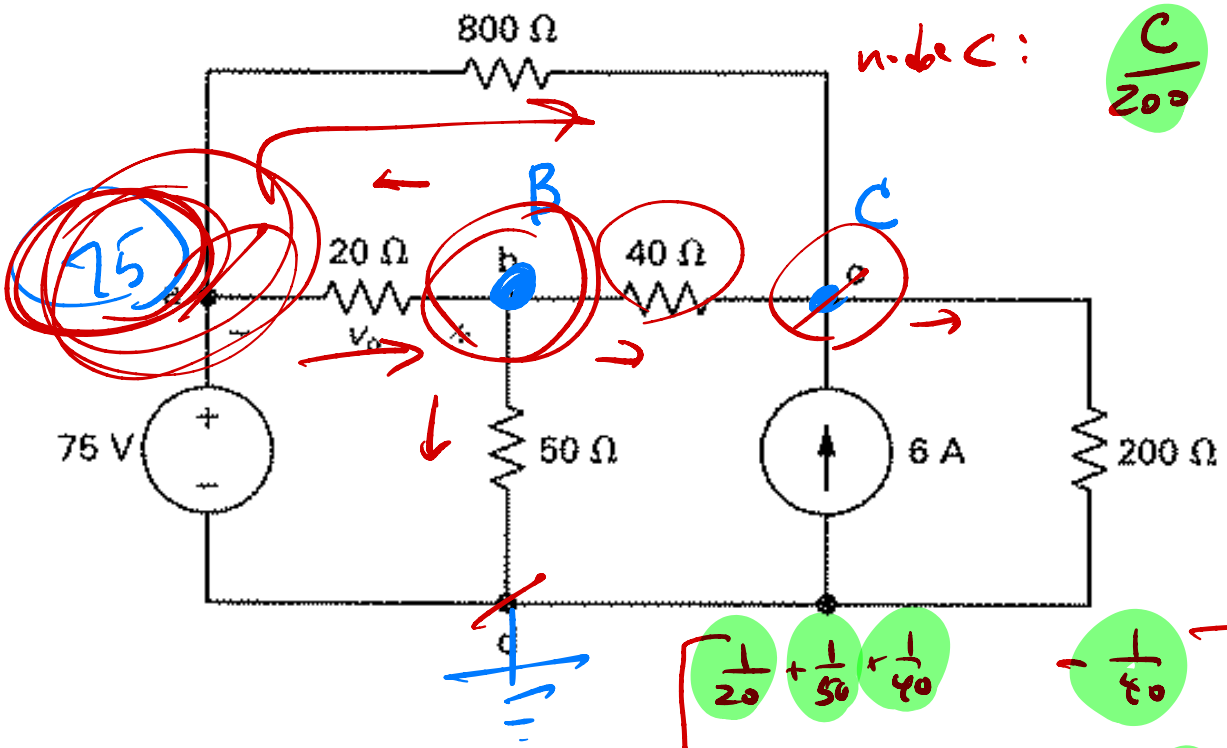
Node 6

examples

Example: find v_o

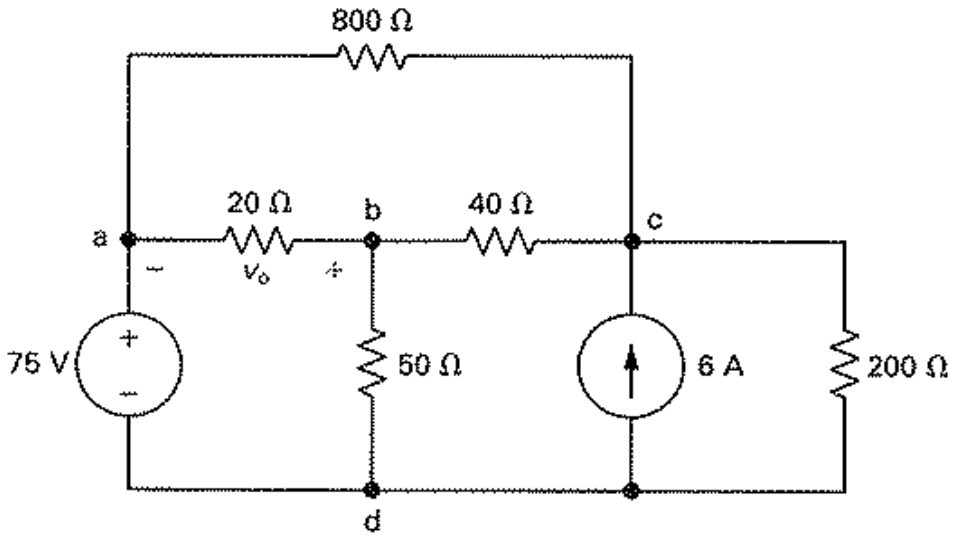


$V_o = B - 75$

node B: $\frac{B-75}{20} + \frac{B}{50} + \frac{B-C}{40} = 0$

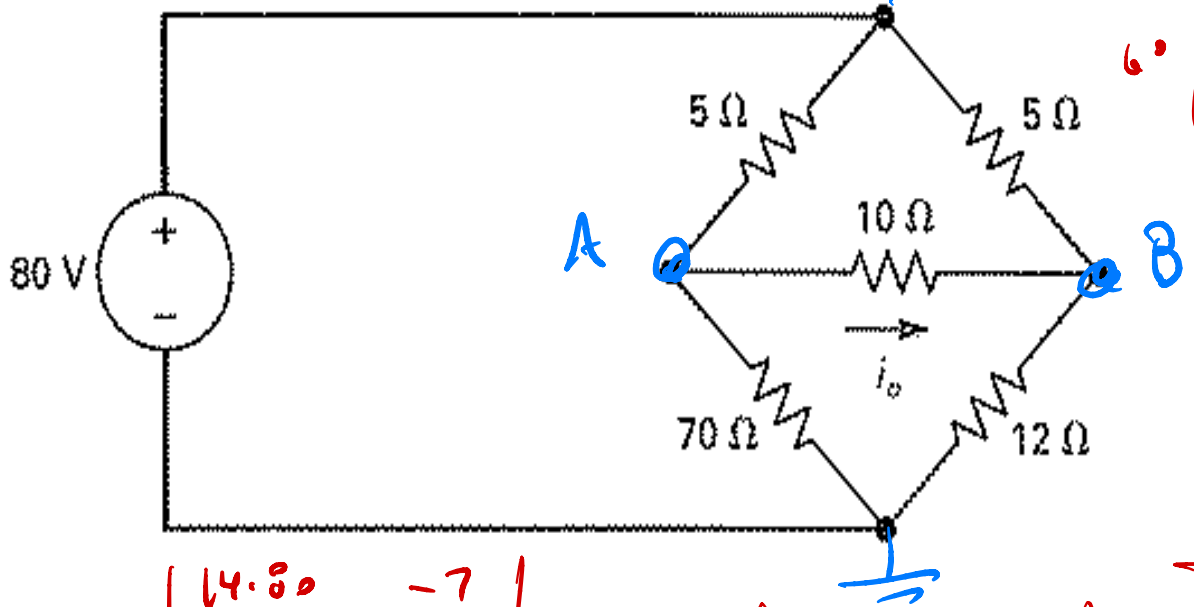
node C: $\frac{C}{200} - 6 + \frac{C-B}{40} + \frac{C-75}{800} = 0$

$$\begin{bmatrix} \frac{1}{20}+\frac{1}{50}+\frac{1}{40} & -\frac{1}{40} \\ -\frac{1}{40} & \frac{1}{40}+\frac{1}{200}+\frac{1}{800} \end{bmatrix} \begin{bmatrix} B \\ C \end{bmatrix} = \begin{bmatrix} 75/20 \\ 6+\frac{75}{800} \end{bmatrix}$$



$v_o = 40\ V$

Example: find i_0



$i_o = \frac{A-B}{10}$

$70\left(\frac{A-80}{5} + \frac{A-B}{10} + \frac{A}{70} = 0\right)$

$6\left(\frac{B-80}{5} + \frac{B-A}{10} + \frac{B}{12} = 0\right)$

$14A + 7A + A - 7B = 14 \cdot 80$

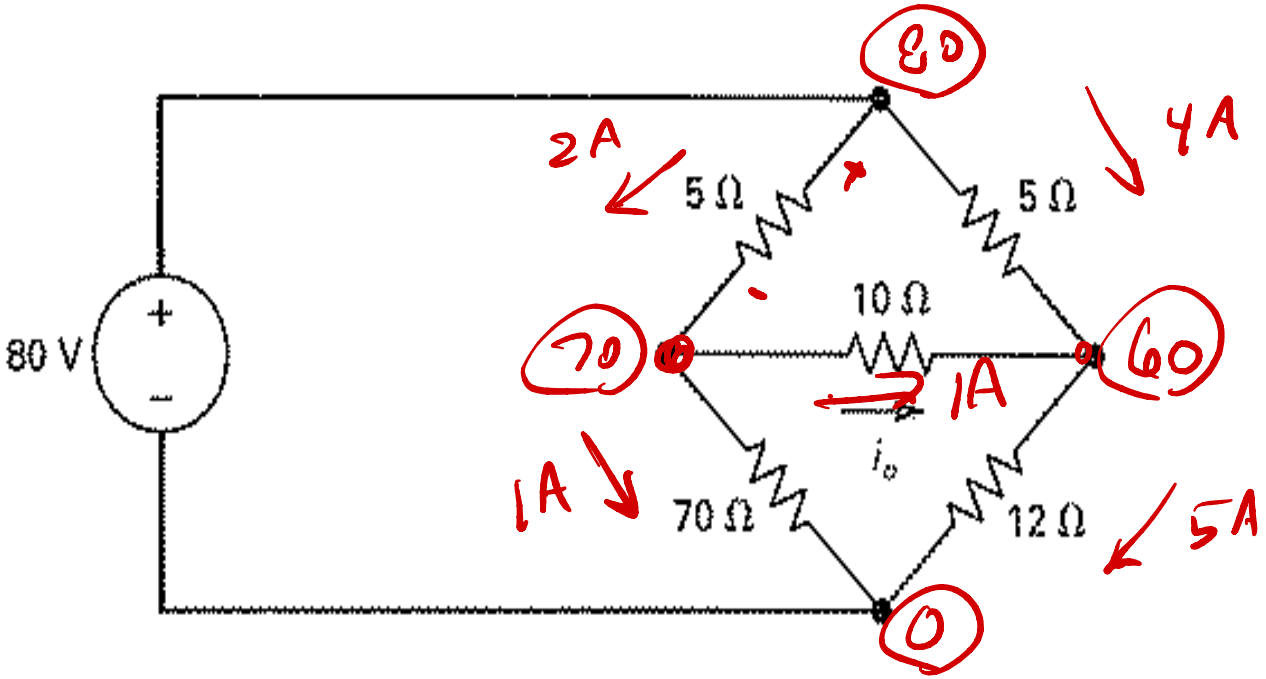
$22A - 7B = 14 \cdot 80$

$12B + 6B - 6A + 5B = 12 \cdot 80$

$-6A + 23B = 12 \cdot 80$

$$A = \frac{\begin{vmatrix} 14 \cdot 80 & -7 \\ 12 \cdot 80 & 23 \end{vmatrix}}{\begin{vmatrix} 22 & -7 \\ -6 & 23 \end{vmatrix}} = \frac{80\left(14 \cdot 23 + 7 \cdot 12\right)}{464}$$

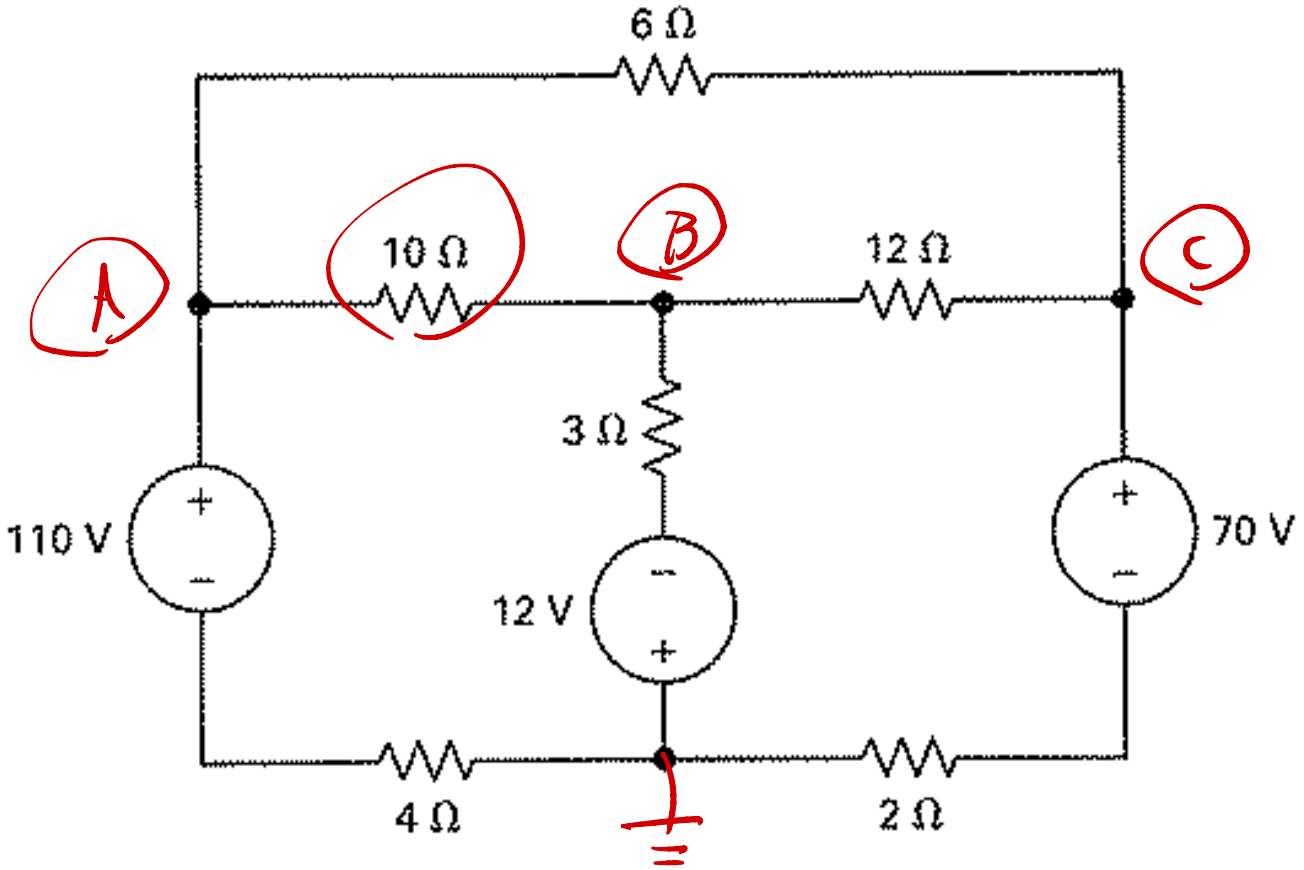
$$= \frac{}{464} = 40 \quad \Rightarrow B = 30$$



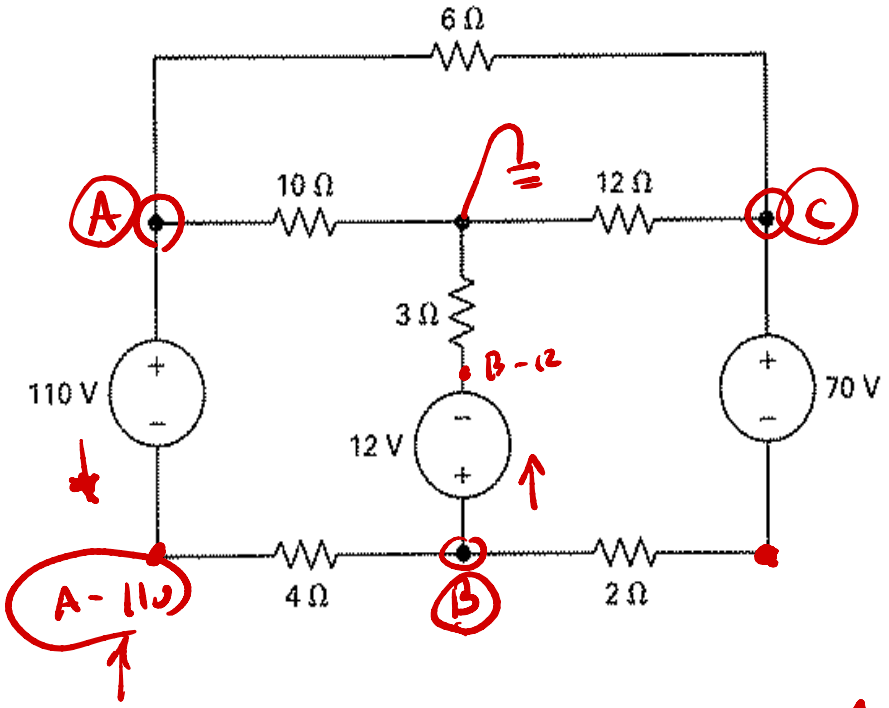
$i_0 = 1\,A$

$P = \frac{(A-B)^2}{10}$

Example: find the power of the 10 Ω resistor



$$P = \frac{I^2}{10}$$



node A:

$$\frac{A-C}{6} + \frac{A}{10} + \frac{A-110-B}{4} = 0$$

node B:

$$\frac{B-(A-110)}{4} + \frac{B-(C-70)}{2}$$

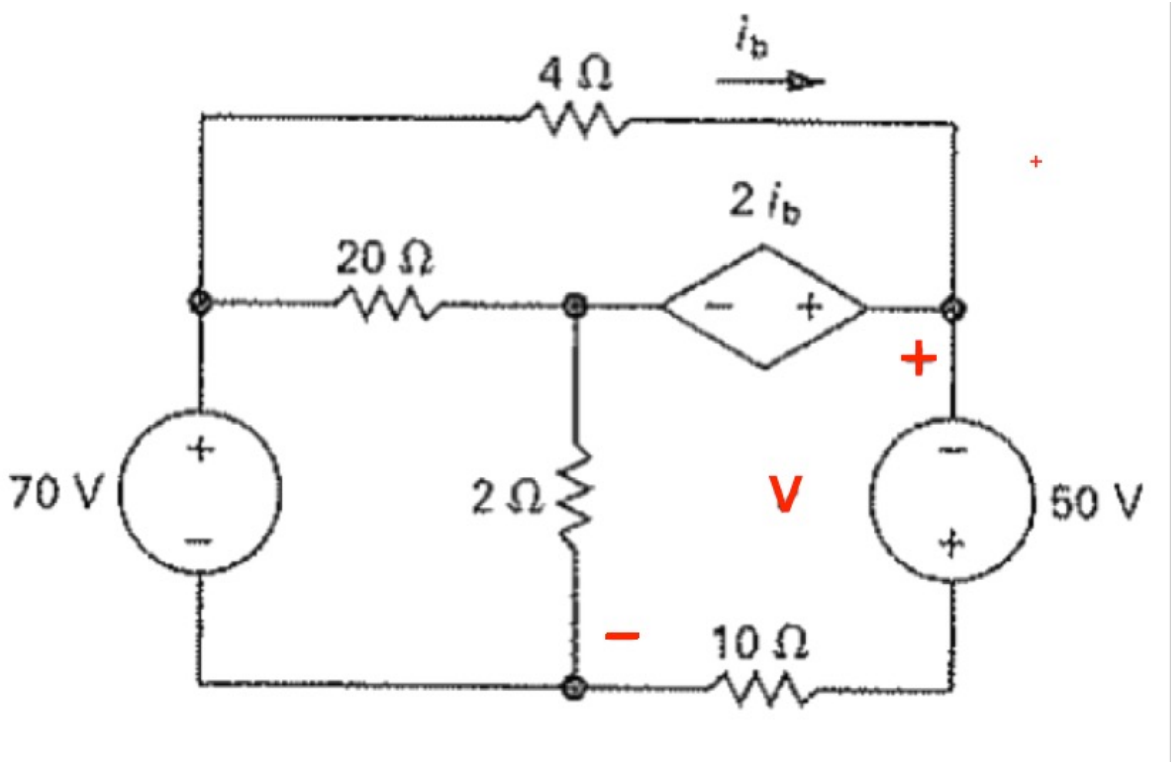
$$\frac{B-12}{3} = 0$$

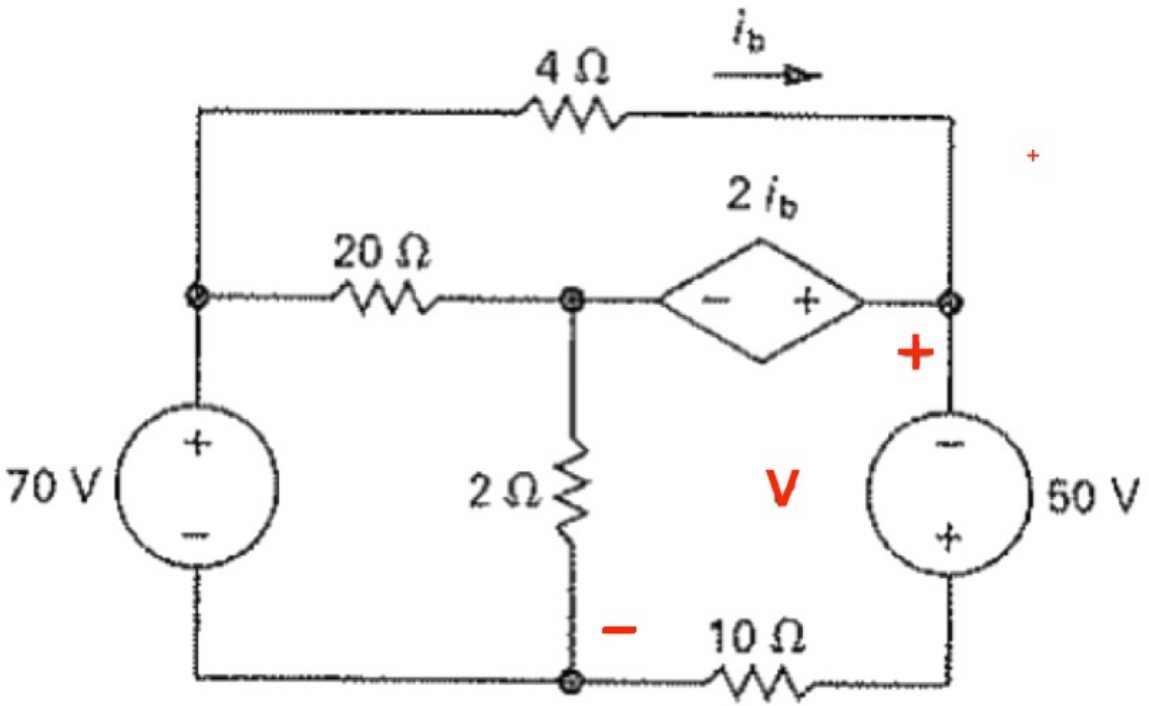
node C:

$$\frac{C}{12} + \frac{C-A}{6} + \frac{C-70-B}{2} = 0$$

P = 360 W

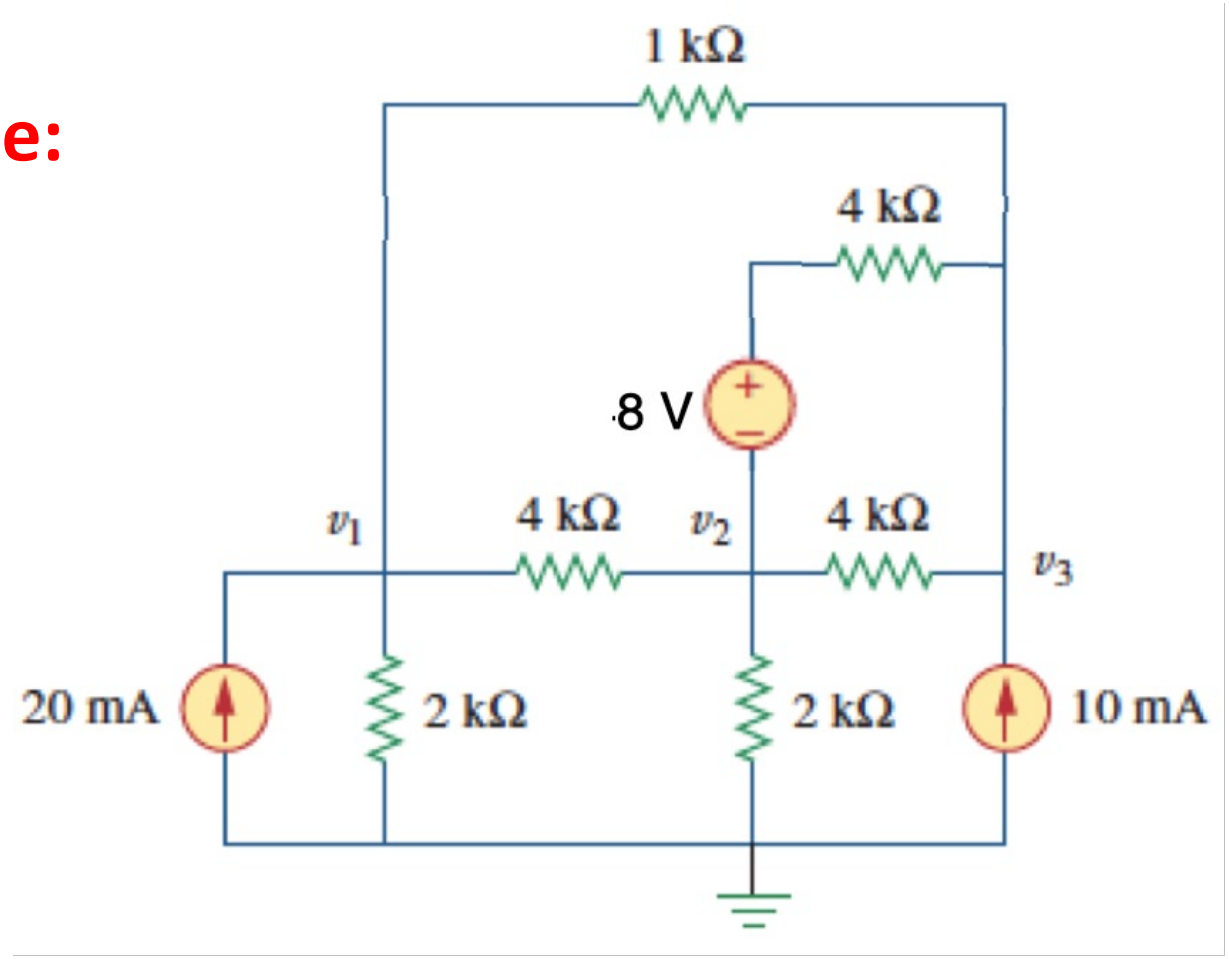
Example: find v

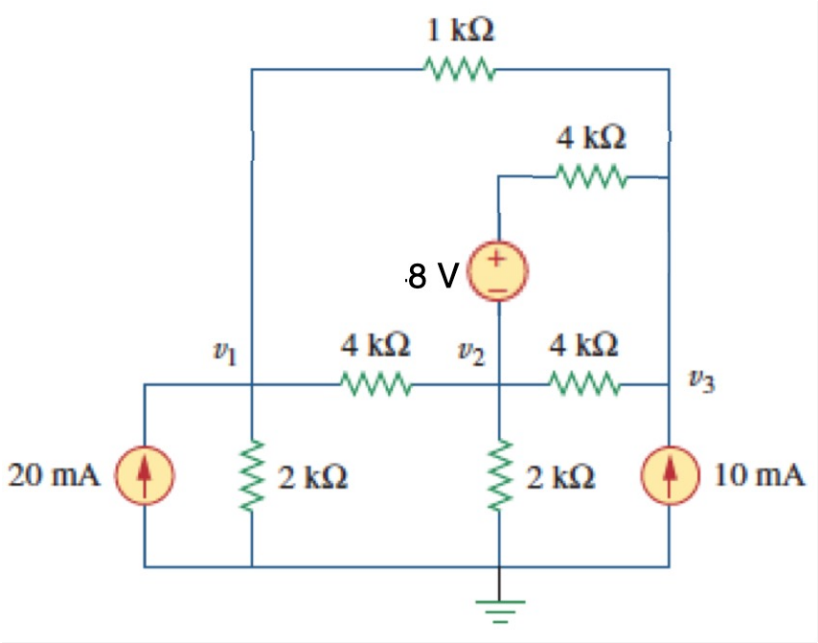




$v = 30\ V$

Example:

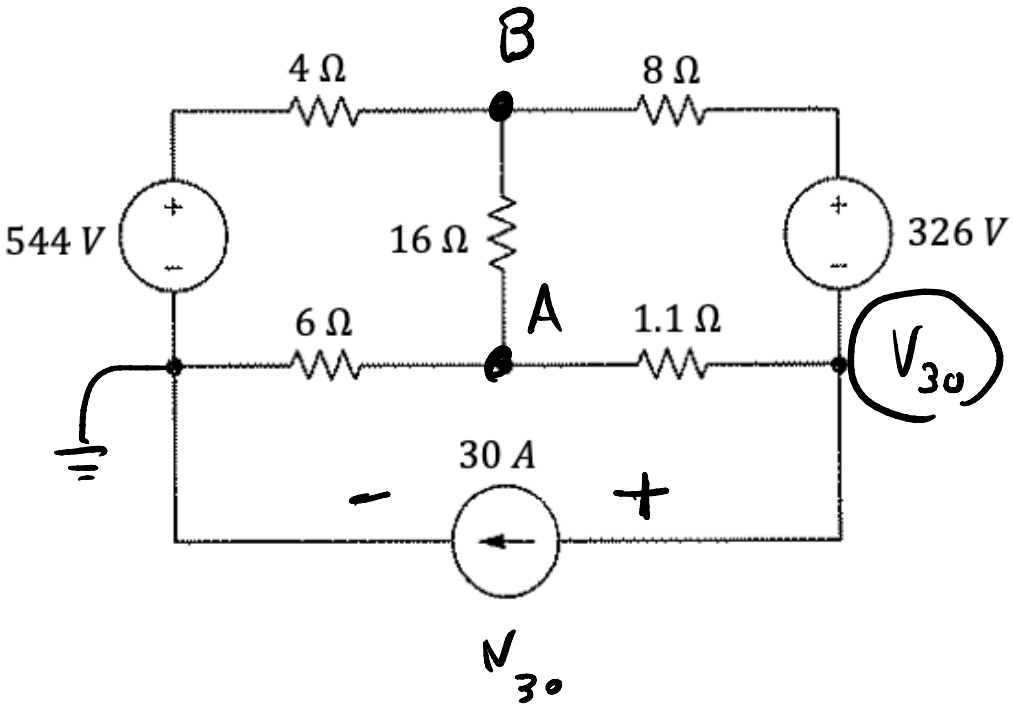




$v_1 = 37.8\ V$
$v_2 = 22.2\ V$
$v_3 = 40.6\ V$

60 W

Practice problem: find the power of the current source



$= 30 \cdot V_{30}$

node A:

$$\frac{A}{6} + \frac{A - V_{30}}{1.1} + \frac{A - B}{16} = 0$$

node B:

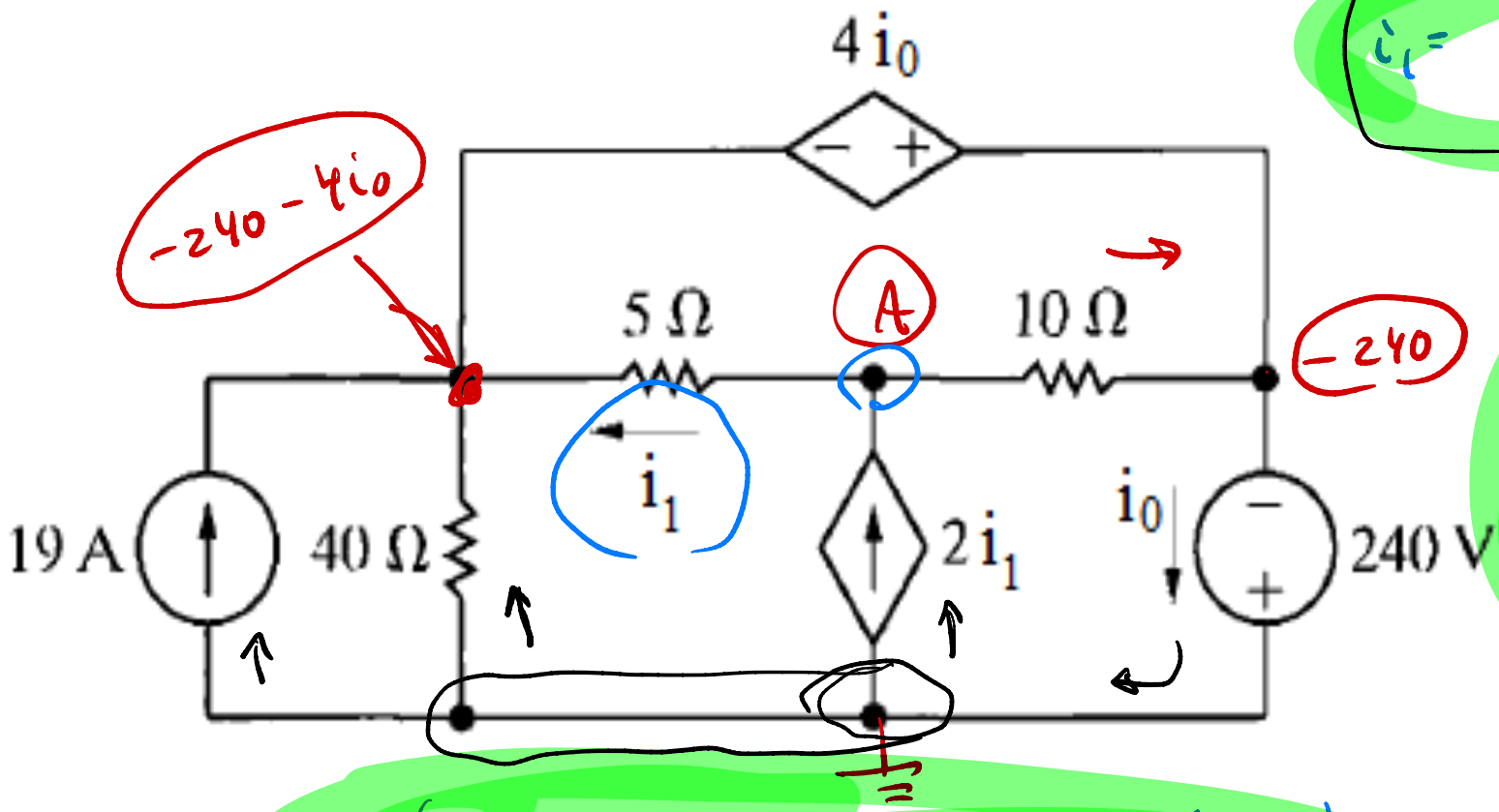
$$\frac{B - 544}{4} + \frac{B - A}{16} + \frac{B - (V_{30} + 326)}{8} = 0$$

node V_{30}: $\quad 30 + \dfrac{V_{30} - A}{1.1} + \dfrac{V_{30} + 326 - B}{8} = 0$

$i_0 = 10\ A$

$i_1 = -8\ A$

Practice problem: find i_0 and i_1



$-240 - 4i_0$

A

-240

$i_1 = \dfrac{A - (-240 - 4i_0)}{5}$

$i_0 = 2i_1 + \dfrac{0 - (-240 - 4i_0)}{40} + 19$

node 1: $\dfrac{A - (-240 - 4i_0)}{5} - 2i_1 + \dfrac{A - (-240)}{10} = 0$

Practice problem: The variable voltage source shown in the circuit below (the source with the diagonal line through it) is adjusted so that the power absorbed by the 5 Ω resistor is 5 watts. Find the value of $v_{DC.}$