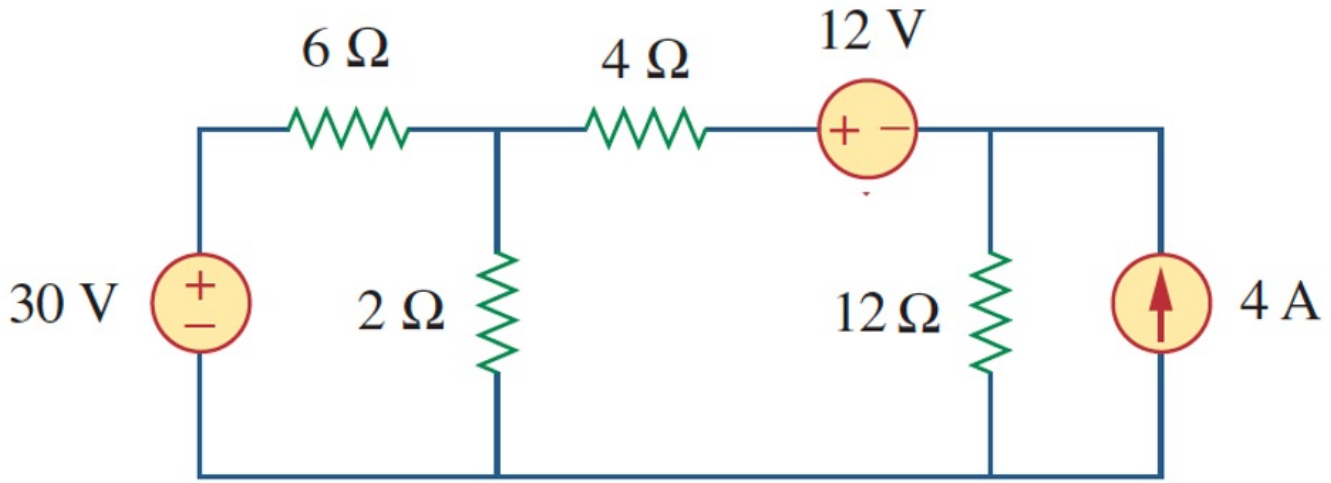
Lecture 9
Node Analysis – 2 of 7

more complex branches

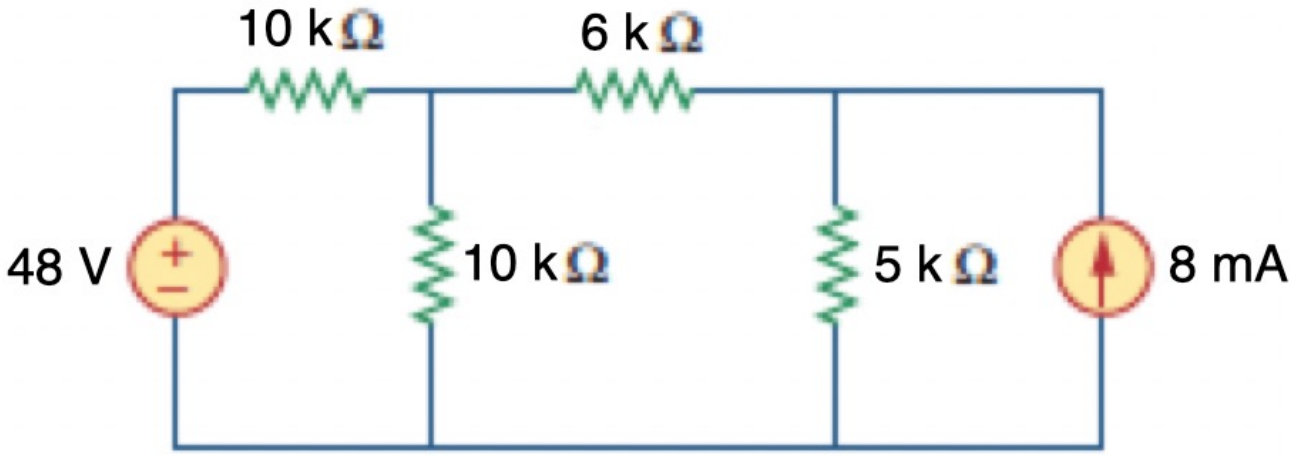
Extension #2 – V + R branches

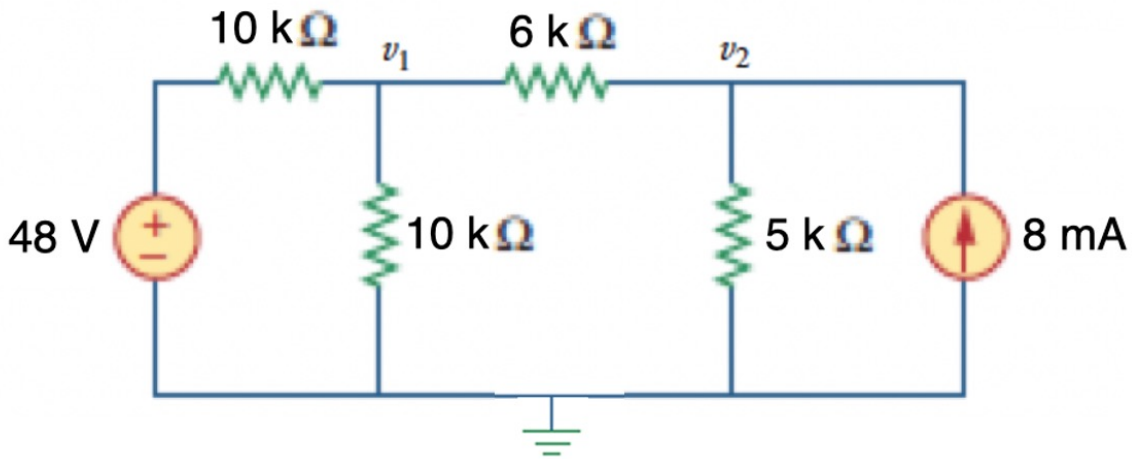
- Consider:



- Solution: Modify the Ohm's Law expression(s) for the individual branch current(s)

Example (solved on next slide)





$$\frac{v_1}{10k} + \frac{v_1 - 48}{10k} + \frac{v_1 - v_2}{6k} = 0$$

$$\frac{v_2}{5k} + \frac{v_2 - v_1}{6k} - .008 = 0$$

$$3v_1 + 3v_1 + 5v_1 - 5v_2 = 144$$

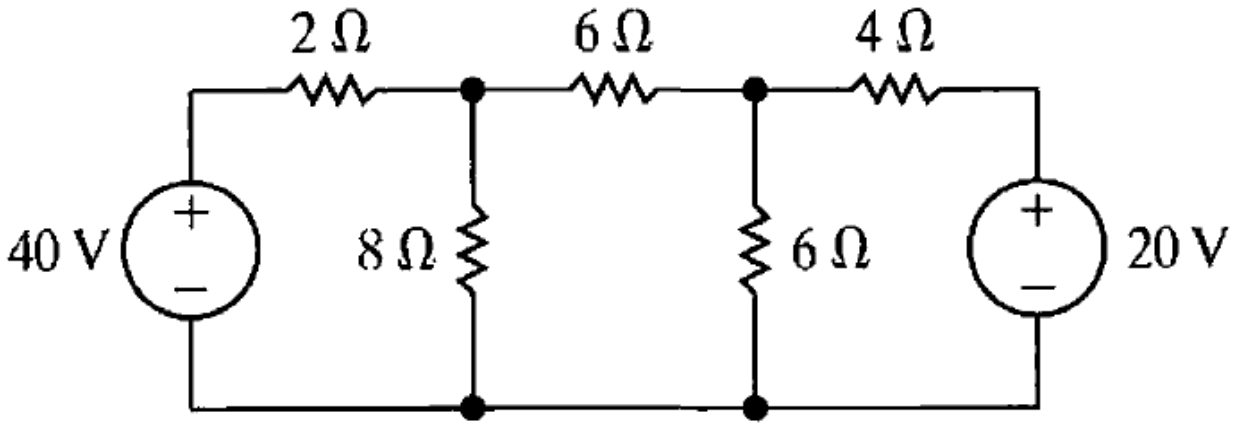
$$6v_2 + 5v_2 - 5v_1 = 240$$

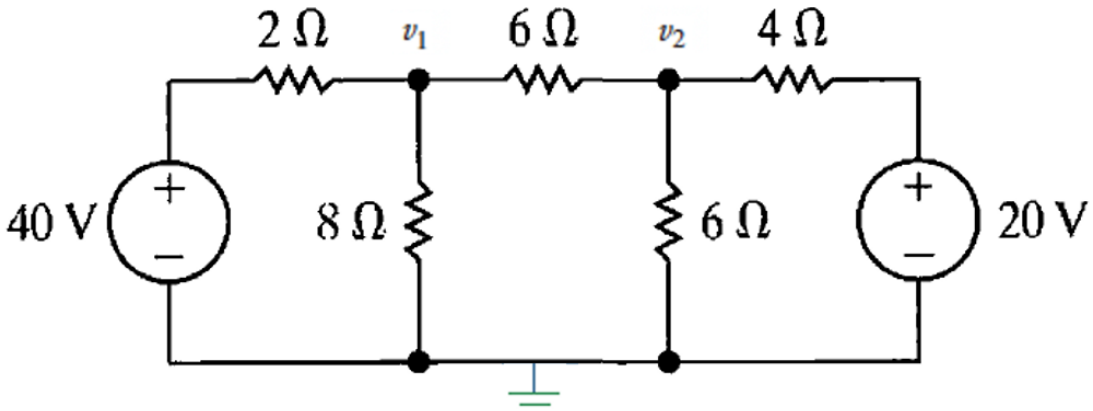
$$11v_1 - 5v_2 = 288$$

$$-5v_1 + 11v_2 = 240$$

$$\Rightarrow \quad v_1 = 29\,V, \quad v_2 = 35\,V$$

Example



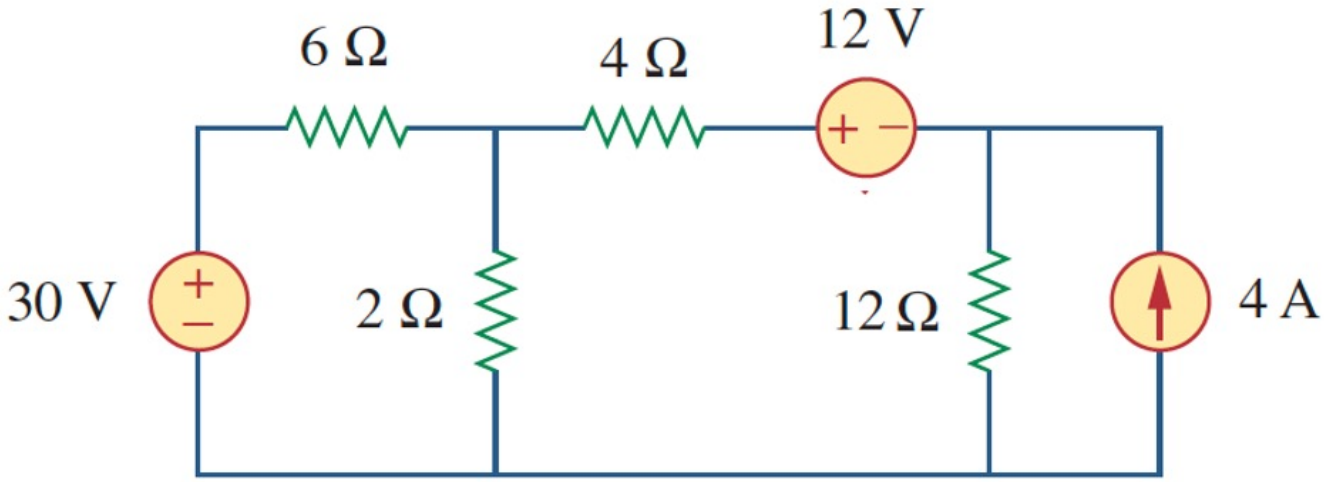


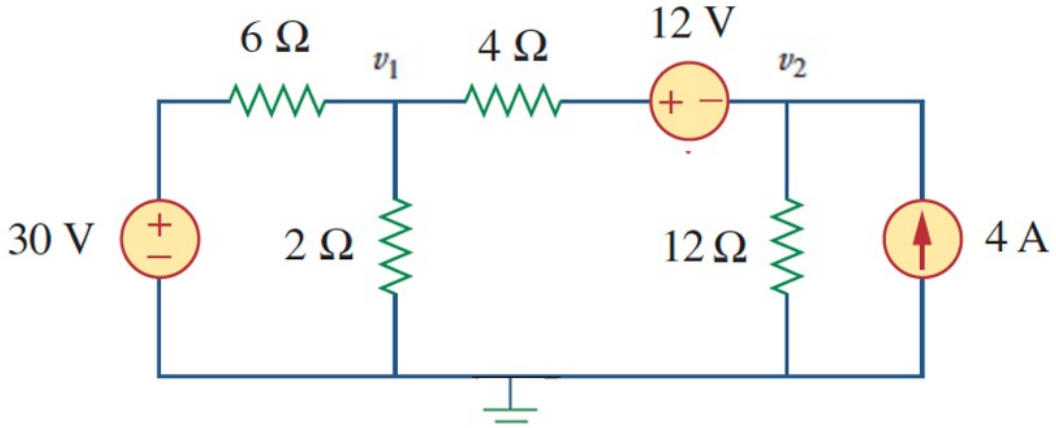
$$\frac{v_1}{8}+\frac{v_1-40}{2}+\frac{v_1-v_2}{6} = 0$$
$$\frac{v_2}{6}+\frac{v_2-v_1}{6}+\frac{v_2-20}{4} = 0$$

$$3v_1+12v_1+4v_1-4v_2 = 480$$
$$2v_2+2v_2-2v_1+3v_2 = 60$$

$$17v_1-4v_2 = 480$$
$$-2v_1+7v_2 = 60$$
$$\Rightarrow \quad v_1 = 27.5\ V,\quad v_2 = 10.4\ V$$

Example: find the power of the current source





$$\frac{v_1}{2} + \frac{v_1 - 30}{6} + \frac{v_1 - v_2 - 12}{4} = 0$$

$$\frac{v_2}{12} + \frac{v_2 + 12 - v_1}{4} + 4 = 0$$

$$P = (-4\ A) * (12\ V) = -48\ W$$

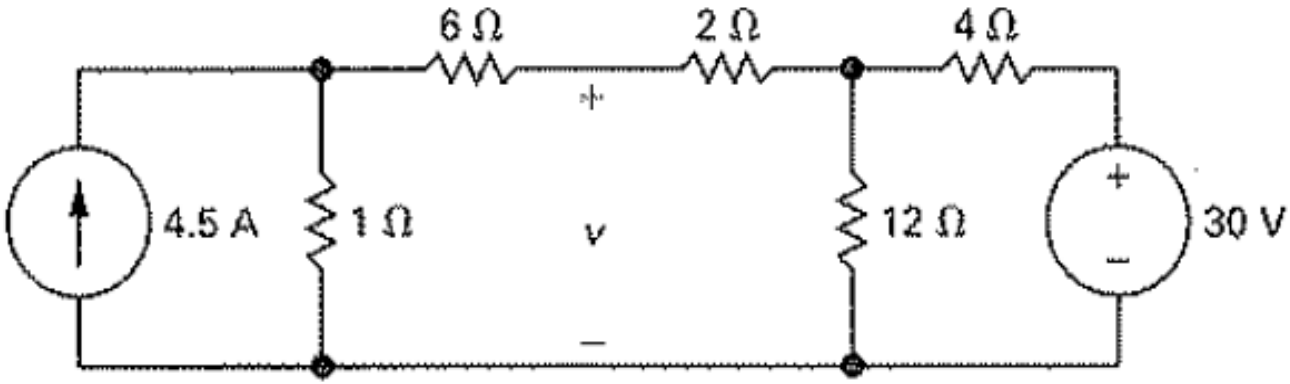
$$6v_1 + 2v_1 + 3v_1 - 3v_2 = 60 + 36$$

$$v_2 + 3v_2 - 3v_1 = -36 - 48$$

$$\begin{aligned} 11v_1 - 3v_2 &= 96 \\ -3v_1 + 4v_2 &= -84 \end{aligned} \Rightarrow \begin{aligned} v_1 &= 12\ V \\ v_2 &= 12\ V \end{aligned}$$

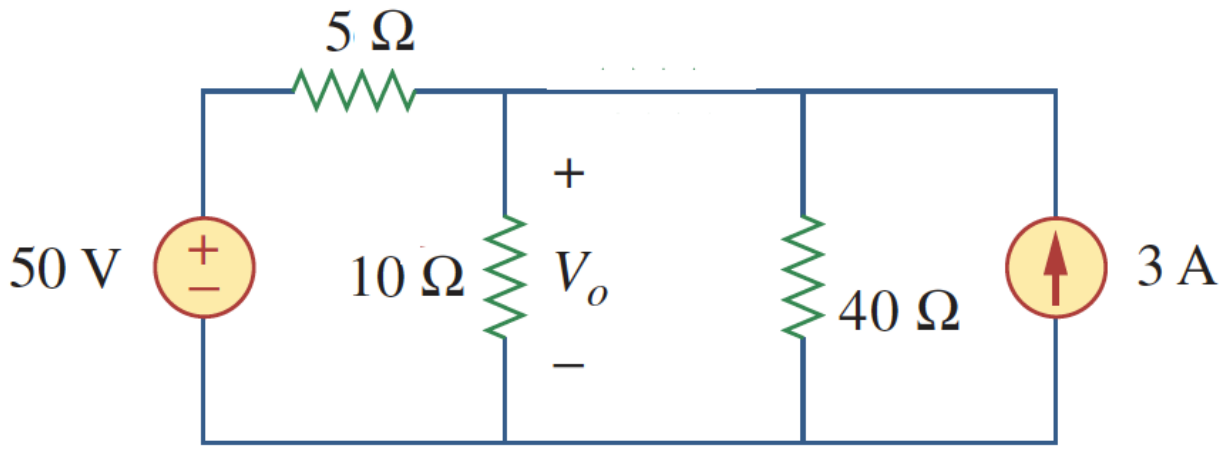
$15\ V$

Example: find v



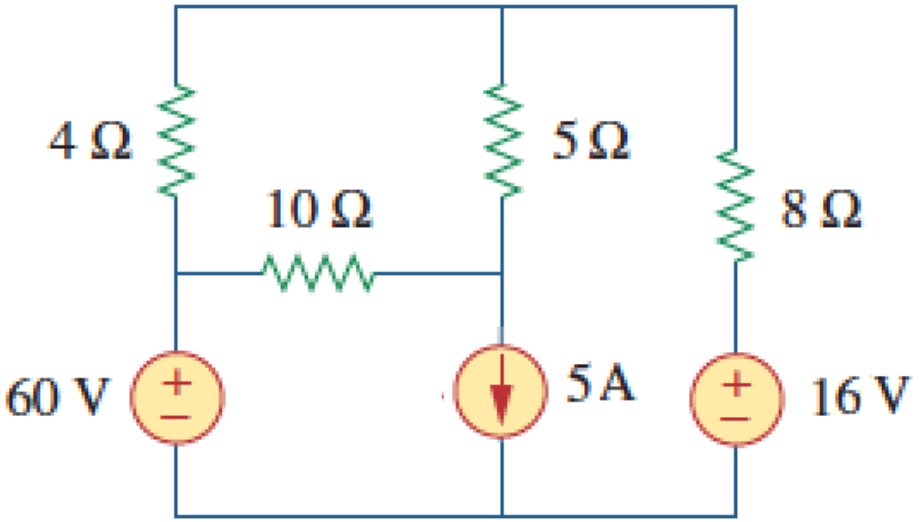
$40\ V$

Practice problem: find V_o



$v_T = 40\ V, v_M = 30\ V$

Practice problem: find the node voltages to the top and bottom of the $5\ \Omega$ resistor relative to the bottom



$-26\ A$

Practice problem: find i_o