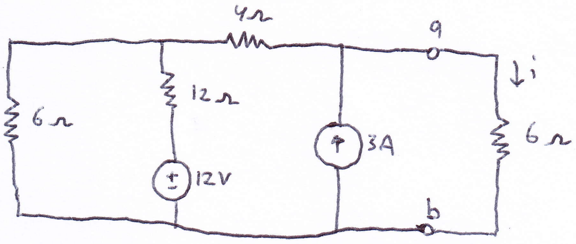
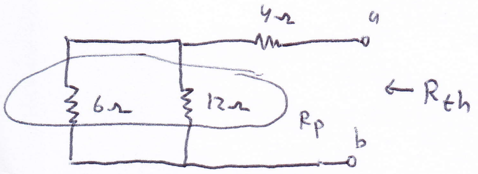
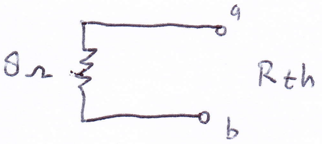
1). Replace the network to the left of terminals a-b by its Thevenin equivalent and use the result to find i.

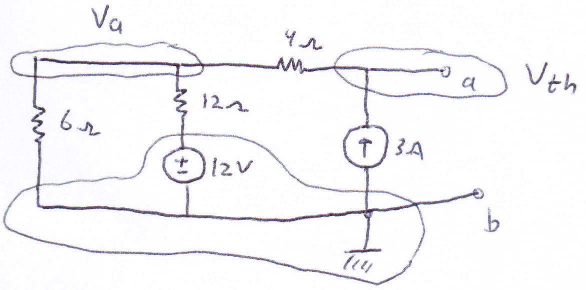


Answer:



$$R_p = \frac{6\times12}{6+12} = \frac{6\times12}{18} = 4$$





Node Va:

$$\frac{V_a}{6} + \frac{V_a - 12}{12} + \frac{V_a - V_{th}}{4} = 0 \qquad \times 12$$

$$2V_a + V_a - 12 + 3V_a - 3V_{th} = 0$$

$$6V_a = 12 + 3V_{th}$$

$$V_a = 2 + \tfrac{1}{2}V_{th} \quad \ldots (1)$$

Node Vth:

$$\frac{V_{th} - V_a}{4} - 3 = 0$$

$$V_{th} - V_a = 12 \quad \ldots (2)$$

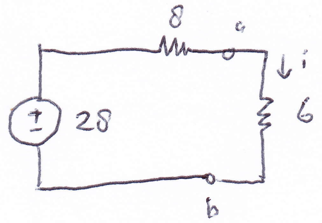
(1) & (2):

$$V_{th} - (2 + \tfrac{1}{2}V_{th}) = 12$$

$$\tfrac{1}{2}V_{th} = 14$$

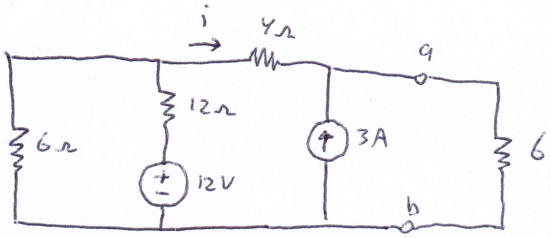
$$V_{th} = 28$$

Thevenin Circuit:

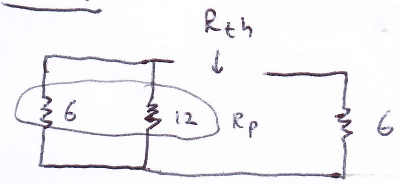


$$i = \frac{28}{8+6} = \frac{28}{14} = 2A$$

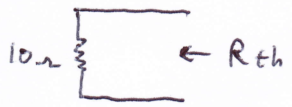
2). Find the Thevenin equivalent of everything except the 4-Ω resistor and use the result to find i

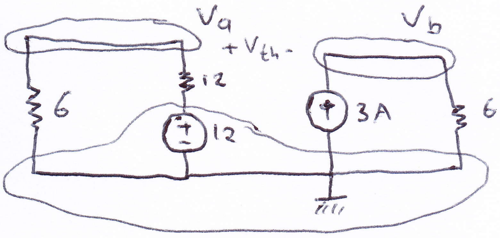


Answer



$$R_p = \frac{6 \times 12}{6+12} = \frac{6 \times 12}{18} = 4$$





node Va:

$$\frac{Va}{6} + \frac{Va-12}{12} = 0 \quad \times 12$$

$$2Va + Va = 12$$

$$Va = 4 \text{ volt}$$

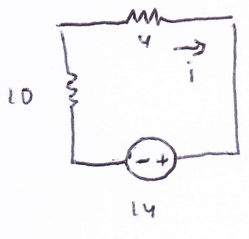
node Vb:

$$-3 + \frac{Vb}{6} = 0$$

$$Vb = 18 \text{ volt}$$

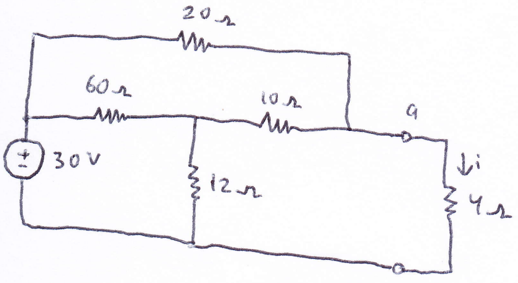
$$Vth = Va - Vb = -14 \text{ volt}$$

Thevenin circuit:

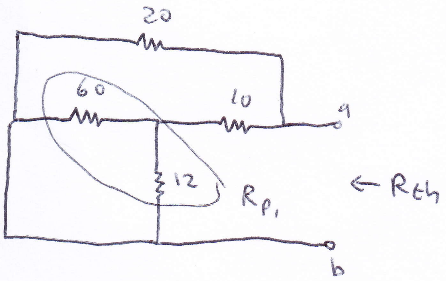


$$i = \frac{-14}{14} = -1A$$ (arah terbalik)

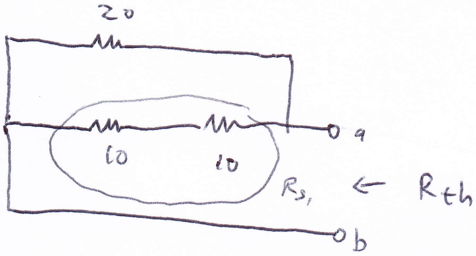
3. Find the Norton equivalent of the circuit to the left of terminal a-b, and use the result to find i.



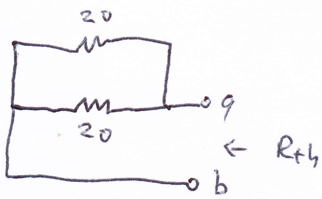
Answer



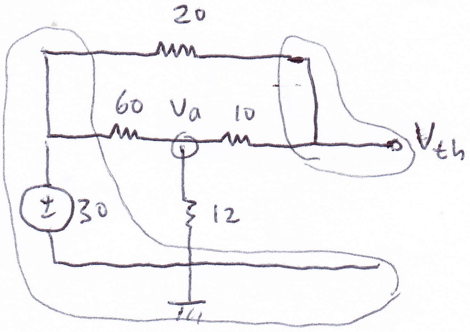
$$R_{p_1} = \frac{60 \times 12}{60+12} = \frac{60 \times 12}{72} = 10$$



$R_{s_1} = 20$



$$R_{th} = \frac{20 \times 20}{20+20} = 10\,\Omega$$



Node Va:

$$\frac{V_a - 30}{60} + \frac{V_a}{12} + \frac{V_a - V_{th}}{10} = 0 \quad \times 60$$

$$V_a - 30 + 5V_a + 6V_a - 6V_{th} = 0$$

$$12V_a - 6V_{th} = 30$$

$$2V_a - V_{th} = 5 \quad \ldots (1)$$

Node Vth:

$$\frac{V_{th} - V_a}{10} + \frac{V_{th} - 30}{20} = 0 \quad \times 20$$

$$2V_{th} - 2V_a + V_{th} - 30 = 0$$

$$-2V_a + 3V_{th} = 30 \quad \ldots (2)$$

(1) & (2):

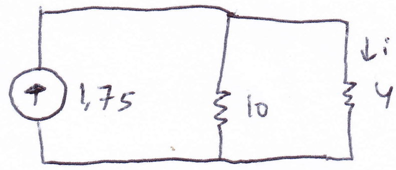
$$2V_a - V_{th} = 5$$
$$-2V_a + 3V_{th} = 30 \quad +$$

$$2V_{th} = 35$$

$$V_{th} = 17,5$$

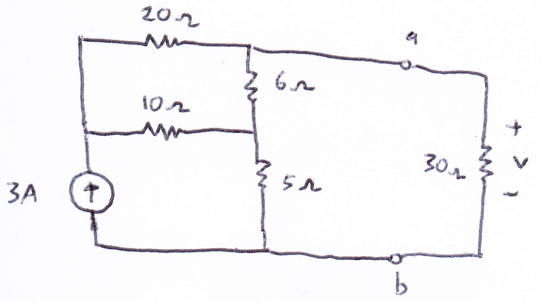
$$I_N = \frac{V_{th}}{R_{th}} = \frac{17,5}{10} = 1,75\ A$$

Norton circuit:

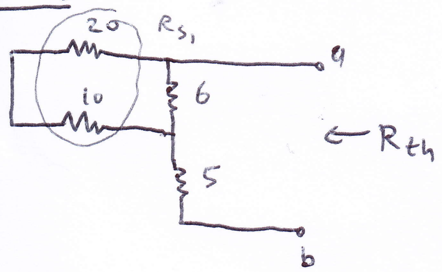


$$i = \frac{10}{10+4} \cdot 1,75 = 1,25\ A$$

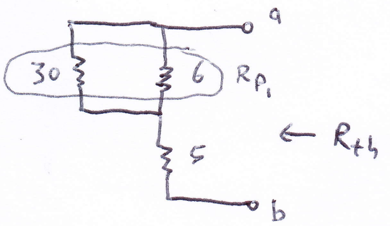
4). Find the Norton equivalent of the circuit to the left of terminal a-b, and use the result to find v



Answer

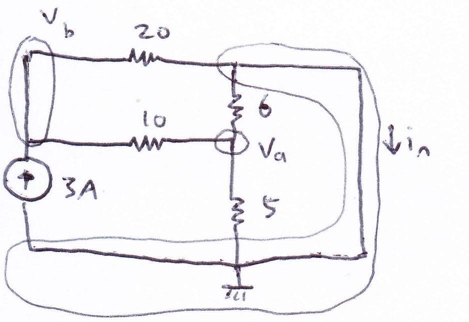


$R_{s_1} = 30$



$$R_{p_1} = \frac{6 \times 30}{6+30} = \frac{6 \times 30}{36\ 6} = 5\ \Omega$$

$R_{th} = 10\ \Omega$



node V_a:

$$\frac{V_a}{5} + \frac{V_a - V_b}{10} + \frac{V_a}{6} = 0 \qquad \times 60$$

$$12V_a + 6V_a - 6V_b + 10V_a = 0$$

$$28V_a - 6V_b = 0$$

$$14V_a - 3V_b = 0 \quad \text{.... (1)}$$

node V_b:

$$\frac{V_b}{20} + \frac{V_b - V_a}{10} - 3 = 0 \qquad \times 20$$

$$V_b + 2V_b - 2V_a - 60 = 0$$

$$-2V_a + 3V_b = 60 \quad \text{.... (2)}$$

(1) & (2):

$$14V_a - 3V_b = 0$$
$$-2V_a + 3V_b = 60 \quad +$$
$$12V_a = 60$$
$$V_a = 5 \text{ volt}$$

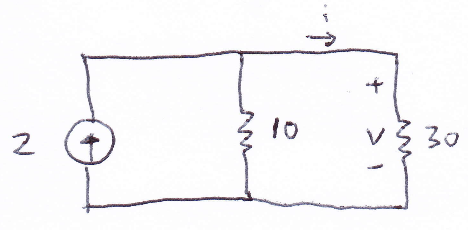
Dari (2):

$$3V_b = 60 + 2V_a$$

$$V_b = \frac{60 + 2 \cdot 5}{3} = \frac{70}{3}$$

$$I_n = \frac{V_a}{6} + \frac{V_b}{20} = \frac{5}{6} + \frac{70}{3 \cdot 20} = \frac{12}{6} = 2A$$

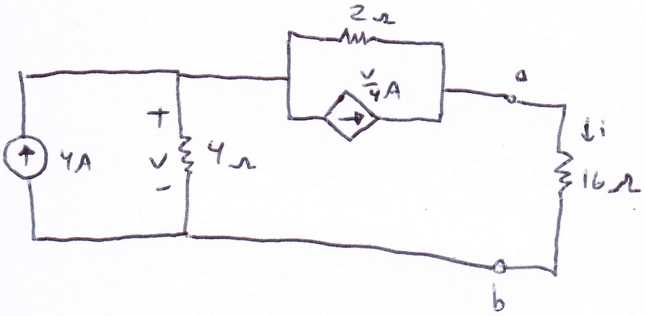
Norton circuit:



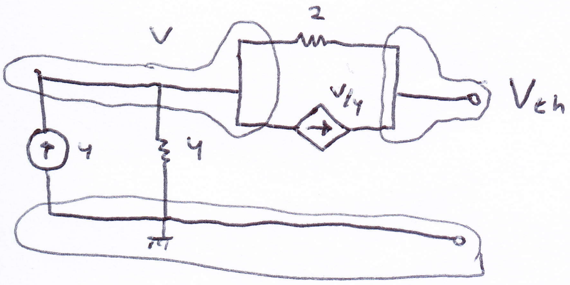
$$i = \frac{10}{10+30} \cdot 2 = \frac{10}{40} \cdot 2 = \frac{1}{2}$$

$$V = 30 \cdot i = 30 \cdot \frac{1}{2} = 15 \text{ volt}$$

5). Find i by replacing the network to the left of terminals a-b by its Norton equivalent.



answer



node V:

$$-4 + \frac{V}{4} + \frac{V}{4} + \frac{V - V_{th}}{2} = 0 \quad \times 4$$

$$V + V + 2V - 2V_{th} = 16$$

$$4V - 2V_{th} = 16$$

$$2V - V_{th} = 8 \quad \ldots (1)$$

node V_{th}:

$$\frac{V_{th} - V}{2} - \frac{V}{4} = 0 \quad \times 4$$

$$2V_{th} - 2V - V = 0$$

$$-3V + 2V_{th} = 0 \quad \ldots (2)$$

(1) & (2):

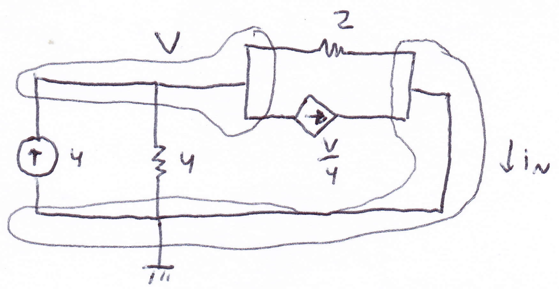
$$2V - V_{th} = 8 \quad \times 3$$

$$-3V + 2V_{th} = 0 \quad \times 2$$

$$6V - 3V_{th} = 24$$

$$-6V + 4V_{th} = 0 \quad +$$

$$V_{th} = 24$$



node V:

$$-4 + \frac{V}{4} + \frac{V}{4} + \frac{V}{2} = 0 \quad \times 4$$

$$V + V + 2V = 16$$

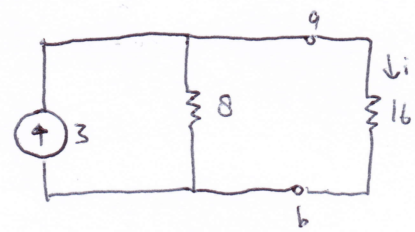
$$4V = 16$$

$$V = 4 \text{ volt}$$

$$i_N = \frac{V}{2} + \frac{V}{4} = 2 + 1 = 3\,A$$

$$R_{th} = \frac{V_{th}}{i_N} = \frac{24}{3} = 8\,\Omega$$

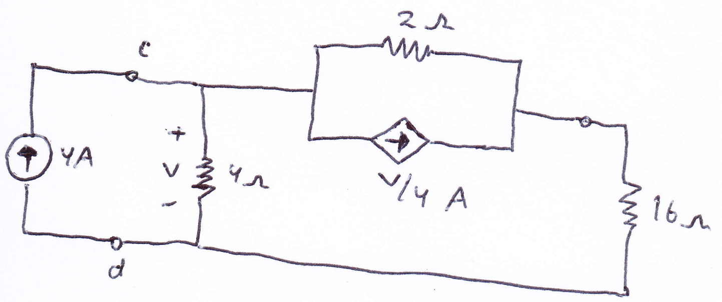
Norton circuit:



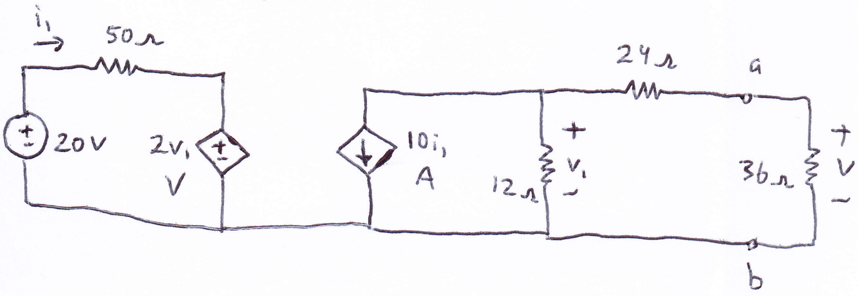
$$i = \frac{8}{8+16} \times 3 = \frac{8^{1}}{24_{3}} \times 3 = 1\,A$$

Soal² Latihan

1). Replace the network to the right of terminals c-d by its thevenin equivalent and use the result to find v



2). Replace the circuit to the left of terminals a-b by its Thevenin equivalent, and use the result to find v



3). Replace the circuit to the left of terminals a-b by its Thevenin equivalent and use the result to find v