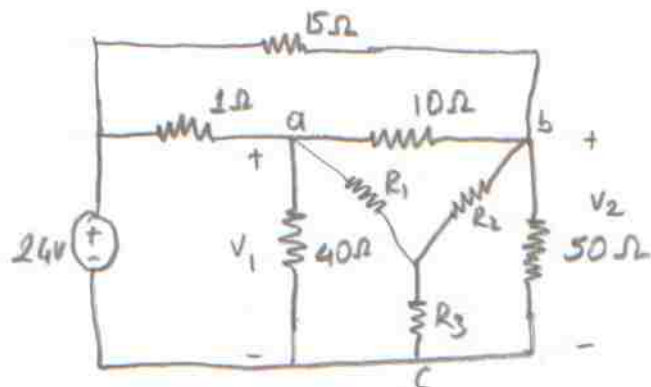


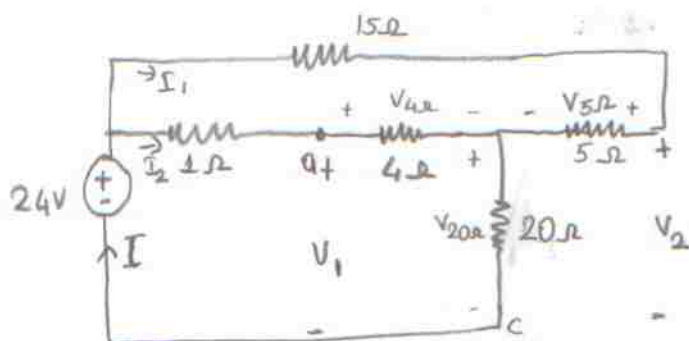
①



$$R_1 = \frac{40 \cdot 10}{100} = 4 \Omega$$

$$R_2 = \frac{50 \cdot 10}{100} = 5 \Omega$$

$$R_3 = \frac{40 \cdot 50}{100} = 20 \Omega$$



$$R_{eq} = ((15+5) // (1+4)) + 20 = (20 // 5) + 20 = \frac{20 \cdot 5}{25} + 20 = 24 \Omega$$

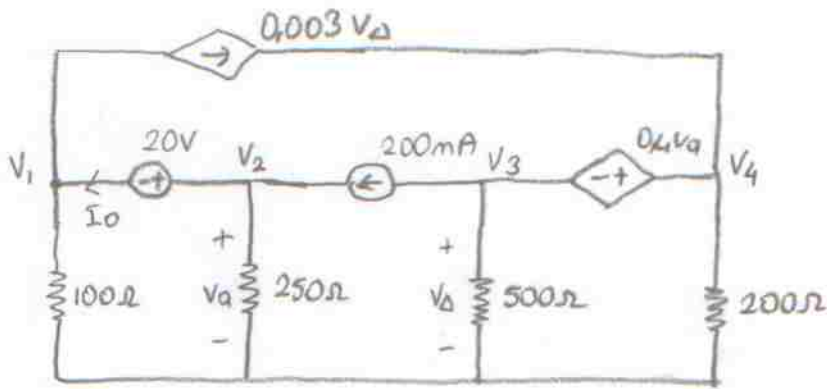
$$I = \frac{24V}{24 \Omega} = 1A \quad I = I_1 + I_2 \Rightarrow 4 \cdot I = 20 I_1 = 5 I_2 \Rightarrow I_1 = 0,2A \quad I_2 = 0,8A$$

$$-V_1 + V_{4\Omega} + V_{20\Omega} = 0$$

$$V_1 = V_{4\Omega} + V_{20\Omega} = 4 \cdot I_2 + 20 \cdot I = 4 \cdot 0,8 + 20 = 23,2V //$$

$$V_2 = V_{5\Omega} + V_{20\Omega} = 5 \cdot I_1 + 20 \cdot I = 5 \cdot 0,2 + 20 = 21V //$$

(2)



$$V_2 = V_q$$

$$V_3 = V_\Delta$$

$$V_4 - V_3 = 0.4 V_q$$

$$V_2 - V_1 = 20$$

1-2

üst düğüm
denklemleri

$$\frac{V_1}{100} + \frac{V_2}{250} + 0.003 V_\Delta - 0.2 = 0$$

3-4

üst düğüm
denklemleri

$$\frac{V_3}{500} + 0.2 + \frac{V_4}{200} - 0.003 V_\Delta = 0$$

$$V_4 - V_3 = 0.4 V_2$$

$$V_2 - V_1 = 20$$

$$V_3 = V_\Delta$$

$$V_4 = 0.4 V_2 + V_3$$

$$V_1 = V_2 - 20$$

ilk iki
denklemlerde
yerleştirirsek

$$\frac{V_2 - 20}{100} + \frac{V_2}{250} + 0.003 V_3 = 0.2$$

$$\frac{V_3}{500} + \frac{0.4 V_2 + V_3}{200} - 0.003 V_3 = -0.2$$

$$0.01 V_2 - 0.2 + 0.004 V_2 + 0.003 V_3 = 0.2$$

$$0.002 V_3 + 0.002 V_2 + 0.005 V_3 - 0.003 V_3 = -0.2$$

$$0.014 V_2 + 0.003 V_3 = 0.4$$

$$0.002 V_2 + 0.004 V_3 = -0.2$$

$$14 V_2 + 3 V_3 = 400$$

$$-7/2 V_2 + 4 V_3 = -200$$

$$-25 V_3 = 1800$$

$$V_3 = -72 V = V_\Delta$$

$$2 V_2 - (4.72) = -200$$

$$2 V_2 = 188 - 200$$

$$V_2 = 44 V$$

$$V_1 = V_2 - 20 = 24 V$$

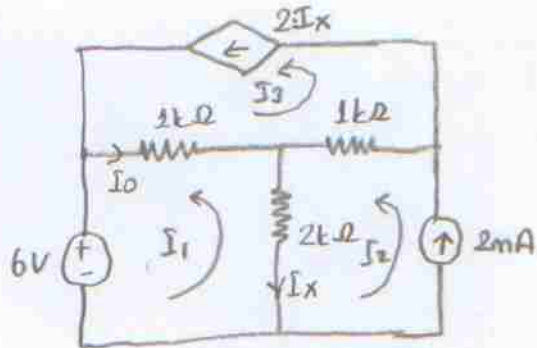
$$\frac{V_1}{100} - I_0 + 0.003 V_\Delta = 0$$

$$0.24 - I_0 + 0.216 = 0$$

$$I_0 = 0.024$$

$$I_0 = 24 \text{ mA}$$

3-



$$I_3 = 2I_x$$

$$I_2 = 2 \cdot 10^{-3} \text{ A}$$

$$I_x = I_2 - I_1 = 2 \cdot 10^{-3} - I_1$$

$$I_3 = 2(2 \cdot 10^{-3} - I_1) = 4 \cdot 10^{-3} - 2I_1$$

1. çevre

$$6 + 2 \cdot 10^3 (I_1 - I_2) + 1 \cdot 10^3 (I_1 - I_3) = 0$$

Bilinenler

yerine koyulursa

$$6 + 3 \cdot 10^3 I_1 - 2 \cdot 10^3 I_2 - 10^3 I_3 = 0$$

$$6 + 3 \cdot 10^3 I_1 - 2 \cdot 10^3 \cdot 2 \cdot 10^{-3} - 10^3 (4 \cdot 10^{-3} - 2I_1) = 0$$

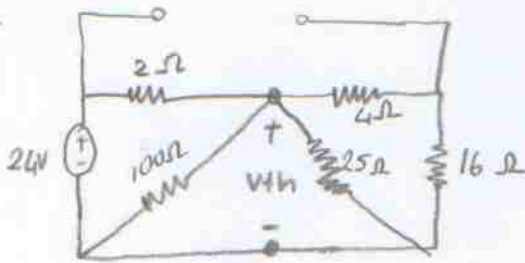
$$6 + 5 \cdot 10^3 I_1 - 4 - 4 = 0$$

$$5 \cdot 10^3 I_1 = 2$$

$$I_1 = \frac{2}{5} = 0,4 \text{ mA}$$

$$I_0 = I_2 - I_1 = 4 \cdot 10^{-3} - 2I_1 - I_1 = 4 \cdot 10^{-3} - 3I_1 = 2,8 \text{ mA} //$$

4 -



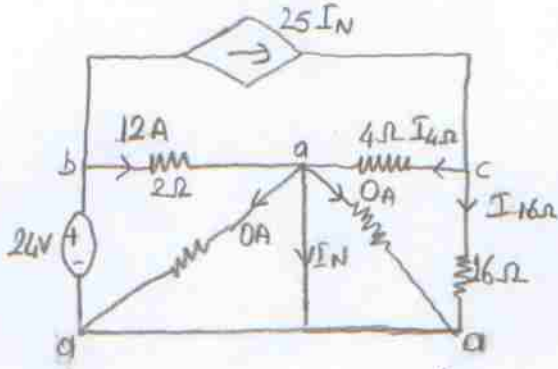
$$\frac{V_{th}}{100} + \frac{V_{th} - 24}{2} + \frac{V_{th}}{25} + \frac{V_{th}}{20} = 0$$

(50) 4 5

$$V_{th} + 50V_{th} - 1200 + 4V_{th} + 5V_{th} = 0$$

$$60V_{th} = 1200$$

$$V_{th} = 20 \text{ V}$$



24 V gerilim kaynağı ile 2Ω direnci aynı noktalar arasına bağlı olduklarından paraleldir. 2Ω üzerine 24 V gerilim düşümü meydana gelir

$$I_{2\Omega} = \frac{24}{2} = 12 \text{ A}$$

$$4I_{4\Omega} = 16I_{16\Omega}$$

$$5I_{16\Omega} = 25I_N$$

$$I_{16\Omega} = 5I_N$$

$$I_{4\Omega} = 20I_N$$

$$12 + 20I_N = I_N \rightarrow a \text{ düğümü için KAY}$$

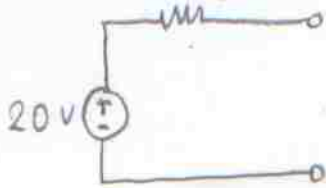
$$-19I_N = 12$$

$$I_N = -\frac{12}{19} \text{ A}$$

$$R_{th} = \frac{V_{th}}{I_N} = -\frac{20}{12} \cdot 19 = -31,67 \Omega$$

Thevenin eşdeğeri

-31,67 Ω



Norton eşdeğeri

