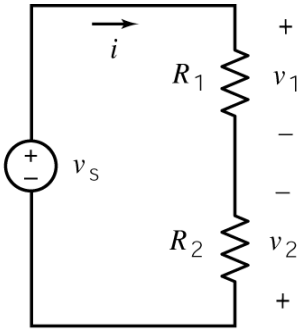
Reference Directions in Voltage and Current Division

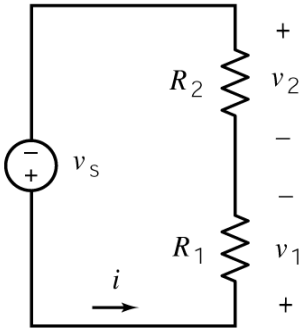


Voltage Division

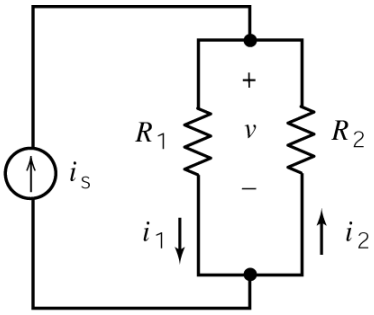
Here are two drawings of the same circuit. The bottom circuit is a mirror image of the top circuit.

In both circuits:

$$i = \frac{v_s}{R_1 + R_2}, \quad v_1 = \left(\frac{R_1}{R_1 + R_2}\right) v_s \quad \text{and} \quad v_2 = -\left(\frac{R_2}{R_1 + R_2}\right) v_s$$



There are two possible reference directions for source voltage: + on top or + on bottom. Similarly, there are two possible reference directions for the resistor voltage: + on top or + on bottom. Taken together, there are four possibilities for the source and resistor voltage reference directions. All four are illustrated by these two circuits.

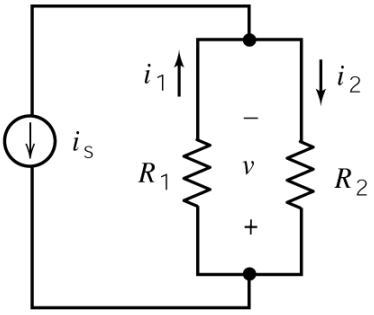


Current Division

Here are two drawings of the same circuit. The bottom circuit is a mirror image of the top circuit.

In both circuits:

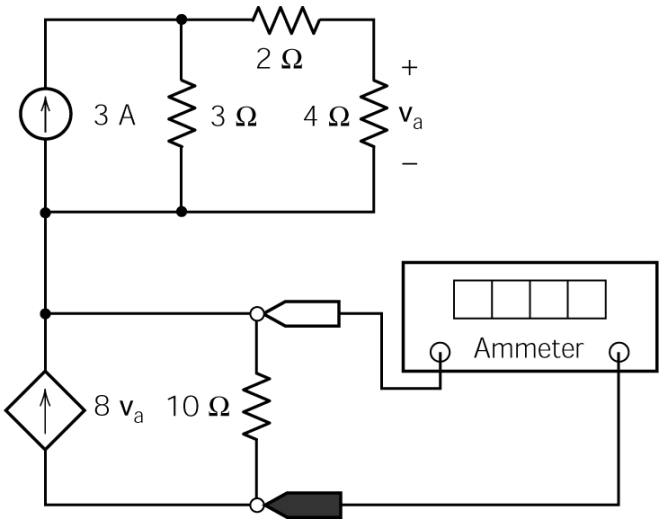
$$v = \left(\frac{R_1 R_2}{R_1 + R_2}\right) i_s, \quad i_1 = \left(\frac{R_2}{R_1 + R_2}\right) i_s \quad \text{and} \quad i_2 = -\left(\frac{R_1}{R_1 + R_2}\right) i_s$$



There are two possible reference directions for the source current: downward or upward. Similarly, there are two possible reference directions for the resistor current: downward or upward. Taken together, there are four possibilities for the source and resistor current reference directions. All four are illustrated by these two circuits.

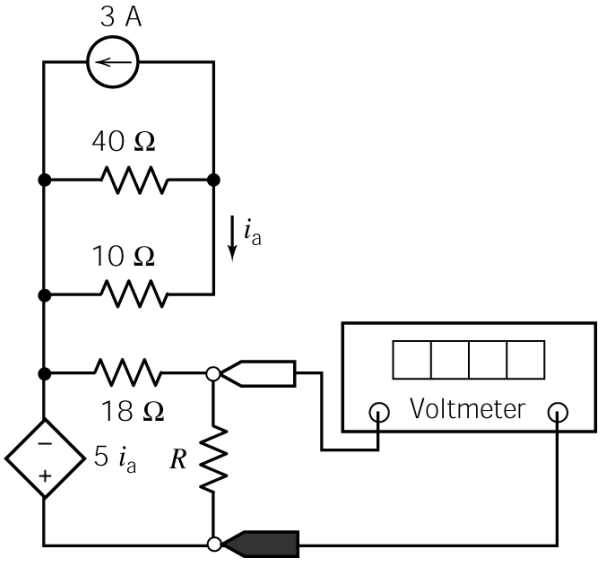
Problem 4

Determine the value of the current measured by the meter.



Problem 5

Determine the value of the resistance *R* required to cause the value of the voltage measured by the voltmeter to be 4 V.



Problem 6

The input to this circuit is the voltage of the independent voltage source, v_s. The output is the current measured by the meter, i_m.

(a) Suppose $v_s = 15$ V. Determine the value of the resistance *R* that causes the value of the current measured by the ammeter to be $i_m = 5$ A.

(b) Suppose $v_s = 15$ V and *R* = 24 Ω. Determine the value of the current measured by the ammeter.

(c) Suppose *R* = 24 Ω. Determine the value of the input voltage, v_s, that causes the value of the current measured by the ammeter to be $i_m = 3$ A.