Chapter 4, Solution 6.

Due to linearity, from the first experiment,

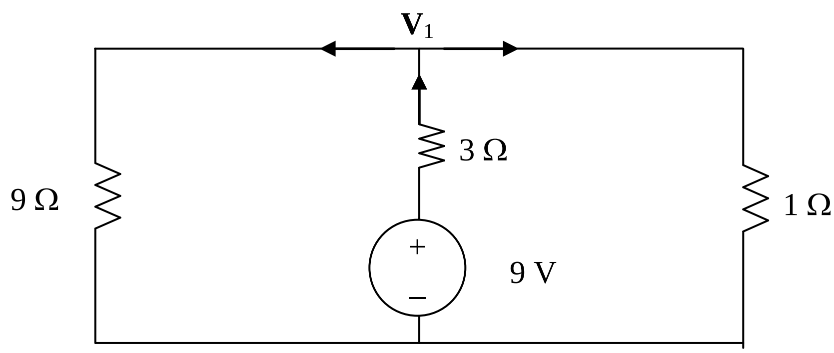
$$V_o = \frac{1}{3} V_s$$

Applying this to other experiments, we obtain:

Experiment	V_s	V_o
2	48	16 V
3	1 V	0.333 V
4	-6 V	-2V

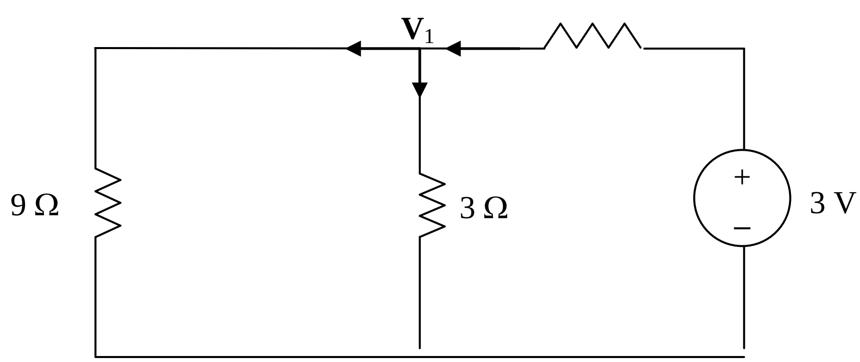
Chapter 4, Solution 8.

Let $V_o = V_1 + V_2$, where V_1 and V_2 are due to 9-V and 3-V sources respectively. To find V_1, consider the circuit below.



$$\frac{9-V_1}{3} = \frac{V_1}{9} + \frac{V_1}{1} \longrightarrow V_1 = 27/13 = 2.0769$$

To find V_2, consider the circuit below.

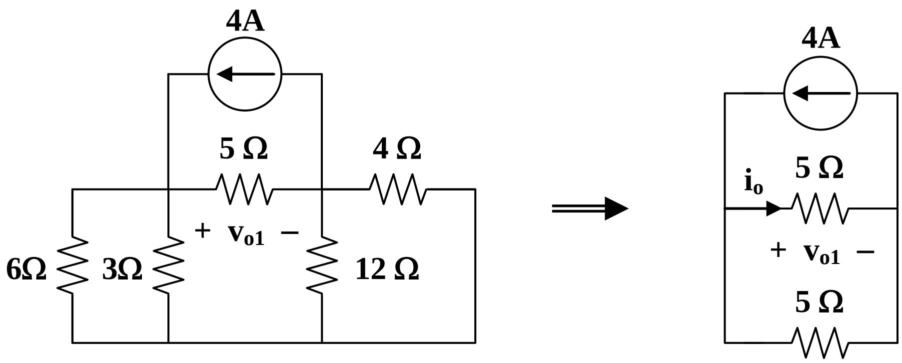


$$\frac{V_2}{9} + \frac{V_2}{3} = \frac{3-V_2}{1} \longrightarrow V_2 = 27/13 = 2.0769$$

$V_o = V_1 + V_2 =$ **$\underline{4.1538\ \text{V}}$**

Chapter 4, Solution 12.

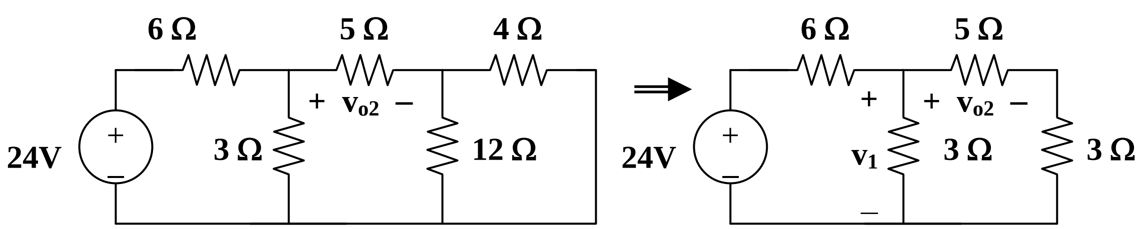
Let $v_o = v_{o1} + v_{o2} + v_{o3}$, where v_{o1}, v_{o2}, and v_{o3} are due to the 4-A, 24-V, and 38-V sources respectively. For v_{o1}, consider the circuit below.



$$6||3 = 2 \text{ ohms}, \ 4||12 = 3 \text{ ohms. Hence,}$$

$$i_o = 4/2 = 2, v_{o1} = 5io = 10 \text{ V}$$

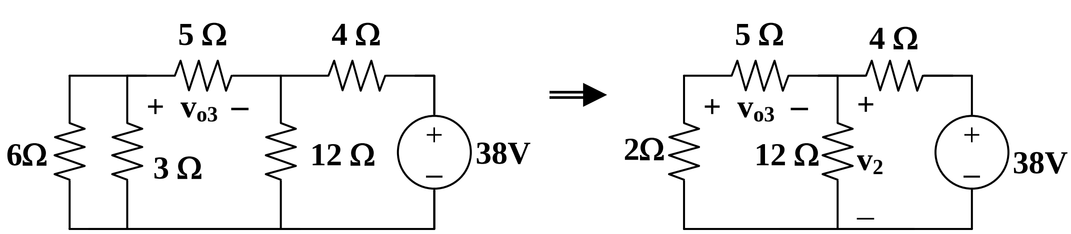
For v_{o2}, consider the circuit below.



$$3||8 = 24/11, \ v_1 = [(24/11)/(6 + 24/11)]24 = 6.4$$

$$v_{o2} = (5/8)v_1 = (5/8)(6.4) = \underline{\mathbf{4\ V}}$$

For v_{o3}, consider the circuit shown below.



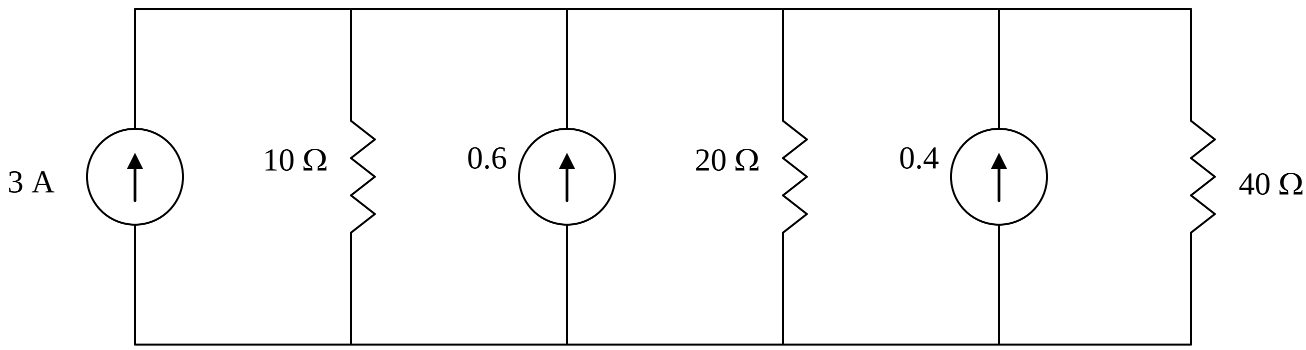
$$7||12 = (84/19) \text{ ohms}, \ v_2 = [(84/19)/(4 + 84/19)]38 = 19.95$$

$$V_{o3} = (-5/7)v2 = -14.25$$

$v_o = 10 + 4 – 14.25 =$ **<u>–250 mV</u>**

Chapter 4, Solution 20.

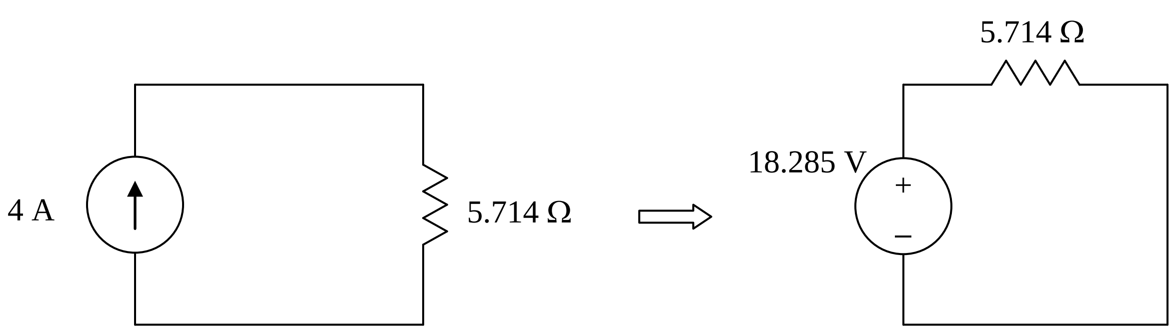
Convert the voltage sources to current sources and obtain the circuit shown below.



$$\frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{20} + \frac{1}{40} = 0.1 + 0.05 + 0.025 = 0.175 \longrightarrow R_{eq} = 5.714\ \Omega$$

$I_{eq} = 3 + 0.6 + 0.4 = 4$

Thus, the circuit is reduced as shown below. Please note, we that this is merely an exercise in combining sources and resistors. The circuit we have is an equivalent circuit which has no real purpose other than to demonstrate source transformation. In a practical situation, this would need some kind of reference and a use to an external circuit to be of real value.



Chapter 4, Solution 27.

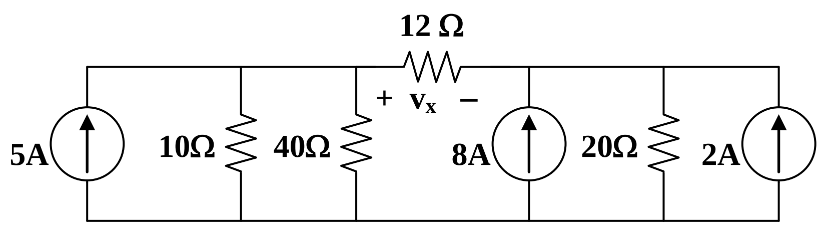
Transforming the voltage sources to current sources gives the circuit in Fig. (a).

$$10||40 \; = \; 8 \text{ ohms}$$

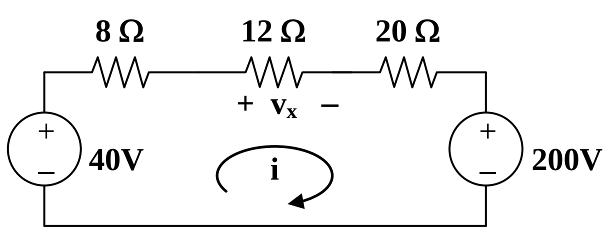
Transforming the current sources to voltage sources yields the circuit in Fig. (b). Applying KVL to the loop,

$$-40 \; + \; (8 + 12 + 20)i + 200 \; = \; 0 \text{ leads to } i \; = \; -4$$

v_x 12i = <u>**-48 V**</u>



(a)



(b)

Chapter 4, Solution 33.

(a) $R_{Th} = 10||40 = 400/50 =$ **8 ohms**

$$V_{Th} = (40/(40 + 10))20 = \underline{\mathbf{16\ V}}$$

(b) $R_{Th} = 30||60 = 1800/90 =$ **20 ohms**

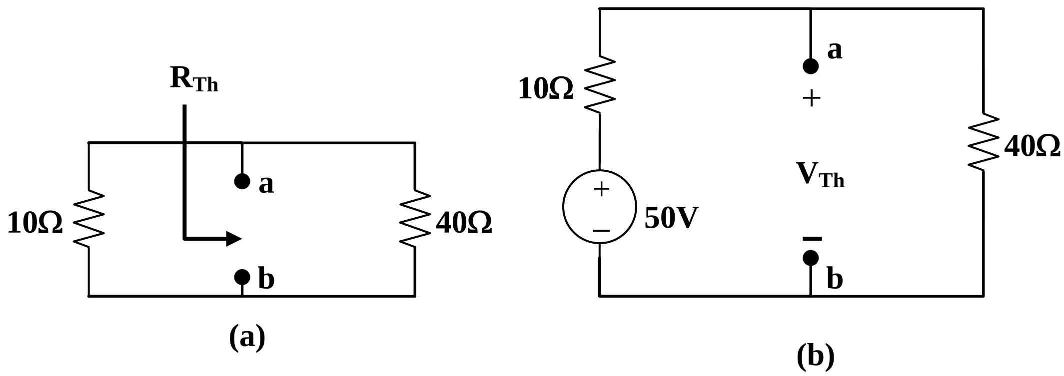
$$2 + (30 - v1)/60 = v_1/30, \text{ and } v_1 = V_{Th}$$

$$120 + 30 - v_1 = 2v_1, \text{ or } v_1 = 50 \text{ V}$$

$$V_{Th} = \underline{\mathbf{50\ V}}$$

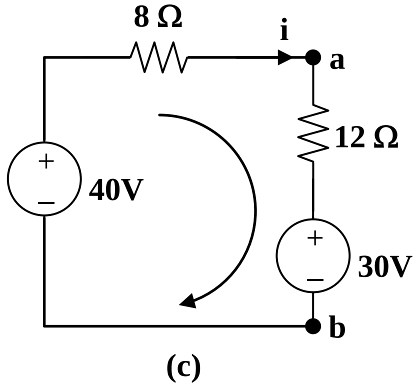
Chapter 4, Solution 36.

Remove the 30-V voltage source and the 20-ohm resistor.



From Fig. (a), R_{Th} = 10||40 = 8 ohms

From Fig. (b), V_{Th} = (40/(10 + 40))50 = 40V



The equivalent circuit of the original circuit is shown in Fig. (c). Applying KVL,

30 – 40 + (8 + 12)i = 0, which leads to i = **500mA**