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NPTEL (<https://swayam.gov.in/explorer?ncCode=NPTEL>) » Basic Electrical Circuits (course)

Announcements (announcements) About the Course (preview) Ask a Question (forum) Progress (student/home) Mentor (student/mentor)

Unit 7 - Week 5 : Mesh analysis; Circuit theorems

Course outline

How does an NPTEL online course work?

Week 0

Week 1: Preliminaries; Current and voltage; Electrical elements and circuits; Kirchoff's laws; Basic elements; Linearity

Week 2: Elements in series and parallel; Controlled sources

Week 3: Power and energy in electrical elements; Circuit analysis methods

Week 4: Nodal analysis

Week 5 : Mesh analysis; Circuit theorems

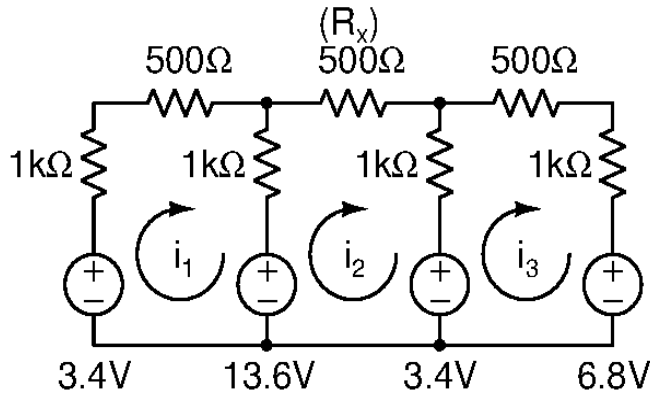
- Planar circuits (unit? unit=16&lesson=81)
- Mesh currents and their relationship to branch currents (unit? unit=16&lesson=82)
- Mesh analysis (unit? unit=16&lesson=83)
- Mesh analysis with independent current sources- Supermesh (unit? unit=16&lesson=84)
- Mesh analysis with current controlled voltage sources (unit?unit=16&lesson=85)
- Mesh analysis with current controlled current sources (unit?unit=16&lesson=93)
- Mesh analysis using voltage controlled sources (unit? unit=16&lesson=86)
- Nodal analysis versus Mesh analysis (unit? unit=16&lesson=94)
- Superposition theorem (unit? unit=16&lesson=87)
- Pushing a voltage source through a node (unit? unit=16&lesson=88)
- Splitting a current source (unit?unit=16&lesson=89)

Assignment 5

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-10-21, 23:59 IST.

1)



Setup the mesh analysis equations for the circuit above with the given source vector. The format of the equations is as shown.

$$\begin{bmatrix} R_{11} & R_{12} & R_{13} \\ R_{21} & R_{22} & R_{23} \\ R_{31} & R_{32} & R_{33} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -10.2 \\ 10.2 \\ -3.4 \end{bmatrix}$$

R_{ij} 's are the numerical values in kilohms($k\Omega$), and the values in the source vector are in volts(V).

You have to evaluate the expression given below using the values from these matrices.

Find the value of the expression:

$$R_{11} \times R_{12} + R_{22} \times R_{23} + R_{31} \times R_{32}$$

(Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -5.5,-4.5

1 point

- Substitution theorem: Current source (unit? unit=16&lesson=90)
- Substitution theorem: Voltage source (unit? unit=16&lesson=92)
- Substituting a voltage or current source with a resistor (unit?unit=16&lesson=91)
- Week 5 Lecture material (unit?unit=16&lesson=187)
- Basic Electrical Circuits : Week 5 Feedback Form (unit?unit=16&lesson=198)
- Quiz : Assignment 5 (assessment?name=215)
- Assignment 5 solutions (unit?unit=16&lesson=218)

Week 6: More circuit theorems; Two port parameters

Week 7: Two port parameters continued; Reciprocity in resistive networks

Week 8: Opamp and negative feedback; Example circuits and additional topics

Week 9 :First Order Circuits

Week 10 : First order circuits with time-varying inputs

Week 11: Second order system response

Week 12: Direct calculation of steady state response from equivalent components

Text Transcripts

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2) Determine the power dissipated in the resistor R_x in the circuit above.

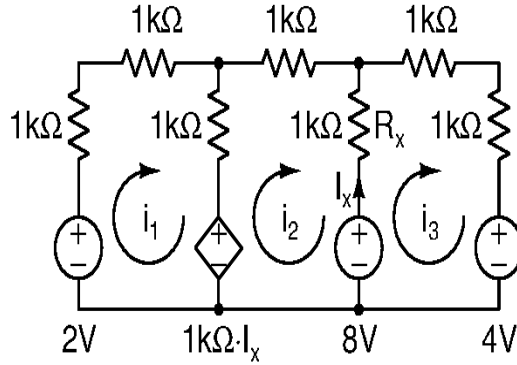
(The answer must be in **milliwatts (mW)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 3.8,4

1 point

3)



Setup the mesh analysis equations for the circuit above with the given source vector. The format of the equations is as shown.

$$\begin{bmatrix} R_{11} & R_{12} & R_{13} \\ R_{21} & R_{22} & R_{23} \\ R_{31} & R_{32} & R_{33} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 2 \\ -8 \\ 4 \end{bmatrix}$$

R_{ij} 's are the numerical values in **kilohms ($k\Omega$)**, and the values in the source vector are in **volts (V)**.

You have to evaluate the expression given below using the values from these matrices.

Find the value of the expression:

$$R_{11} \times R_{12} + R_{22} \times R_{23} + R_{31} \times R_{32}$$

(Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -14.5,-13.5

1 point

4) Determine I_x in the circuit above.

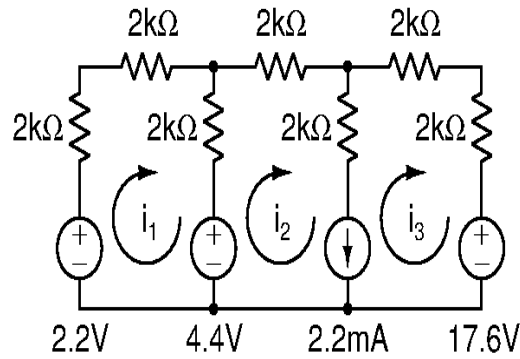
(The answer must be in **milliamperes (mA)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 2.4,2.7

1 point

5)



Setup the mesh analysis equations for the circuit above with the given source vector. The format of the equations is as shown.

$$\begin{array}{l} \text{Mesh} \\ \text{Supernode} \\ \text{Current source} \end{array} \begin{bmatrix} R_{11} & R_{12} & R_{13} \\ R_{21} & R_{22} & R_{23} \\ a & b & c \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -2.2V \\ -13.2V \\ 2.2mA \end{bmatrix}$$

R_{ij} 's are the numerical values in kilohms ($k\Omega$).
 a, b, c are scalars.

You have to evaluate the expression given below using the values from these matrices.

Find the value of the expression:

$$R_{11} \times R_{12} + R_{22} \times R_{23} + b \times c$$

(Round off fractional answers to one decimal place.)

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) 2.9,3.1

1 point

6) Determine the power *delivered* by the current source in the circuit above.

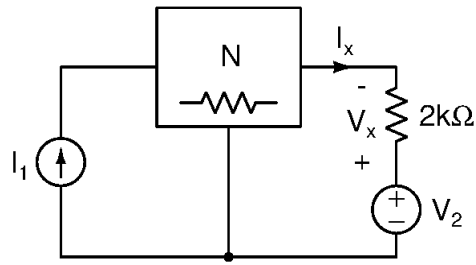
(The answer must be in **milliwatts (mW)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) -3.6,-3.4

1 point

7)



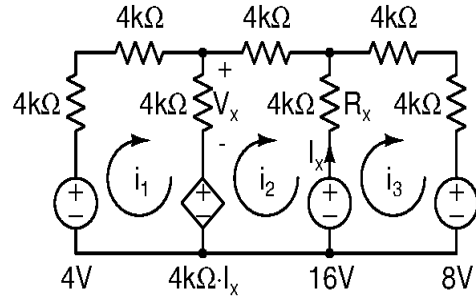
In the circuit above, $I_x = 0.5 \text{ mA}$ when $I_1 = 4 \text{ mA}$, $V_2 = 4 \text{ V}$ and $V_x = 1 \text{ V}$ when $I_1 = 2 \text{ mA}$, $V_2 = 8 \text{ V}$. Determine the power dissipated in the $2 \text{ k}\Omega$ resistor when $I_1 = 8 \text{ mA}$, $V_2 = 16 \text{ V}$. The network N consists only of resistors.

(The answer must be in **milliwatts (mW)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 0

1 point

8)

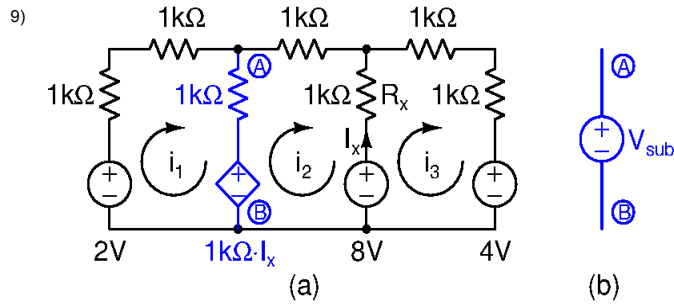


In the circuit above, determine the contribution of *only the 4 V* source to V_x . You can use any method you wish, but you are encouraged to use mesh analysis. You could also possibly use part of the solution to one of the previous problems.

(The answer must be in **volts (V)**. Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.9,1.2

1 point

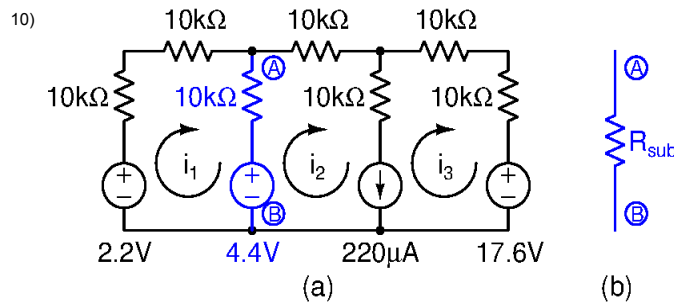


In the circuit above, the entire combination between A and B, shown in blue, must be substituted by a voltage source of value V_{sub} as shown in (b). Determine V_{sub} . You can use any method you wish, but you are encouraged to use mesh analysis. You could also possibly use part of the solution to one of the previous problems.

(The answer must be in volts (V). Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 3.5,3.7

1 point



In the circuit above, the entire combination between A and B, shown in blue, must be substituted by a resistance of value R_{sub} as shown in (b). Determine R_{sub} . You can use any method you wish, but you are encouraged to use mesh analysis. You could also possibly use part of the solution to one of the previous problems.

(The answer must be in kilohms (kΩ). Round off fractional answers to one decimal place.)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 52,56

1 point

