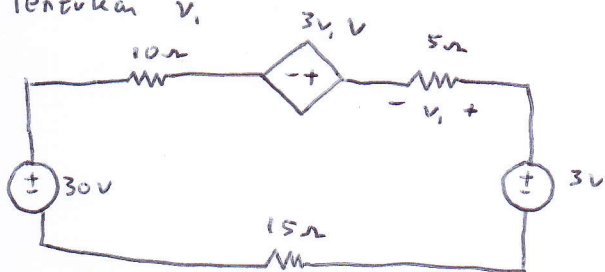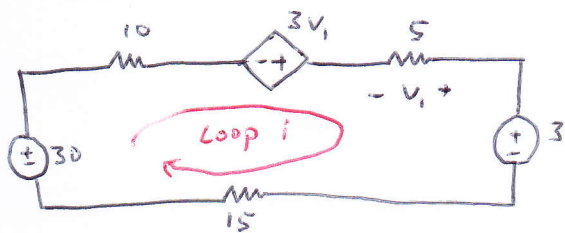① Tentukan v_1

Jawab:

KVL loop i:

$$-30 + 10i - 3v_1 + 5i + 3 + 15i = 0$$

$$30i - 3v_1 = 27 \quad \dots (1)$$

Dari resistor 5Ω:

$$5i = -v_1$$

$$i = -\tfrac{1}{5}v_1 \quad \dots (2)$$

(1) & (2):
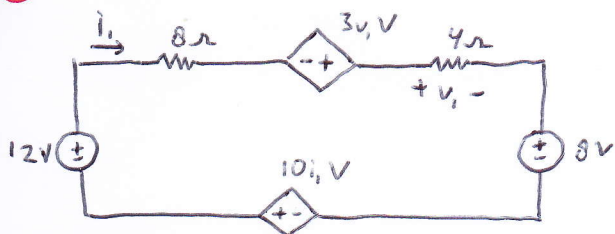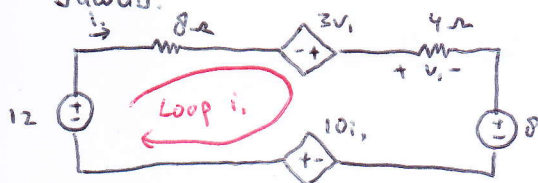
$$30\left(-\tfrac{1}{5}v_1\right) - 3v_1 = 27$$

$$-6v_1 - 3v_1 = 27$$

$$v_1 = \frac{27}{-9} = -3 \text{ volt}$$

② Tentukan v_1 dan i_1

Jawab:

KVL loop i:

$$-12 + 8i - 3v_1 + 4i + 8 - 10i_1 = 0$$

$$2i_1 - 3v_1 - 4 = 0 \quad \dots (1)$$

Dari resistor 4Ω:
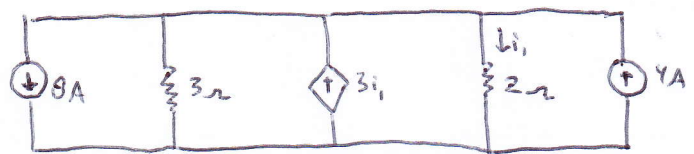
$$4i_1 = v_1 \quad \dots (2)$$

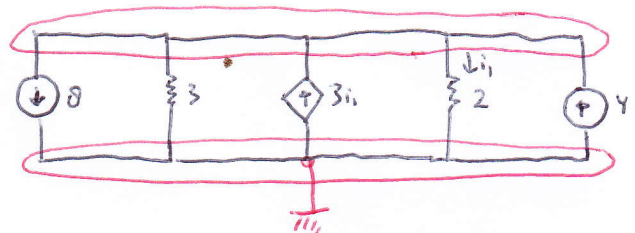(1) & (2):

$$2i_1 - 3(4i_1) - 4 = 0$$

$$2i_1 - 12i_1 = 4$$

$$i_1 = \frac{4}{-10} = -0,4 \text{ A}$$

$$v_1 = 4i_1 = -1,6 \text{ volt}$$

③ Tentukan i_1

Jawab:

KCL node V:

$$8 + \frac{V}{3} - 3i_1 + \frac{V}{2} - 4 = 0 \quad \times 6$$

$$24 + 5V - 18i_1 = 0 \quad \dots (1)$$

Dari resistor 2Ω:

$$\frac{V}{2} = i_1$$

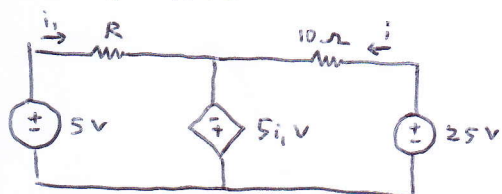$$V = 2i_1 \quad \dots (2)$$

(1) & (2):

$$24 + 5(2i_1) - 18i_1 = 0$$

$$-8i_1 = -24$$

$$i_1 = 3 \text{ A}$$
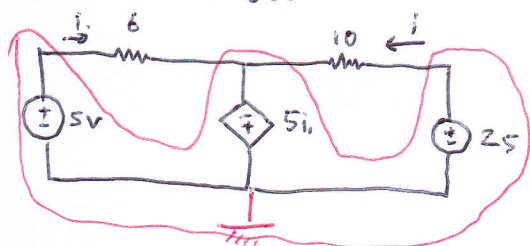
(4) Tentukan i jika:

(a) $R = 6\,\Omega$
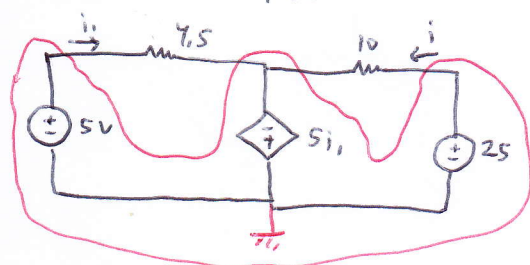
(b) $R = 4,5\,\Omega$

Jawab:

(a) Jika $R = 6\,\Omega$

$$i_1 = \frac{5 - (-5i_1)}{6} = \frac{5 + 5i_1}{6}$$

$$6i_1 = 5 + 5i_1$$

$$i_1 = 5$$

$$i = \frac{25 - (-5i_1)}{10} = \frac{25 + 5(5)}{10} = 5\,A$$

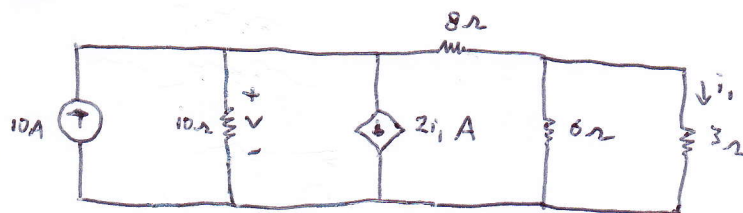(b) Jika $R = 4,5\,\Omega$

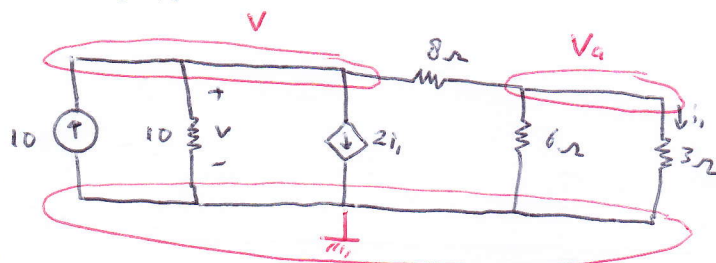$$i_1 = \frac{5 - (-5i_1)}{4,5}$$

$$4,5 i_1 = 5 + 5i_1$$

$$-0,5 i_1 = 5$$

$$i_1 = \frac{5}{-0,5} = -10\,A$$

$$i = \frac{25 - (-5i_1)}{10} = \frac{25 + 5(-10)}{10} = -2,5\,A$$

(5) Tentukan i_1 dan v

Jawab:

KCL node V:

$$-10 + \frac{V}{10} + 2i_1 + \frac{V - V_a}{8} = 0 \qquad \times 40$$

$$-400 + 4V + 80i_1 + 5V - 5V_a = 0$$

$$-400 + 9V + 80i_1 - 5V_a = 0 \quad \dots (1)$$

KCL node V_a:

$$\frac{V_a - V}{8} + \frac{V_a}{6} + \frac{V_a}{3} = 0 \qquad \times 24$$

$$3V_a - 3V + 4V_a + 8V_a = 0$$

$$15 V_a = 3V$$

$$5 V_a = V \quad \dots (2)$$

Resistor $3\,\Omega$:

$$i_1 = \frac{V_a}{3} \quad \dots (3)$$

(2) & (3): $i_1 = \frac{V}{15} \quad \dots (4)$

(1), (2) & (4):

$$-400 + 9V + \overset{16}{80}\left(\frac{V}{\underset{3}{15}}\right) - V = 0$$
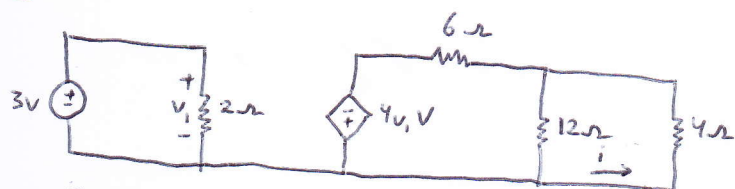
$$8V + \frac{16V}{3} = 400 \qquad \times 3$$

$$24V + 16V = 1200$$

$$V = \frac{1200}{40} = 30\ \text{volt}$$

dari (4):

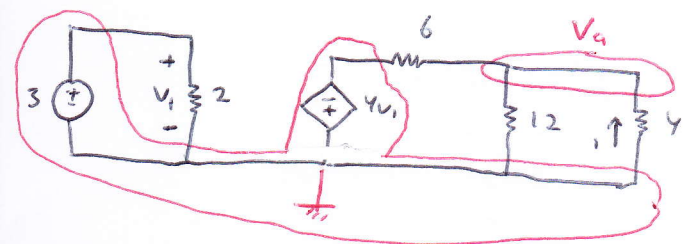$$i_1 = \frac{V}{15} = \frac{30}{15} = 2\,A$$

6. Tentukan i.

Jawab:

$V_1 = 3$ volt

KCL node V_a:

$$\frac{V_a - (-4v_1)}{6} + \frac{V_a}{12} + \frac{V_a}{4} = 0 \qquad \times 12$$
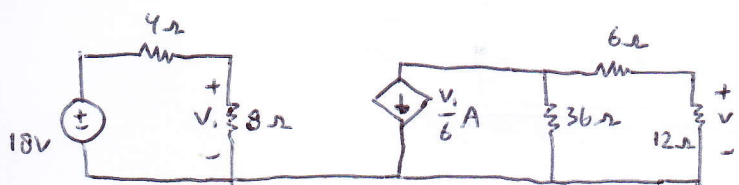
$$2V_a + 8V_1 + V_a + 3V_a = 0$$
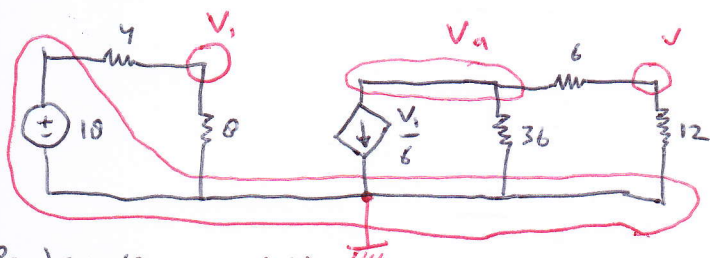
$$6V_a + 8 \cdot 3 = 0$$

$$V_a = \frac{-24}{6} = -4 \text{ volt}$$

$$i = \frac{0 - V_a}{4} = \frac{0 - (-4)}{4} = 1 \text{ Ampere}$$

7. Tentukan V.

Jawab:

Pembagi tegangan di V_1:

$$V_1 = \frac{8}{4+8} \cdot 18 = \frac{8^2}{12} \cdot 18_6 = 12 \text{ volt} \quad \ldots (1)$$

KCL node V:

$$\frac{V}{12} + \frac{V - V_a}{6} = 0 \qquad \times 12$$

$$V + 2V - 2V_a = 0$$

$$3V = 2V_a \qquad\qquad V_a = \frac{3}{2}V \ldots (2)$$

KCL node V_a:

$$\frac{V_1}{6} + \frac{V_a}{36} + \frac{V_a - V}{6} = 0 \qquad \times 36$$

$$6V_1 + V_a + 6V_a - 6V = 0$$

$$6V_1 + 7V_a - 6V = 0 \qquad \ldots (3)$$

(1) & (3):

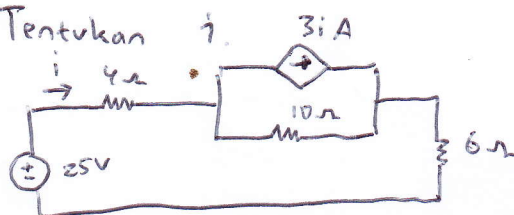$$6 \cdot 12 + 7V_a - 6V = 0 \qquad \ldots (4)$$

(4) & (2):

$$6 \cdot 12 + 7 \cdot \frac{3}{2}V - 6V = 0 \qquad \times 2$$
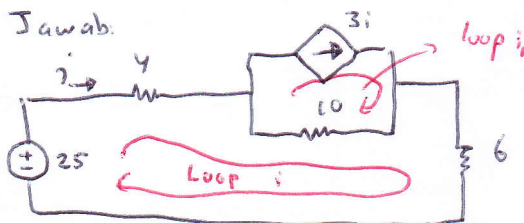
$$12 \cdot 12 + 21V - 12V = 0$$

$$9V = -144$$

$$V = -\frac{144}{9} = -16 \text{ volt}$$

8. Tentukan i.

Jawab:

loop i_1: $\quad i_1 = 3i \quad \ldots (1)$
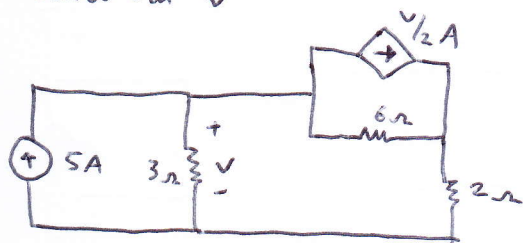
loop i:

$$-25 + 4i + 10(i - i_1) + 6i = 0$$
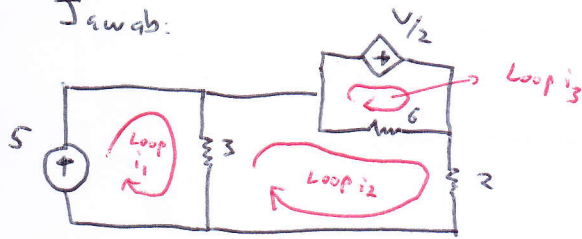
$$-25 + 20i - 10i_1 = 0 \quad \ldots (2)$$

(1) & (2):

$$20i - 10(3i) = 25$$

$$i = \frac{25}{-10} = -2,5 \text{ A}$$

9. Tentukan v

Jawab:

Loop i_1: $\quad i_1 = 5A \quad \ldots (1)$

Loop i_3: $\quad i_3 = \dfrac{V}{2} \quad \ldots (2)$

Loop i_2:

$$3(i_2 - i_1) + 6(i_2 - i_3) + 2i_2 = 0$$

$$11 i_2 - 3i_1 - 6i_3 = 0 \quad \ldots (3)$$

dari resistor 3Ω:

$$V = 3(i_1 - i_2) = 3i_1 - 3i_2$$

$$= 15 - 3i_2 \quad \ldots (4)$$

(1), (2), (3) & (4):

$$11 i_2 - 3(5) - \overset{3}{\cancel{6}}\left(\dfrac{V}{2}\right) = 0$$

$$11 i_2 - 15 - 3(15 - 3i_2) = 0$$

$$11 i_2 - 15 - 45 + 9 i_2 = 0$$

$$20 i_2 = 60$$

$$i_2 = 3$$

dari (4):

$$V = 15 - 3 i_2$$

$$= 15 - 9 = \underline{\underline{6 \text{ volt}}}$$