Test 1 – Circuit Analysis

Question 1 (parallel and series network)

7.5 For the network shown in Fig. 7.67: (a) Determine R_T; (b) Find I_s, I_1, and I_2; (c) Find V_a

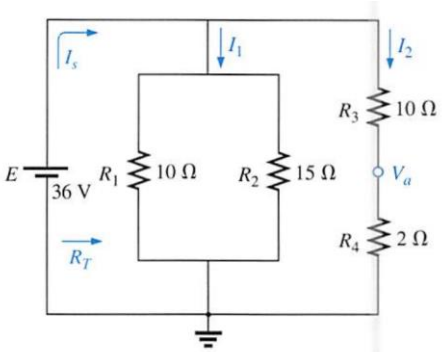
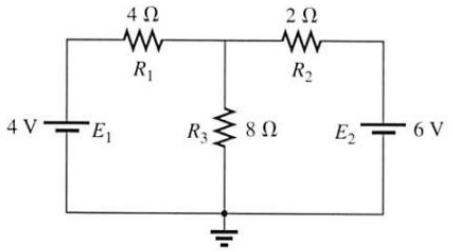


FIG. 7.67
Problem 5.

Question 2 (mesh analysis)

8-12-a Using mesh analysis (KVL), find the magnitude and direction of the current through each of the resistor, for the circuit shown below.

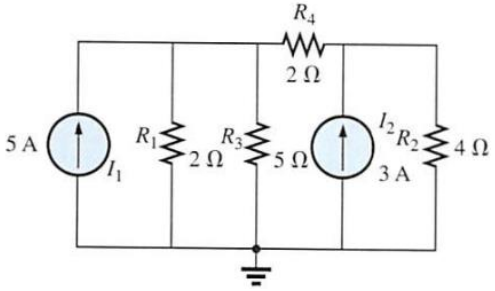


(a)

Fig 8.102

Question 3 (nodal analysis)

8-32-a Write nodal equations for the circuit shown below, and solve for all the nodal voltage points.



(a)

Fig 8.111.a

Question 4 (Superposition Theorem)

9-3-a Using Superposition Theorem, Find the current through R_1.

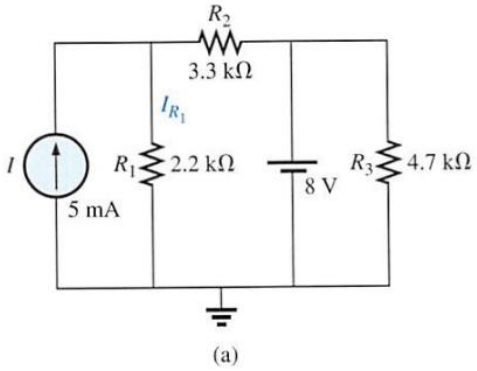


Fig. 9.127

Question 5 (Thevenin Theorem)

9-7-a Find the Thevenin equivalent circuit for the network external to the resistor R, in the figure shown below.

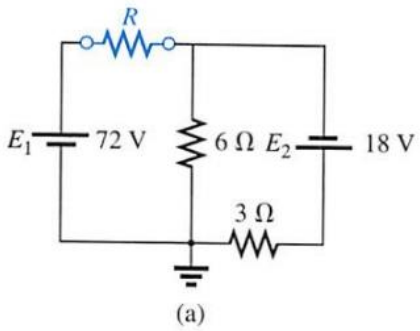


Fig. 9.131

Solution

Question 1

5. a. $R' = R_1 \parallel R_2 = 10\ \Omega \parallel 15\ \Omega = 6\ \Omega$

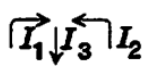
$R_T = R' \parallel (R_3 + R_4) = 6\ \Omega \parallel 12\ \Omega = 4\ \Omega$

b. $I_s = \frac{E}{R_T} = \frac{36\ \text{V}}{4\ \Omega} = 9\ \text{A}, I_1 = \frac{E}{R'} = \frac{36\ \text{V}}{6\ \Omega} = 6\ \text{A}$

$I_2 = \frac{E}{R_3 + R_4} = \frac{36\ \text{V}}{12\ \Omega} = 3\ \text{A}$

c. $V_a = I_2 R_4 = (3\ \text{A})(2\ \Omega) = 6\ \text{V}$

Question 2

12. a. 

$$\begin{aligned} 4 - 4I_1 - 8I_3 &= 0 \\ 6 - 2I_2 - 8I_3 &= 0 \\ I_1 + I_2 &= I_3 \end{aligned}$$

$I_1 = -\frac{1}{7}\ \text{A}, I_2 = \frac{5}{7}\ \text{A}, I_3 = \frac{4}{7}\ \text{A}$

$I_{R_1} = I_1 = -\frac{1}{7}\ \text{A}, I_{R_2} = I_2 = \frac{5}{7}\ \text{A}, I_{R_3} = I_3 = \frac{4}{7}\ \text{A}$

Question 3

32. a. $\circ V_1 \quad \circ V_2$

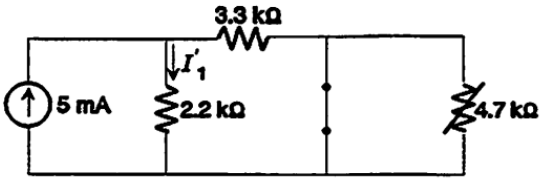
$$V_1\left[\frac{1}{2} + \frac{1}{5} + \frac{1}{2}\right] - \frac{1}{2}V_2 = 5$$

$$V_2\left[\frac{1}{2} + \frac{1}{4}\right] - \frac{1}{2}V_1 = 3$$

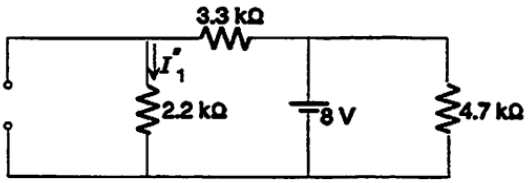
$V_1 = 8.077\ \text{V}$
$V_2 = 9.385\ \text{V}$

Question 4

3. a.



$$I_1 = \frac{3.3\ \text{k}\Omega(5\ \text{mA})}{2.2\ \text{k}\Omega + 3.3\ \text{k}\Omega} = \frac{16.5\ \text{mA}}{5.5}$$
$$= 3\ \text{mA}$$

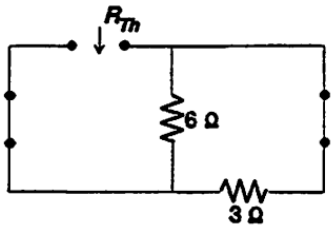


$$I''_1 = \frac{8\ \text{V}}{3.3\ \text{k}\Omega + 2.2\ \text{k}\Omega} = \frac{8\ \text{V}}{5.5\ \text{k}\Omega}$$
$$= 1.4545\ \text{mA}$$

$$I_1 = I'_1 + I''_1 = 3\ \text{mA} + 1.4545\ \text{mA} = 4.4545\ \text{mA}$$

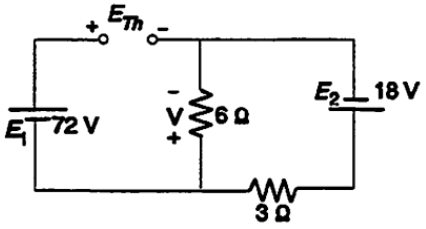
Question 5

7. (I): R_{Th}:



$$R_{Th} = 6\ \Omega \parallel 3\ \Omega = 2\ \Omega$$

E_{Th}:



$$V = \frac{6\ \Omega(18\ \text{V})}{6\ \Omega + 3\ \Omega} = 12\ \text{V}$$
$$E_{Th} = 72\ \text{V} + \text{V} = 84\ \text{V}$$