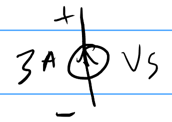
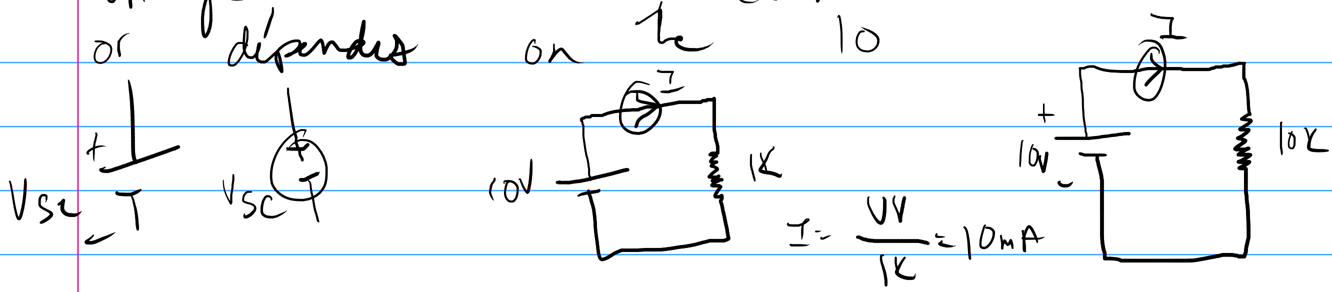
Chapter 8
Current Source



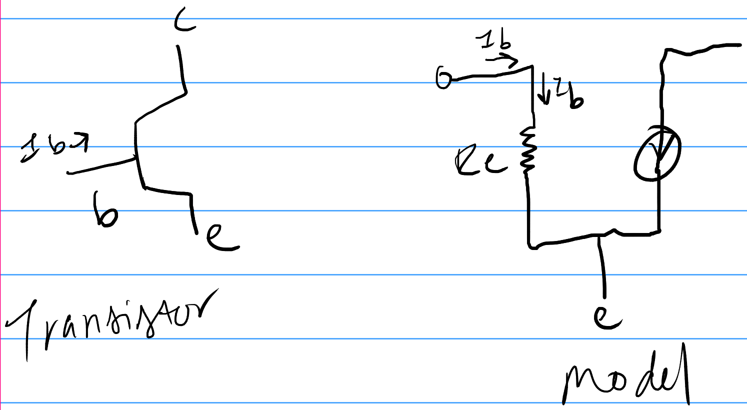
Supply a fixed current, but the voltage across it can change

Ideally, a current source internal resistance is very large, therefore, the internal resistance of a current source is infinite.

Voltage source can supply a fixed voltage however the current will be variable or depends on the 10

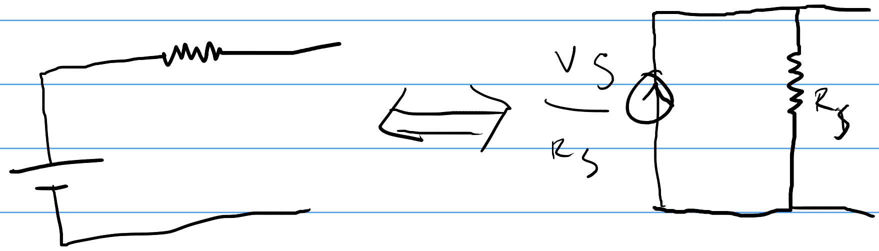


The internal individual resistance of a voltage source is very small, so ideally it is zero, short

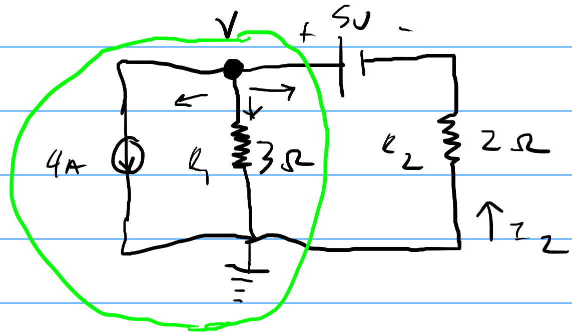


$h_{fe} = 20^{0}$

Source Transformation



Example: Determine the current I_2 in the circuit below



$$6\left(\frac{V-6}{3}+\frac{V-i}{2}+4\right)=0$$

$$2V+3(V-5)+24=0$$

$$5V-15+24=0$$

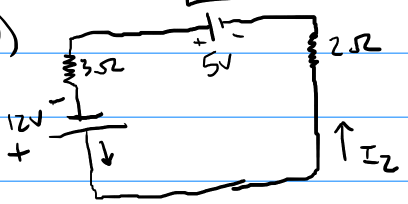
$$5V=-24+15=-9$$

$$V=\frac{-9}{5}=-1.8V$$

$$\downarrow I'=\frac{V-5}{2}=\frac{-1.8-5}{2}=-3.4A$$

$$\uparrow I_2=\boxed{+3.4A}$$

$(3\Omega\cdot 4A=12V)$

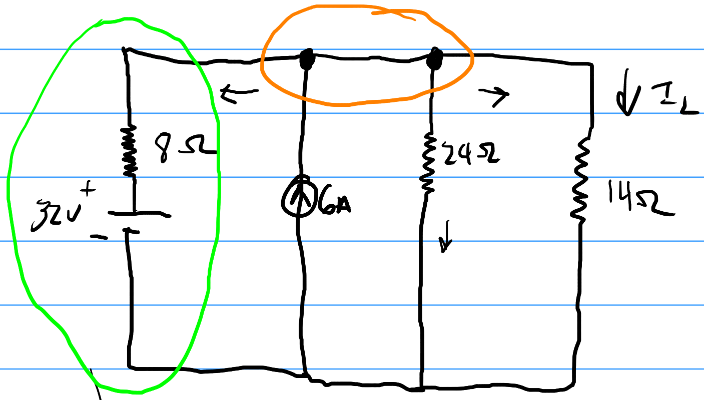


$$-12+2I_2-5+3I_2=0$$

$$5I_2=17$$

$$I_2=\frac{17}{5}=3.4A$$

Example: find I_L



$$\frac{V-32}{8} - 6 + \frac{V}{\cancel{24}} + \frac{V}{\cancel{14}} = 0$$

$\cancel{3\times 8}$ $\cancel{2\times 7}$

4×2

$3\times 8\times 7$

$$V\left(\frac{1}{8} + \frac{1}{24} + \frac{1}{14}\right) = 10$$

$$\frac{V}{8} - \frac{32}{8} - 6 + \frac{V}{24} + \frac{V}{14} = 0$$

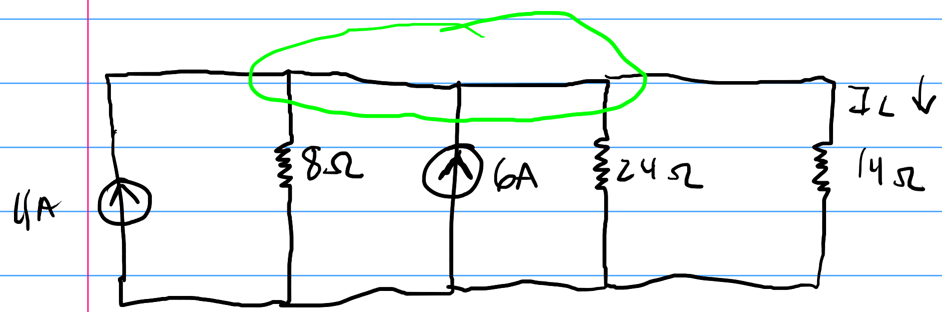
$$V\left(\frac{1}{8} + \frac{1}{24} + \frac{1}{14}\right) = 10$$

$$V = \frac{10}{\frac{1}{8} + \frac{1}{24} + \frac{1}{14}} = 42V$$

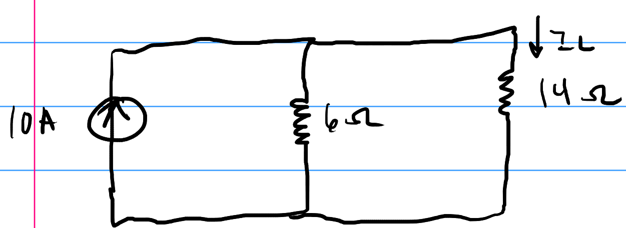
$$21(V-32) - 6\times 7\times 8\times 3$$

$$+7V + 12V = 0$$

$$I_L = \frac{42V}{14} = 3A$$



$$\frac{8\times 24}{8+24} = 6\Omega$$



$$I_L = \frac{6}{6+14}(10A)$$

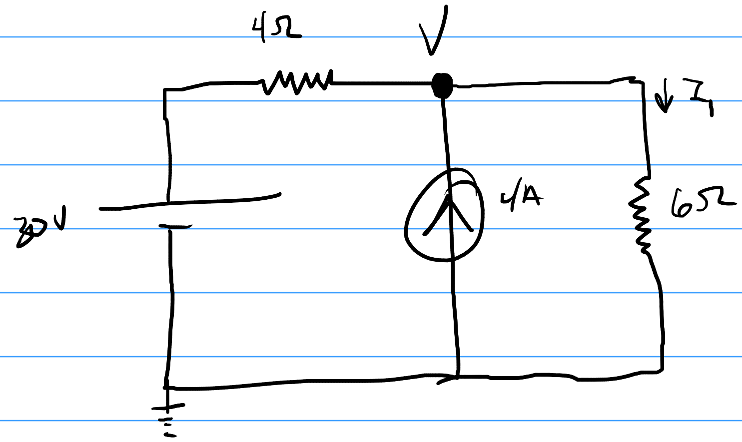
$$= 3A$$

Network Theorem

1- Super position

The current through, or Voltage across an element is in linear Network equal to the algebraic Sum of the currents or voltages produced independenty by each source

Example:



$$\frac{V-30}{4} - 4 + \frac{V}{6} = 0$$

$$3(V-30) - 48 + 2V = 0$$

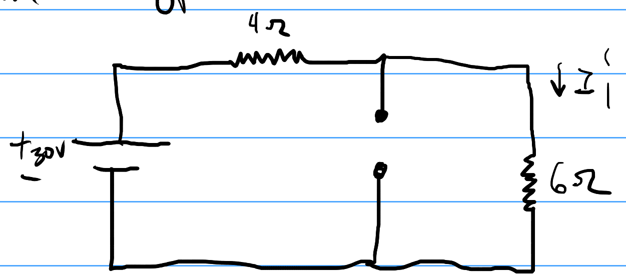
$$3V - 90 - 48 + 2V = 0$$

$$5V = 90 + 48 \qquad V = \frac{138}{5} = 27.6V$$

$$I_1 = \frac{27.6V}{6\Omega} = 4.6A$$

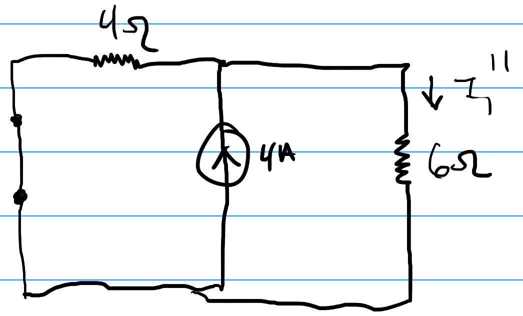
Super Point

1. Turn off the current source, replace it by an open



$$I_1' = \frac{30}{4+6} = 3A$$

2. Turn off 30 V voltage source, replace it by a short



$$I_1'' = \frac{4}{4+6}(4A) = 1.6A$$

$$I_{1T} = I_1' + I_1'' = 3A + 1.6A = 4.6A$$