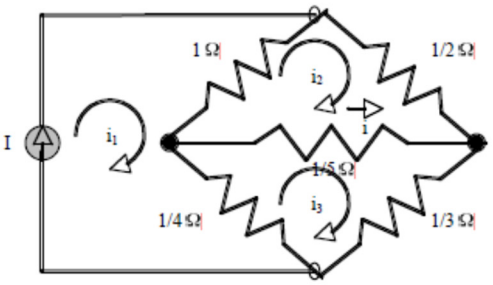
Problem 1

Solution:

Known quantities:
The values of the resistors in the circuit of Figure P3.30.

Find:
The current in the circuit of Figure P3.30 using mesh current analysis.



Analysis:

Since I is unknown, the problem will be solved in terms of this current.

For mesh #1, it is obvious that: $i_1 = I$

For mesh #2: $i_1(-1)+i_2\left(1+\frac{1}{2}+\frac{1}{5}\right)+i_3\left(-\frac{1}{5}\right)=0$

For mesh #3: $i_1\left(-\frac{1}{4}\right)+i_2\left(-\frac{1}{5}\right)+i_3\left(\frac{1}{4}+\frac{1}{3}+\frac{1}{5}\right)=0$

Solving, $i_2 = 0.645I$
$i_3 = 0.483I$

Then, $i = i_3 - i_2$ and $i = 0.483I - 0.645I = -0.163I$

Problem 2

Solution:

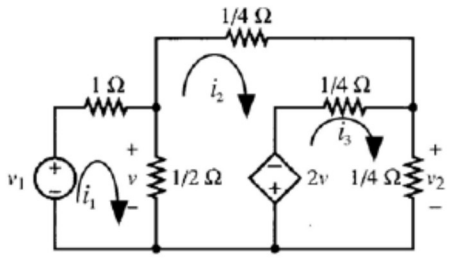
Known quantities:
The values of the resistors of the circuit in Figure P3.31.

Find:

The voltage gain, $A_V = \frac{v_2}{v_1}$, in the circuit of Figure P3.31 using mesh current analysis.

Analysis:

Note that $v = \frac{i_1 - i_2}{2}$



For mesh #1:
$i_1\left(1+\frac{1}{2}\right)+i_2\left(-\frac{1}{2}\right)+i_3(0)=v_1$

For mesh #2:
$i_1\left(-\frac{1}{2}\right)+i_2\left(\frac{1}{2}+\frac{1}{4}+\frac{1}{4}\right)+i_3\left(-\frac{1}{4}\right)=2v$

or

$i_1(-1.5)+i_2(2)+i_3(-0.25)=0$

For mesh #3:
$i_1(0)+i_2\left(-\frac{1}{4}\right)+i_3\left(\frac{1}{4}+\frac{1}{4}\right)=-2v$

or

$i_1(1)+i_2(-1.25)+i_3(0.5)=0$

Solving, $i_3 = -0.16v_1$

from which $v_2 = \frac{1}{4}i_3 = -0.04v_1$

and $A_V = \frac{v_2}{v_1} = -0.04$

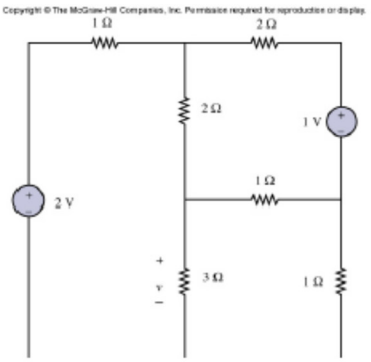
Problem 3

Solution:

Circuit shown in Figure P3.16.

Find:

Voltage across the 3Ω resistance.



Analysis:

Meshes 1, 2 and 3 are clockwise from the left

For mesh #1:

$$i_1(1+2+3)+i_2(-2)+i_3(-3)=2$$

For mesh #2:

$$i_1(-2)+i_2(2+2+1)+i_3(-1)=-1$$

For mesh #3:

$$i_1(-3)+i_2(-1)+i_3(3+1+1)=0$$

Solving,

$$i_1 = 0.5224 \text{ A}$$
$$i_2 = 0.0746 \text{ A}$$
$$i_3 = 0.3284 \text{ A}$$

and $v = 3(i_1 - i_3) = 3(0.194) = 0.5821 \text{ V}$