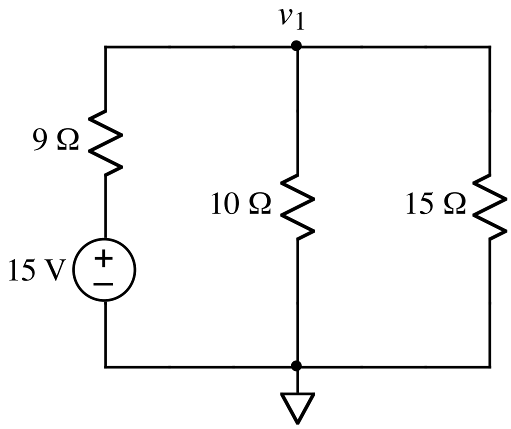
Ex:



a) Use the node-voltage method to find v_1.

b) Find the equivalent resistance for the 10Ω and 15Ω resistors in parallel. Then use the voltage divider formula to find v_1. Verify that both (a) and (b) have the same answer.

SOL'N: a) We sum the currents out of the v_1-node.

$$\frac{v_1 - 15\,V}{9\,\Omega} + \frac{v_1}{10\,\Omega} + \frac{v_1}{15\,\Omega} = 0\,A$$

Now group the factors multiplying v_1 and move constants the other side of the equation:

$$v_1\left(\frac{1}{9\,\Omega} + \frac{1}{10\,\Omega} + \frac{1}{15\,\Omega}\right) = \frac{15\,V}{9\,\Omega}$$

Multiplying both sides by the least common denominator simplifies the math.

$$90\Omega \cdot v_1 \left(\frac{1}{9\Omega} + \frac{1}{10\Omega} + \frac{1}{15\Omega} \right) = \frac{15V}{9\Omega} \cdot \overset{10}{90}\Omega$$

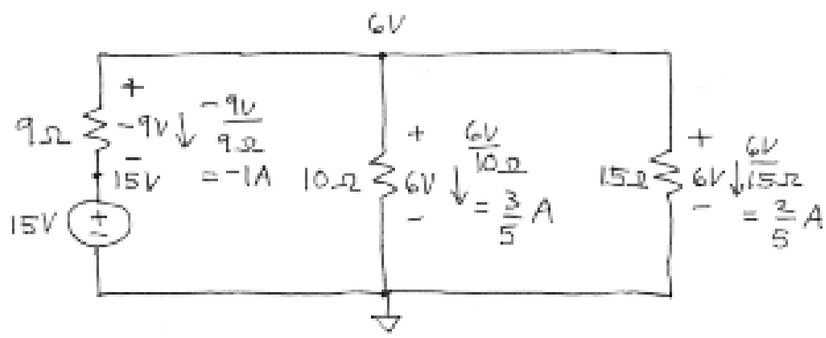
or

$$v_1 \left(10 + 9 + 6 \right) = 150V$$

or

$$v_1 = \frac{150V}{25} = 6V$$

To check our answer, we calculate the currents in the resistors and verify that the total current out of the v_1-node equals zero:

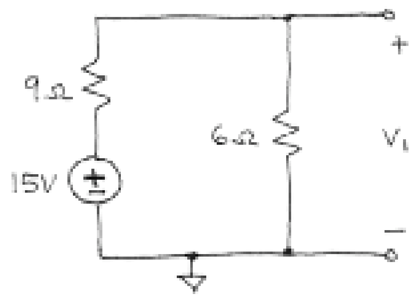


$$-1A + \frac{3}{5}A + \frac{2}{5}A = 0A \quad \checkmark$$

b) If we combine the 10Ω and 15Ω in parallel, we get 6Ω:

$$10\Omega \,\|\, 15\Omega = 5\Omega \cdot 2 \,\|\, 3 = 5\Omega \cdot \frac{2(3)}{2+3} = 6\Omega$$

Substituting one 6Ω resistor for the 10Ω and 15Ω resistors creates a voltage divider:



$$V_1 = 15\,V \cdot \frac{6\,\Omega}{6\,\Omega + 9\,\Omega} = 15\,V \cdot \frac{6}{15} = 6\,V$$

Thus, we get the same answer as before.