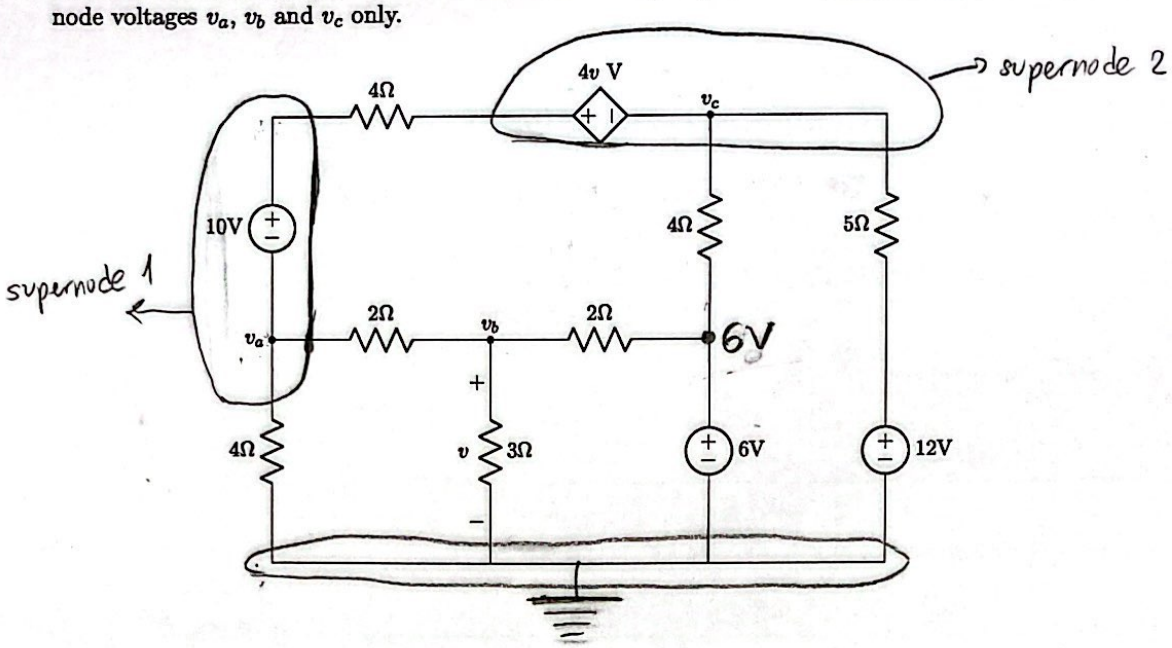
1. Consider the circuit given below. Write the node-voltage equations in **matrix form**, in terms of the node voltages v_a, v_b and v_c only.



KCL supernode 1: $\frac{v_a}{4\Omega} + \frac{v_a - v_b}{2\Omega} + \frac{v_a + (10V) - (v_c + (4vV))}{4\Omega} = 0$

KCL supernode 2: $\frac{(4vV) + v_c - (v_a + (10V))}{4\Omega} + \frac{v_c - (6V)}{4\Omega} + \frac{v_c - (12V)}{5\Omega} = 0$

KCL v_b: $\frac{v_b - v_a}{2\Omega} + \frac{v_b}{3\Omega} + \frac{v_b - (6V)}{2\Omega} = 0$

$$\begin{bmatrix} 1 & -1/2 & -1/4 \\ -1/4 & 0 & 7/10 \\ -1/2 & 4/3 & 0 \end{bmatrix} \begin{bmatrix} v_a \\ v_b \\ v_c \end{bmatrix} = \begin{bmatrix} v - \frac{5}{2} \\ \frac{32}{5} - v \\ 3 \end{bmatrix}$$