clase 5 21.10.2022

P 4.3-2 Para el circuito de la figura P 4.3-2, determine los voltajes v_a y v_b cuando $R_1 = 100\,\Omega$, $R_2 = 200\,\Omega$ y $R_3 = 400\,\Omega$.

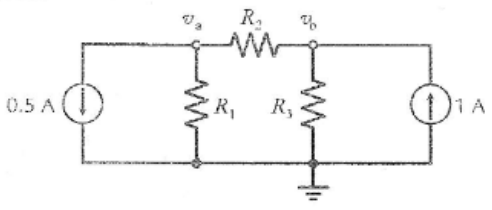
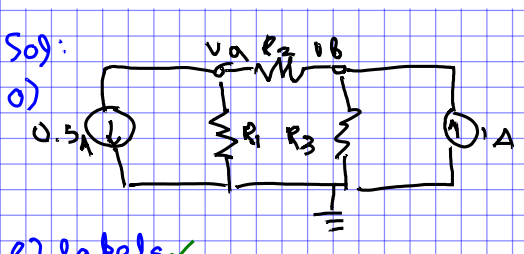


Figura P 4.3-2

Sol:

0)



1)

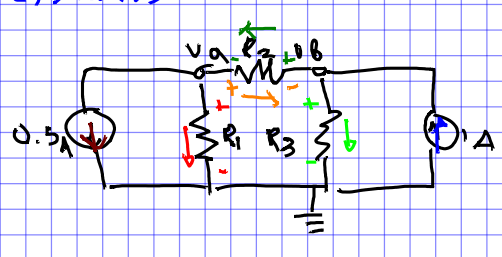
$V_a = ?$ $R_1 = 100\Omega$

$V_B = ?$ $R_2 = 200\Omega$

$R_3 = 400\Omega$

2) Labels ✓

3) ✓



4)

Applying KCL at node a:

KCL (+) i (?) v

KVL v i

$-0.5A - \frac{V_a}{R_1} - \frac{V_a - V_b}{R_2} = 0$

$-\frac{V_a}{100\Omega} - \frac{V_a - V_b}{200\Omega} = 0.5A$

$-2V_a - V_a + V_b = 100V$

$-3V_a + V_b = 100V$ ... (1)

Applying KCL at node b:

$-i_{R2} - i_{R3} + 1A = 0$

$-\frac{V_b - V_a}{R_2} - \frac{V_b}{R_3} = -1A$

$-\frac{V_b - V_a}{200\Omega} - \frac{V_b}{400\Omega} = -1A$

$-2V_b + 2V_a - V_b = -400V$

$2V_a - 3V_b = -400V$ ... (2)

$R_1 = 100\Omega$

$R_2 = 200\Omega$

$R_3 = 400\Omega$

Por Suma resta:

$(-3V_a + V_b = 100V)3 \Rightarrow -9V_a + 3V_b = 300V$

$2V_a - 3V_b = -400V$

$-7V_a = -100V$

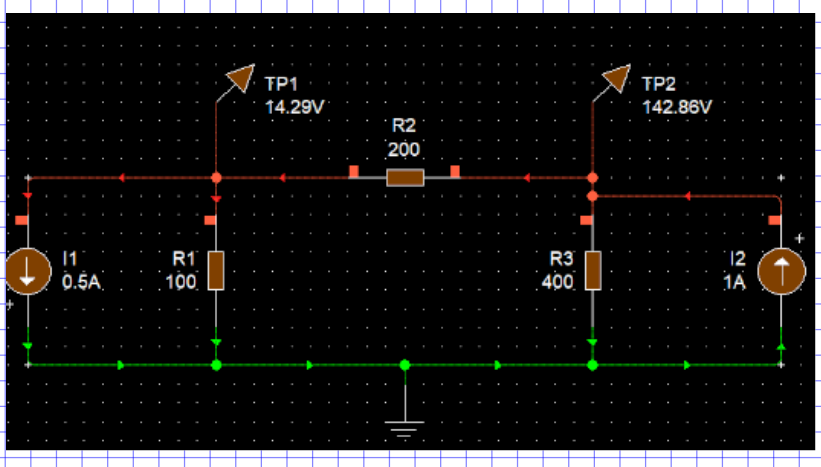
$V_a = 14.28V$

$V_b = 100V + 3V_a$

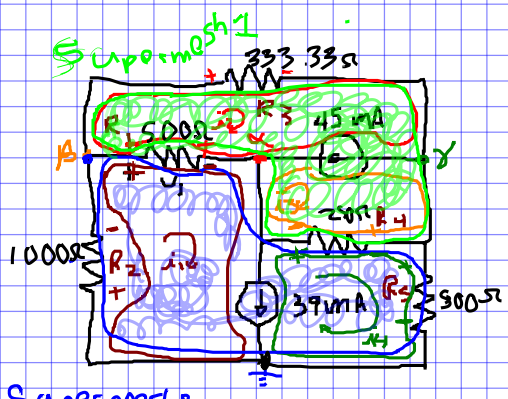
$= 100V + 3(14.28V)$

$V_b = 142.84V$

5) Comprobación:



Supermesh 1



Supermesh2

Applying KVL at Supermesh 1

$-V_{R3} - V_{R4} - V_{R1} = 0$

$-V_{R3} - V_{R4} - V_1 = 0$

$-R_3 i_1 - R_4(i_3 - i_4) - R_1(i_2 - i_1) = 0$

$-333.33 i_2 - 250 i_3 + 250 i_4 - 500 i_2 + 500 i_1 = 0$

$500 i_1 - 833.3 i_2 - 250 i_3 + 250 i_4 = 0$ ... (1)

Applying KVL at Supermesh 2

$-V_{R2} - V_{R1} - V_{R4} - V_{R5} = 0$

$-R_2 i_1 - R_1(i_1 - i_2) - R_4(i_4 - i_3) - R_5 i_4 = 0$

$-R_2 i_1 - R_1 i_1 + R_1 i_2 - R_4 i_4 + R_4 i_3 - R_5 i_4 = 0$

$-(R_2 + R_1) i_1 + R_1 i_2 + R_4 i_3 - (R_4 + R_5) i_4 = 0$

$-1500 i_1 + 500 i_2 + 250 i_3 - 750 i_4 = 0$ ... (2)

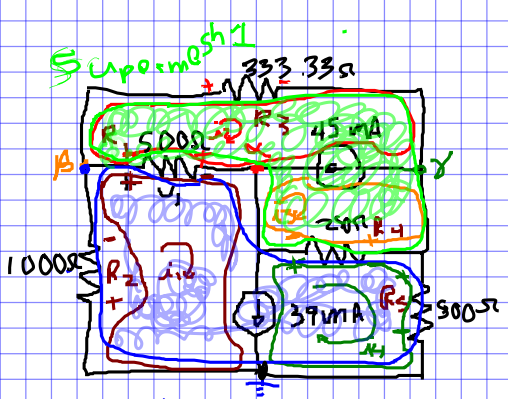
$R_1 = \frac{1}{G_1} = \frac{1}{2\,mS} = 500\,\Omega$

$R_2 = \frac{1}{G_2} = \frac{1}{1\,mS} = 1000\,\Omega$

$R_3 = \frac{1}{G_3} = \frac{1}{3\,mS} = 333.33\,\Omega$

$R_4 = \frac{1}{G_4} = \frac{1}{4\,mS} = 250\,\Omega$

$R_5 = \frac{1}{G_5} = \frac{1}{2\,mS} = 500\,\Omega$



esh2

ng KVL

Applying KCL at node a

$45\,mA - i_2 + i_3 = 0$

$-i_2 + i_3 = -45\,mA$

$i_2 - i_3 = 45\,mA$ ... (3)

Applying KCL at node GND

$39\,mA + i_4 - i_1 = 0$

$39\,mA = i_1 - i_4$

$i_1 - i_4 = 39\,mA$ ... (4)