Answer

ANSWER:

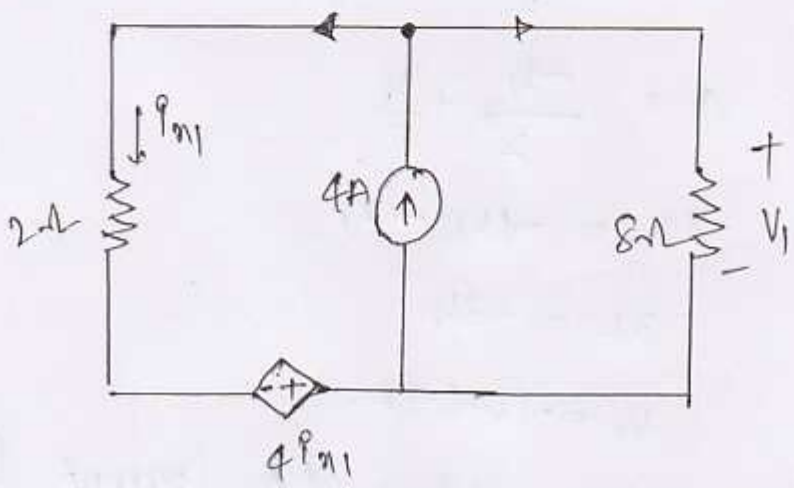
→ Use Superposition to solve for V_n in the circuit as shown in below figure.

→ The circuit has two Independent Sources. Assume that the output voltage is

$$V_n = V_1 + V_2$$

Here V_1 and V_2 are the voltage Response due to 4A current source and 6A current source Respectively.

TO Obtain V_1 set the 6A current Source to Zero as shown in following figure.



Then, Applying Nodal Analysis at node V_1

$$4 = \frac{V_1 + 4i_{n1}}{2} + \frac{V_1}{8} \quad \text{— (1)}$$

from circuit in figure (1) write the Kirchhoff's Voltage Law around the outer loop.

$$V_1 = 2i_{n1} - 4i_{n1}$$

$$V_1 = -2i_{n1}$$

$$i_{n1} = -0.5V_1 \quad \text{— (2)}$$

Substitute $-0.5V_1$ for i_{n1} in equation (1) then we get,

$$4 = \frac{V_1 + 4(-0.5V_1)}{2} + \frac{V_1}{8}$$

$$4 = \frac{V_1 - 2V_1}{2} + \frac{V_1}{8}$$

$$4 = \frac{-V_1}{2} + \frac{V_1}{8}$$

$$32 = -4V_1 + V_1$$

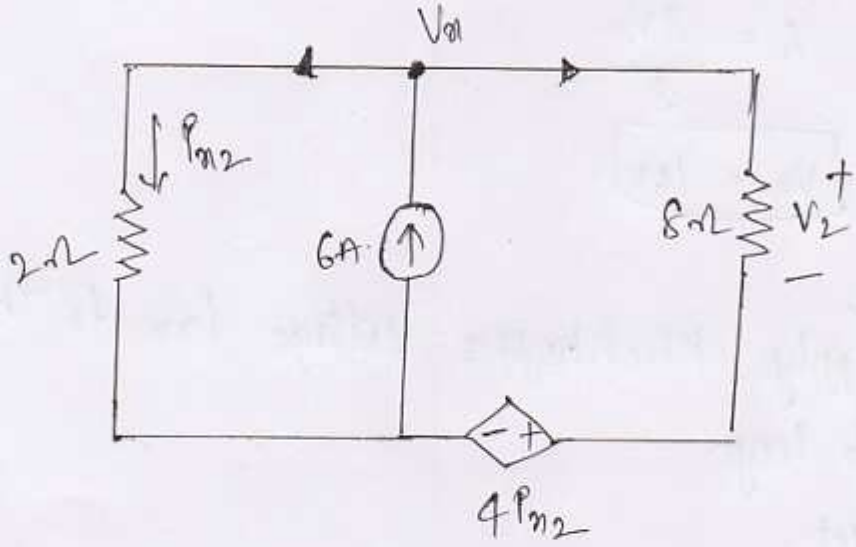
$$32 = -3V_1$$

$$V_1 = -10.67V.$$

∴ The o/p voltage when 4A current source Acting is $\boxed{V_1 = -10.67V}$

→ Then

To obtain V_2, Set the 4A current Source to Zero as shown in the following figure. Shown below.



Then

→ Applying nodal Analysis at node V_n.

we get,

$$6 = \frac{V_n}{2} + \frac{V_n - 4i_{n2}}{8} \quad \ldots (3)$$

from Above figure the current i_{n2} is

$$i_{n2} = \frac{V_n}{2} \quad \ldots (4)$$

then,

Substitute $\frac{V_n}{2}$ for i_{n2} Equation (3)

$$6 = \frac{V_n}{2} + \frac{V_n - 4\left(\frac{V_n}{2}\right)}{8}$$

$$6 = \frac{V_n}{2} + \frac{V_n - 2V_n}{8}$$

$$6 = \frac{V_n}{2} - \frac{V_n}{8}$$

$$6 = \frac{3V_n}{8}$$

$$\boxed{V_n = 16V}$$

→ Then,
Apply Kirchhoff's voltage law to the right side loop.

We get,

$$-V_n + V_2 + 4i_{n2} = 0.$$

Substituting $\frac{V_n}{2}$ for i_{n2} - replace.

$$-V_n + V_2 + 4\left(\frac{V_n}{2}\right) = 0.$$

$$-V_n + V_2 + 2V_n = 0$$

$$V_2 + V_n = 0$$

$$V_2 = -V_n$$

$$V_2 = -16V.$$

$$\therefore V_n = 16V$$

$$\boxed{V_2 = -16V}$$

→ The output voltage when 6A current source Acting $V_2 = -16$ V.

→ Then
Add both the Responses to get the Actual output voltage V_n when both source Active.

$$V_n = V_1 + V_2$$
$$= -10.67 - 16$$
$$= -26.67V$$

Therefore,

The voltage V_n in the circuit is

$$\boxed{-26.67V.}$$

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