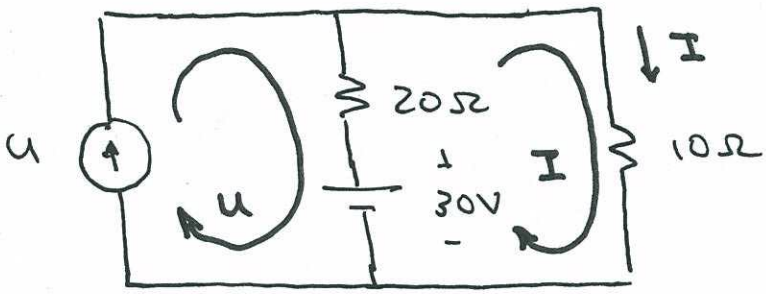
Exercises
Chapter 4.1

1. Rather arbitrarily, use mesh analysis. Mesh & dependent loops shown below:

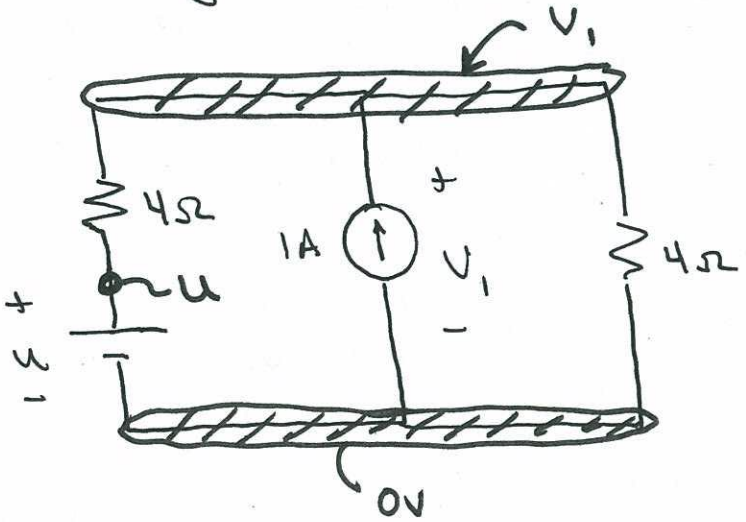


KVL, Loop I: $-30V + 20\Omega\,(I-u) + 10\Omega\,(I) = 0$

$$30 + 20u = 30I$$

$$\underline{\underline{I = 1 + \frac{2}{3}u}}$$

2. Use nodal analysis. Node voltages & dependent voltages shown below:



KCL, node V_1:

$$\frac{V_1 - u}{4\Omega} - 1A + \frac{V_1}{4\Omega} = 0$$

$$2V_1 = u + 4$$

$$\underline{\underline{V_1 = \frac{u+4}{2}}}$$

Exercises
Chapter 4.2

1.

(a) $V_a = 20\Omega(2A) = 40.V$

(b) $V_b = 20\Omega(3A) = 60\,V$

(c) $V_c = 20\Omega(5A) = 100\,V$

$V_c = V_a + V_b \Rightarrow$ looks like superposition holds!

2.

$V_1 = 3V \rightarrow$ [Linear circuit] $\rightarrow V_2 = 2V$

↓ multiply input by 2, so output also scaled by 2

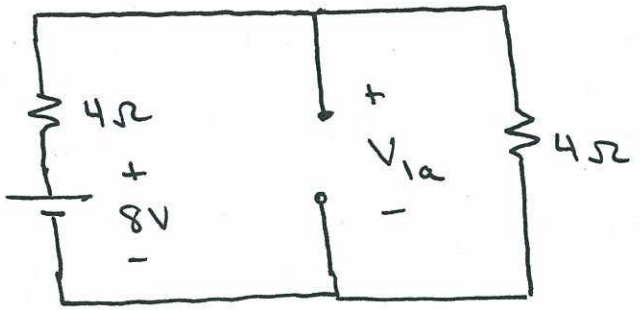
$V_1 = 6V \rightarrow$ [Linear circuit] $\rightarrow V_2 = 4V$

Exercises

Chapter 4.3

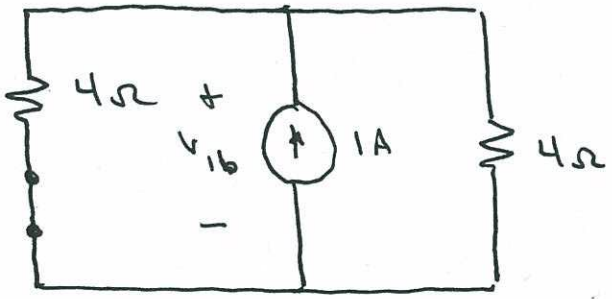
1.

(a) Contribution from 8V source:



$\Rightarrow \underline{V_{1a} = 4V}$ (voltage divider)

(b) Contribution from 1A source:



$\underline{V_{1b} = 2V}$ (current divider)

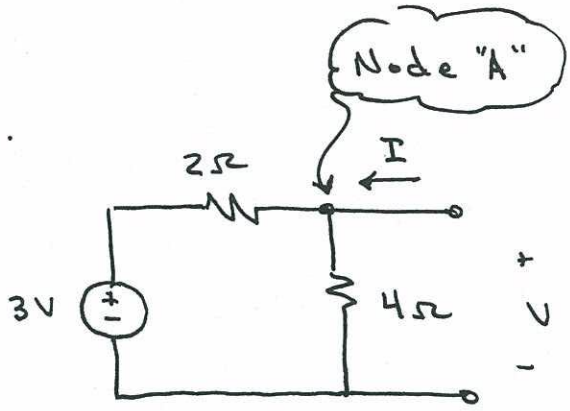
$$V_1 = V_{1a} + V_{1b} = 4V + 2V$$

$$\underline{\underline{V_1 = 6V}}$$

Exercises

Chapter 4.4

1.



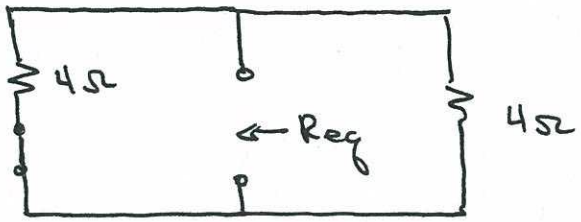
KCL at A: $I = \frac{V}{4\Omega} + \frac{V - 3V}{2\Omega}$

$\underline{\underline{4I = 3V - 6}}$ ← (or any other equivalent mathematical statement)

Exercises

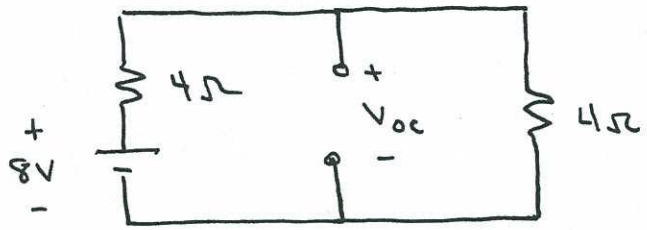
Chapter 4.5

1. Find R_{TH}:



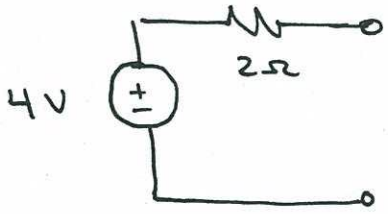
$R_{eq} = 2\Omega$

Find V_{oc}:

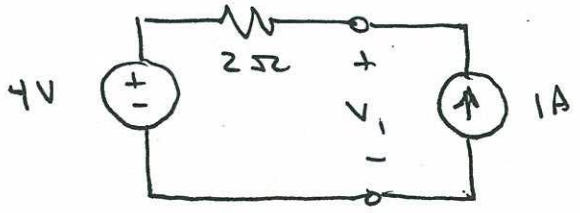


$V_{oc} = 4V$

Thevenin circuit:



To find V_1:



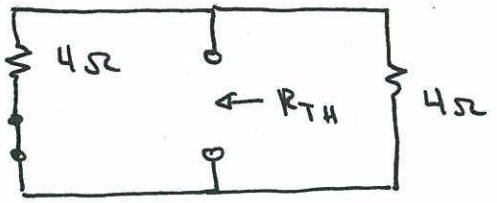
$V_1 = 4V + 2\Omega(1A)$

$V_1 = 6V$

Exercises
Chapter 4.5

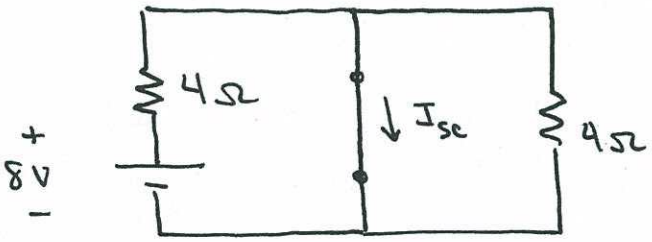
2.

Find R_{TH}:



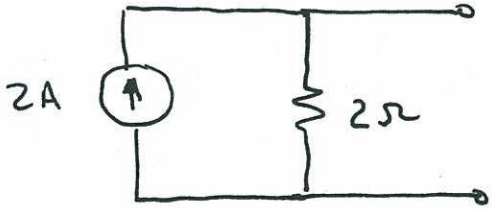
$R_{TH} = 2\Omega$

Find I_{sc}

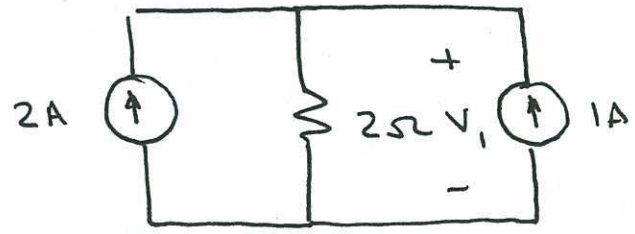


$I_{sc} = 2A$

Norton circuit:



Find V_1:



$V_1 = (3A)(2\Omega)$

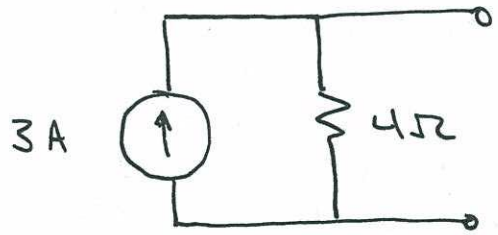
$V_1 = 6V$

Exercises
Chapter 4.5

3.

We are given (basically) a Thevenin circuit. To convert to a Norton circuit, $I_{SC} = \frac{V_{OC}}{R_{TH}} = \frac{12V}{4\Omega} = 3A$

The Norton circuit is:



Exercises
Chapter 4.6

1. The circuit to the left of the resistor R is a Thevenin circuit. Therefore, for maximum power, set:

$$R = R_{TH} = \underline{\underline{24\,\Omega}}$$