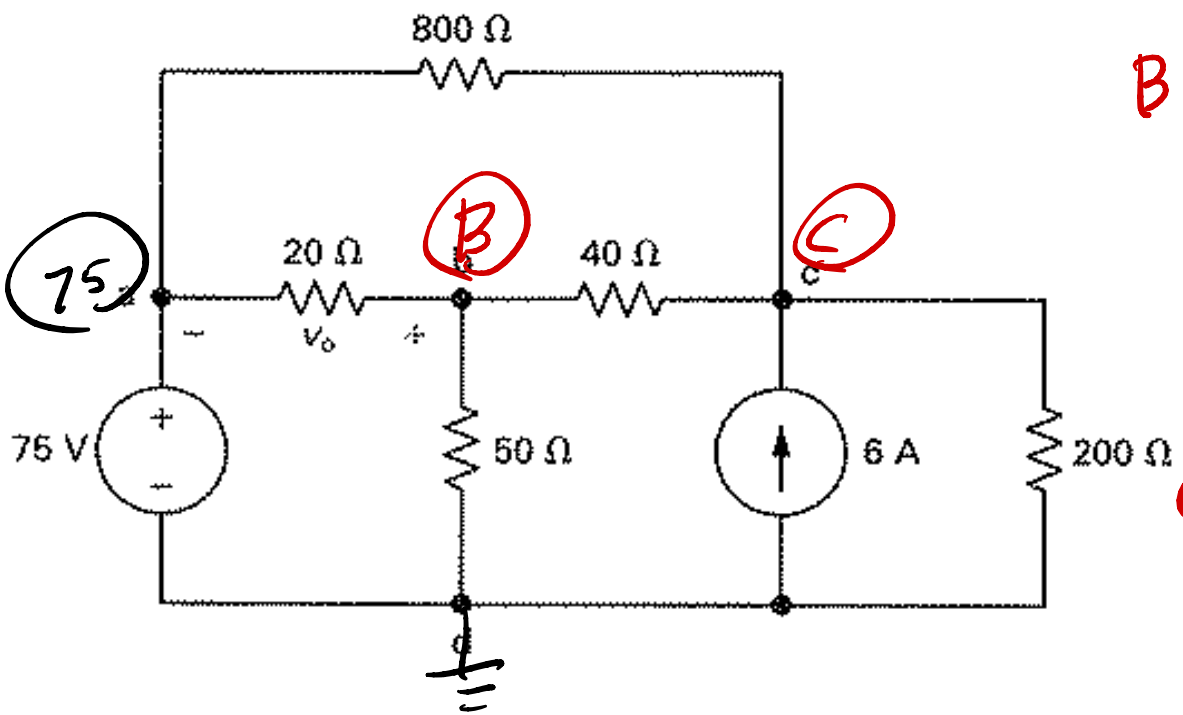
Lecture 13
Node Analysis – 6 of 7

examples

Example: find v_o

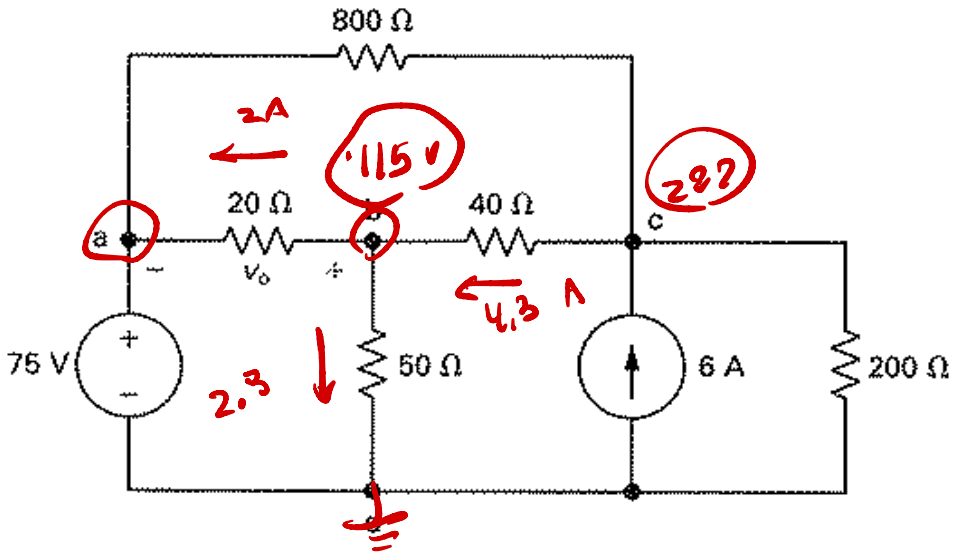


1- labels

2- KCL

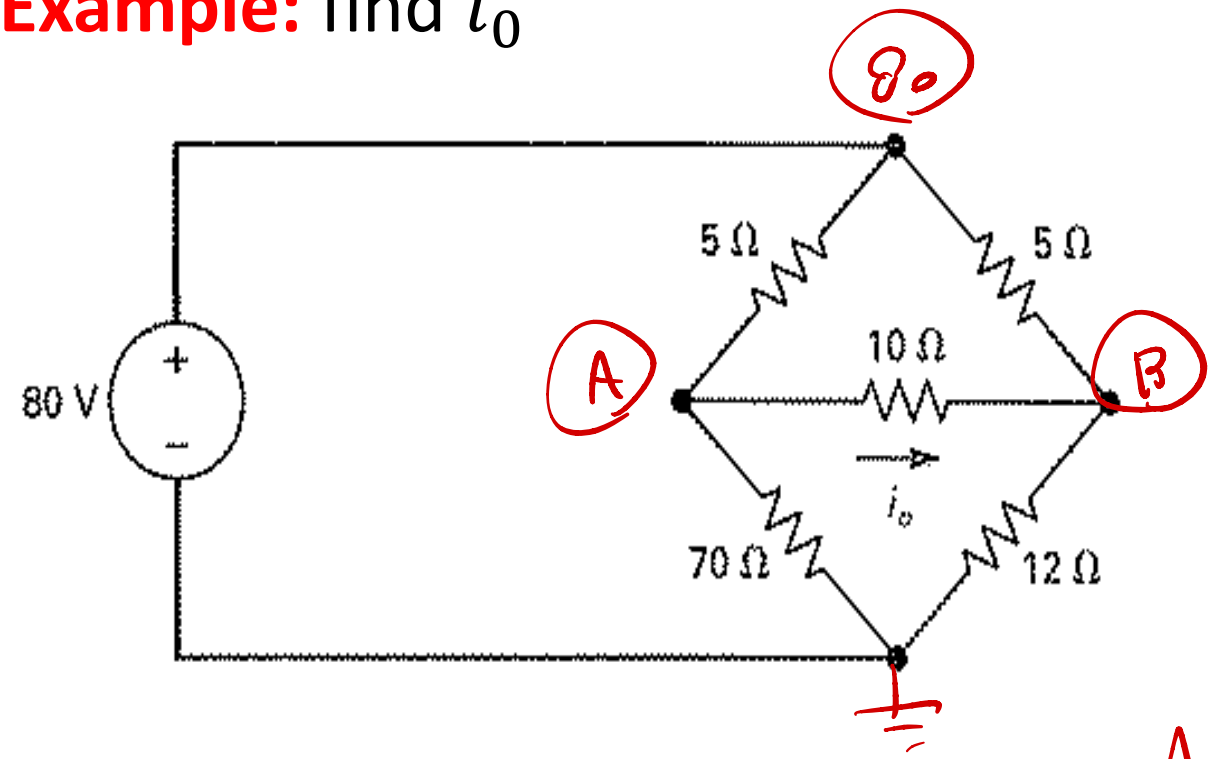
B: $\frac{B-75}{20} + \frac{B}{50} + \frac{B-C}{40} = 0$

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



$v_o = 40\ V$

Example: find i_0



1- Label A, B

2- KCL

A: $\frac{A-80}{5} + \frac{A}{70} + \frac{A-B}{10} = 0$

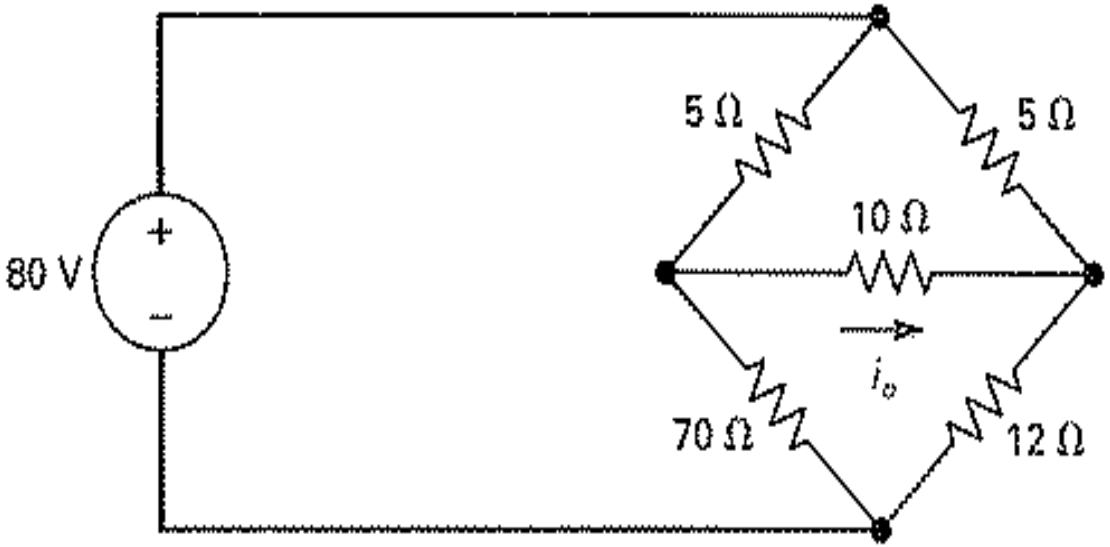
B: $\frac{B-80}{5} + \frac{B}{12} + \frac{B-A}{10} = 0$

A = ——

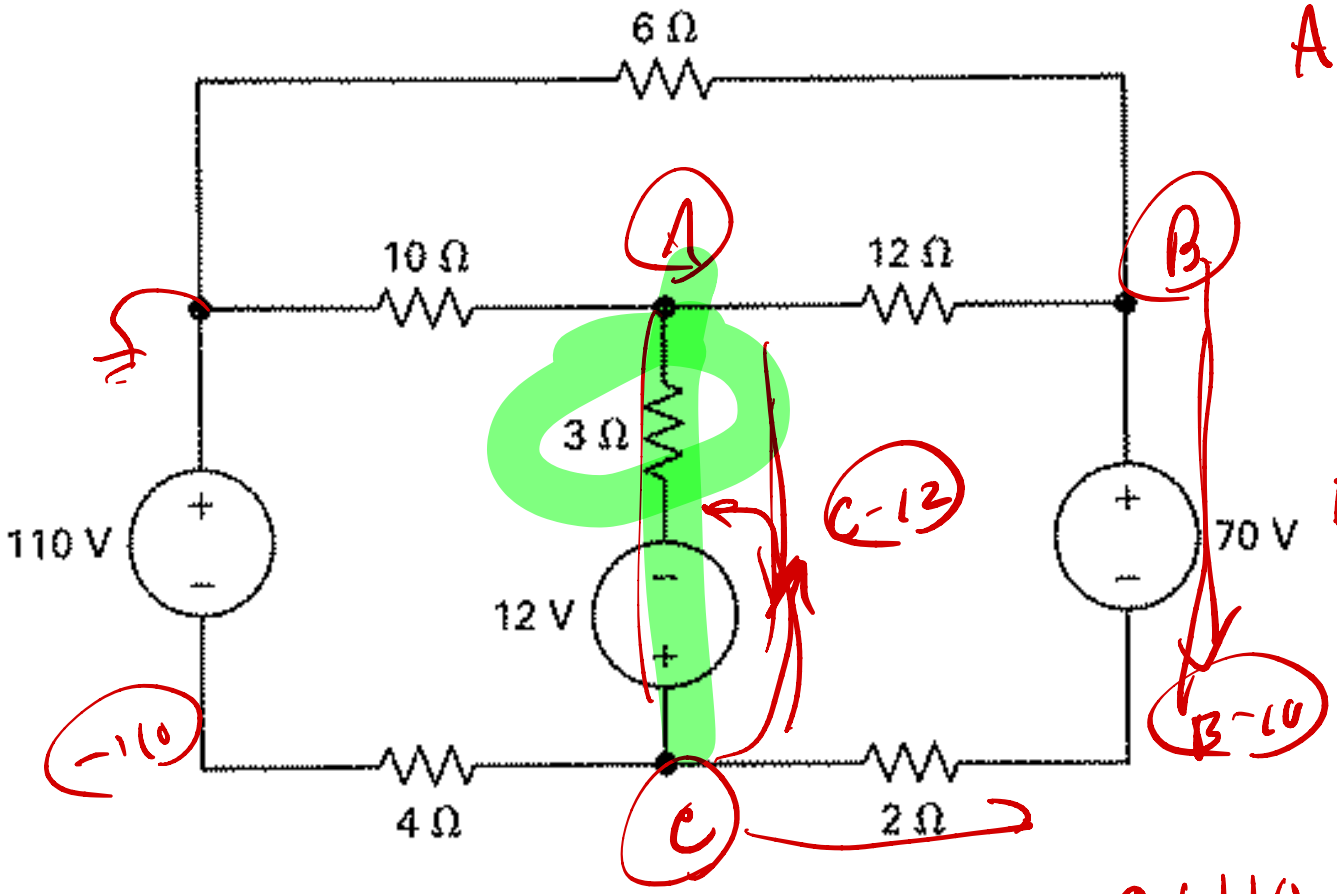
B = ——

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

$i_0 = 1\ A$



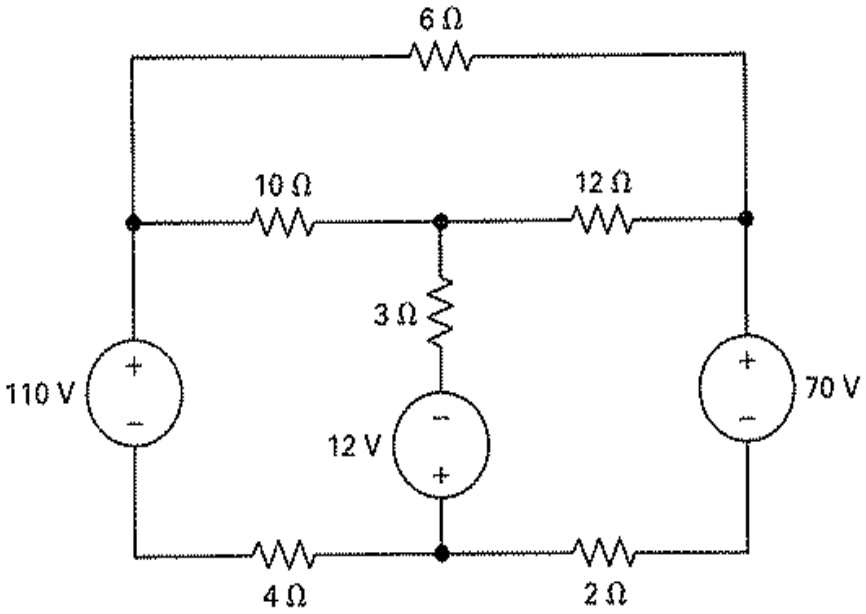
Example: find the power of the 10 Ω resistor



$$A: \quad \frac{A}{10} + \frac{A-B}{12} + \frac{A-C+12}{3} = 0$$

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

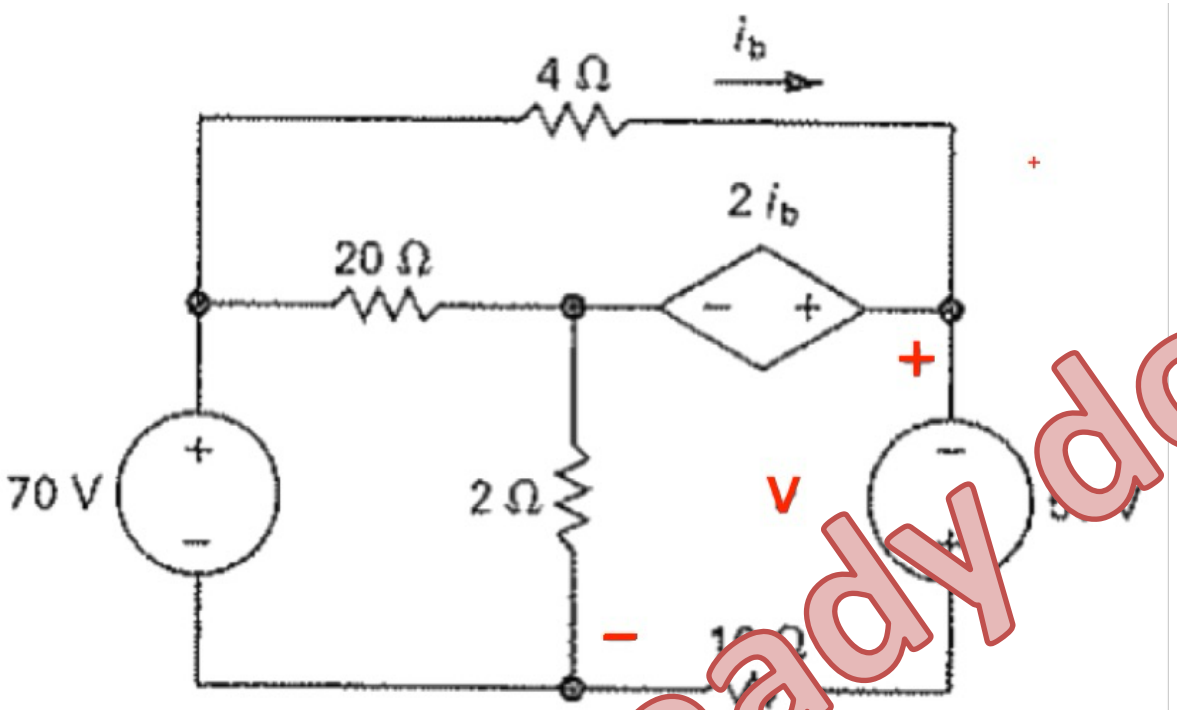
$$C: \quad \frac{C+110}{4} + \frac{C-12-A}{3} + \frac{C-(B-70)}{2} = 0$$



$P = 360\ W$

$v = 30\ V$

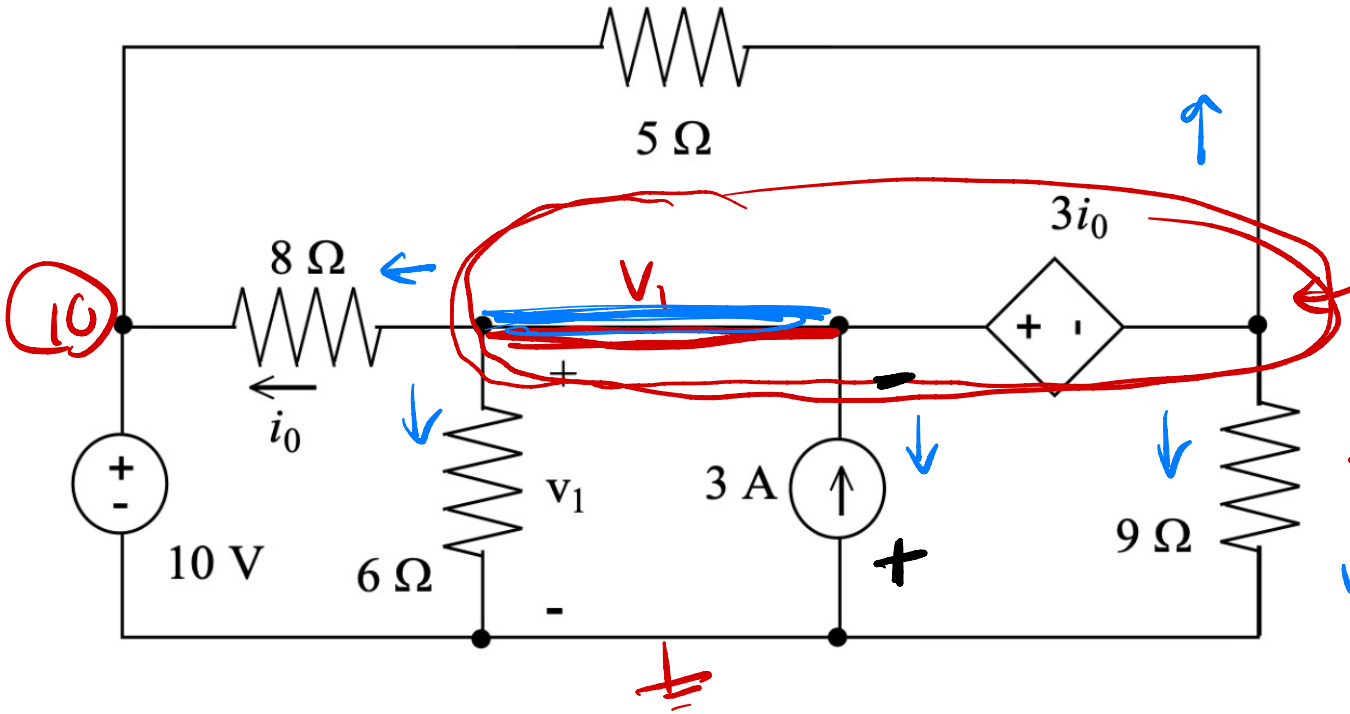
Example: find v



2. For the circuit shown below, find v_1. How much power is supplied by the current source?

$P = v \cdot i = (-v_1)(3)$

1- label with supermode



$v_1 - 3i_0$

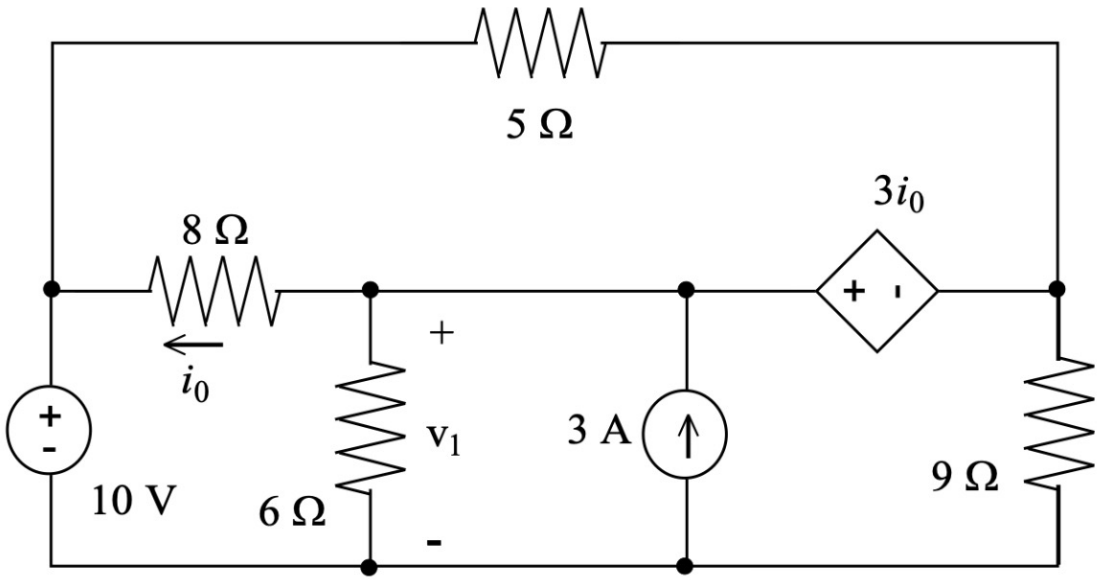
2- write KCL

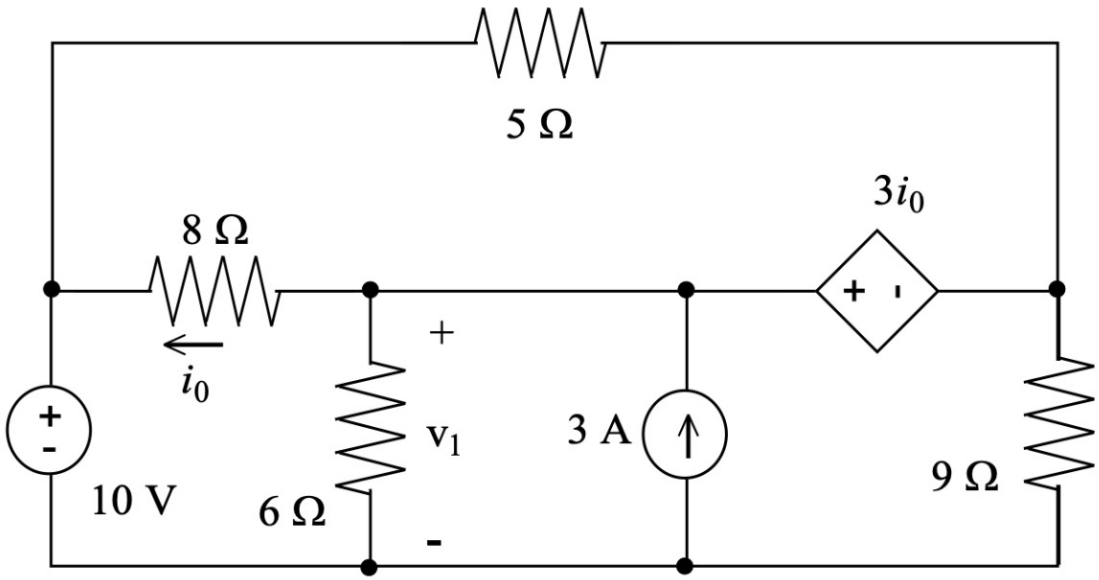
$\frac{v_1 - 10}{8} + \frac{v_1}{6} - 3 + \frac{v_1 - 3i_0}{9} + \frac{v_1 - 3i_0 - 10}{5} = 0$

$v_1 =$ _____ Power = _____

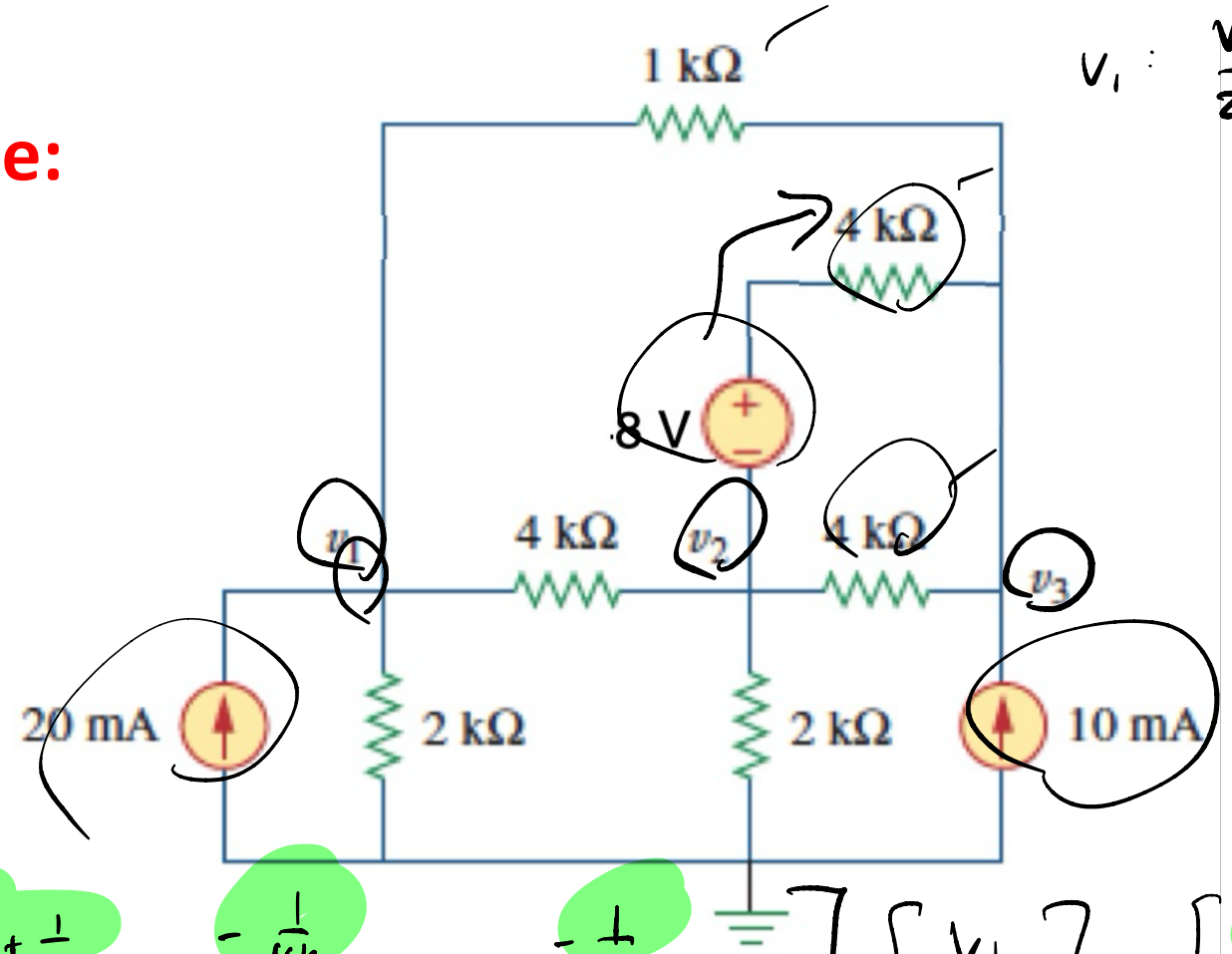
3 - Define i_0

$i_0 = \frac{v_1 - 10}{8}$


5 Ω
8 Ω
$3i_0$
i_0
+
v_1
-
10 V
6 Ω
3 A
9 Ω

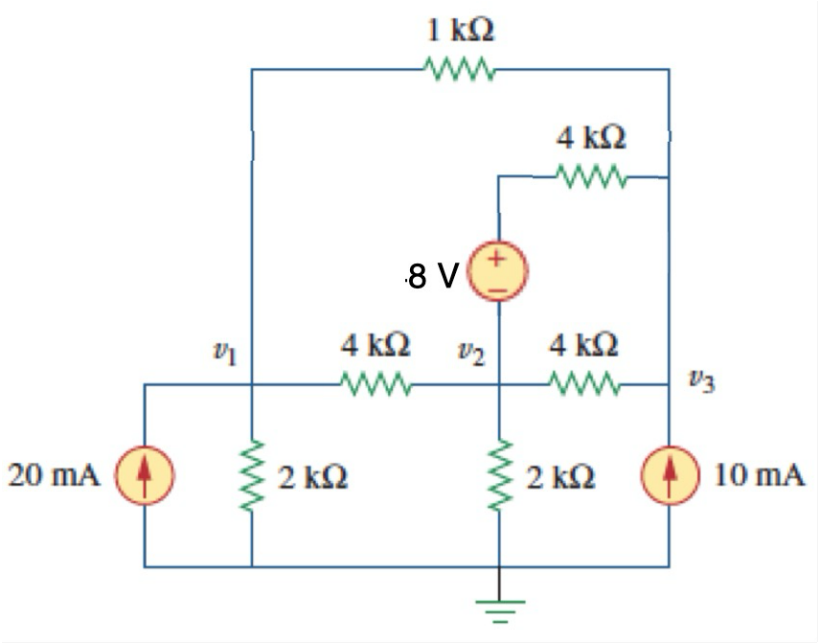

5 Ω
8 Ω
$3i_0$
i_0
+
v_1
-
10 V
6 Ω
3 A
9 Ω

Example:



V_1 : $\frac{V_1}{2k} + \frac{V_1 - V_2}{4k} + \frac{V_1 - V_3}{1k} - .02 = 0$

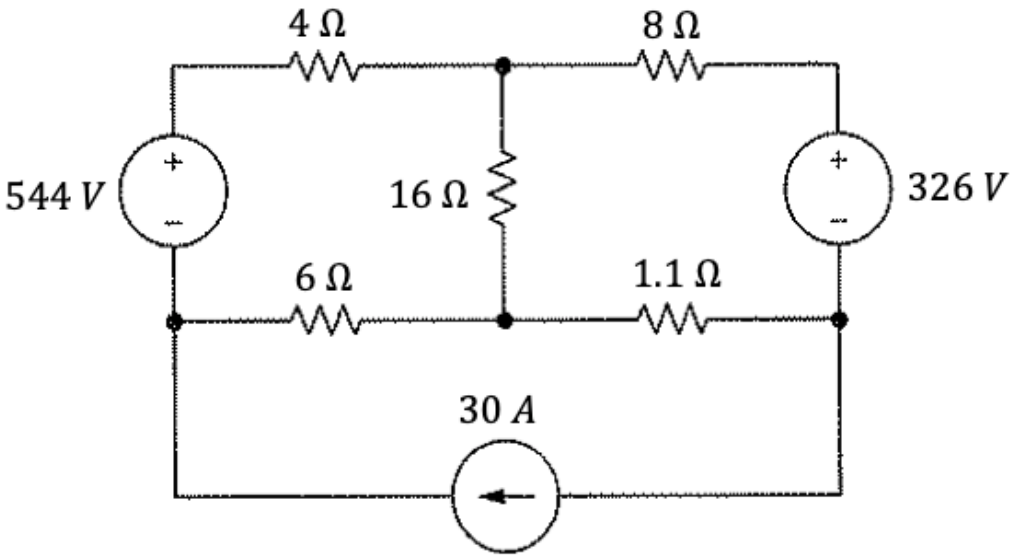
$$\begin{bmatrix} \frac{1}{2k} + \frac{1}{4k} + \frac{1}{1k} & -\frac{1}{4k} & -\frac{1}{1k} \\ -\frac{1}{4k} & \frac{3}{4k} + \frac{1}{2k} & -\frac{2}{4k} \\ -\frac{1}{1k} & -\frac{2}{4k} & \frac{1}{1k} + \frac{2}{4k} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} .02 \\ -.02 \\ .01 + .02 \end{bmatrix}$$



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

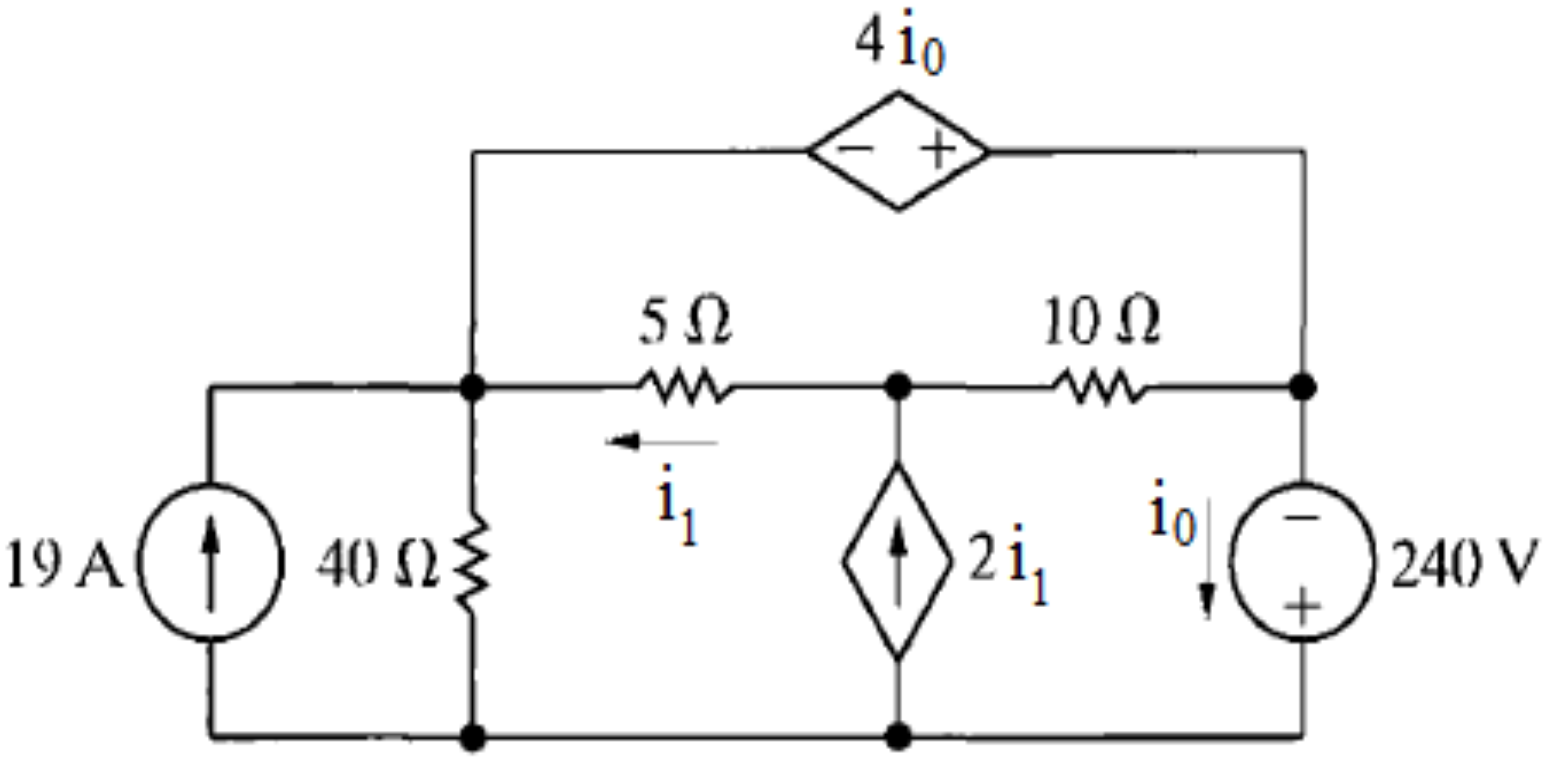
$60\ W$

Practice problem: find the power of the current source



$i_0 = 10\ A$
$i_1 = -8\ A$

Practice problem: find i_0 and i_1



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 $v_{DC.}$