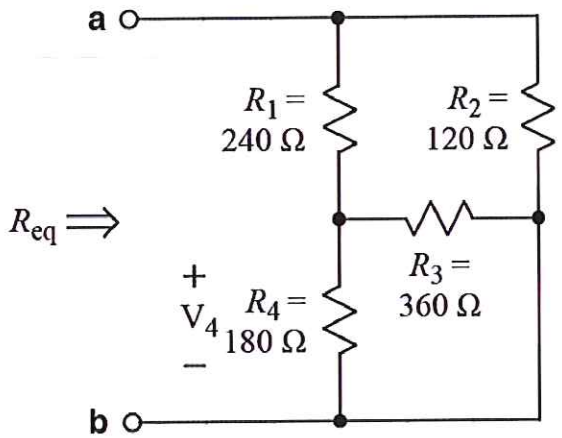
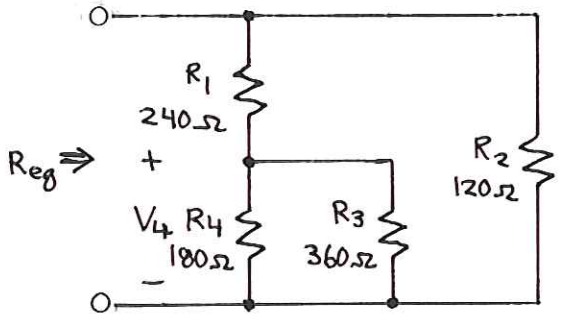
2. (20 points)



a) Find the value of the equivalent resistance, R_{eq}.

b) If 12 Volts is applied across **a** and **b** with + on top, find V_4.

soln: a) We may redraw the circuit as follows:



$$R_{eq} = (R_1 + R_3 \| R_4) \| R_2$$

$$R_3 \| R_4 = 180\Omega \| 360\Omega = 180\Omega \cdot 1 \| 2$$

$$= 180\Omega \cdot \frac{2}{3} = 120\Omega$$

$$R_{eq} = (240\Omega + 120\Omega) \| 120\Omega = 360\Omega \| 120\Omega$$

$$= 120\Omega \cdot 3 \| 1 = 120\Omega \cdot \frac{3}{4} = 90\Omega$$

$$R_{eq} = 90\Omega$$

b) The voltage across R_4 is the same as the voltage across $R_3 \| R_4$. We know the voltage across $R_1 + R_3 \| R_4$, allowing us to use a voltage divider (with R_2 not involved).

$$V_4 = 12V \cdot \frac{R_3 \| R_4}{R_1 + R_3 \| R_4}$$

or

$$V_4 = 12V \cdot \frac{120\Omega}{240\Omega + 120\Omega}$$

or

$$V_4 = 12V \cdot \frac{1}{3} = 4V$$