Solution

College of Technological Studied, Electronics Department

Electrical Circuits (ENT#140)

Midterm (2)

Name: Date:

Problem-1:

For this Series-parallel circuit, find the current and voltage at each resistor.

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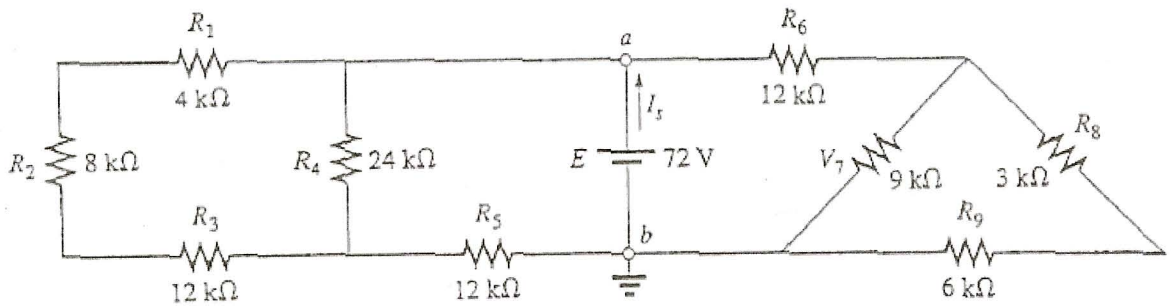
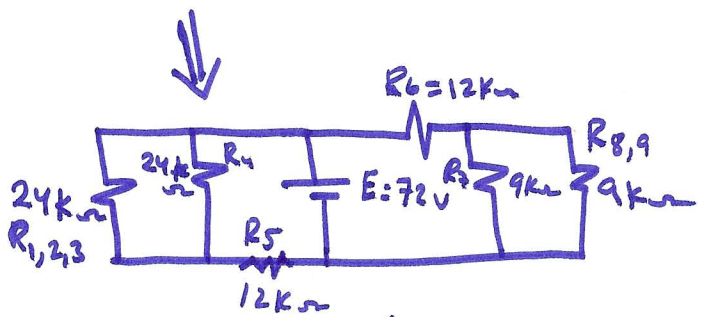


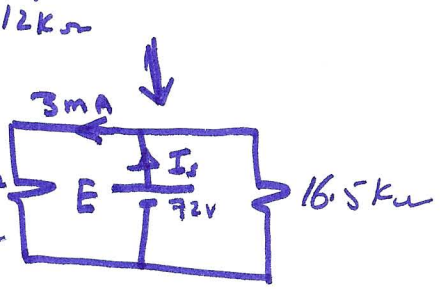
Solution-1:



① $R_T = 24k\Omega \,//\, 16.5k\Omega$

$$R_T = \frac{24k\Omega \times 16.5k\Omega}{24k\Omega + 16.5k\Omega} = 9.78k\Omega$$

$R_T = 9.78k\Omega$



② $I_S = \frac{E}{R_T} = \frac{72V}{9.78k\Omega} = 7.36mA \Rightarrow I_S = 7.36mA$

③ $I_S = \frac{E}{24k\Omega} = \frac{72V}{24k\Omega} = 3\times10^{-3}A = 3mA \Rightarrow I_S = 3mA$

④ $I_6 = \frac{E}{16.5k\Omega} = \frac{72V}{16.5k\Omega} = 4.36\times10^{-3}A = 4.36mA \Rightarrow I_6 = 4.36mA$

⑤ $I_{1,2,3} = \frac{3A}{2} = 1.5A \Rightarrow I_4 = 1.5mA$

⑥ $I_7 = \frac{4.36mA}{2} = 2.18mA$, $I_8 = I_9 = 2.18mA$

⑦ $V_1 = R_1 \times I_1 = 4k\Omega \times 1.5mA = 6V \Rightarrow V_1 = 6V$

$V_2 = 8k\Omega \times 1.5mA = 12V \Rightarrow V_2 = 12V$

$V_3 = 12k\Omega \times 1.5mA = 18V \Rightarrow V_2 = 18V \Rightarrow V_3 = 18V$

$V_4 = 24k\Omega \times 1.5mA = 36V \Rightarrow V_4 = 36V$

$V_5 = 12k\Omega \times 3mA \Rightarrow V_5 = 36V$

$V_6 = 12k\Omega \times 4.36mA \Rightarrow V_6 = 52.32V$

$V_7 = 9k\Omega \times 2.18mA \Rightarrow V_7 = 19.62V$

$V_8 = 3k\Omega \times 2.18mA = 6.54V$

$V_9 = 6k\Omega \times 2.18mA = 13.08V$

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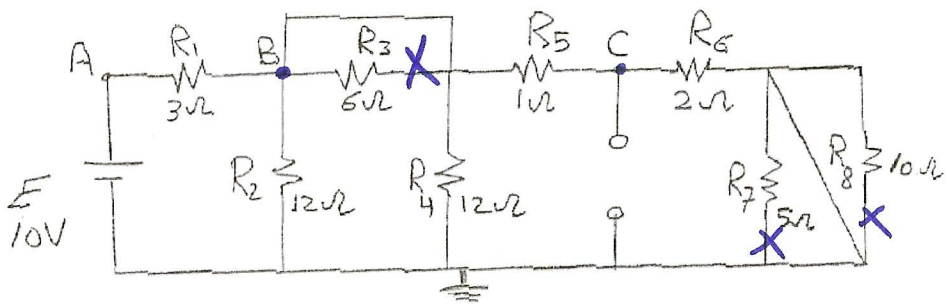
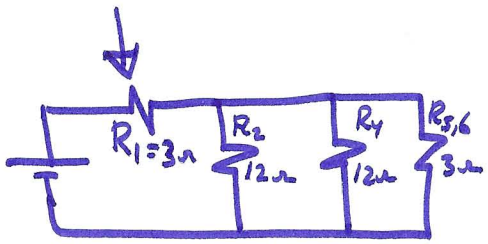
Problem-2:

For the circuit shown, find the following:

1. R_T.
2. I_1.
3. I_4 by using (CDR).
4. V_2 by using (VDR).
5. V_{BC}.
6. P_5.
7. P_{del}.
8. V_{CA}.

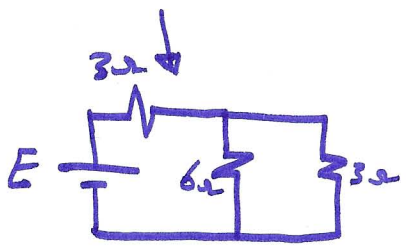


Solution-2:



① $R_T = 5\Omega$

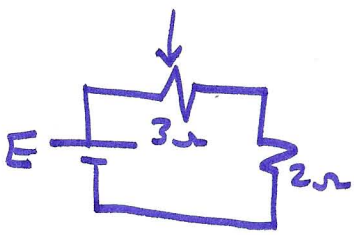
② $I_1 = \frac{E}{R_T} = \frac{10V}{5\Omega} = 2A \Rightarrow I_1 = 2A$



③ $I_4 = \frac{R_T''}{R_4} I_5 = \frac{2\times 2}{12} = \frac{4}{12} = \frac{1}{3} \Rightarrow I_4 = \frac{1}{3}A$

OR $I_{2,4} = \frac{3\times 2}{6+3} I_5 = \frac{6}{9} = \frac{2}{3}A \Rightarrow I_2 = \frac{1}{3}A$, $I_4 = \frac{1}{3}A$

$I_2 = \frac{1}{3}A$, $I_4 = \frac{1}{3}A$



④ $V_2 = \frac{R_T'' \cdot E}{R_T} = \frac{2\times 10V}{5\Omega} = 4V \Rightarrow V_2 = 4V$

⑤ $V_{BC} = V_B - V_C = V_{R_5} = I_5 \times R_5 = \frac{4}{3}\times 1\Omega = 1.33V$

OR $V_{BC} = R_4 I_4 - R_6 \cdot I_6$

$V_{BC} = (12\Omega)\times(\frac{1}{3}A) - (2\Omega)\times(\frac{4}{3}A) = 4 - \frac{8}{3} = 1.33V \Rightarrow V_{BC} = 1.33V$

⑥ $P_5 = R_5 \times I_5^2 = 1\times(\frac{4}{3})^2 = \frac{16}{9} = 1.78W \Rightarrow P_5 = 1.78V$

⑦ $P_{del} = I_5 E = 2A\times 10V = 20watt \Rightarrow P_{del} = 20watt$

⑧ $V_{CA} = V_C - V_A \Rightarrow V_{CA} = \frac{8}{3}V - 10V \Rightarrow V_{CA} = 2.67V - 10V = -7.33V \Rightarrow V_{CA} = -7.34V$

$V_{CA} = -7.34V$

Midterm (2)

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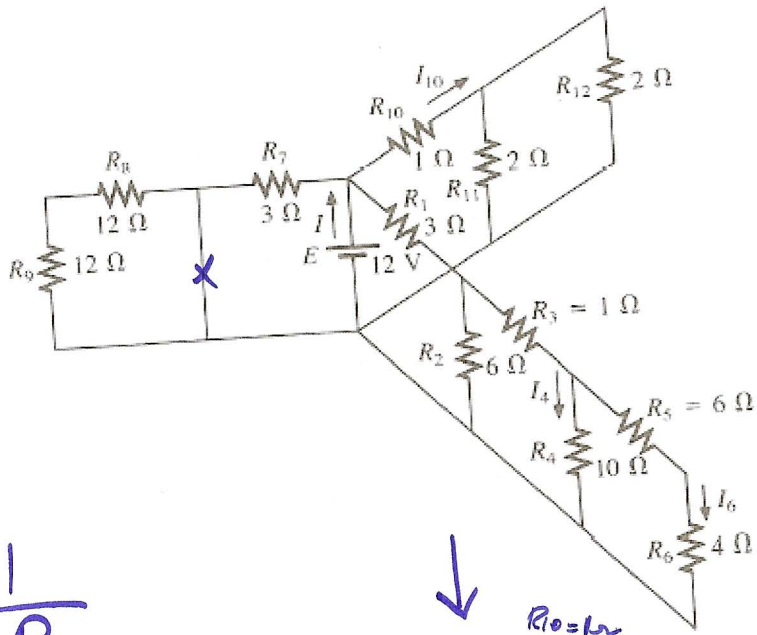
Name: Date:

Problem-3:

For the circuit shown, calculate the following:

1. R_T.
2. I_T.



Solution-3:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

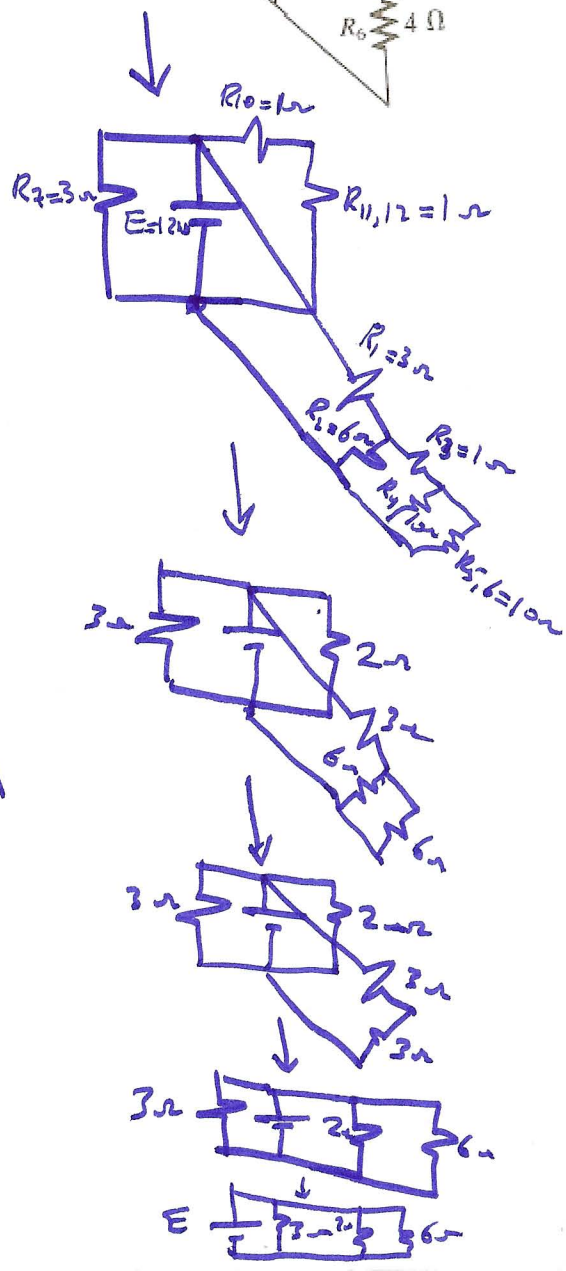
$$\frac{1}{R_T} = \frac{1}{3\Omega} + \frac{1}{2\Omega} + \frac{1}{6\Omega}$$

$$\frac{1}{R_T} = \frac{2+3+1}{6} = \frac{6}{6} = 1$$

$$R_T = 1\Omega$$

$$I_t = \frac{E}{R_T} = \frac{12V}{1\Omega} = 12A$$

$$I_t = 12A$$



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Electrical Circuits (ENT#140)

Midterm (2)

Name: **Date:**

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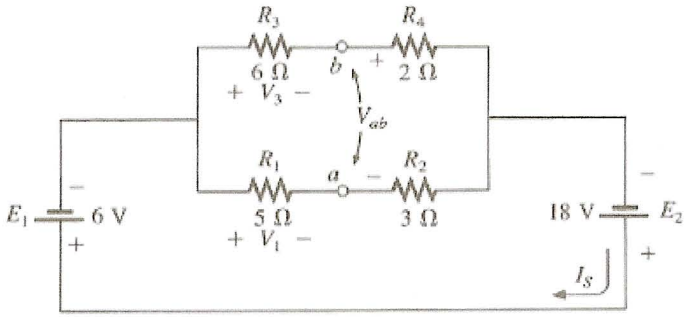
Problem-4:

For the circuit shown, calculate the following:

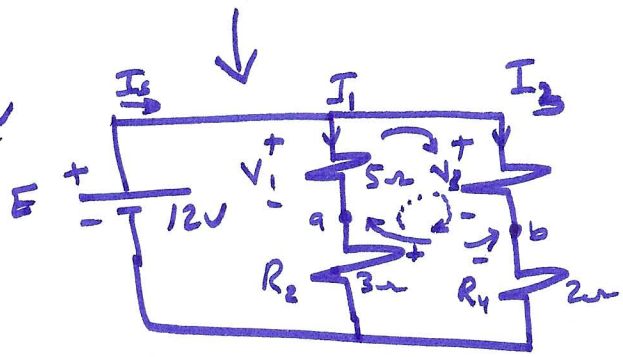
1. V_1.
2. V_3.
3. V_{ab}.
4. I_s.



Solution-4:

$$V_1 = \frac{R_1 E}{R_1 + R_2} = \frac{(5\Omega)*(12V)}{(5\Omega)+(3\Omega)} = \frac{60V}{8}$$

$$\boxed{V_1 = 7.5V}$$



$$V_3 = \frac{R_3 E}{R_3 + R_4} = \frac{(6\Omega)\times(12V)}{(6\Omega)+(2\Omega)} = \frac{72V}{8} = 9V$$

$$\boxed{V_3 = 9V}$$

From the simple figure, with clockwise direction starting at terminal (a).

$$+V_1 - V_3 + V_{ab} = 0 \quad \text{-(KVL)}$$

$$V_{ab} = V_3 - V_1$$

$$V_{ab} = 9V - 7.5V = 1.5V \Rightarrow \boxed{V_{ab} = 1.5V}$$

By ohm's Law:

$$I_1 = \frac{V_1}{R_1} = \frac{7.5V}{5\Omega} = 1.5A \Rightarrow \boxed{I_1 = 1.5A}$$

$$I_3 = \frac{V_3}{R_3} = \frac{9V}{6\Omega} = 1.5A \Rightarrow \boxed{I_3 = 1.5A}$$

By (KCL) $I_s = I_1 + I_3 \Rightarrow I_s = 1.5A + 1.5A = 3A$

$$\boxed{I_s = 3A}$$

Solution

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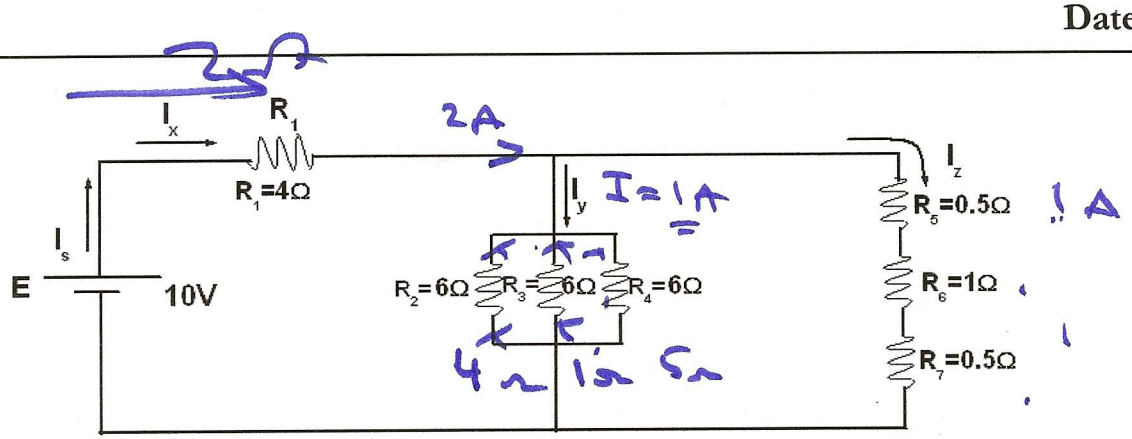
Electrical Circuits (ENT#140)

Quiz (6)

Name: **Date:**

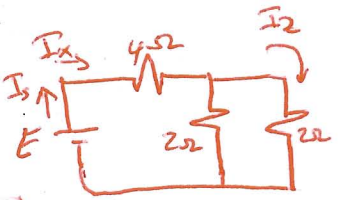


Q) For the circuit shown, calculate:

a. R_T.
b. I_s.
c. I_x.
d. I_y.
e. I_z.
f. ~~V_{R1}.~~
g. V_{R1}.
h. V_{R3}.
i. V_{R7}.

a) $R_T = 4 + 1 = 5\Omega$

$R_T = 5\Omega$



b) $I_s = \frac{E}{R_T} = \frac{10V}{5\Omega} = 2A$

$2 // 2$

$\frac{2 \times 2}{2+2} = \frac{4}{4} = 1\Omega$

c) $I_x = I_s = 2A$

d) $I_y = \frac{2}{2} = 1A \Rightarrow$ OR $I_y = \frac{R_T \cdot I_s}{R_{1,3,R}}$

e) $I_z = \frac{2}{2} = 1A$

$I_y = \frac{1 \times 2}{2} = 1A$

f) $V_{R_1} = R_1 I_x = 4\Omega \times 2A = 8V$ OR $V_{R_1} = \frac{R_1 E}{R_T}$

$V_{R_1} = \frac{4 \times 10}{5} = \frac{40}{5} = 8V$

g) $V_{R_3} = 2\Omega \times 1A = 2V \Rightarrow$ OR

$V_{R_3} = R_3 \times I_{R_3}$

$= 6\Omega \times \frac{1}{3}A = 2V$

h) $V_{R_7} = 0.5\Omega \times I_z$

$0.5\Omega \times 1A$

$V_{R_7} = 0.5V$

$4\Omega \times \frac{1}{3} =$