



PENGANTAR TEKNIK ELEKTRO

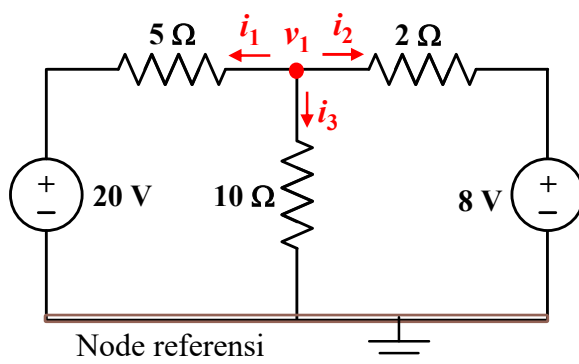
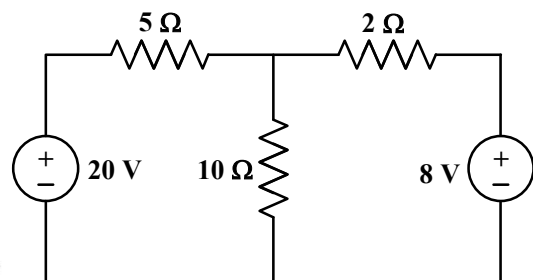
NODAL ANALYSIS Bagian 2

Wike Handini

CONTOH 4

Hitunglah arus yang mengalir pada tahanan $5\ \Omega$, $2\ \Omega$ dan $10\ \Omega$ dari rangkaian dengan analisa nodal.

Solusi



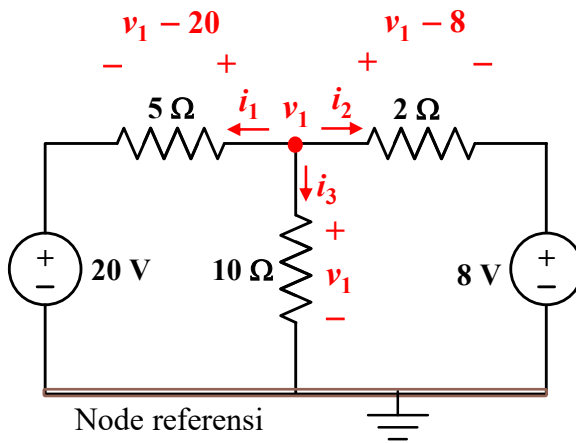
Asumsi arus i_1 , i_2 dan i_3 seperti terlihat pada gambar

KCL

$$i_1 + i_2 + i_3 = 0$$

SOLUSI CONTOH 4

Hukum Ohm



$$v = iR \quad \Rightarrow \quad i = \frac{v}{R}$$

$$i_1 = \frac{(v_1 - 20)}{5} = 0,2(v_1 - 20)$$

$$i_2 = \frac{(v_1 - 8)}{2} = 0,5(v_1 - 8)$$

$$i_3 = \frac{v_1}{10} = 0,1v_1$$

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SOLUSI CONTOH 4

$$i_1 = 0,2(v_1 - 20)$$

$$i_1 + i_2 + i_3 = 0$$

$$= 0,2(10 - 20) = -2 \text{ A}$$

$$0,2(v_1 - 20) + 0,5(v_1 - 8) + 0,1v_1 = 0$$

Tanda minus menunjukkan bahwa arah arus berlawanan dengan asumsi arah arus i_1

$$0,2v_1 - 4 + 0,5v_1 - 4 + 0,1v_1 = 0$$

$$0,8v_1 - 8 = 0$$

$$i_2 = 0,5(v_1 - 8)$$

$$0,8v_1 = 8$$

$$= 0,5(10 - 8) = 1 \text{ A}$$

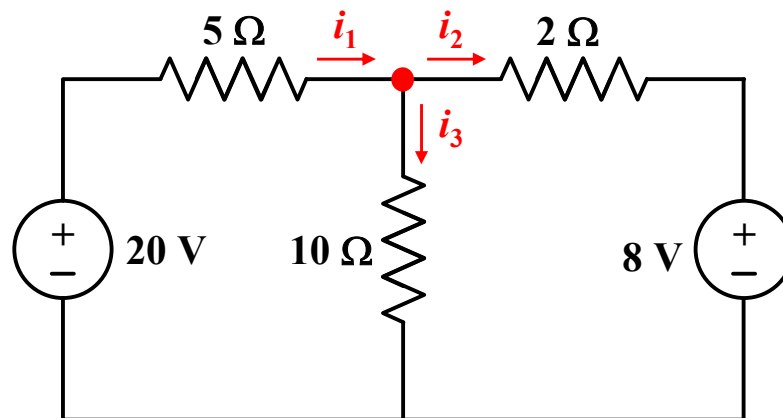
$$v_1 = \frac{8}{0,8}$$

$$i_3 = 0,1v_1 = 0,1 \cdot 10 = 1 \text{ A}$$

$$= 10 \text{ V}$$

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SOLUSI CONTOH 4



$$i_1 = 2 \text{ A}$$

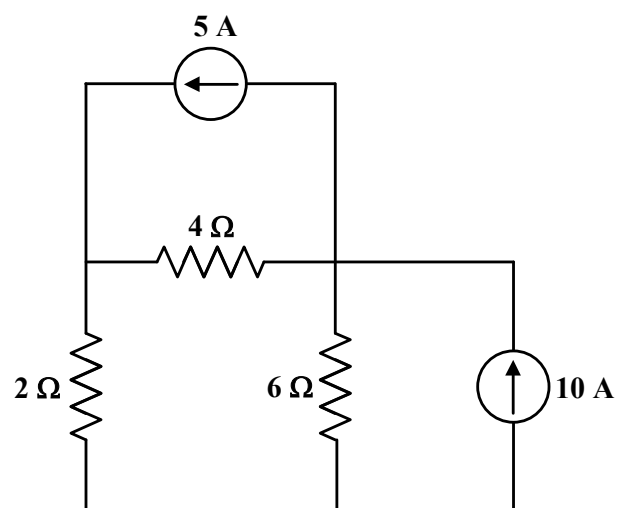
$$i_2 = 1 \text{ A}$$

$$i_3 = 1 \text{ A}$$

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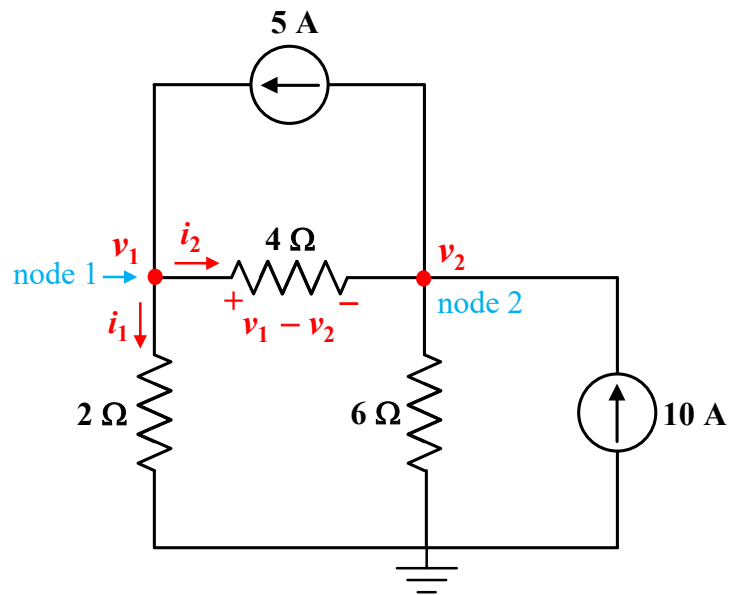
CONTOH 5

Hitunglah tegangan node dari rangkaian



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SOLUSI CONTOH 5



Node 1

$$i_1 + i_2 = 5$$

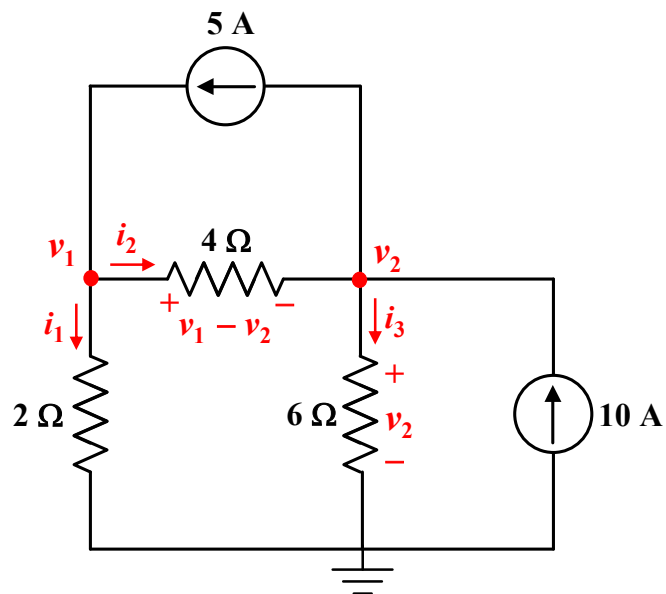
$$i_1 = \frac{v_1}{2}$$

$$i_2 = \frac{(v_1 - v_2)}{4}$$

$$\frac{v_1}{2} + \frac{(v_1 - v_2)}{4} = 5$$

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SOLUSI CONTOH 5



Node 2

$$5 + i_3 = 10 + i_2$$

$$i_3 - i_2 = 10 - 5$$

$$i_3 - i_2 = 5$$

$$i_3 = \frac{v_2}{6}$$

$$i_2 = \frac{(v_1 - v_2)}{4}$$

$$\frac{v_2}{6} - \frac{(v_1 - v_2)}{4} = 5$$

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SOLUSI CONTOH 5

$$\begin{aligned}\frac{v_1}{2} + \frac{(v_1 - v_2)}{4} &= 5 & \Rightarrow & \frac{4v_1}{2} + \frac{4(v_1 - v_2)}{4} = 5 \cdot 4 \\ & & & 2v_1 + (v_1 - v_2) = 20 & \Rightarrow & 3v_1 - v_2 = 20 \\[10pt]\frac{v_2}{6} - \frac{(v_1 - v_2)}{4} &= 5 & \Rightarrow & \frac{12v_2}{6} - \frac{12(v_1 - v_2)}{4} = 5 \cdot 12 \\ & & & 2v_2 - 3(v_1 - v_2) = 60 & & \\ & & & 2v_2 - 3v_1 + 3v_2 = 60 & \Rightarrow & -3v_1 + 5v_2 = 60\end{aligned}$$

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SOLUSI CONTOH 5 → METODE ELIMINASI

$$\begin{array}{rcll}3v_1 - v_2 & = & 20 & \\-3v_1 + 5v_2 & = & 60 & \\ \hline & + & & \\0 + 4v_2 & = & 80 & \\v_2 & = & \frac{80}{4} & \\ & = & 20 \text{ V} & \end{array} \qquad \begin{array}{rcll}3v_1 - v_2 & = & 20 & \\3v_1 - 20 & = & 20 & \\3v_1 & = & 20 + 20 & \\v_1 & = & \frac{40}{3} & \\ & = & 13,33 \text{ V} & \end{array}$$

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SOLUSI CONTOH 5 → METODE CRAMER

$$\begin{array}{l} 3v_1 - v_2 = 20 \\ -3v_1 + 5v_2 = 60 \end{array} \quad \Rightarrow \quad \begin{bmatrix} 3 & -1 \\ -3 & 5 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 20 \\ 60 \end{bmatrix}$$

$$\begin{aligned} v_1 &= \frac{\begin{vmatrix} 20 & -1 \\ 60 & 5 \end{vmatrix}}{\begin{vmatrix} 3 & -1 \\ -3 & 5 \end{vmatrix}} \\ &= \frac{100 - (-60)}{15 - 3} \\ &= \frac{160}{12} = 13,33 \text{ V} \end{aligned}$$

$$\begin{aligned} v_2 &= \frac{\begin{vmatrix} 3 & 20 \\ -3 & 60 \end{vmatrix}}{\begin{vmatrix} 3 & -1 \\ -3 & 5 \end{vmatrix}} \\ &= \frac{180 - (-60)}{12} \\ &= \frac{240}{12} = 20 \text{ V} \end{aligned}$$