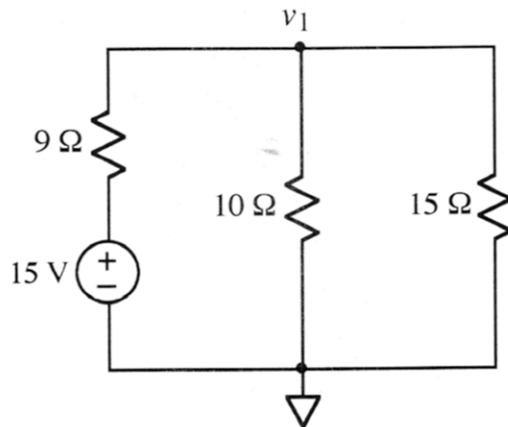


Ex:



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

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

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

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

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

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

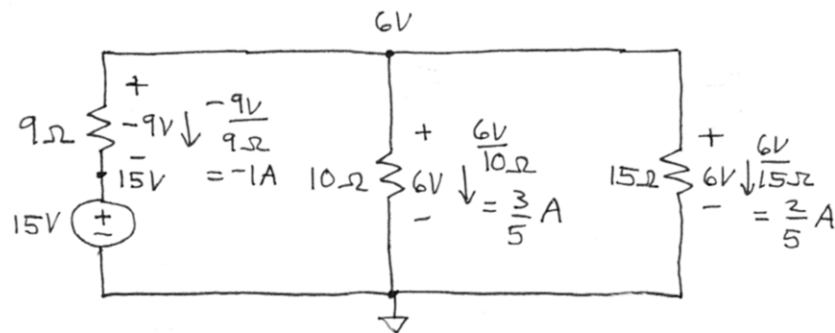
or

$$v_1 (10 + 9 + 6) = 150V$$

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:

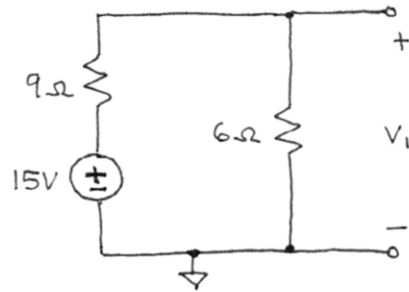


$$-1A + \frac{3}{5}A + \frac{2}{5}A = 0A \quad \checkmark$$

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

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

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



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

Thus, we get the same answer as before.