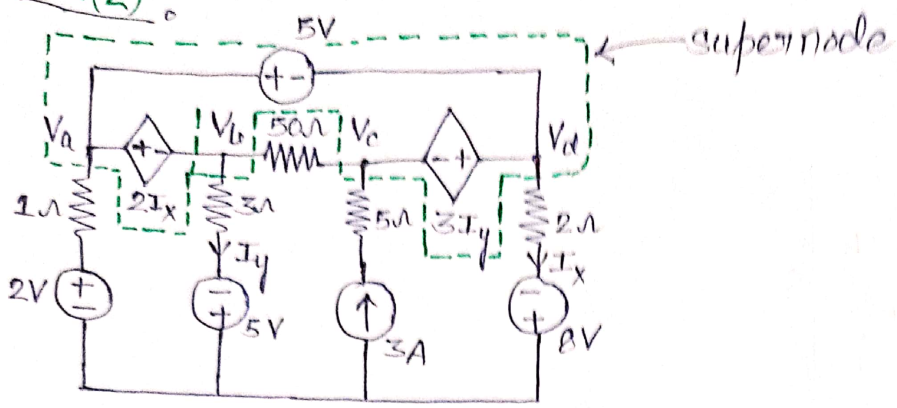
SOL(2) :



Here ideal & practical voltage source is directly connected between the nodes. Hence to get node voltage, we will use supernode technique (KVL + KCL + Ohm's law).

By Supernode technique –

$$\frac{V_a-2}{1} + \frac{V_b+5}{3} + \frac{V_b-V_c}{50} + \frac{V_c-V_b}{50} - 3 + \frac{V_d+8}{2} = 0$$

$$\frac{V_a-2}{1} + \frac{V_b+5}{3} + \frac{V_d+8}{2} = 3$$

$$-12\cancel{4} + 6V_a + 2V_b + 10 + 3V_d + 24 = 18$$

$$6V_a + 2V_b + 3V_d = (-4) \quad \text{—— (1)} \qquad \text{— (1 Point)}$$

$$V_a - V_d = 5 \quad \text{— (2)} \qquad \text{— (1 Point)}$$

$$V_a - V_b = 2I_x \quad \text{— (3)} \qquad \text{— (1 Point)}$$

$$-V_c + V_d = 3I_y \quad \text{— (4)} \qquad \text{— (1 Point)}$$

$$\frac{V_b+5}{3} = I_y \quad \text{— (5)}$$

$$\frac{V_d+8}{2} = I_x \quad \text{— (6)}$$

Put the value of I_y & I_x from eqn (5) & (6) in eqn (4) & (3) respectively

$$V_d - V_c = 3\left(\frac{V_b+5}{3}\right) \qquad V_a - V_b = 2\left(\frac{V_d+8}{2}\right)$$

$$V_d - V_c - V_b = 5 \quad \text{—— (7)} \qquad -V_b + V_a - V_d = 8 \quad \text{—— (8)}$$

After solving, we get —

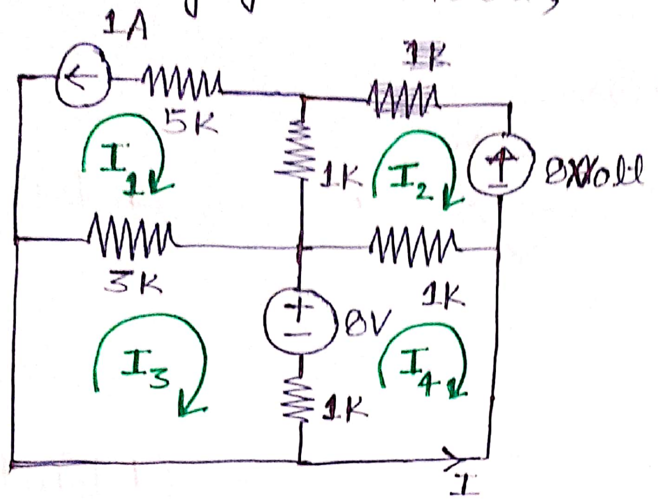
$V_a = 1.89$ Volt — 0.5 Points

$V_b = -3$ Volt — 0.5 Points

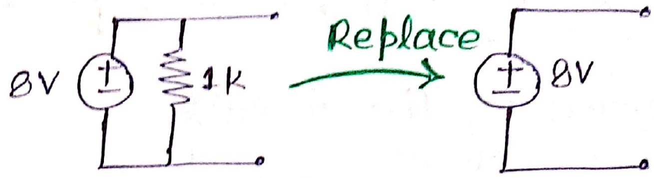
$V_c = -5.11$ Volt — 0.5 Points

$V_d = -3.11$ Volt — 0.5 Points

1.(3):- By given circuit, we can reduce it by —
(using ~~source transformation~~)



In mesh analysis—



By applying mesh analysis —

$\therefore I_1 = -1\,A$ —— (1) —(1 Point)

$(I_2 - I_1)\times 1 + 8 + (I_2 - I_4)\times 1 = 0$

$2I_2 - I_4 = -1008$ —— (2) —(1 Point)

$(I_3 - I_1)\times 3 + 8 + (I_3 - I_4)\times 1 = 0$

$4I_3 - I_4 = -3008$ —— (3) —(1 Point)

$(I_4 - I_3)\times 1 - 8 + (I_4 - I_2)\times 1 = 0$

$2I_4 - I_3 - I_2 = 8$ —— (4) —(1 Point)

$I_4 = -I$ —— (5)

Put value of I_3 & I_2 from eqⁿ (3) & (2) in eqⁿ (4), we get—

$2I_4 - [(-3008 + I_4)/4] - [(-1008 + I_4)/2] = 8$

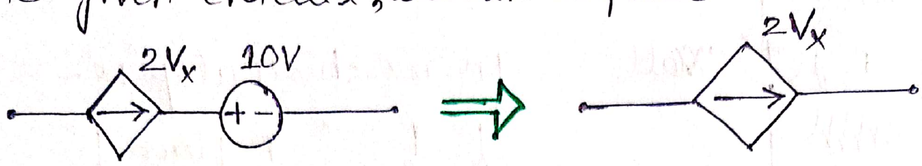
$2I_4 + 752 - I_4/4 + 504 - I_4/2 = 8$

$\therefore I_4 = -998.4\,mA$

$\therefore I = -I_4 = 0.9984\,A \cong 1\,A$ —(1 Point)

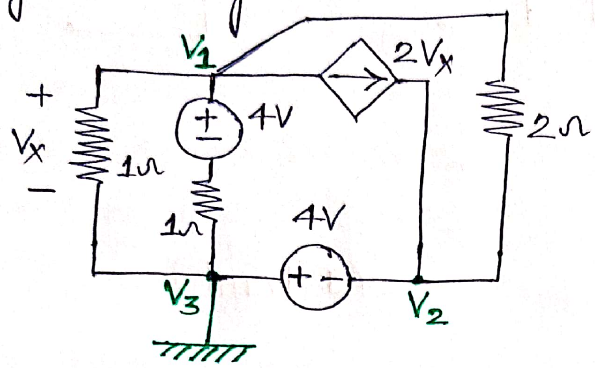
SOL.(4):

In the given circuit, we can replace —



— (1 Point)

By reducing the circuit —



— (1 Point)

By nodal analysis, we get —

$$\frac{V_1}{1} + \frac{V_1 - 4}{1} + \frac{(V_1 - V_2)}{2} + 2V_x = 0$$

$$-V_2 + 2V_1 + 2V_1 - 8 + V_1 + 4V_x = 0$$

$$-V_2 + 5V_1 + 4V_x = 8 \quad \text{— (1)}$$ — (1 Point)

$$V_1 = V_x \quad \text{— (2)}$$ — (1 Point)

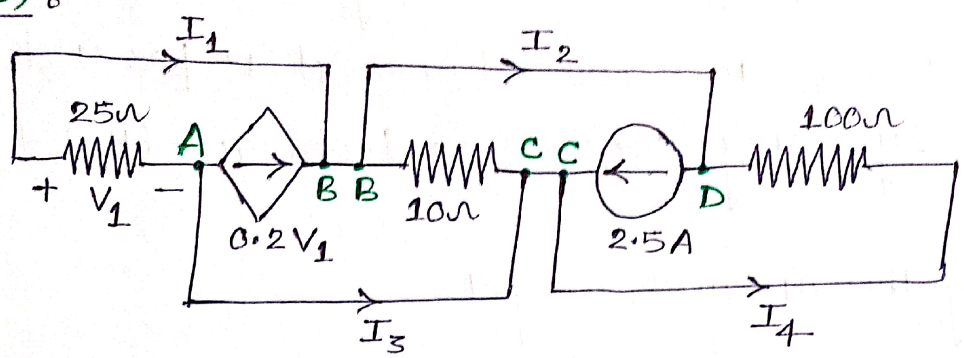
$$V_2 = -4 \text{ Volt} \quad \text{— (3)}$$ — (1 Point)

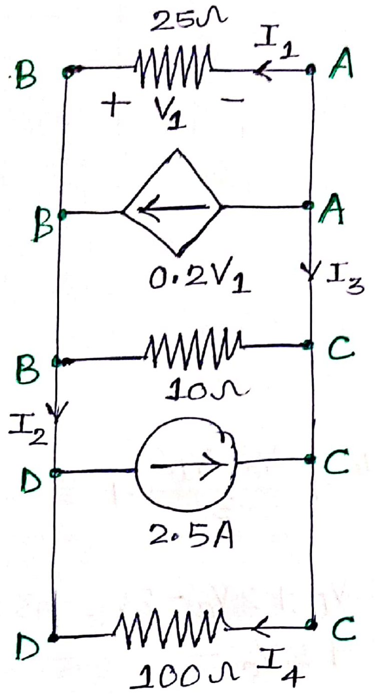
By eqn (1) & eqn (2), we get —

$$9V_x = 4$$

$$\therefore V_x = (4/9) \text{ Volt}$$ — (1 Point)

SOL.(5):-





— (1 Point)

By nodal analysis at point B/D — $(V_B = V_D = V_1)$

$$\frac{V_1}{25} + \frac{V_1}{10} + \frac{V_1}{100} + 2.5 = 0.2V_1$$

$\therefore V_1 = 50$ Volt

$\therefore I_1 = \frac{-V_1}{25} = \frac{-50}{25} = (-2A)$ — (1.5 Point)

By nodal analysis at point A — $-2 + 0.2 \times 50 + I_3 = 0$

$\therefore I_3 = (-8A)$ — (1.5 Point)

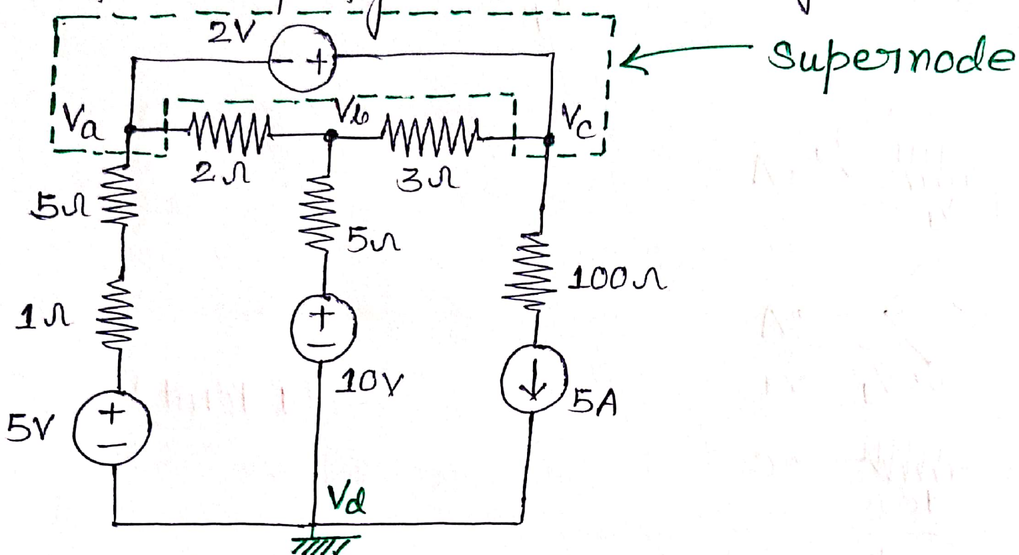
$\therefore I_4 = \frac{-V_1}{100} = \frac{-50}{100} = (-0.5A)$ — (1.5 Point)

By nodal analysis at point D — $I_2 + I_4 = 2.5$

$\therefore I_2 = 3A$ — (1.5 Point)

SOL(6):- By given circuit — Ideal voltage source '2V' is connected between two node hence it is possible to find solution by using super node technique (KVL + KCL + Ohm's law).

After simplify the circuit, we get —



By supernode — $\frac{V_a-5}{6}+\frac{V_a-V_b}{2}+\frac{V_c-V_b}{3}+5=0$ [K.C.L.]

$V_a-5+3V_a-3V_b+2V_c-2V_b+30=0$

$4V_a-5V_b+2V_c=-25$ — (1) —(1 Point)

By circuit — $V_c-V_a=2$ [K.V.L.] —— (2) —(1 Point)

Nodal analysis at V_b, we get —

$\frac{V_b-V_a}{2}+\frac{V_b-10}{5}+\frac{V_b-V_c}{3}=0$ [K.C.L.]

$15V_b-15V_a+6V_b-60+10V_b-10V_c=0$

$-15V_a+31V_b-10V_c=60$ —— (3) —(1 Point)

By $eq^n(1)$, $eq^n(2)$ and $eq^n(3)$, we get —

$\therefore V_a=(-8.18)$ Volt —(1 Point)

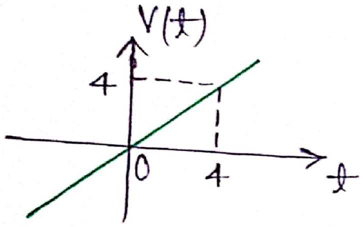
$\therefore V_b=(-4.02)$ Volt —(1 Point)

$\therefore V_c=(-6.18)$ Volt —(1 Point)

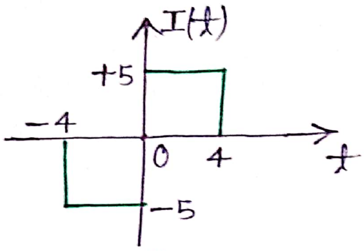
SOL (7) :-

as we know that — $P = V \cdot I$

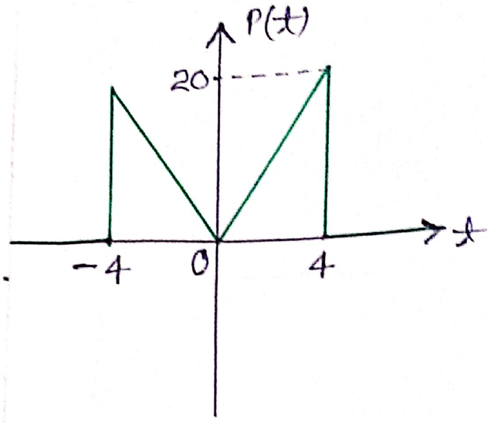
$P(t) = V(t) \cdot I(t)$



$V(t) = t$

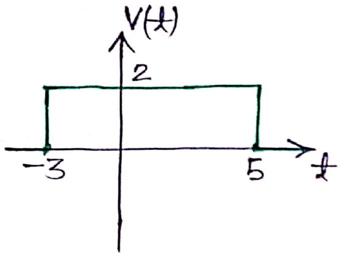


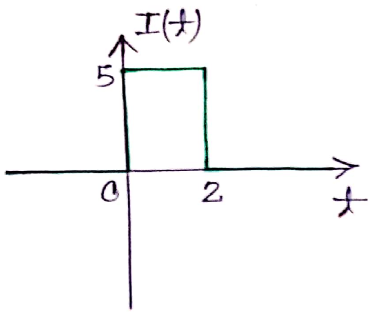
$I(t) = -5[u(t+4) - u(t)] + 5[u(t) - u(t-4)]$

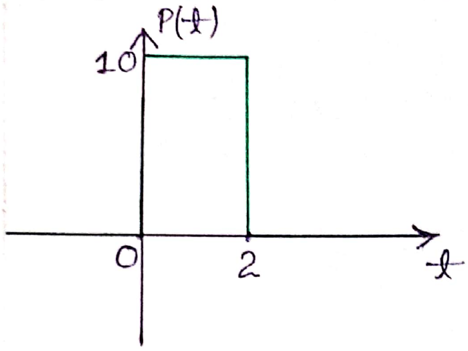


$P(t) = V(t) \cdot I(t)$

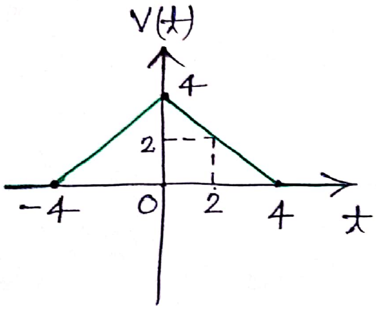
— (2 Point)

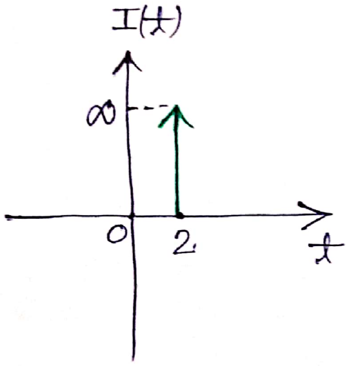


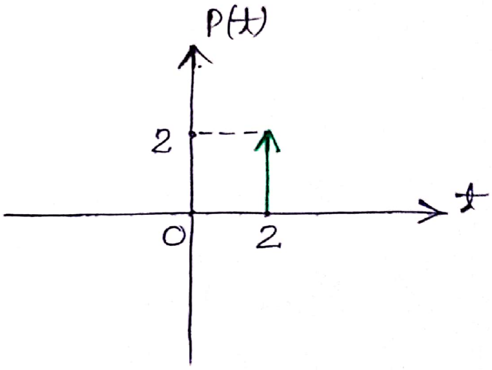




— (2 Point)







$P(t) = V(t) \times I(t)$

— (2 Point)