JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

Electronics and Communication Engineering

Electrical Science-1 (15B11EC111): 2019-2020 (EVEN SEM)

Tutorial Sheet Solution# 04

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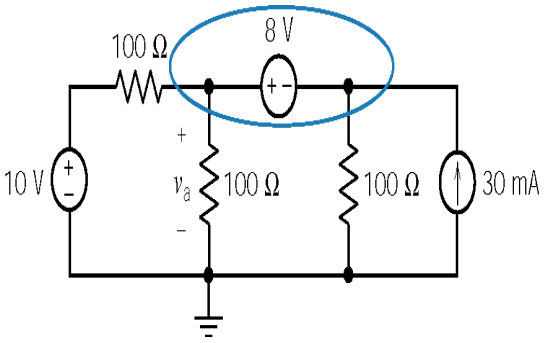
1. $I_S = I_1 + I_4 + I_5 \Rightarrow I_5 = 7 - 4.5 - 0.5 = \mathbf{2\ A}$; $I_3 = 4.5 - 3 = \mathbf{1.5\ A}$

2. $\frac{V_B - 120}{0.2} + \frac{V_B - V_C}{0.3} = -30$ and $\frac{V_C - V_B}{0.3} + \frac{V_C - 116}{0.1} = -20 \Rightarrow V_B = V_C = \mathbf{114\ V}$

3. $I_3 = \mathbf{-4\ A}$; $2(I_1 - I_3) + 1(I_1 - I_2) = 12$; $1(I_2 - I_1) + 2(I_2 - I_3) = -6$; $I_1 = \mathbf{-0.25\ A}$; $I_2 = \mathbf{-4.75\ A}$

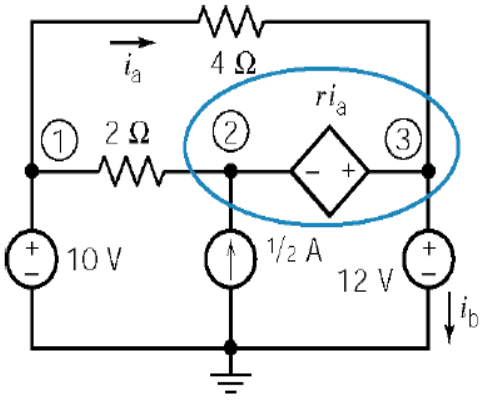
4.



Apply KCL to the supernode:

$$\frac{v_a - 10}{100} + \frac{v_a}{100} + \frac{v_a - 8}{100} - .03 = 0 \Rightarrow \underline{v_a = 7\ \text{V}}$$

5.



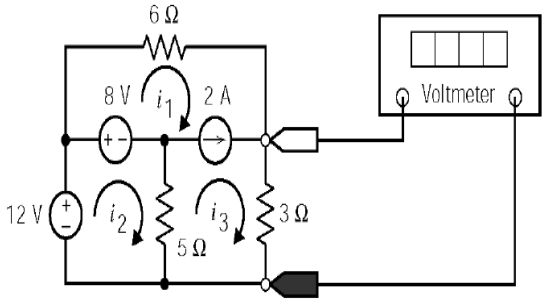
Apply KCL to the supernode of the CCVS to get

$$\frac{12-10}{4}+\frac{14-10}{2}-\frac{1}{2}+i_b=0 \quad \Rightarrow \quad i_b=-2\ \text{A}$$

Next

$$\left.\begin{aligned} i_a &= \frac{10-12}{4}=-\frac{1}{2} \\ r\,i_a &= 12-14 \end{aligned}\right\} \quad \Rightarrow \quad r=\frac{-2}{-\frac{1}{2}}=4\ \frac{\text{V}}{\text{A}}$$

6.



Express the current source current in terms of the mesh currents:

$$i_3 - i_1 = 2 \quad \Rightarrow \quad i_1 = i_3 - 2$$

Supermesh: $6\,i_1 + 3\,i_3 - 5\left(i_2 - i_3\right) - 8 = 0 \quad \Rightarrow \quad 6\,i_1 - 5\,i_2 + 8\,i_3 = 8$

Lower, left mesh: $-12 + 8 + 5\left(i_2 - i_3\right) = 0 \quad \Rightarrow \quad 5\,i_2 = 4 + 5\,i_3$

Eliminating i_1 and i_2 from the supermesh equation:

$$6\left(i_3 - 2\right) - \left(4 + 5\,i_3\right) + 8\,i_3 = 8 \quad \Rightarrow \quad 9\,i_3 = 24$$

The voltage measured by the meter is: $3\,i_3 = 3\left(\frac{24}{9}\right) = 8$ V