Faculty of Engineering and Technology

JAMIA MILLIA ISLAMIA

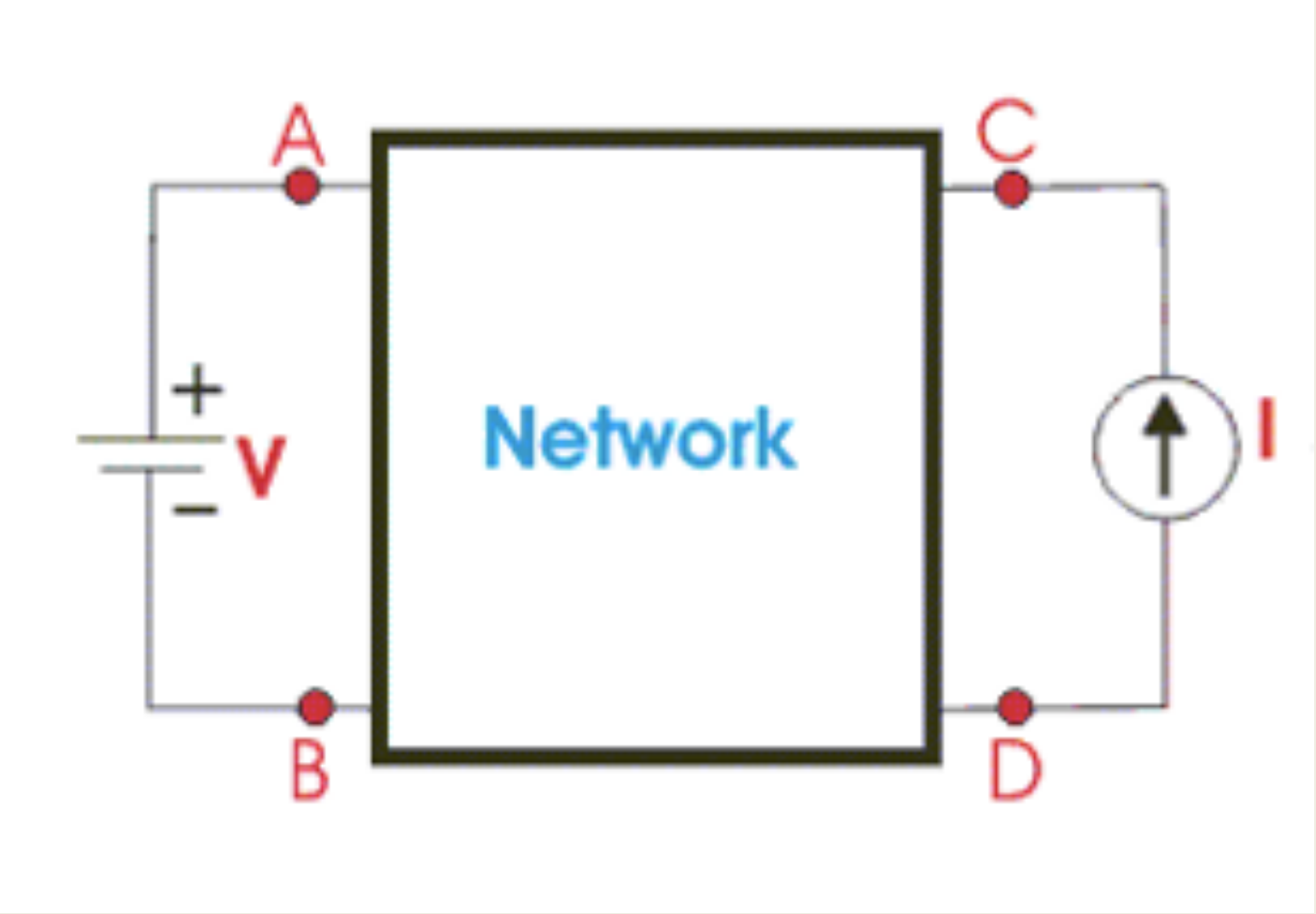
TEAM

MAYANK DUTTA
HAIDER ALI
KASHIF ZUHAIR

RECIPROCAL PROPERTY

?

- In electrical network you might have seen that after inter-changing the Ammeter with the voltage source the reading remains the SAME !!



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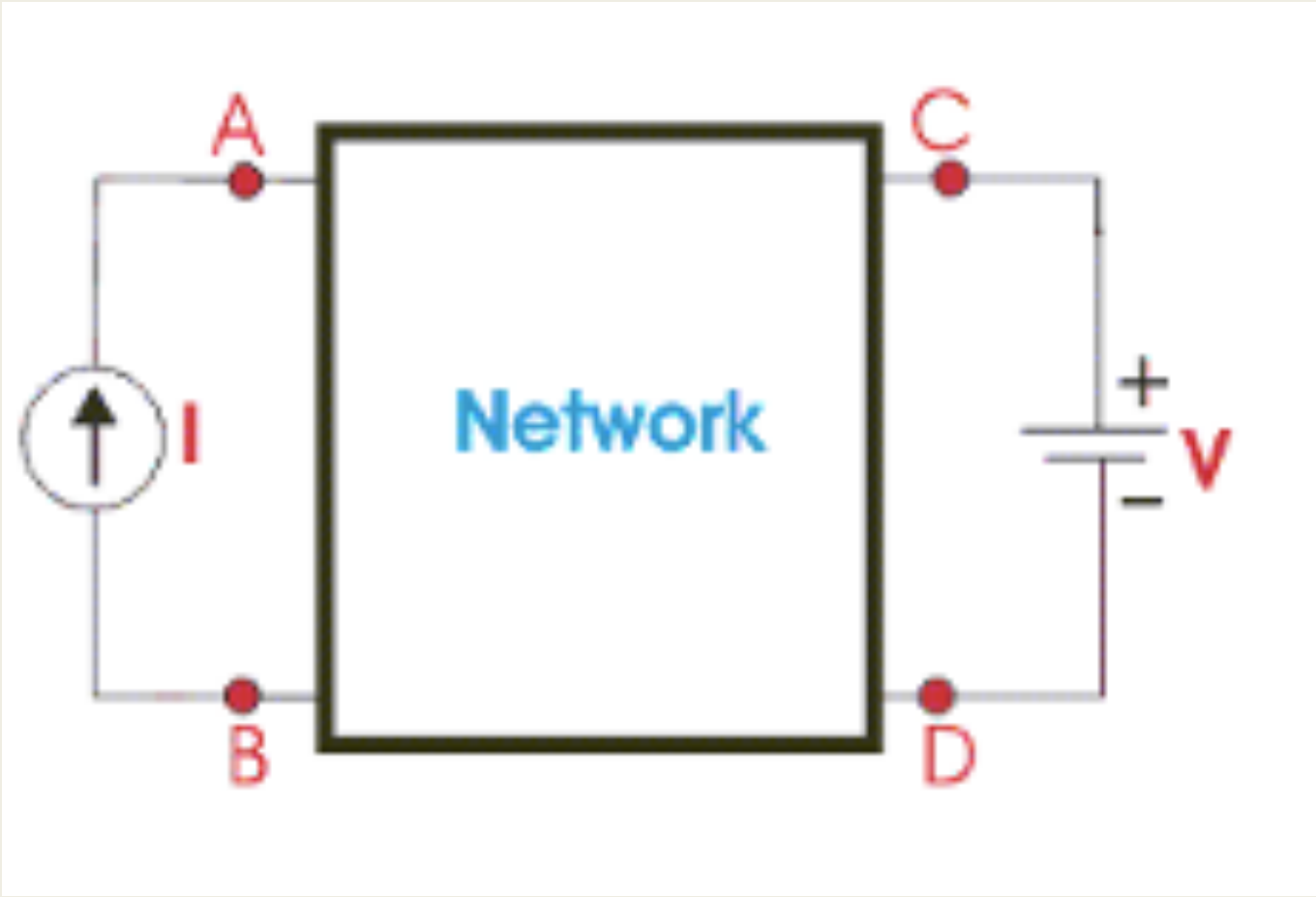

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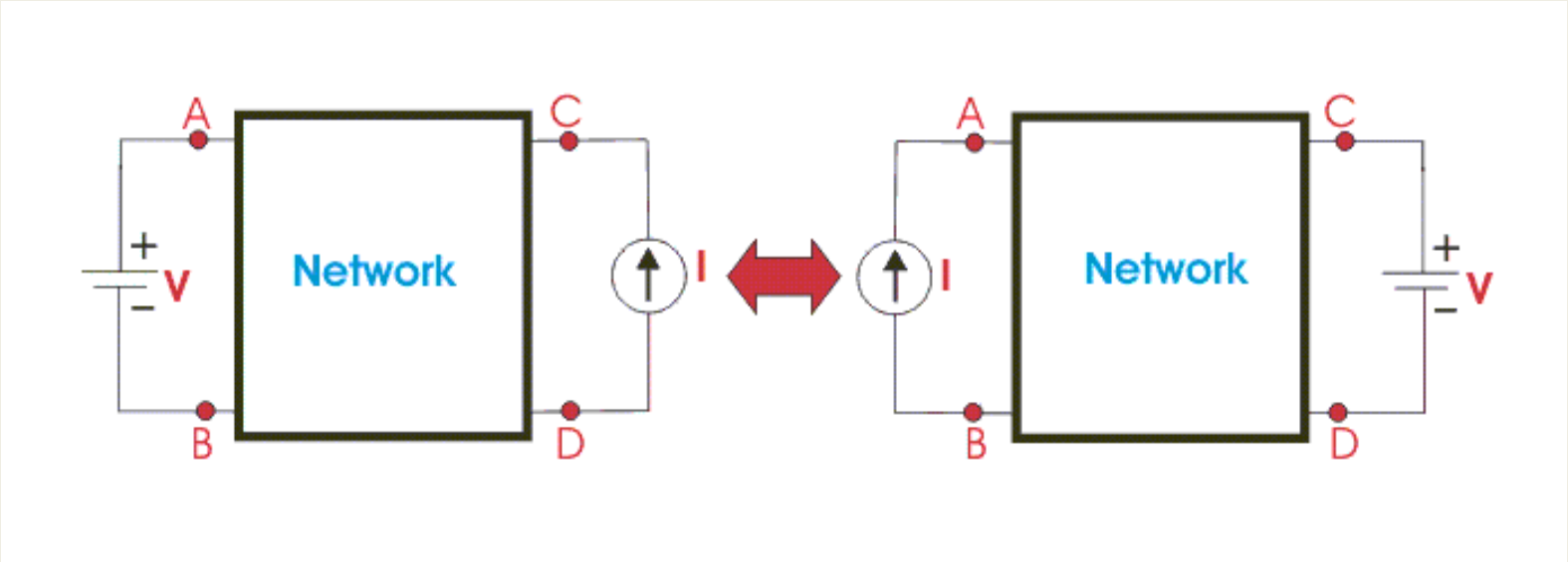

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- This is where the property this property of RECIPROCAL came into the picture,
And the circuit following this property is said to be the reciprocal circuit.

RECIPROCITY THEOREM

By Mayank Dutta

STATEMENT

In a BIDRECTIONAL SINGLE SOURCE network

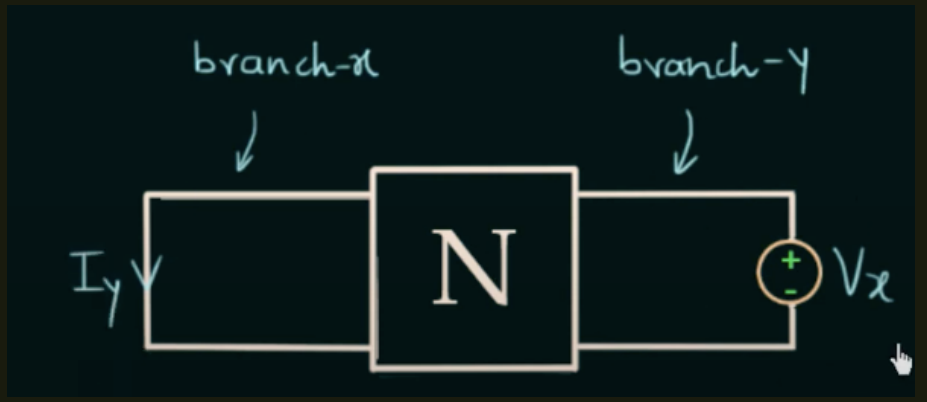
the ratio of response to excitation remains the same even when the positions of the response and excitation are interchanged.

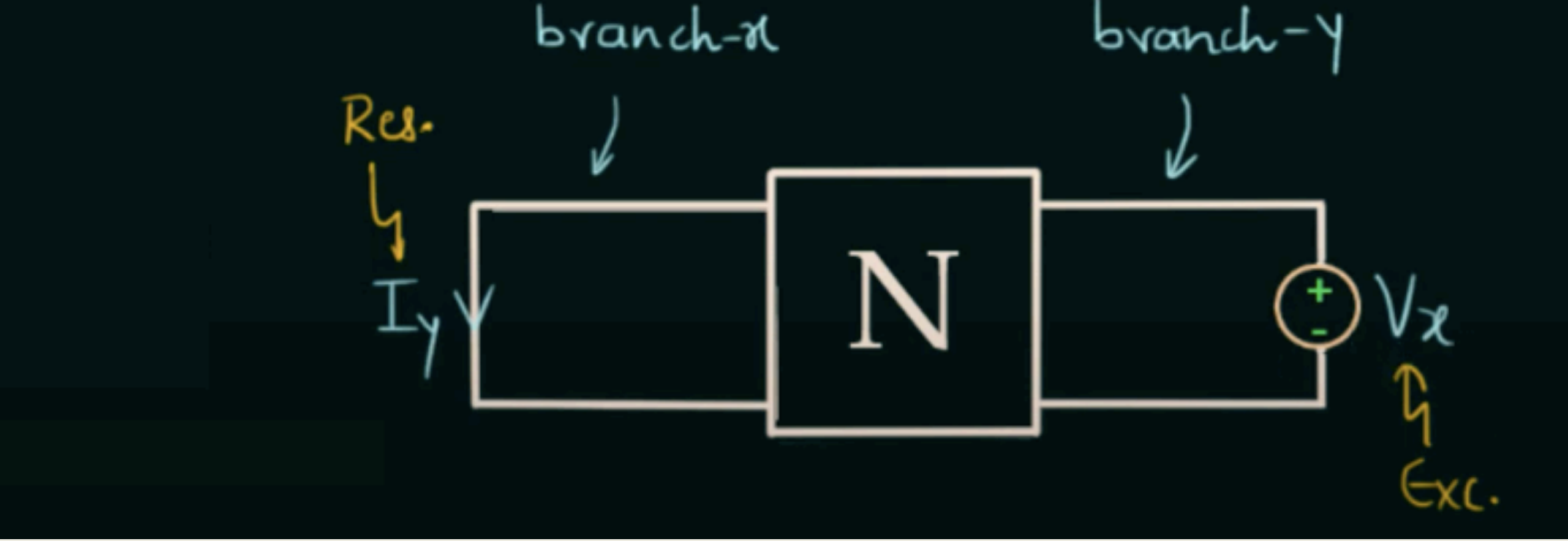
LINEAR, BIDIRECTIONAL NETWORK WITH ONE INDEPENDENT SOURCE

V_X : VOLTAGE SOURCE
I_Y : CURRENT DUE TO V_X

V_X IS OUR EXCITATION
I_Y IS OUR RESPONSE

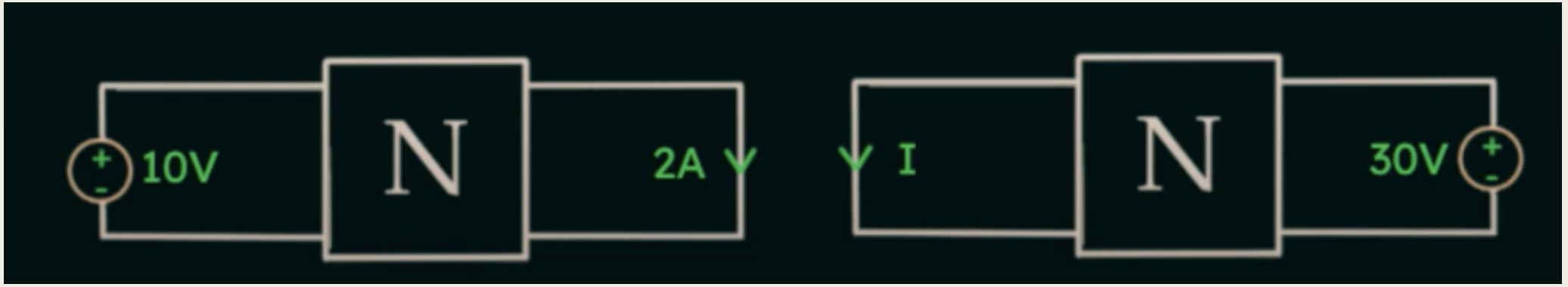
ON INTERCHANGING THE POSITIONS





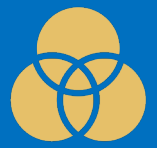
OUR EXCITATION AND RESPONSE WILL ALSO CHANGE BUT THE RATIO WILL BE THE SAME.

EXAMPLE

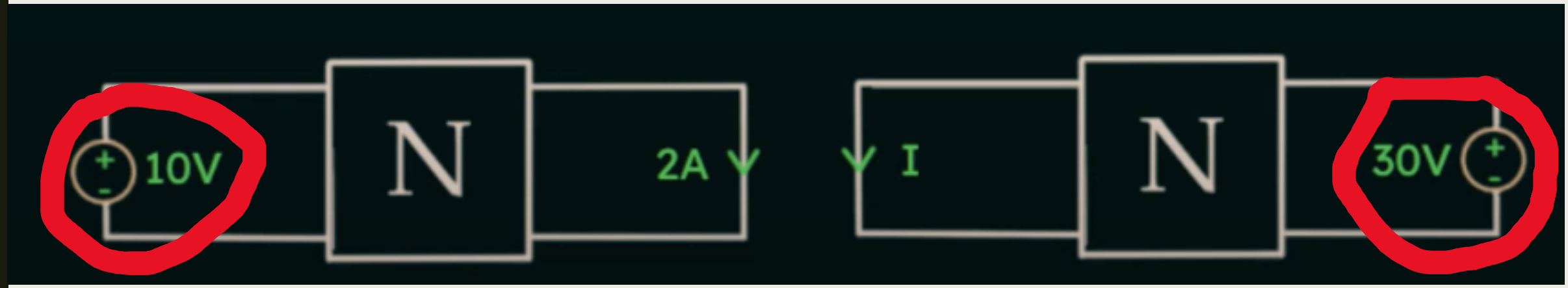


FIND THE VALUE OF I WHEN THE NETWORK SATISFIES THE RECIPROCITY CONDITIONS.

LET’S ANALYZE



Is there independent source ?


10V
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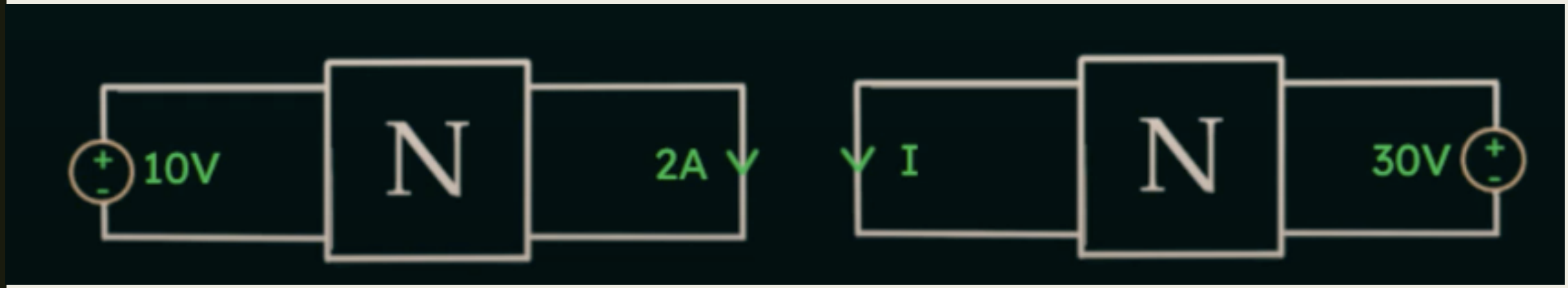
2A
I
N
30V

Is there independent source ?

Is there independent source ?

Is there any dependent source ?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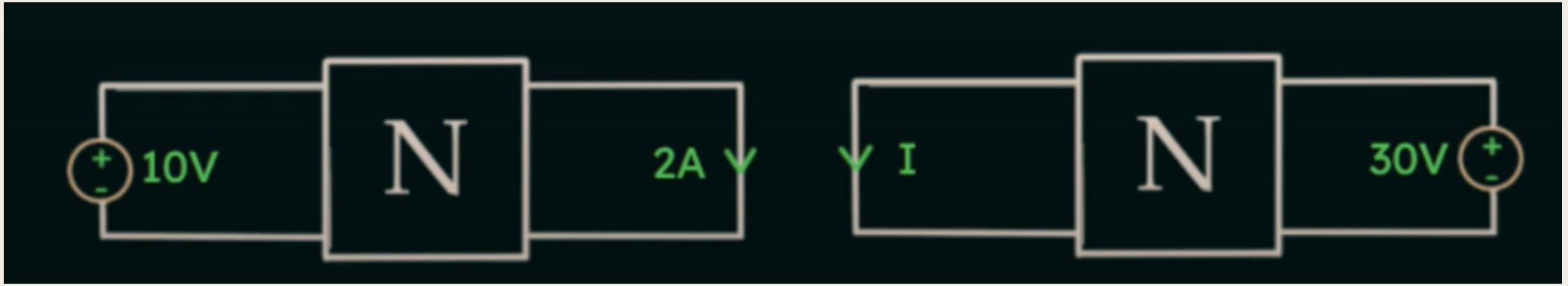

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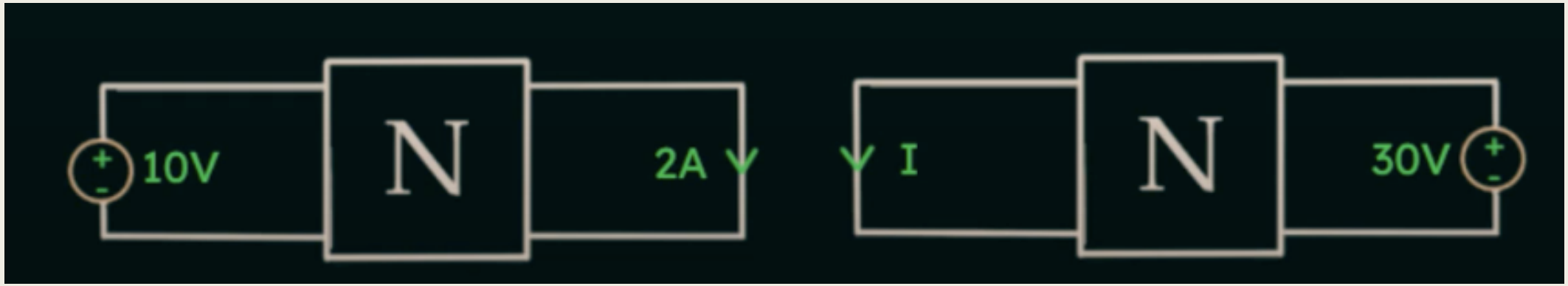
CALCULATIONS



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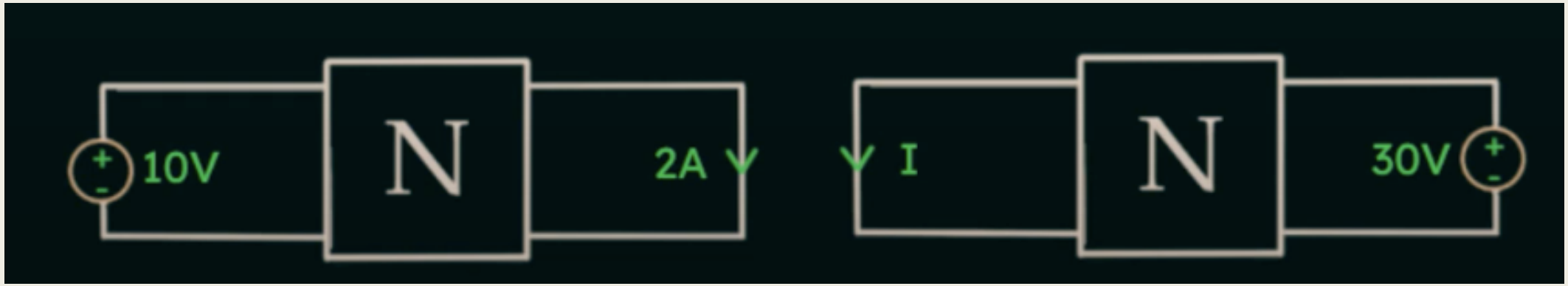

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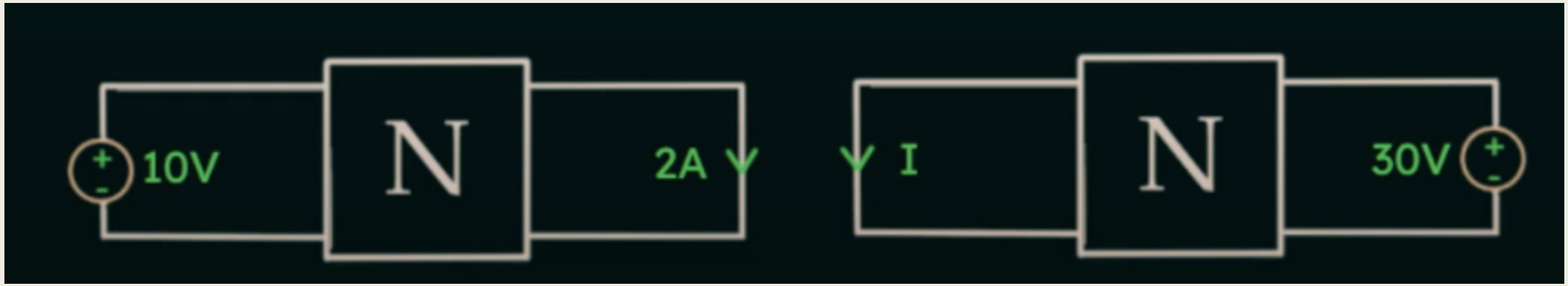
ACCORDING TO

RECIPROCITY THEOREM



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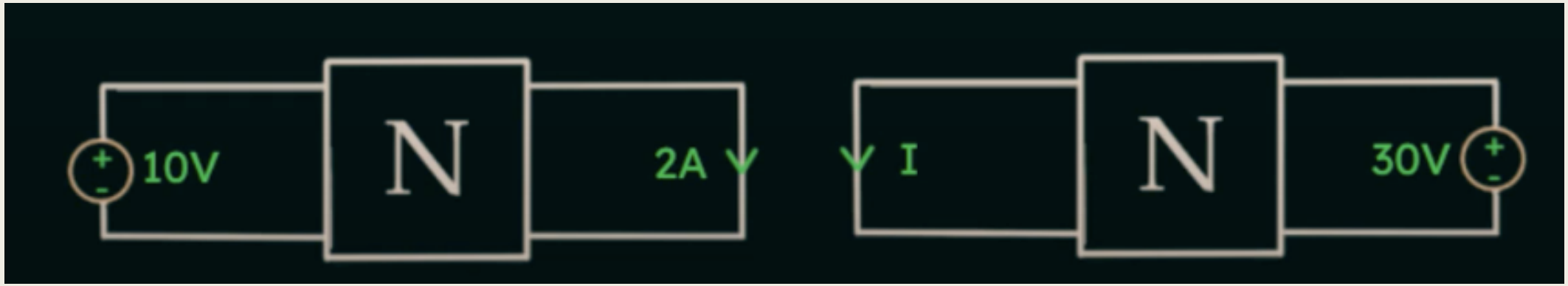

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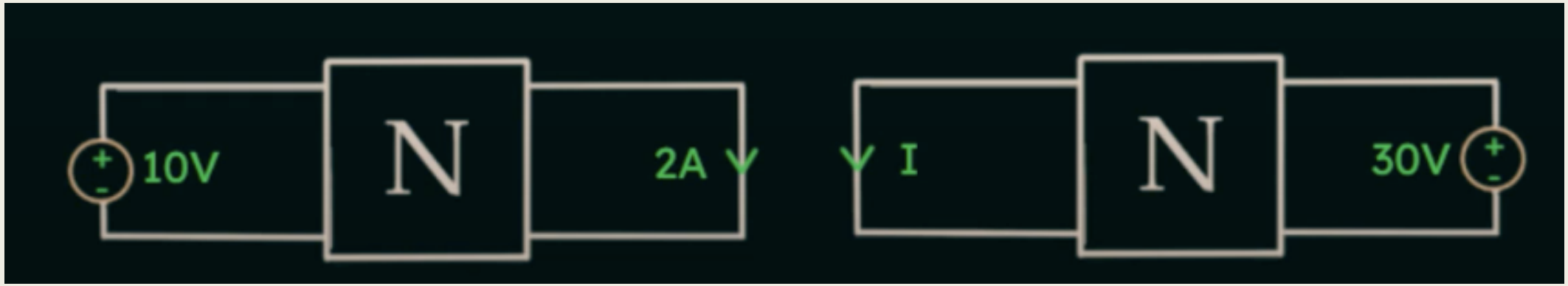
- i = 6 Amp.



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HAIDER_ALI

CONDITIONS

Reciprocity theorem will be applicable when.

The ratio of response to excitation is either Ohm or Mho.

Only one independent source is present in the circuit

No dependent source is present in the circuit

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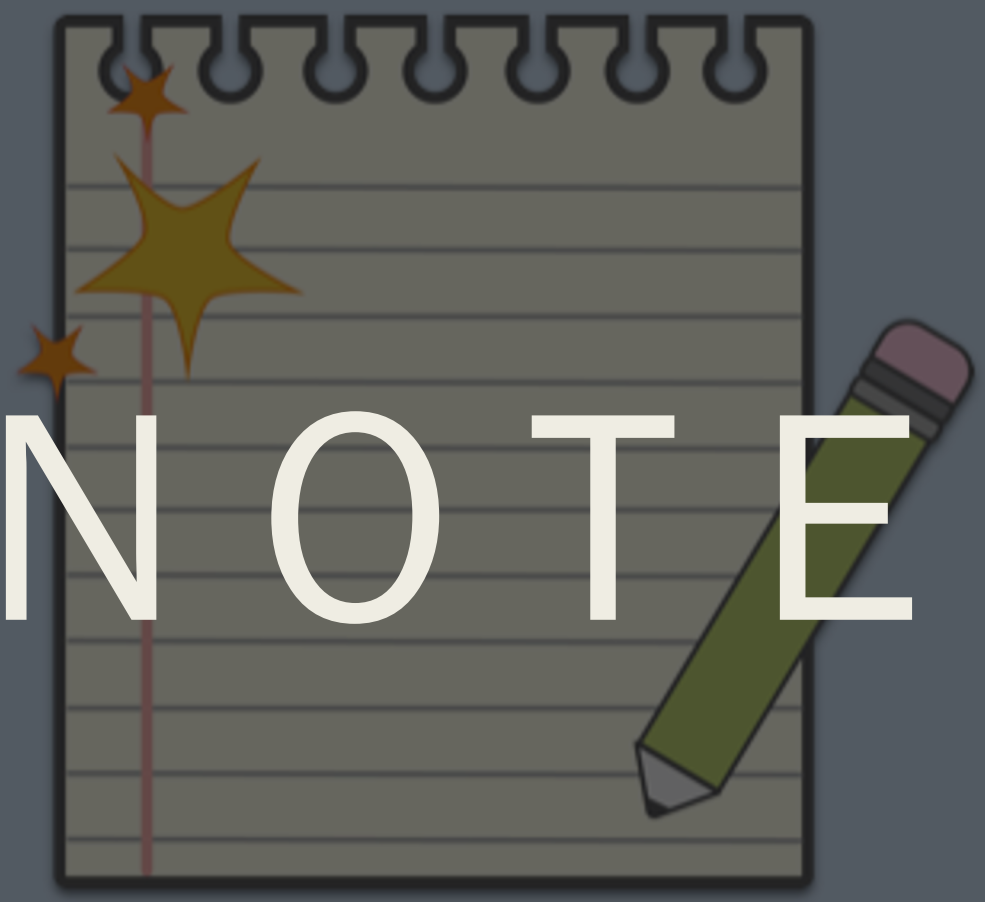
NOTE

- The reciprocity theorem is applicable for both AC and DC circuits.

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- While applying Reciprocity theorem, the circuit does not have time varying element.

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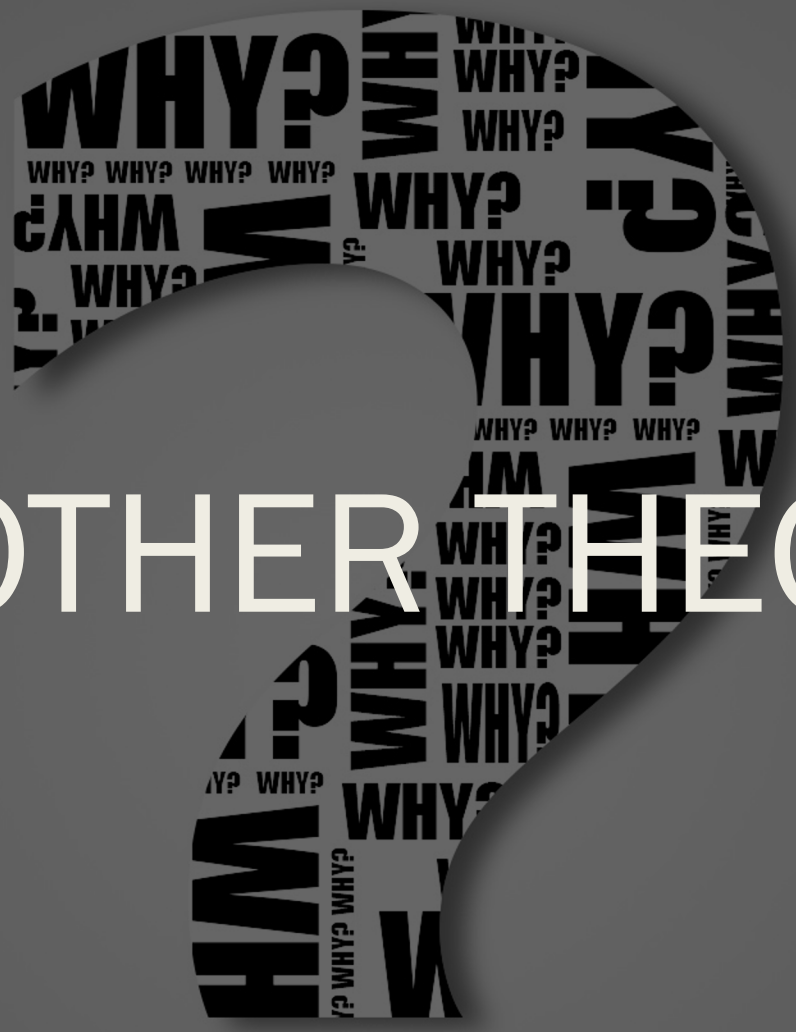
- Using Reciprocity theorem, it is possible to conclude if a network is linear or non-linear.



WHY ANOTHER THEOREM?

APPLICATIONS

- This theorem is applied to analyze ultrasound generated by high-intensity surface heating of elastic bodies.

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- Making impedance calculations
- Treating properties like Polarizations, magnetization like properties.

KASHIF ZUHAIR

LIMITATIONS

- Not applicable to the circuits consisting of any time varying element.

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- Not applicable to the circuits consisting of non-linear elements like diode, transistor.

EXAMPLE

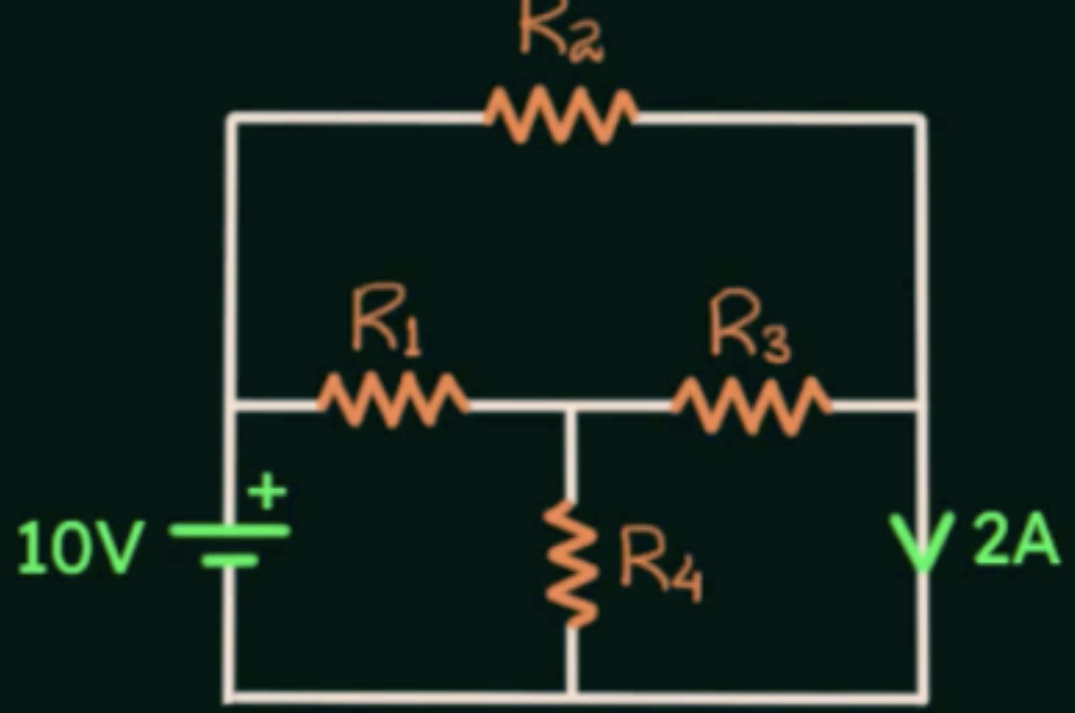


Fig.(a)

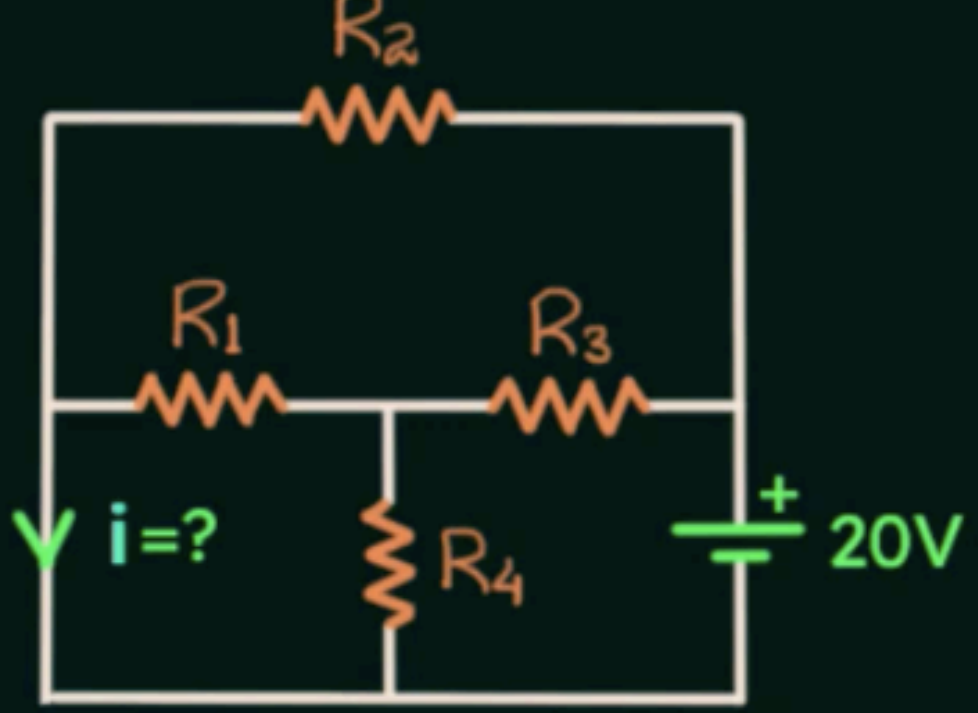
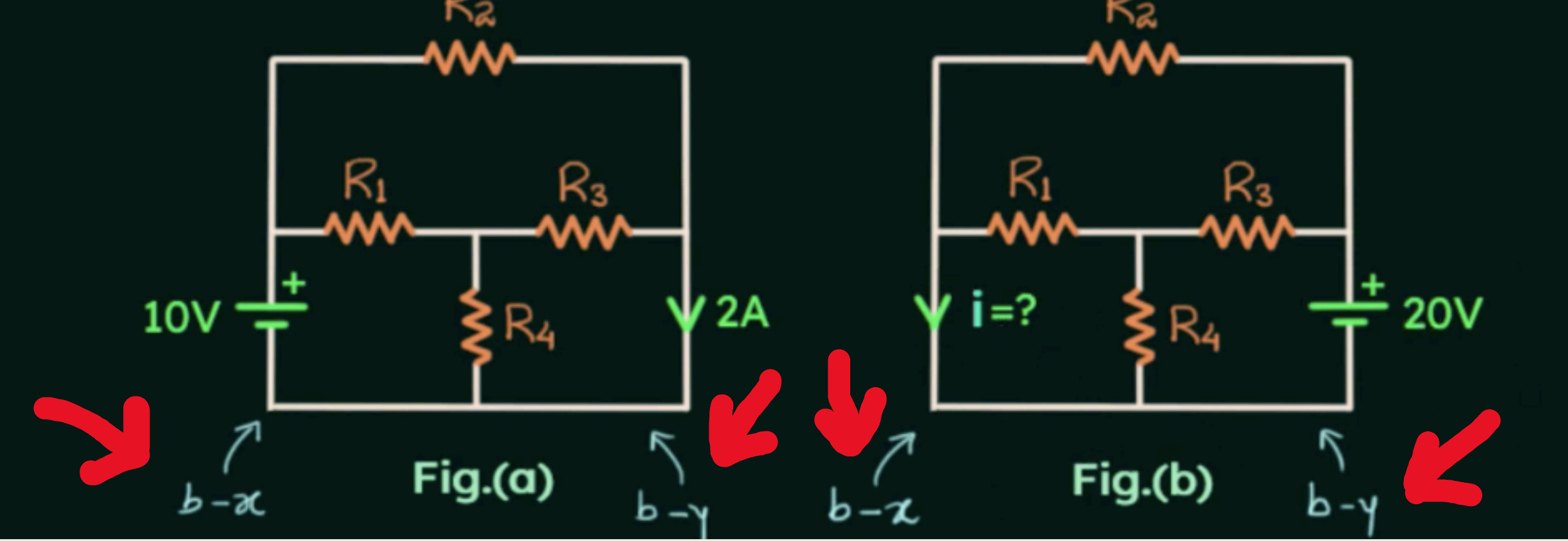


Fig.(b)

USING DATA GIVEN IN FIGURE (A), FIND THE VALUE OF CURRENT IN FIGURE (B).

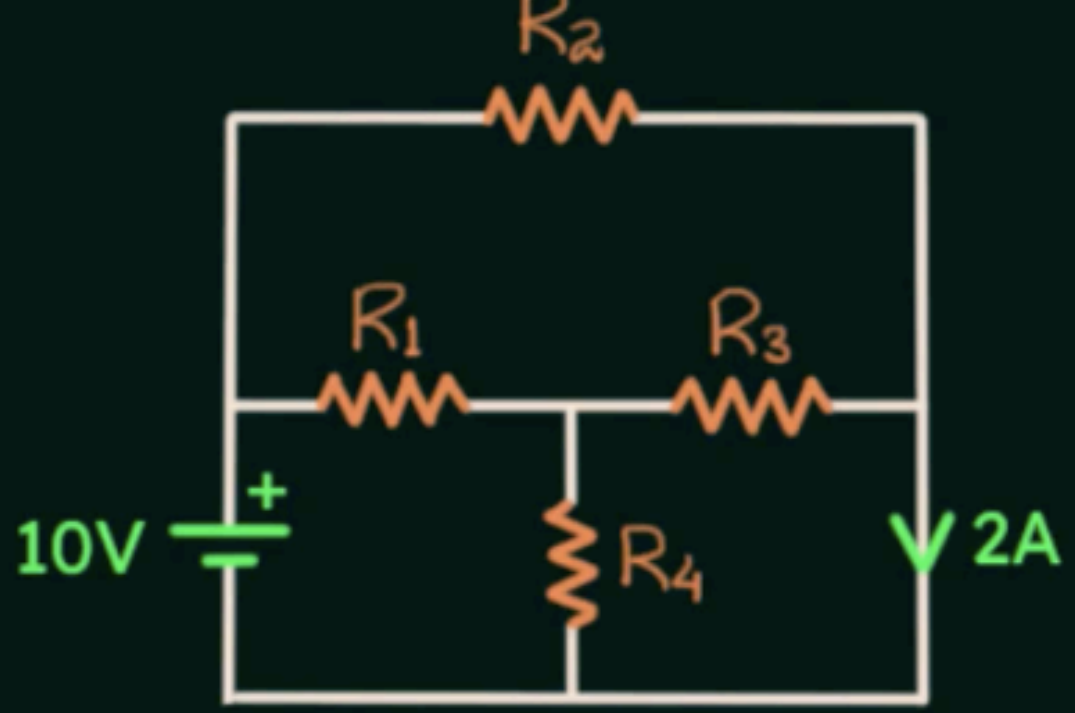


LET'S NAME THE BRANCHES FIRST.

LET’S ANALYZE

All linear elements ?

- Res / exc = mho (or) ohm ?
- One independent source ?
- No dependent source ?



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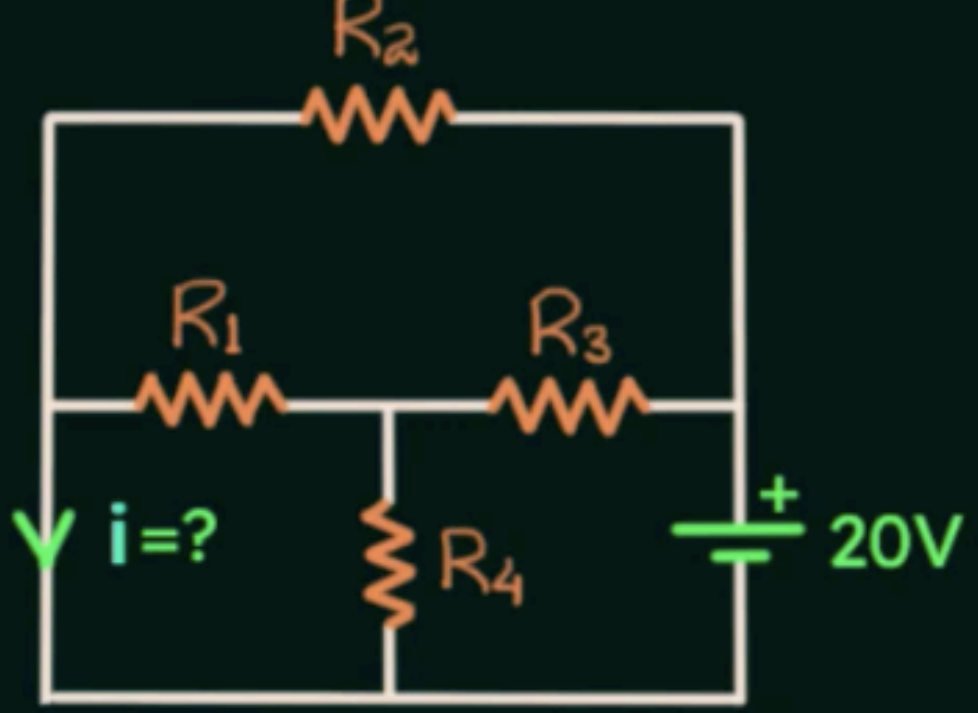

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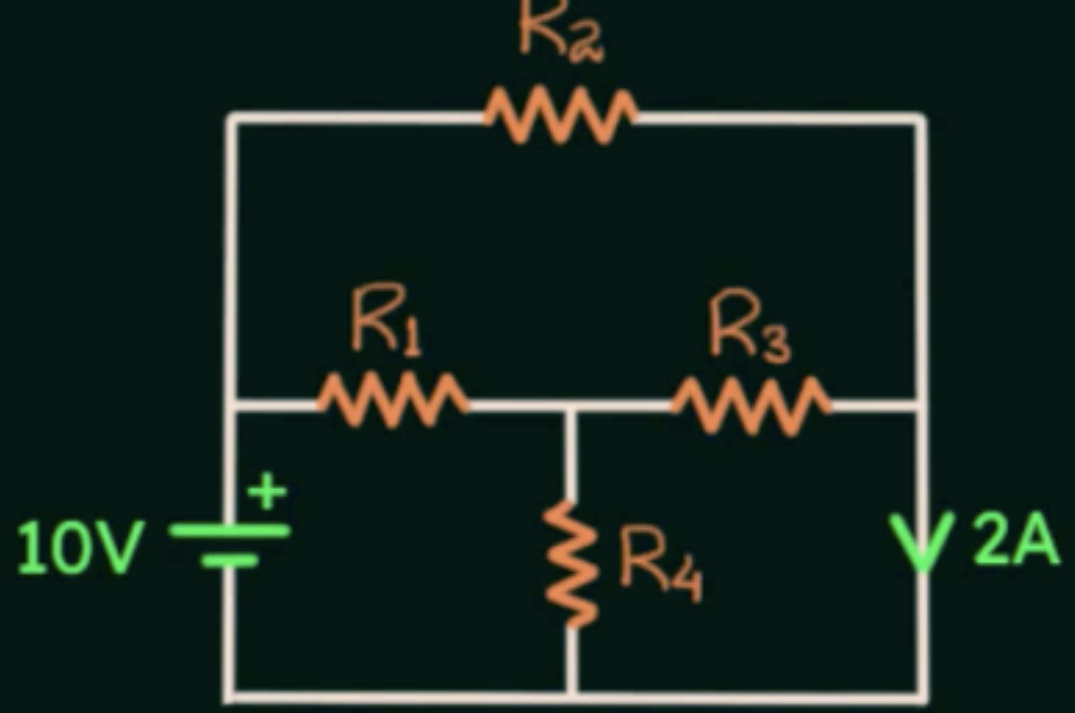

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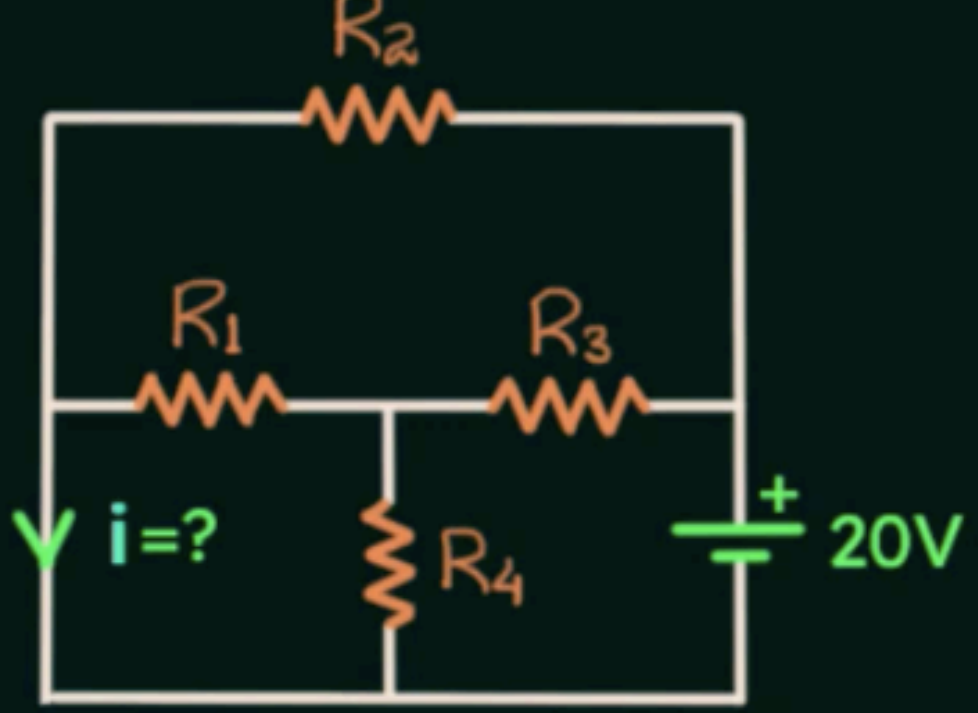

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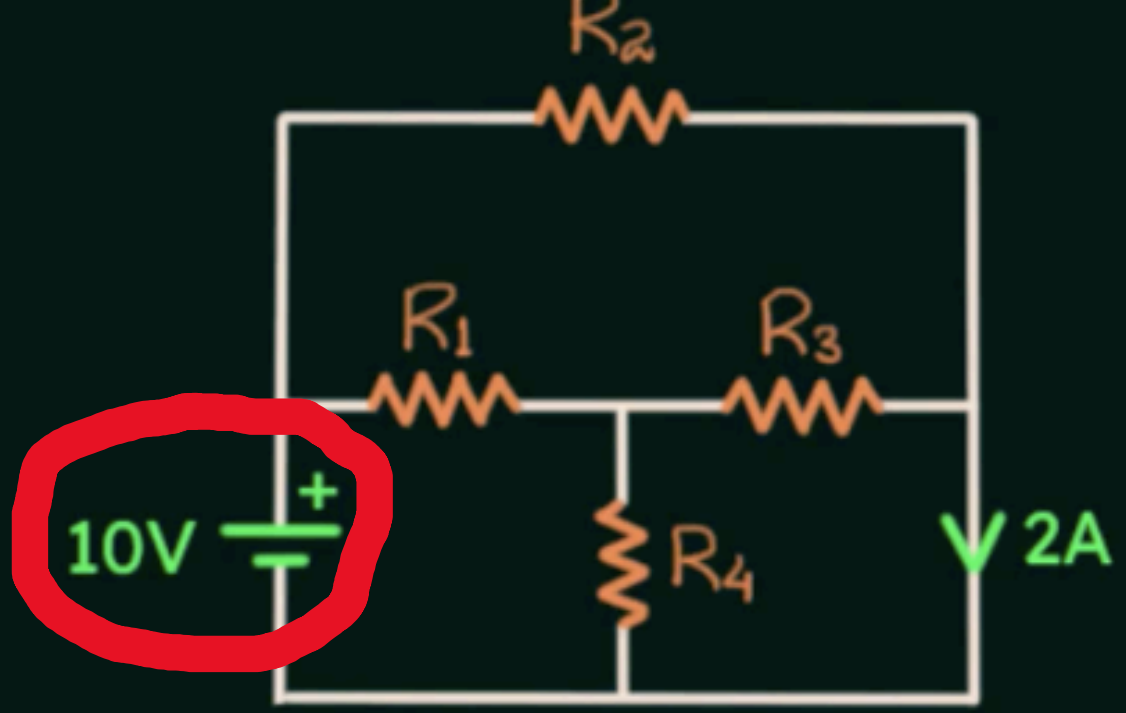

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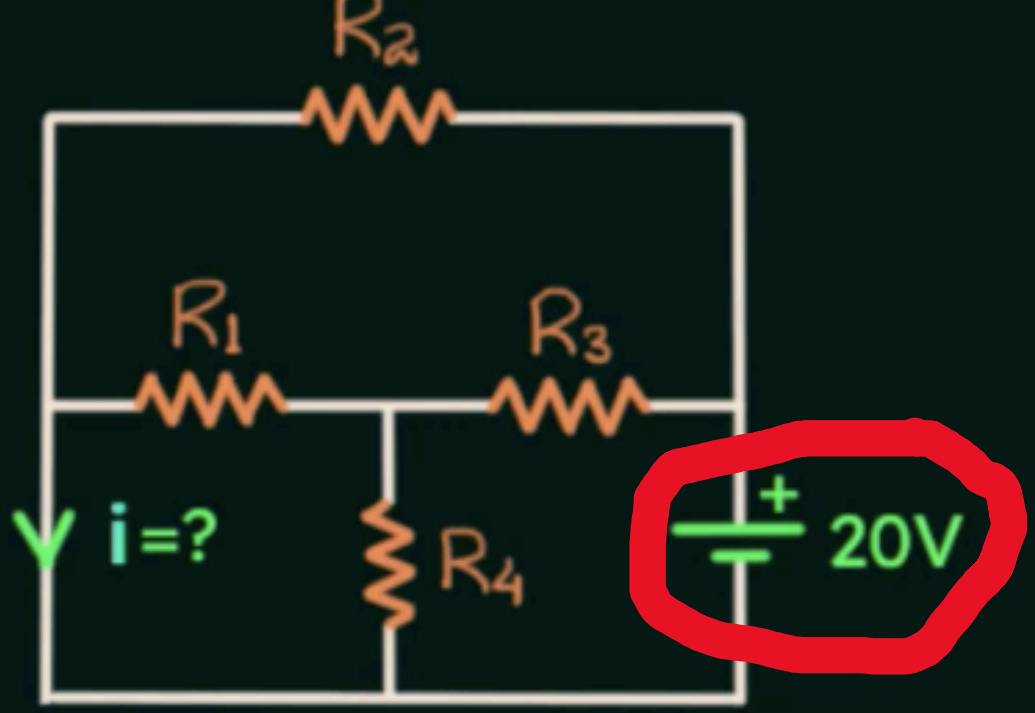

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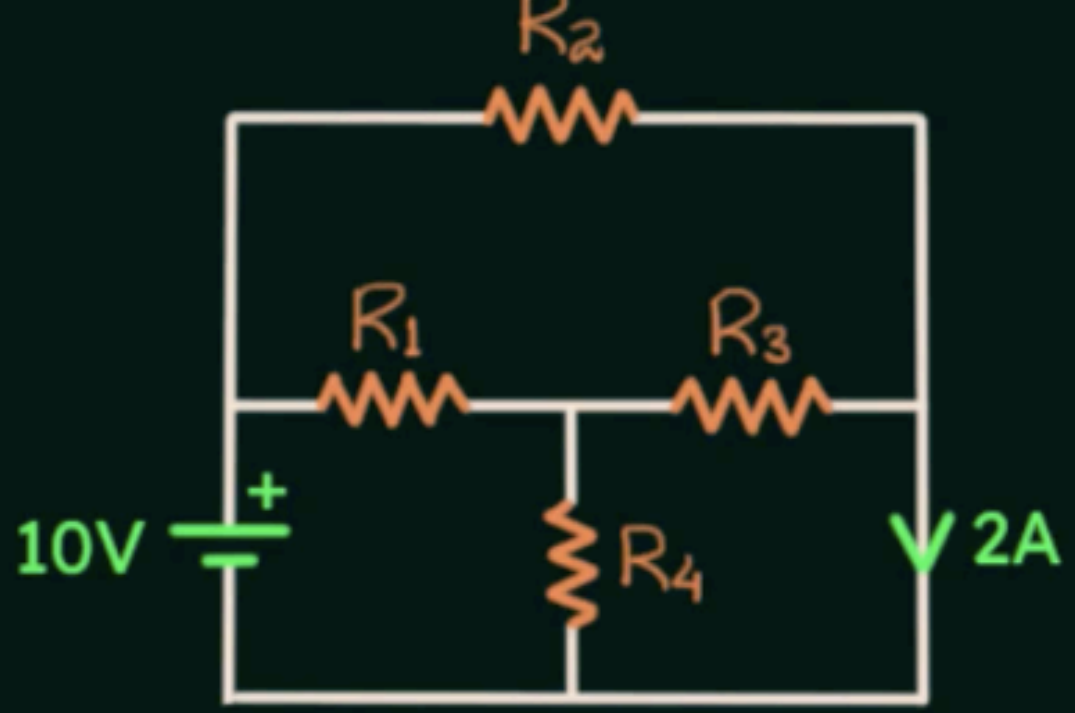

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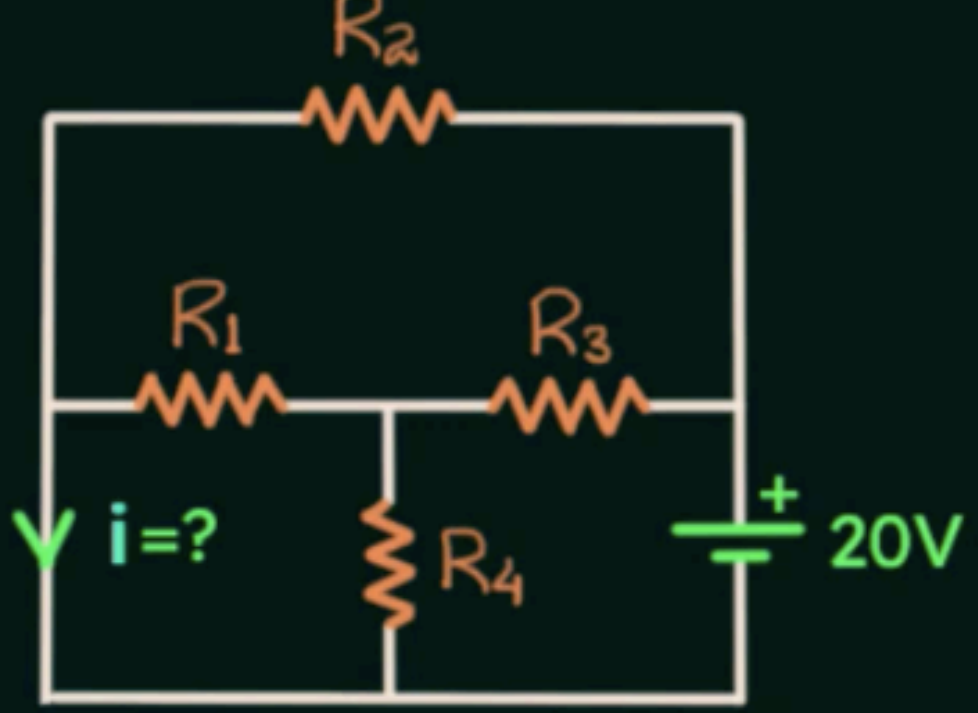

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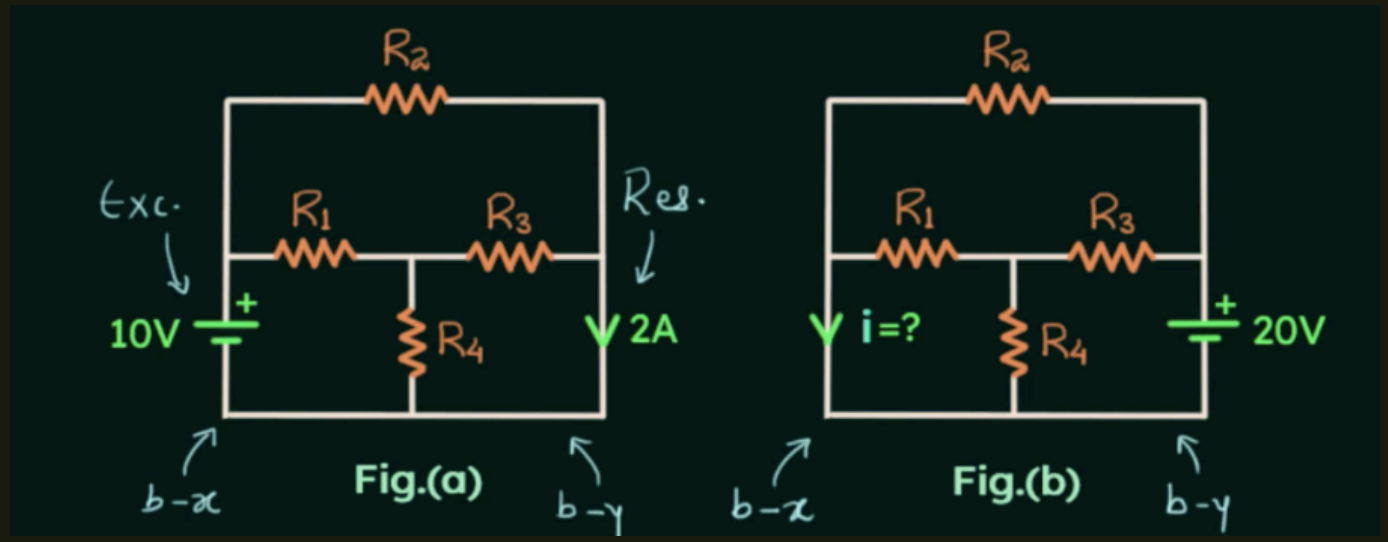

- Ratio of Res and excit. in left side = 2 / 10
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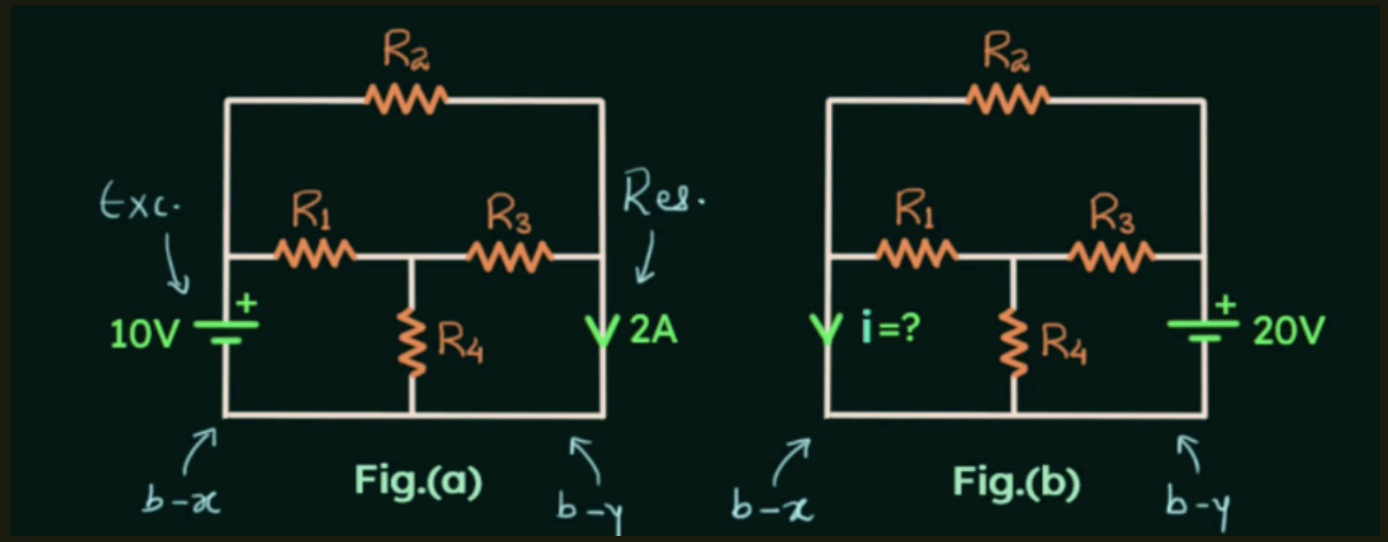
  - 2 / 10 = i / 20
  - i = 4 Amp.
    [our answer]



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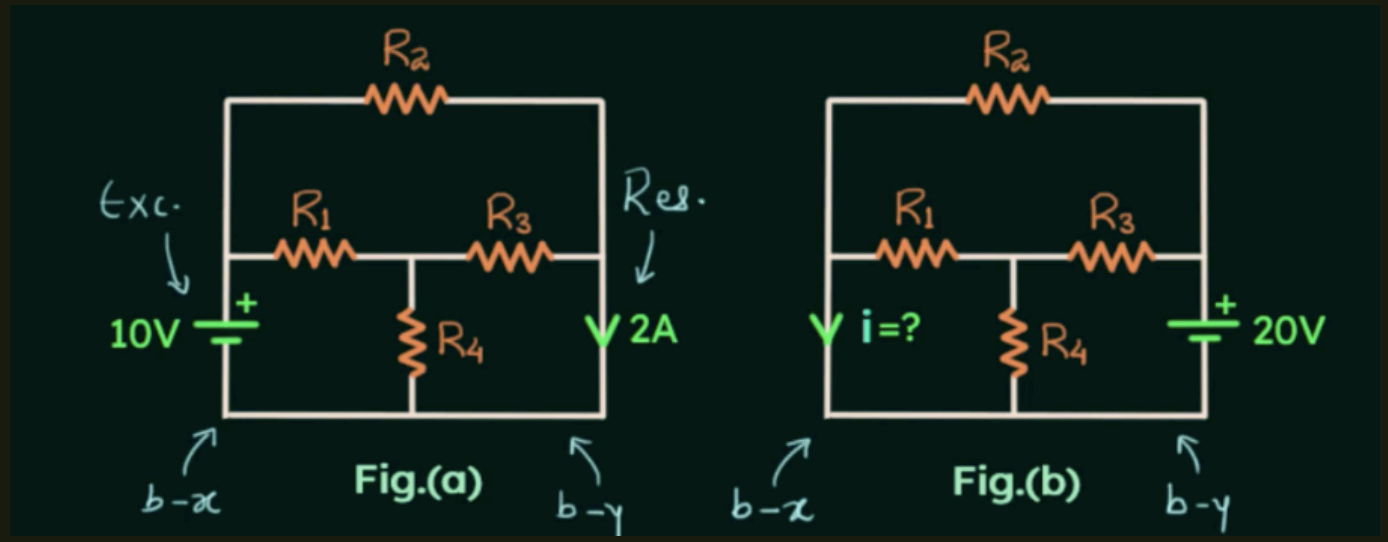

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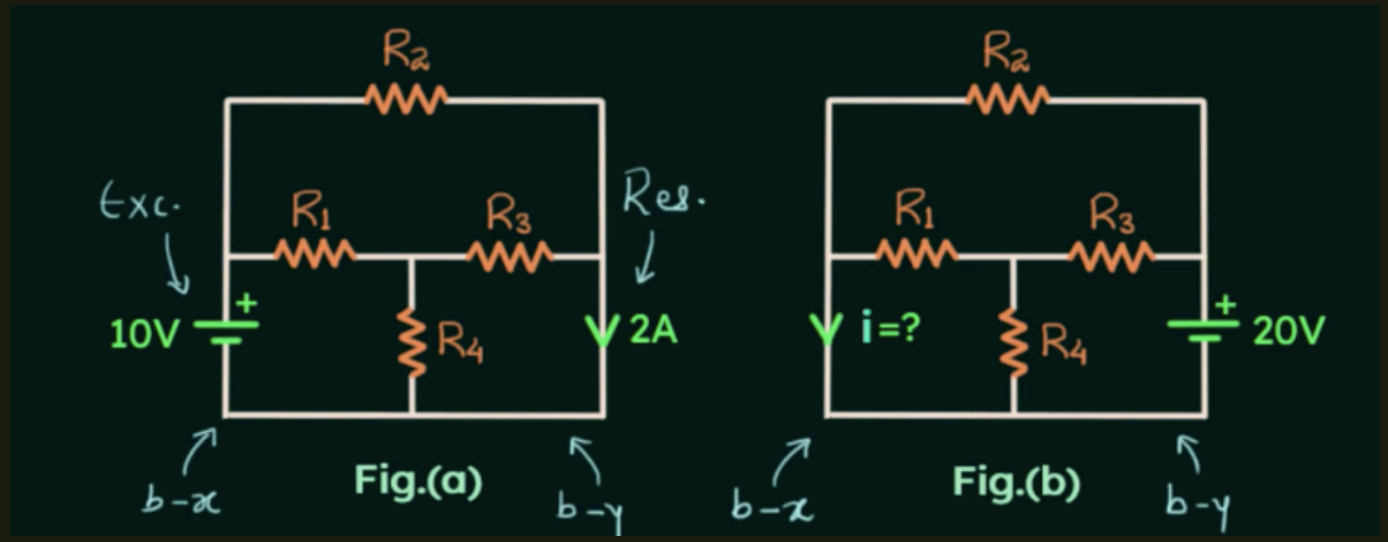

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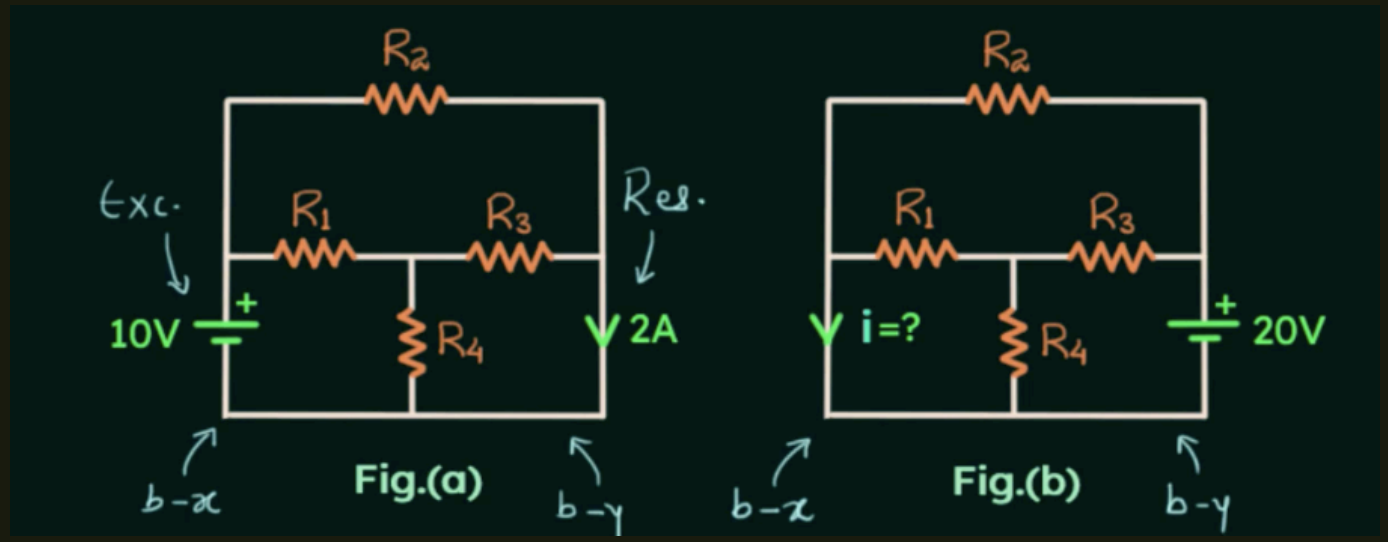

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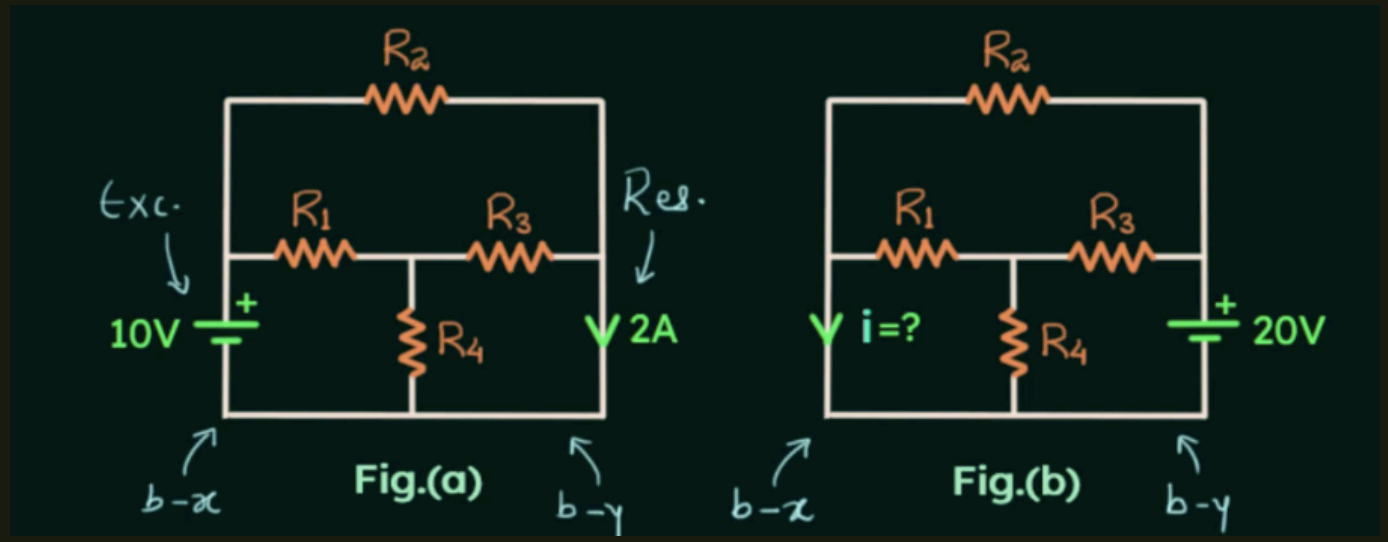

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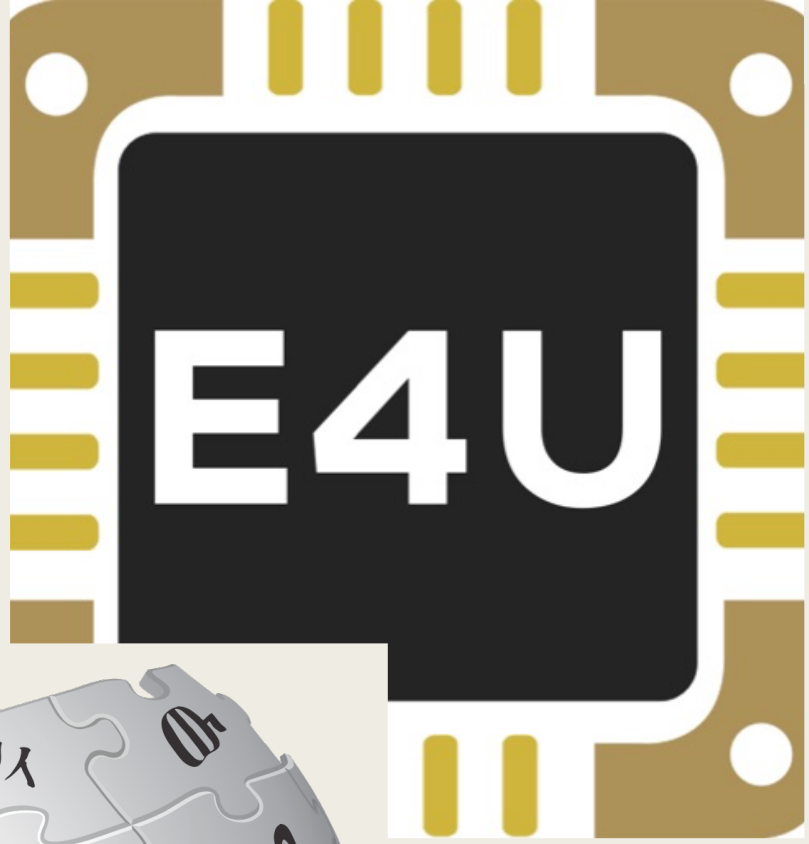

- Neso academy (YouTube)
- Electrical4u
- Electrical voice
- Wikipedia


THANK YOU
FOR YOUR
TIME