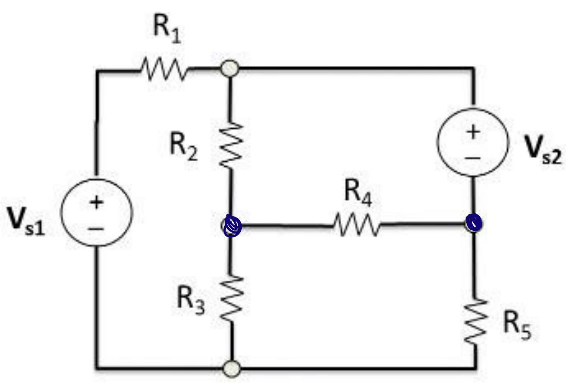
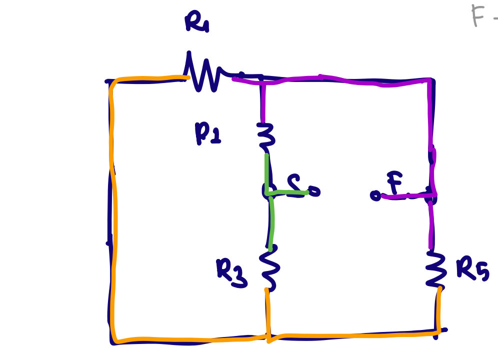
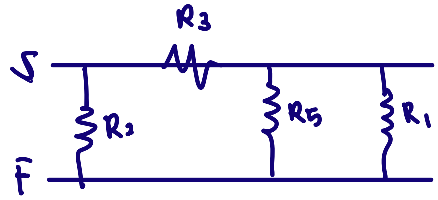
What's the equivalent resistance seen by R_4 in the following circuit? (Hint: short circuit V_{s1} and V_{s2})

Given $R_1 = R_2 = R_3 = R_4 = R_5 = 4\ \Omega$







- 2.4 Ω
- 0.4 Ω
- 3.4 Ω
- 1.4 Ω

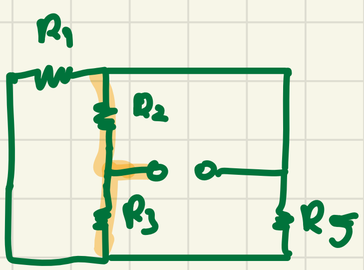
$R_5 \parallel R_1 \Rightarrow \left(\frac{1}{4} + \frac{1}{4}\right)^{-1}$

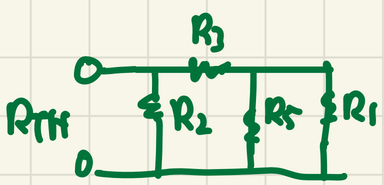
$= 2\Omega$

$R_3 + R_5 \parallel R_1 = 6\Omega$

$R_T = \left(\frac{1}{4} + \frac{1}{6}\right)^{-1}$

$= 2.4\Omega$





$\left(\frac{1}{4}+\frac{1}{4}\right)^{-1} = 2$

$R_T = R_2 \parallel (R_3 + (R_5 \parallel R_1))$

$= \left(\frac{1}{4} + \frac{1}{4+2}\right)^{-1}$

$= 2.4\ \Omega$

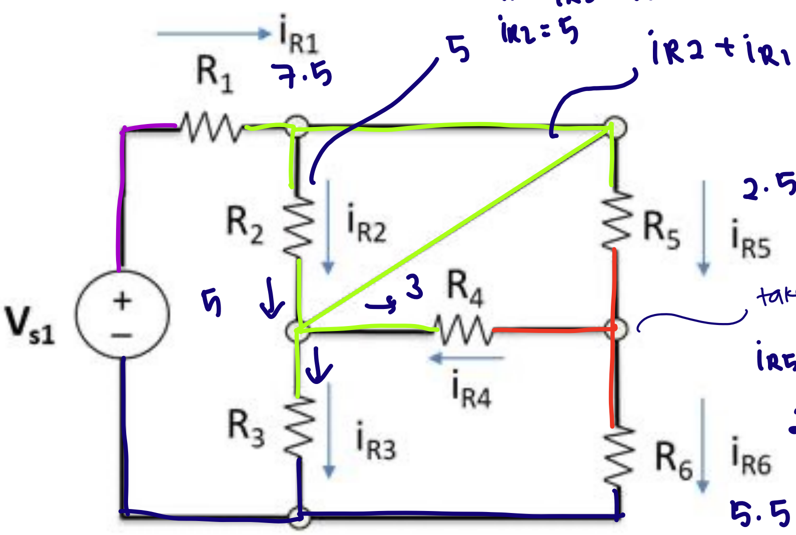
0

What's the current in R_3, i.e., i_{R3}, in the following circuit? (Hint: use supernode)

$i_{R1} = i_{R2} + i_{R5}$

$i_{R2} = 5$

$i_{R2} + i_{R1} + i_{R4} = i_{R3}$



take this node.

$i_{R5} - i_{R4} = i_{R6}$

$2.5 - 5.5 = i_{R4}$

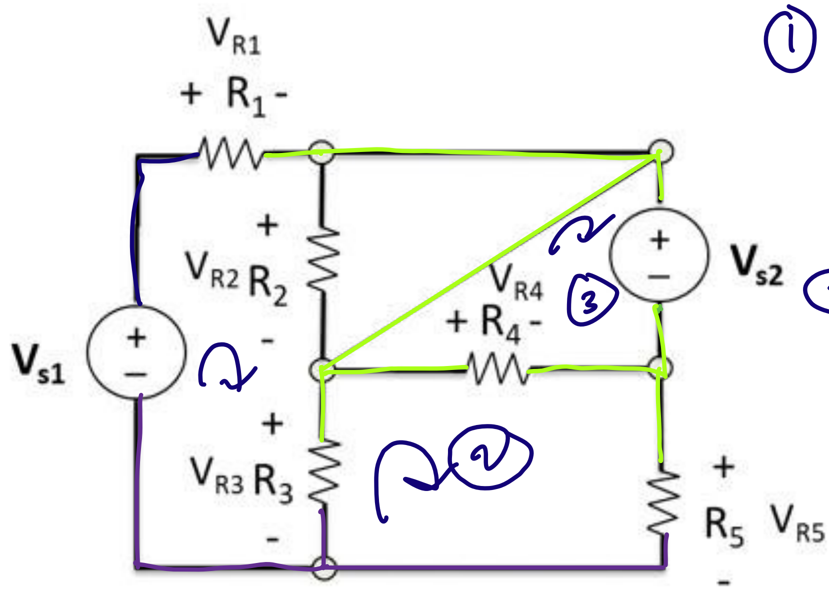
$i_{R4} = -3\,A$

Given iR1 = 7.5A, i_{R5} =2.5A, i_{R6} = 5.5A

Which among the following values most closely matches the correct answer?

- a. 2.5A
- b. 3.0A
- c. 2.0A
- d. 1.5A

What's the voltage across R_3, i.e., V_{R3}, in the following circuit? (Hint: label different node with different color)



① : $-V_{S1} + V_{R1} + V_{R2} + V_{R3} = 0$

$-10 + 8 + V_{R2} + V_{R3} = 0$

$V_{R2} + V_{R3} = 2$ — (1)

② : $-V_{R3} + V_{R4} + V_{R5} = 0$

$-V_{R3} + V_{R4} = -1$.

③ : $V_{S2} - V_{R4} = 0$

$V_{R4} = 1$

$V_{R3} = 1+1$

$= 2V$.

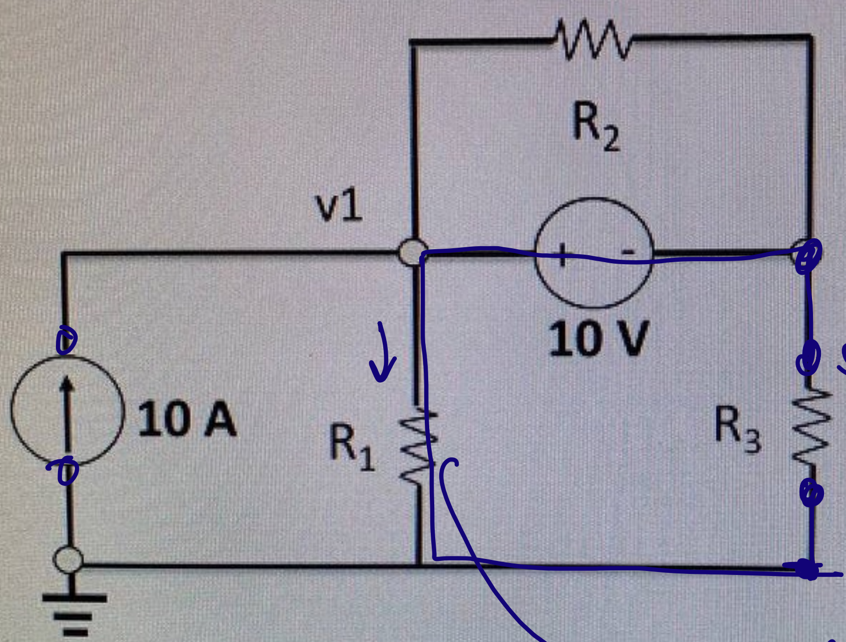
Given V_{R1} = 8V, V_{R5} = 1 V, V_{S1} = 10 V, and V_{S2} = 1 V
Which among the following values most closely matches the correct answer?

- a. 1V
- b. 3V
- c. 4V
- d. 2V

$-V_{S1} + V_{R1} + V_{R3} = -10 + 8 + V_{R3} = 0$

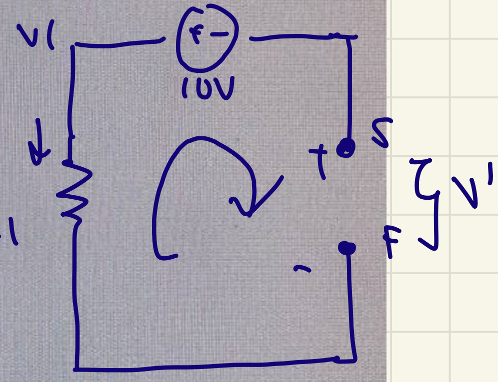
$V_{R3} = 2$

In the circuit below, what is the Thevenin (open-circuit) voltage when R_3 is the load?



① open circuit

V ✓ I ✗



$-\cancel{IR_1} + 10 + V' = 0$

$R_T = R_1 = 8\,\Omega$

Given $R_1 = R_2 = R_3 = 8\ \Omega$

Which among the following values most closely matches the correct answer?

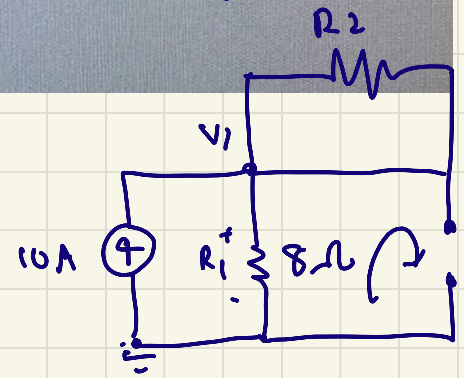
- a. 65V
- b. 75V
- c. 60V
- d. 70V

$10 + V' = 0$

$V' = -10$

② close circuit

I ✓ V ✗



$-IR_1 + V'' = 0$

$V'' = 10 \times 8$

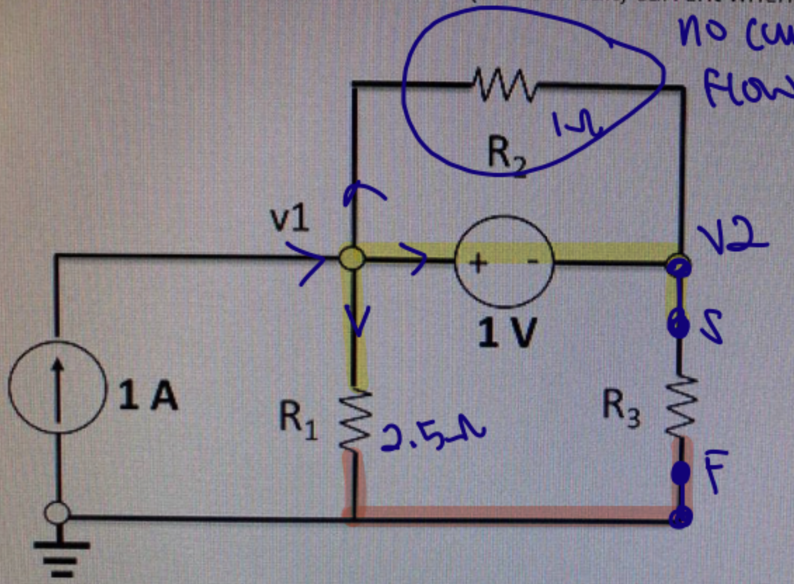
$= 80\text{ V}$

$V_T = V' + V''$

$= -10 + 80$

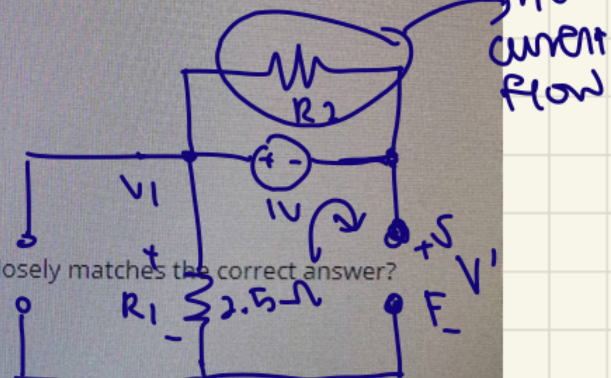
$= 70\text{V}$

In the circuit below, what is the Norton (short-circuit) current when R_3 is the load?



$R_T = 2.5\,\Omega$

when V ✓ I X :



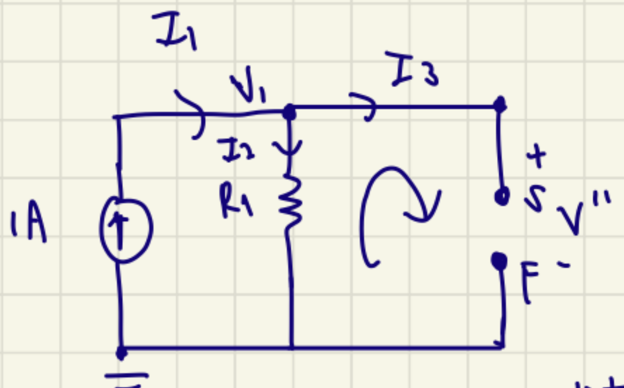
Given $R_1 = 2.5\ \Omega$, $R_2 = 1\ \Omega$ Which among the following values most closely matches the correct answer?

- a. 0.8A
- b. 0.5A
- c. 0.6A ✓
- d. 0.7A

$V' + 1 = 0$

$V' = -1V$

when I X V ✓ :



$-R_1 I_2 + V'' = 0$

$V'' = 1 \times 2.5$

$= 2.5$

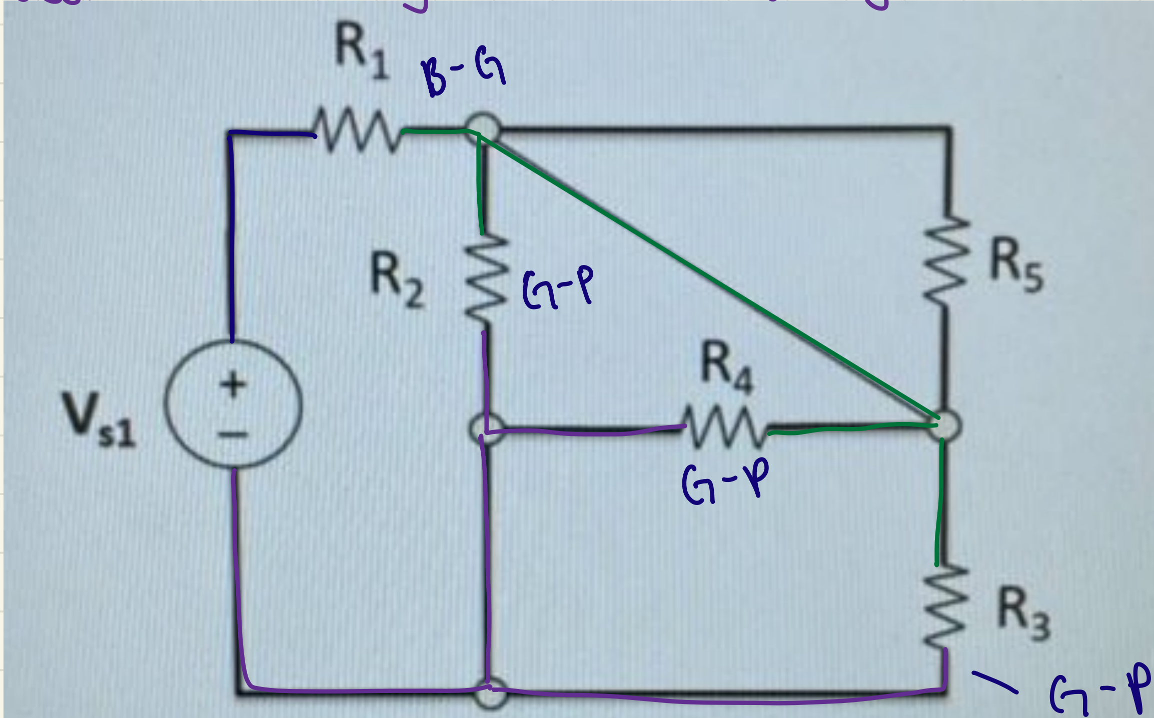
total $V = -1 + 2.5$

$= 1.5V$

$I_n = \frac{1.5}{2.5}$

$= 0.6A$

assume Qn asking about R_T seen by V_{s1}.



Given $R_1 = 3\ \Omega$, $R_2 = 3\ \Omega$, $R_3 = 3\ \Omega$, $R_4 = 3\ \Omega$, $R_5 = 2\ \Omega$

Which among the following values most closely matches the correct answer?

- a. 2 Ω
- b. 4 Ω ✓
- c. 3 Ω
- d. 1 Ω

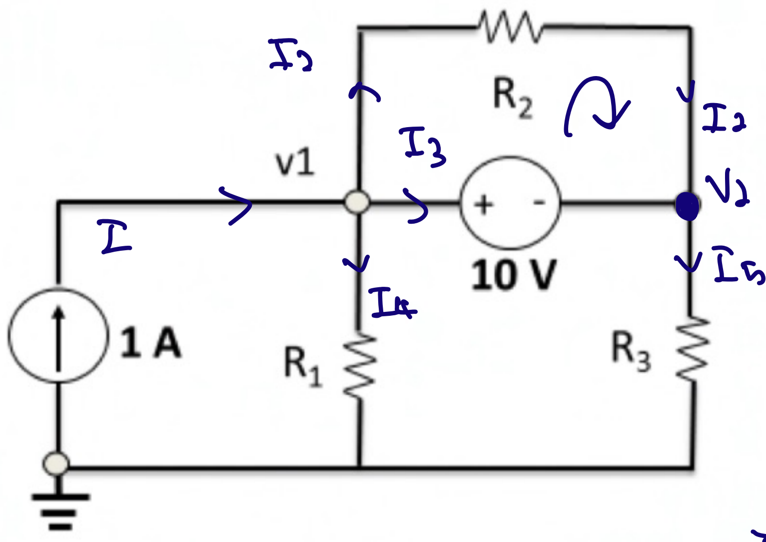
$$R_T = 3 + \left(\frac{1}{3} + \frac{1}{3} + \frac{1}{3}\right)^{-1}$$

$$= 4\ \Omega$$

Question 1

In the circuit below, what is the node voltage v1?

Given $R_1 = R_2 = R_3 = 110\ \Omega$



$I = I_2 + I_3 + I_4$

$I_2 + I_3 + I_4 = 1$

$I_4 = \frac{V_1}{110}$

$V_1 - V_2 = 10$

$I_5 = I_2 + I_3$

$= \frac{V_2}{110}$

$I = \frac{V_2}{110} + \frac{V_1}{110}$

$V_1 + V_2 = 110 \quad -(1)$

$V_1 = 60.0\text{V}$

Selected Answer: 60.0 V

Answers: 65.0 V

30.0 V

35.0 V

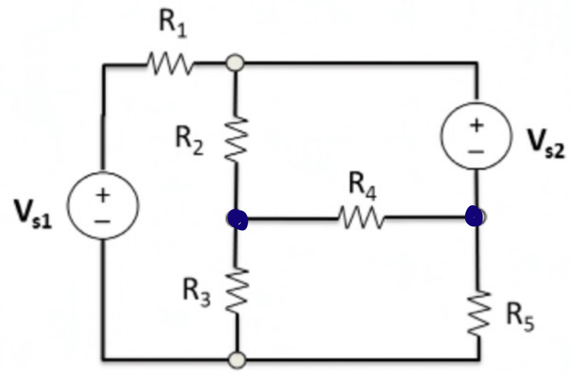
60.0 V

Question 2

20 ou

What's the equivalent resistance seen by R_4 in the following circuit? (Hint: short circuit V_{s1} and V_{s2})

Given $R_1 = R_2 = R_3 = R_4 = R_5 = 13\ \Omega$



Selected Answer: 7.8 Ω

Answers:

6.8 Ω

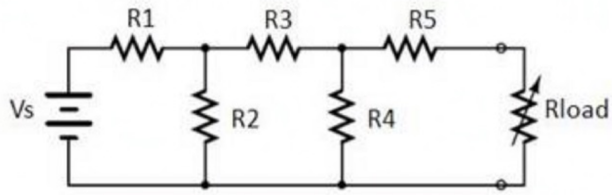
7.8 Ω

9.8 Ω

8.8 Ω

Question 3

Referring to the following circuit



$$\left(\frac{1}{10.1} + \frac{1}{9.5}\right)^{-1} = 4.8954$$

$$+ 2.3$$

$$= 7.1954$$

$$\left(\frac{1}{3.3} + \frac{1}{7.1954}\right)^{-1}$$

$$= 2.2624$$

$$2.2624 + 5 = 7.7624\,\Omega$$

and knowing that

Vs = 10 [V]
R1 = 10.1 [Ohms]
R2 = 9.5 [Ohms]
R3 = 2.3 [Ohms]
R4 = 3.3 [Ohms]
R5 = 5.5 [Ohms]

determine the value of Rload which ensures maximum power transfer.

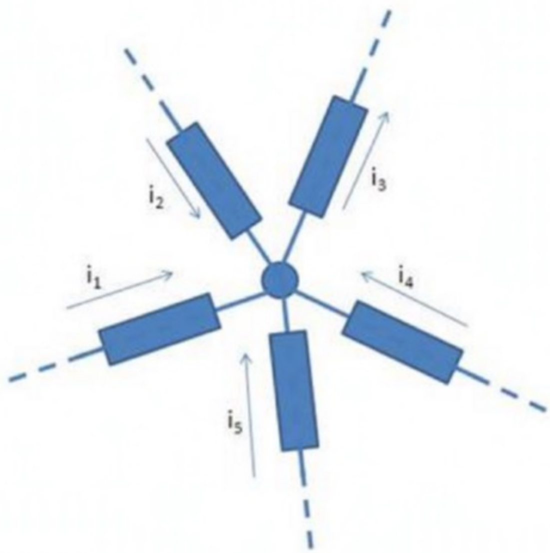
Allowing for some numerical approximation, which among the following values most closely matches the correct answer?

Selected Answer: Rload = 7.7624 [Ohms]

Answers:
- Rload = 15.5248 [Ohms]
- Rload = -2.2376 [Ohms]
- Rload = 7.7624 [Ohms]
- Rload = 30.7 [Ohms]

Question 4

Referring to the following circuit



$i_2 + i_1 + i_5 + i_4 = i_3$

$-2.4 + 9.1 + i_5 - 11.9 = -1.9$

$i_5 = 3.3\,A$

and knowing that

I1 = 9.1 [A]
I2 = -2.4 [A]
I3 = -1.9 [A]
I4 = -11.9 [A]

determine the value of I5.

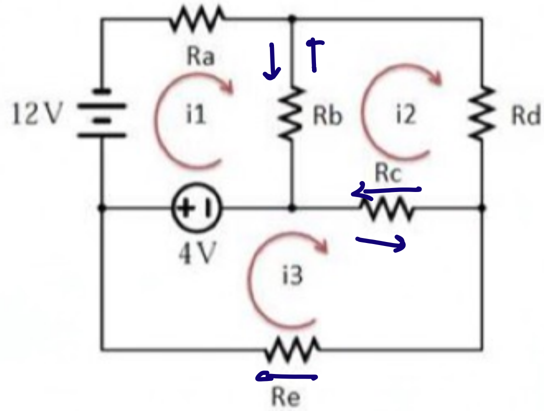
Allowing for some numerical approximation, which among the following values most closely matches the correct answer?

Selected Answer: I5 = 3.3 A

Answers:
- I5 = -3.3 A
- I5 = -1.3 A
- I5 = 0.3 A
- I5 = 3.3 A

Question 5

The mesh-current method, applied to the following circuit



① $12 + i_1 Ra + Rb(i_1 - i_2) - 4 = 0$

$12 + 3.1 i_1 + 4.5(i_1 - i_2) - 4 = 0$

$7.6 i_1 - 4.5 i_2 = -8 \quad -(1)$

② $Rb(i_2 - i_1) + i_2 Rd + (i_2 - i_3) Rc = 0$

$4.5(i_2 - i_1) + 20.3 i_2 + 20.2(i_2 - i_3) = 0$

$4.5 i_2 - 4.5 i_1 + 20.3 i_2 + 20.2 i_2 - 20.2 i_3 = 0$

$-4.5 i_1 + 45 i_2 - 20.2 i_3 = 0$

③ $i_3 Re + 4 + Rc(i_3 - i_2) = 0$

$15.5 i_3 + 4 + 20.2(i_3 - i_2) = 0$

$-20.2 i_2 + 35.7 i_3 = -4$

will lead to a 3x3 system of equations such as

$$\begin{bmatrix} R_{11} & R_{12} & R_{13} \\ R_{21} & R_{22} & R_{23} \\ R_{31} & R_{32} & R_{33} \end{bmatrix} \cdot \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -8V \\ 0V \\ -4V \end{bmatrix}$$

Allowing for some numerical approximation and knowing

Ra = 3.1 [Ohms]
Rb = 4.5 [Ohms]
Rc = 20.2 [Ohms]
Rd = 20.3 [Ohms]
Re = 15.5 [Ohms]

which among the following matrices best represents the resistance matrix [Rij] in the equation above?

Selected Answer:

[7.6 -4.5 0]
[-4.5 45 -20.2]
[0 -20.2 35.7]

Answers:

[7.6 0 0]
[0 45 0]
[0 0 35.7]

[7.6 -4.5 -20.2]
[0 45 40.6]
[0 0 35.7]

[3.1 4.5 20.2]/
[4.5 20.3 15.5]
[20.2 15.5 18.6]

[7.6 -4.5 0]
[-4.5 45 -20.2]
[0 -20.2 35.7]