23S-EC ENGR-3-LEC-1 Homework 3

SANJIT SARDA

TOTAL POINTS

100 / 100

QUESTION 1

1 Q1a: V4 reference **50 / 50**

✓ **- 0 pts** *Correct*

- 50 pts Incorrect/Blank

- 10 pts Partially incorrect

- 25 pts Mostly incorrect

QUESTION 2

2 Q1b: V2 reference **50 / 50**

✓ **- 0 pts** *Correct*

- 10 pts Partially incorrect

- 25 pts Mostly incorrect

- 50 pts Incorrect/Blank

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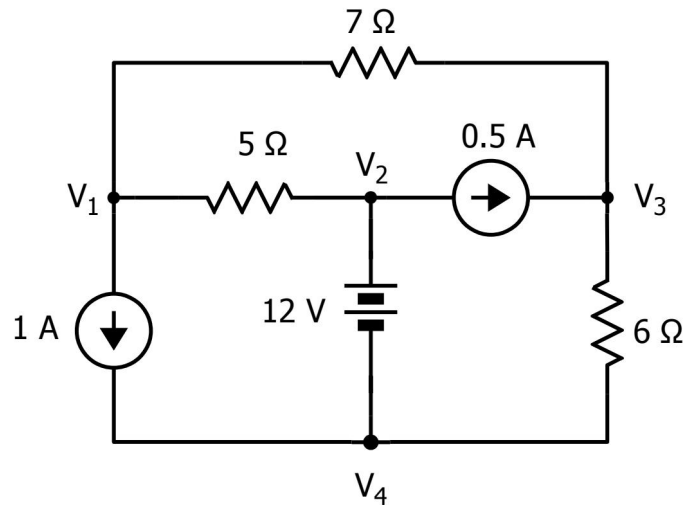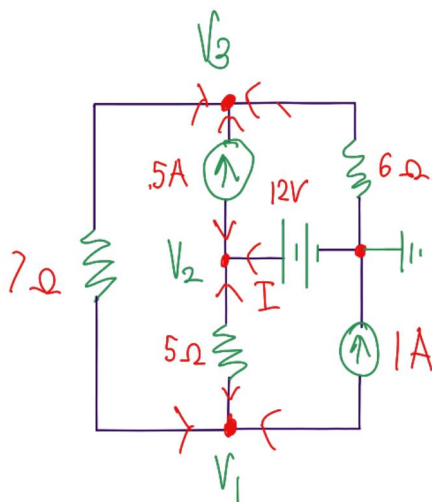
EE3 Spring 2023
Homework Problem 3

Find the current magnitude and direction through the battery, two ways:

– with V_4 as the reference node

– with V_2 as the reference node

$7\,\Omega$

$5\,\Omega$

V_2

$0.5\ A$

$V_1 \bullet$ $\bullet V_3$

$1\ A$ $12\ V$ $6\,\Omega$

V_4

V_4 as Datum

V_3

$.5A$ $6\,\Omega$ $12V$

$7\,\Omega$ V_2 I $1\cdot$

$5\,\Omega$ $1A$

V_1

$V_2 = 12$

@V_2:

$$\frac{V_1 - 12}{5} + -\frac{1}{2} + I = 0$$

@V_1: $-1 + \frac{12 - V_1}{5} + \frac{V_3 - V_1}{7} = 0$

@V_3: $\frac{1}{2} + \frac{V_1 - V_3}{7} - \frac{V_3}{6} = 0$

$$\frac{2V_1}{10} - \frac{24}{10} - \frac{5}{10} + \frac{10I}{10} = 0 \qquad \boxed{2V_1 - 29 + 10I = 0}$$

$$-\frac{35}{35} + \frac{84}{35} - \frac{7V_1}{35} + \frac{5V_3}{35} - \frac{5V_1}{35} = 0 \qquad \boxed{49 - 12V_1 + 5V_3 = 0}$$

$$\frac{21}{42} + \frac{6V_1 - 6V_3}{42} - \frac{7V_3}{42} = 0 \qquad \boxed{21 + 6V_1 - 13V_3 = 0}$$

$V_1 = \frac{53}{9}, V_3 = \frac{13}{3}$ ← Solving

$I = \frac{81}{8} = 1.72A$ Flowing Out of Battery

Using V_2 as Datom

V_3

.5A ↑   12V   6Ω V_4 7Ω

I↑   5Ω   ↑1A

V_1

$V_4 = -12$

@V_1:
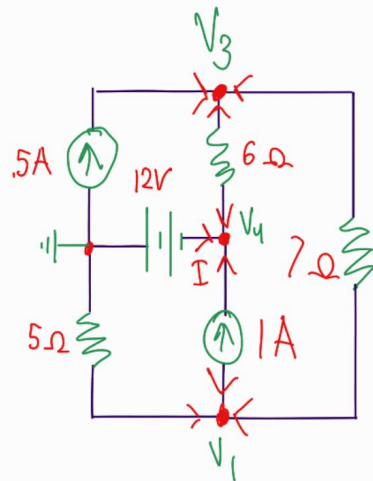
$$-\frac{V_1}{5} + -1 + \frac{V_3 - V_1}{7} = 0$$

@V_4: $I + \frac{V_3 + 12}{6} + 1 = 0$

@V_3: $\frac{1}{2} + \frac{V_1 - V_3}{7} - \frac{12 + V_3}{6} = 0$

$$\frac{-2V_1}{35} - \frac{35}{35} + \frac{5V_3 - 5V_1}{35}$$

$$\frac{6I}{6} + \frac{V_3 + 12}{6} + \frac{6}{6} = 0$$

$$\frac{21}{42} + \frac{6V_1 - 6V_3}{42} - \frac{84 - 7V_3}{42} = 0$$

$$-12V_1 - 35 + 5V_3 = 0$$

$$6I + V_3 + 18 = 0$$
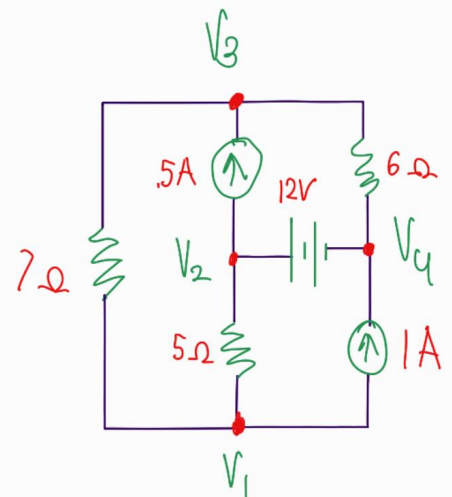
$$-63 + 6V_1 - 13V_3 = 0$$

Solving

$$V_1 = -\frac{55}{9}, \quad V_3 = -\frac{23}{3}$$

$$\oint I = -1.72 \text{ A}$$

Flowing
Into Battery

$= 1.72$A Flowing Into
Battery.

V_3

.5A ↑   12V   6Ω V_4

7Ω V_2 |ı|ı

5Ω   ↑ 1A

V_1

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