BEE1133 Circuit Analysis

Chapter 3A
Circuit Theorem(DC Circuits)

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Chapter Description

Aims

This chapter is aimed to:

1. Explain the Superpositions principle in solving problem related to electric circuit
2. Explain the source transformation principle

Expected Outcomes

Student should be able to

1. Apply the superposition principle for solving the electric circuits problem
2. Use the technique learn in chapter 1 and 2 for finding the current and voltage.
3. Apply the source transformation principle and draw the circuit for solving the electric circuits problem.

References

1. C. Alexander and M. Sadiku, “Fundamentals of Electric Circuits”, 4th ed., McGraw-Hill, 2008.
2. J. Nilsson and S. Riedel, “Electric Circuits”, 8th ed., Prentice Hall, 2008.

BASIC CONCEPT

6.1 Superposition Principles

6.2 Source Transformation

SUPERPOSITION'S THEOREM

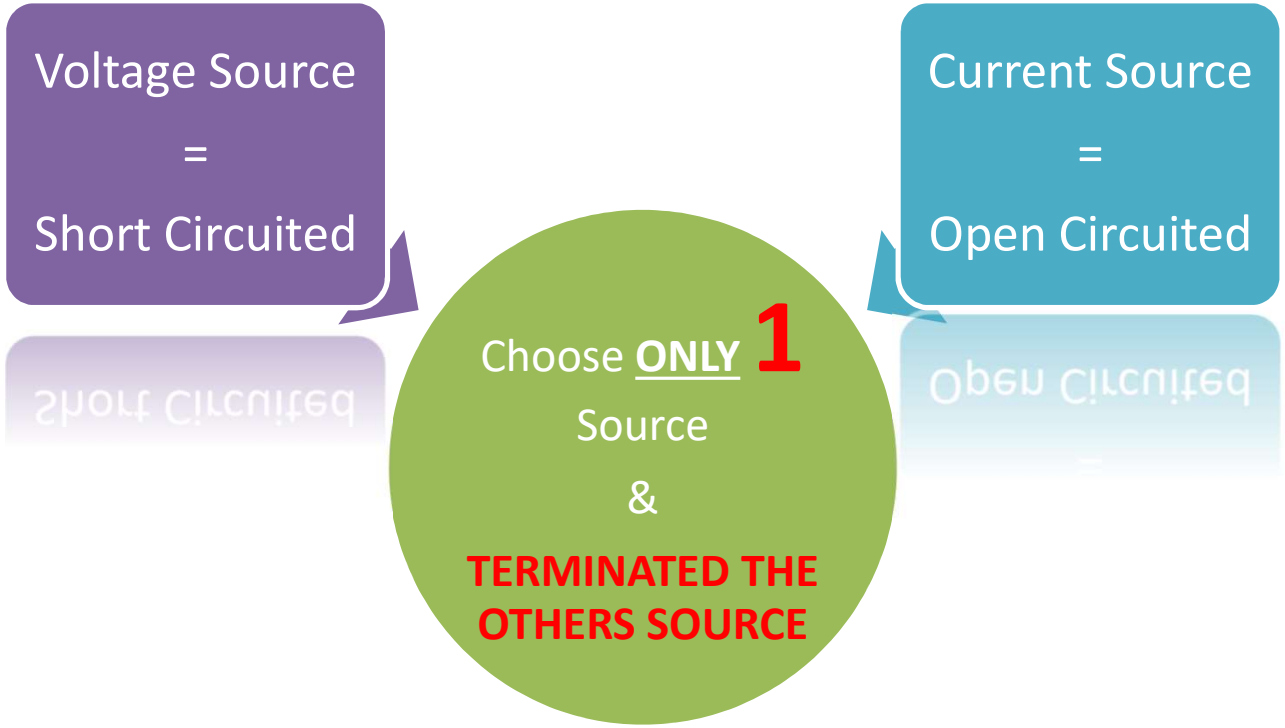
Superposition Theorem

- Apply when the circuit consist 2 or more source that are not in series or parallel. (Why? Discuss with friend)
- Assume that, each source is work independently and the algebraic sum is found to determine a particular unknown quantity of the network.

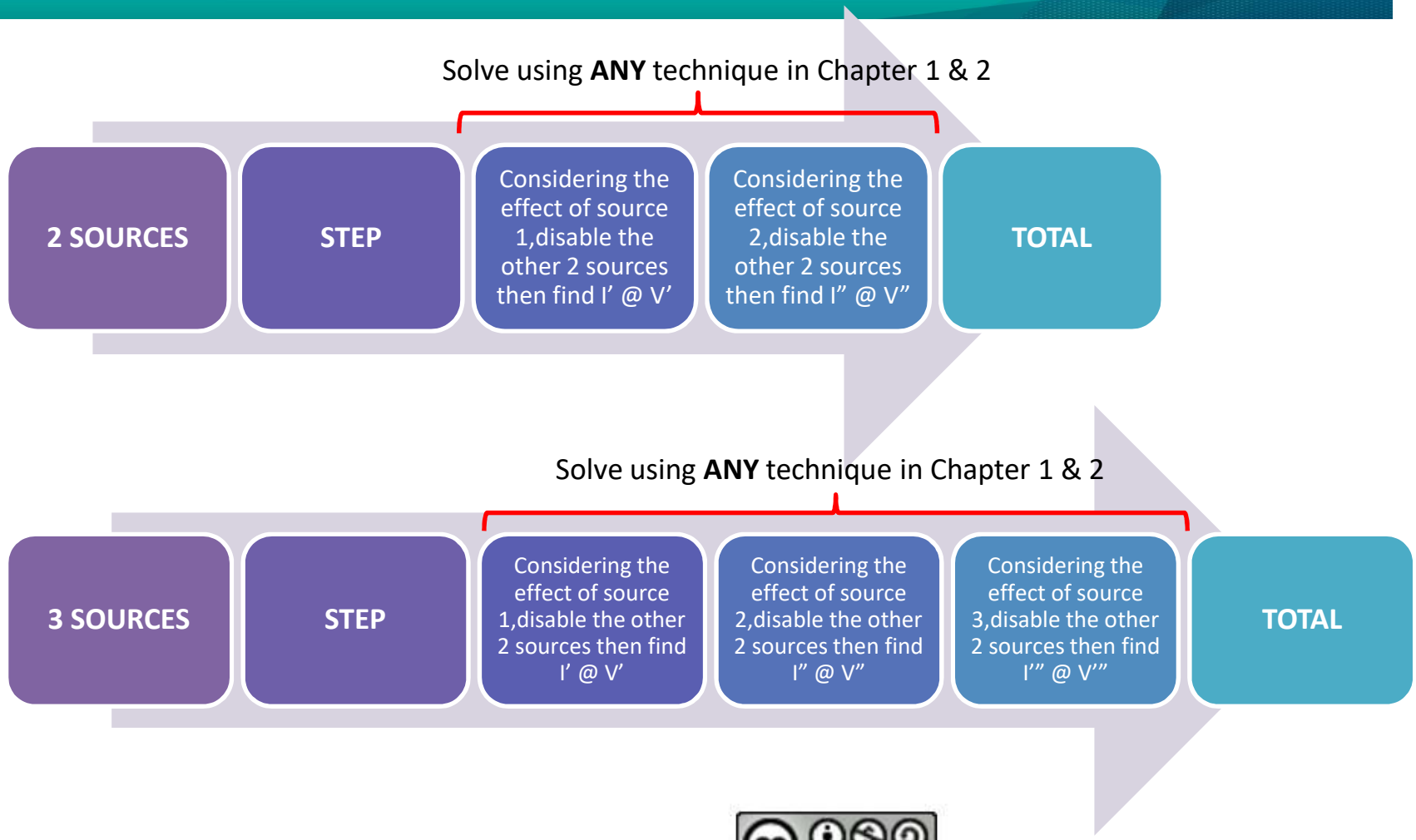
States:

"The current through, or voltage across, an element in a bilateral network is equal to the algebraic sum of the currents or voltages produced independently by each source."

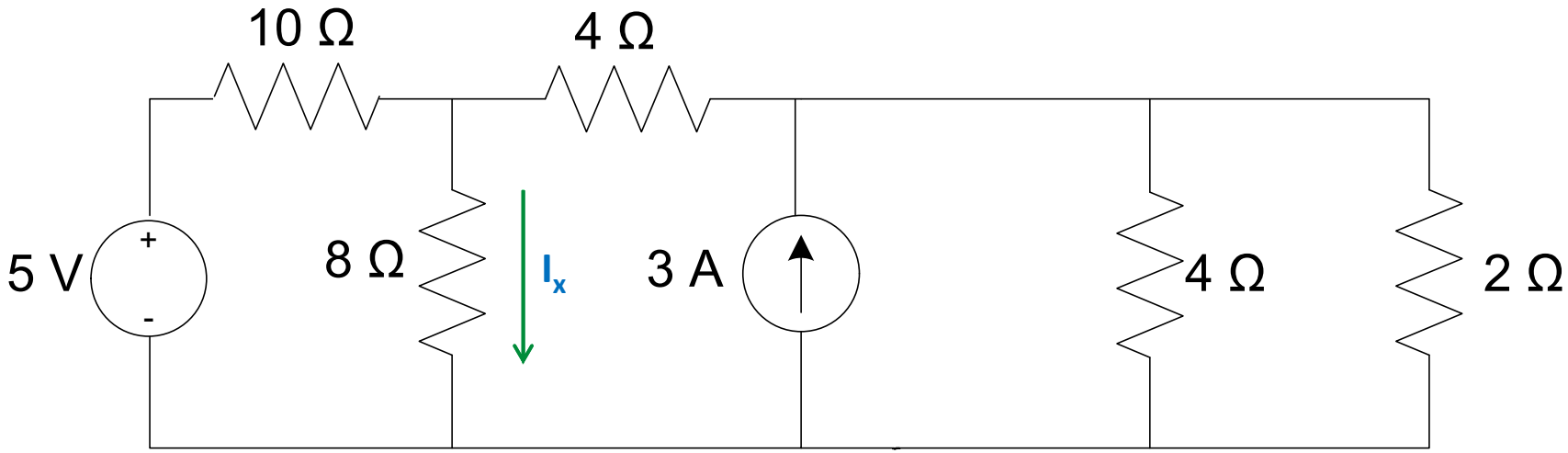
Remember!



Process



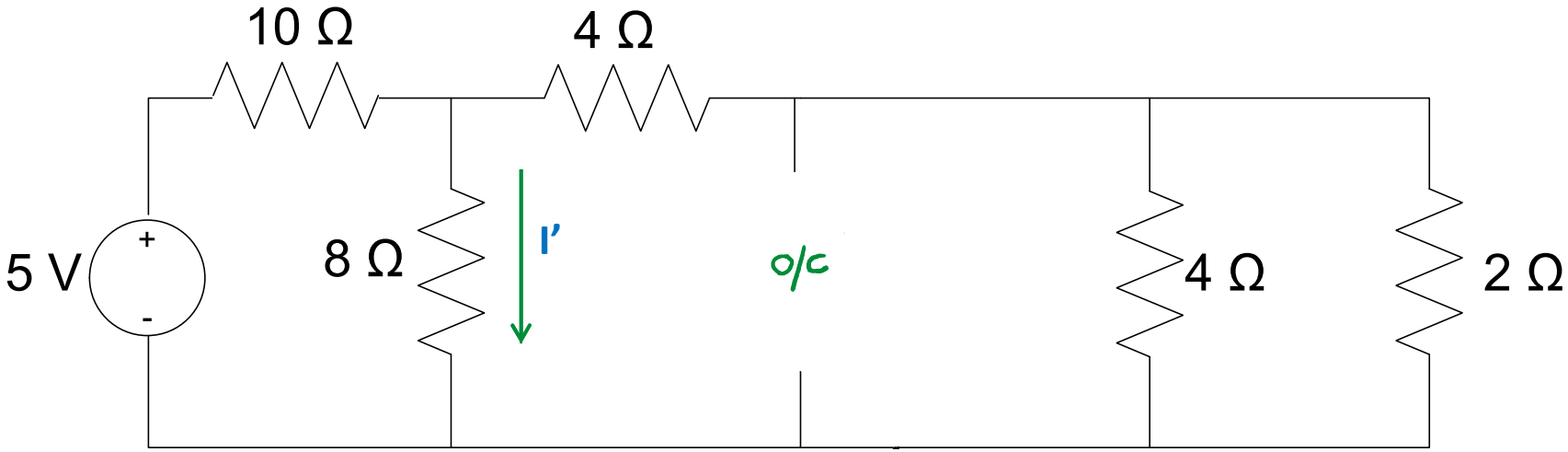
BASIC STEP



Assume that we are trying to find the current, I_x flow through resistor, 8 Ω.

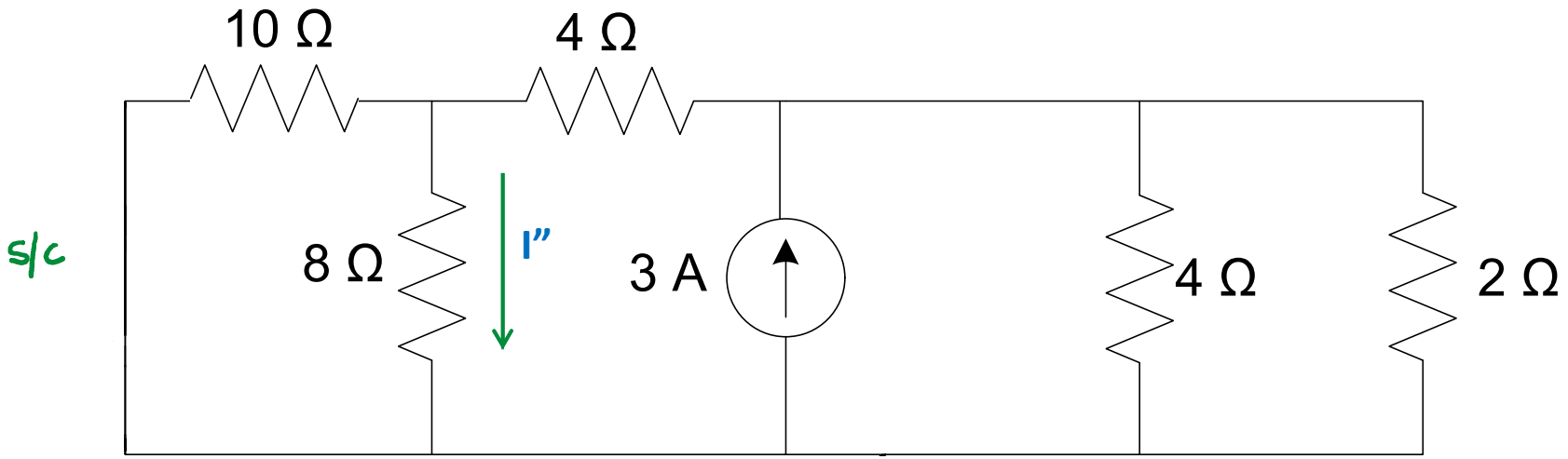
Step 1: Consider the effect of 5-V voltage source

- ✓ **Terminated the 3-A current source by open circuited.**
- ✓ **Find I'.**



Step 2: Consider the effect of 3-A current source

- ✓ **Terminated the 5-V voltage source by short circuited.**
- ✓ **Find I".**



Step 3: Find the total I_x

$$I_x = I' + I''$$

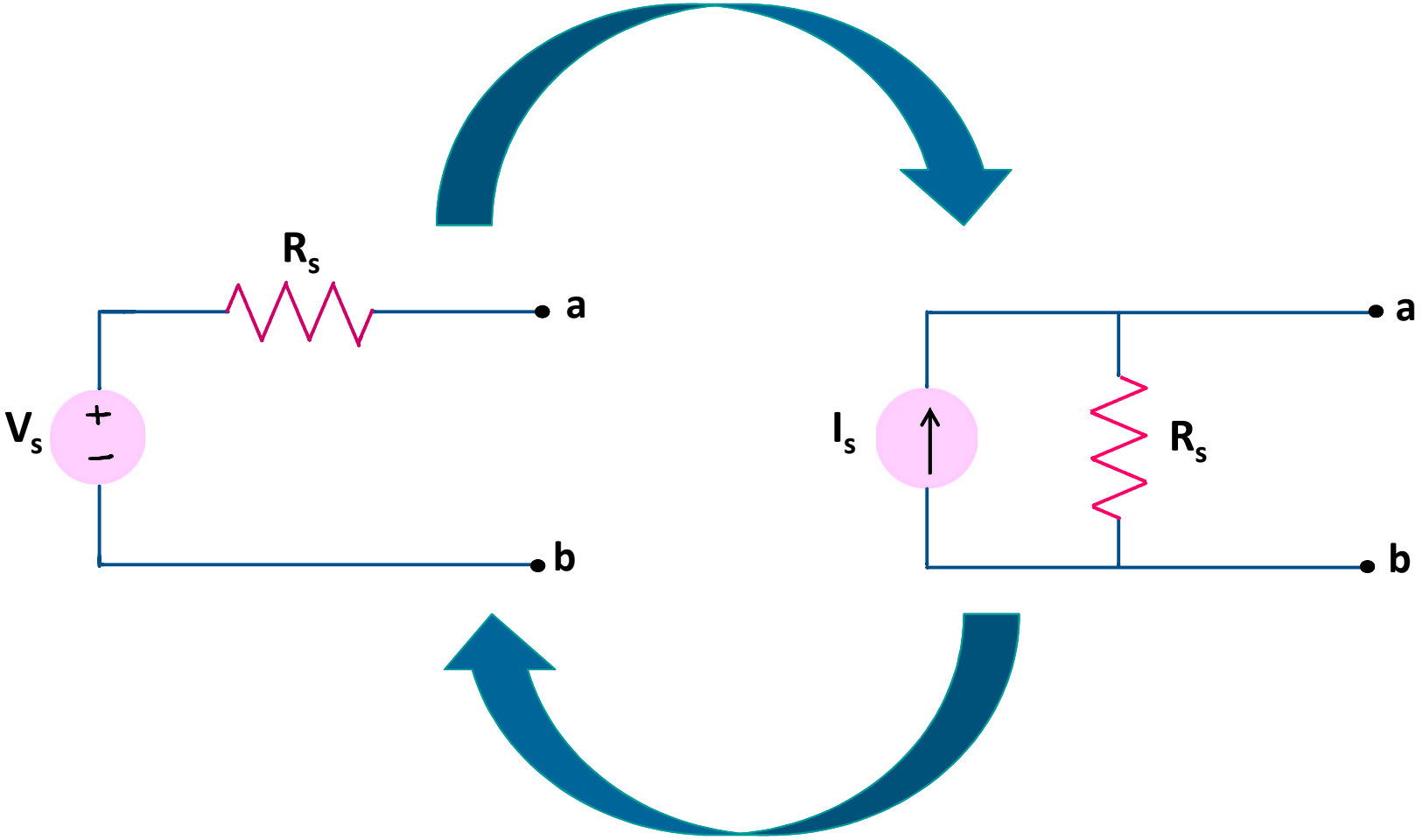
So, what is the answer?

SOURCE TRANSFORMATION'S THEOREM

Source Transformation

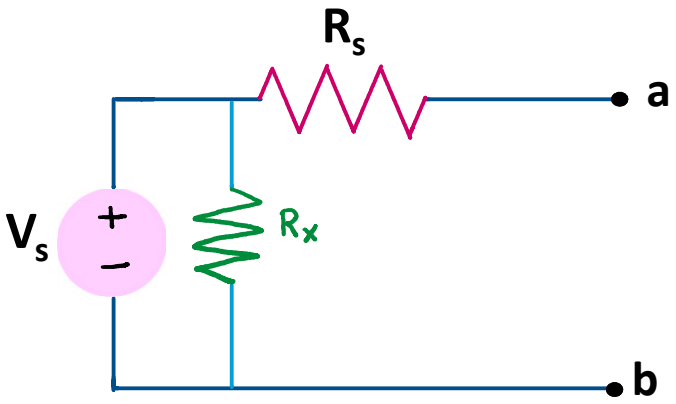
- Simplifying the circuit
- Independent Source ONLY
- By transforming the source, the resistor can be simplified by series or parallel (Before, the resistor not in series or parallel)
- The final circuit should consist ONLY 1 mesh loop and the element that being asked.

HOW TO TRANSFORM?



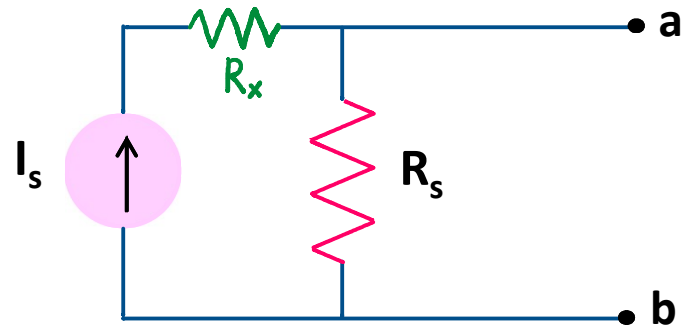
Remember!

Voltage source parallel with R_x



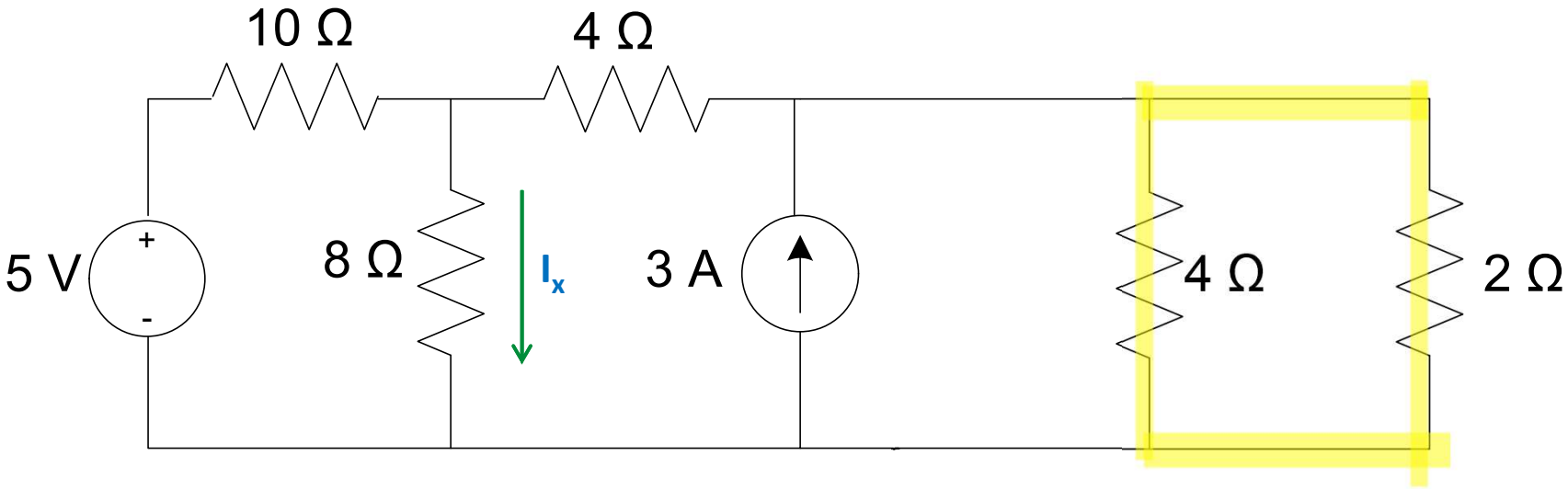
- R_x neglect (remove from the circuit).
- The resistance has no effect on the equivalent circuit because it produce the same voltage in any resistor inserted parallel with V_s

Current source series with R_x



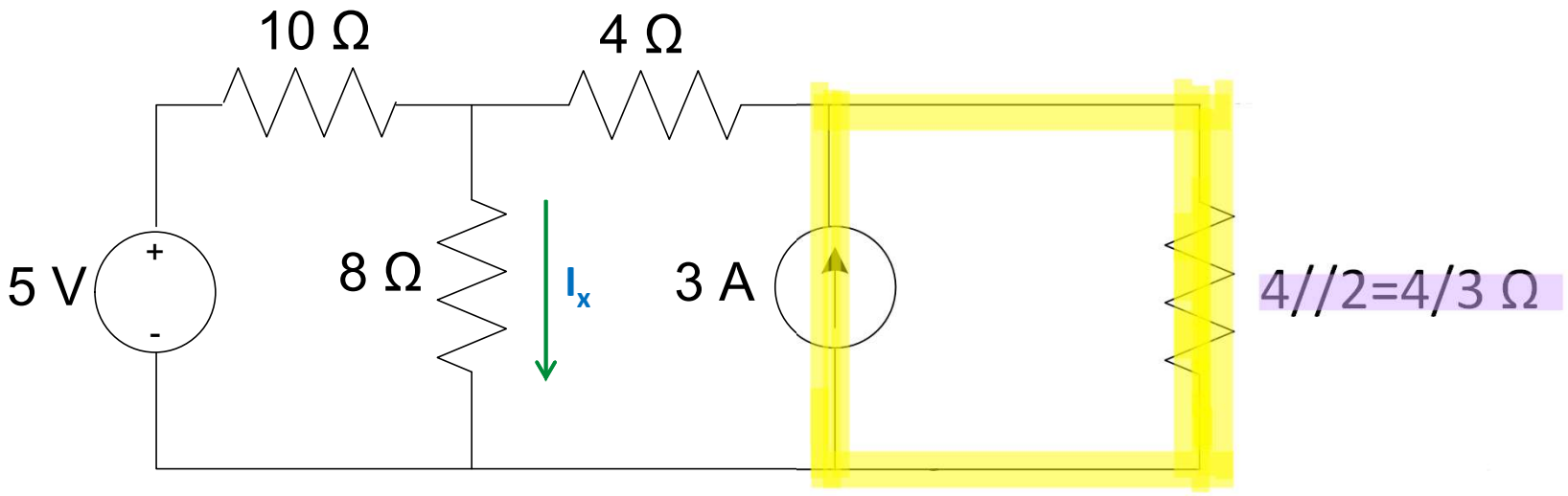
- R_x neglect.
- The resistance has no effect on the equivalent circuit because it produce the same current in any resistor inserted series with the I_s

BASIC STEP

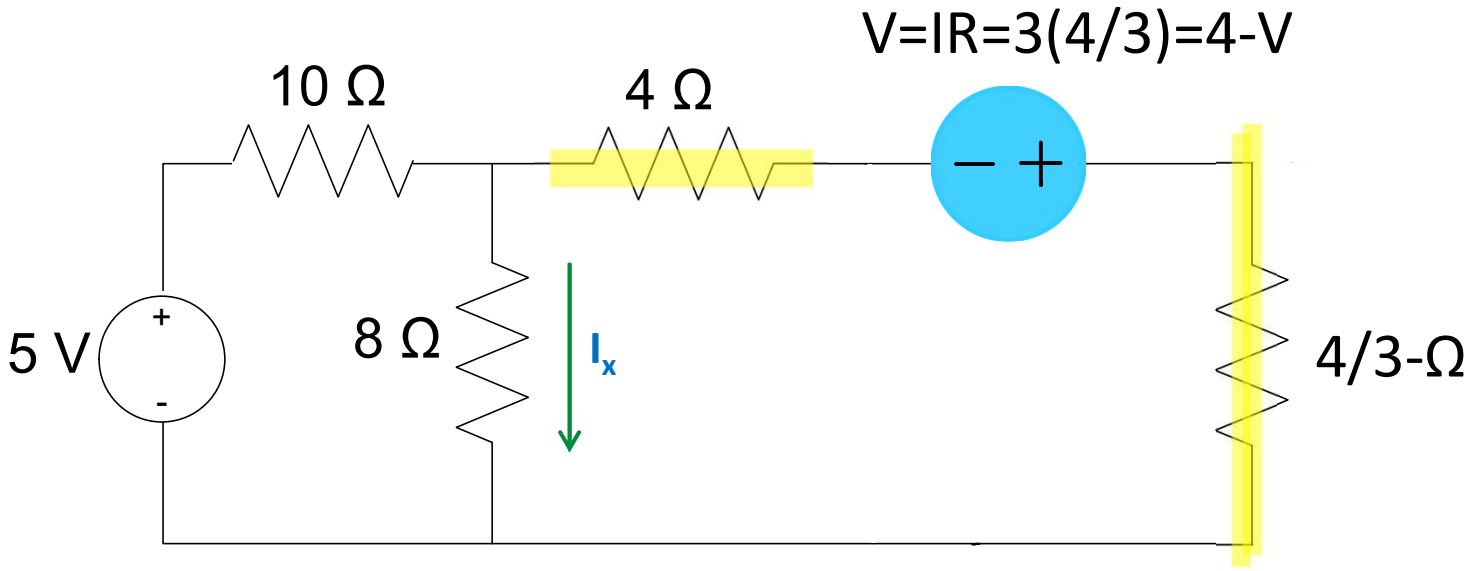


Assume that we are trying to find the current, I_x flow through resistor, 8 Ω.

Step 1



Step 2



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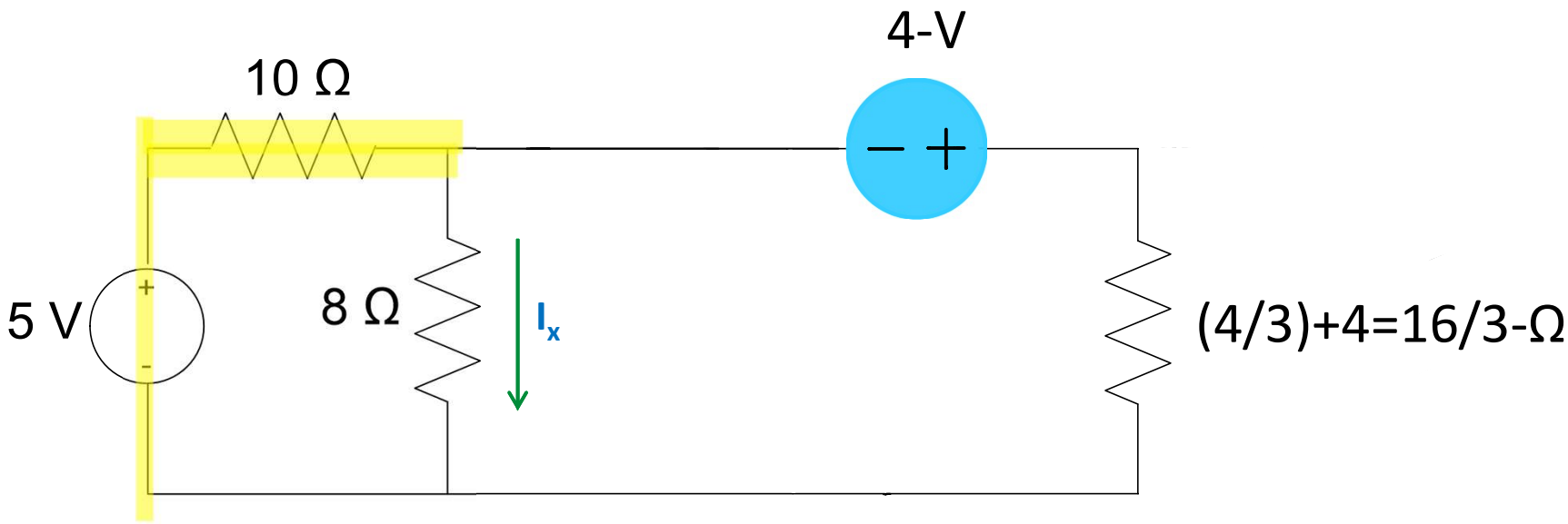
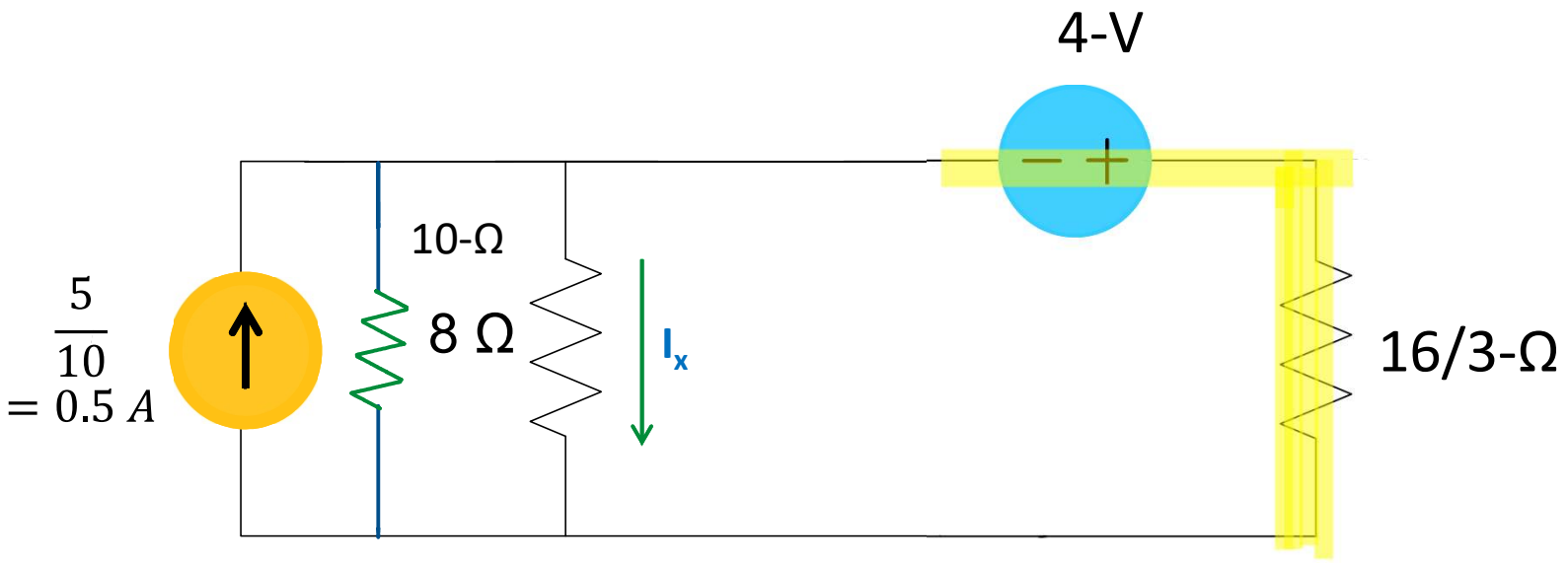
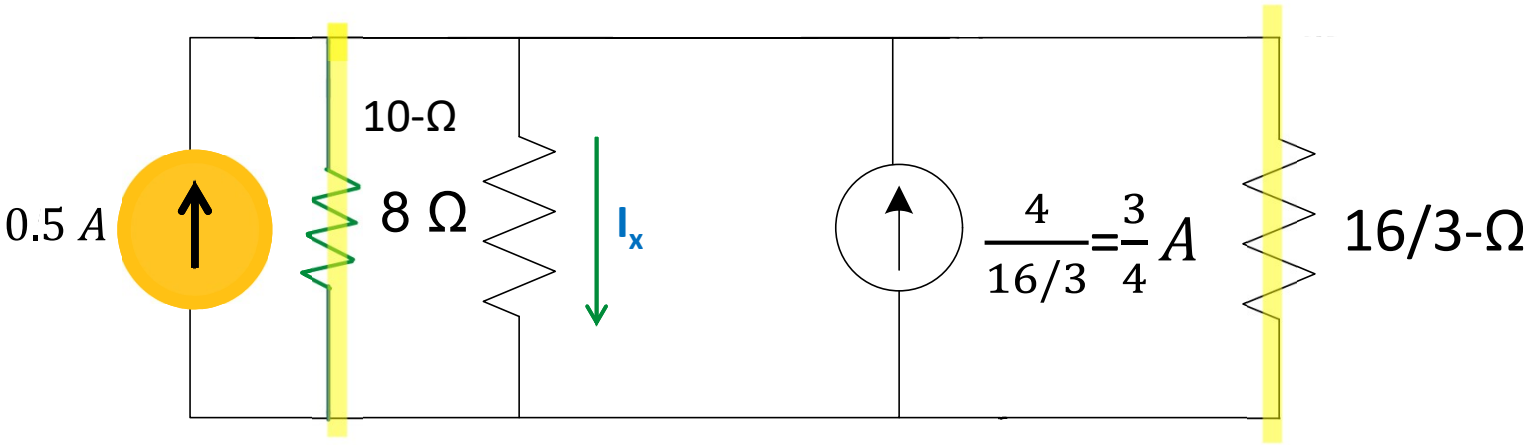
Step 3



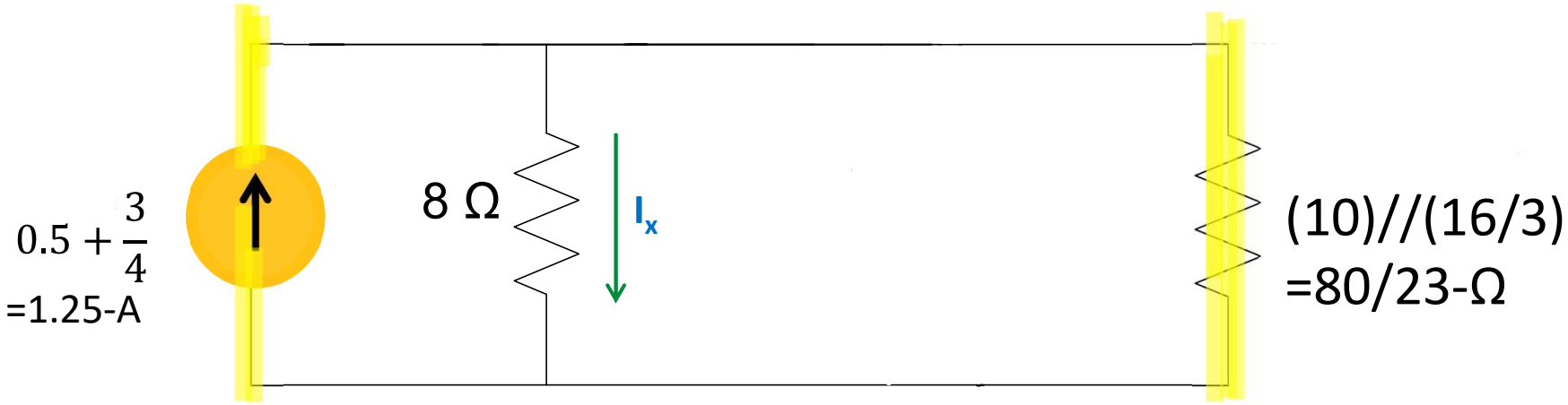
Step 4



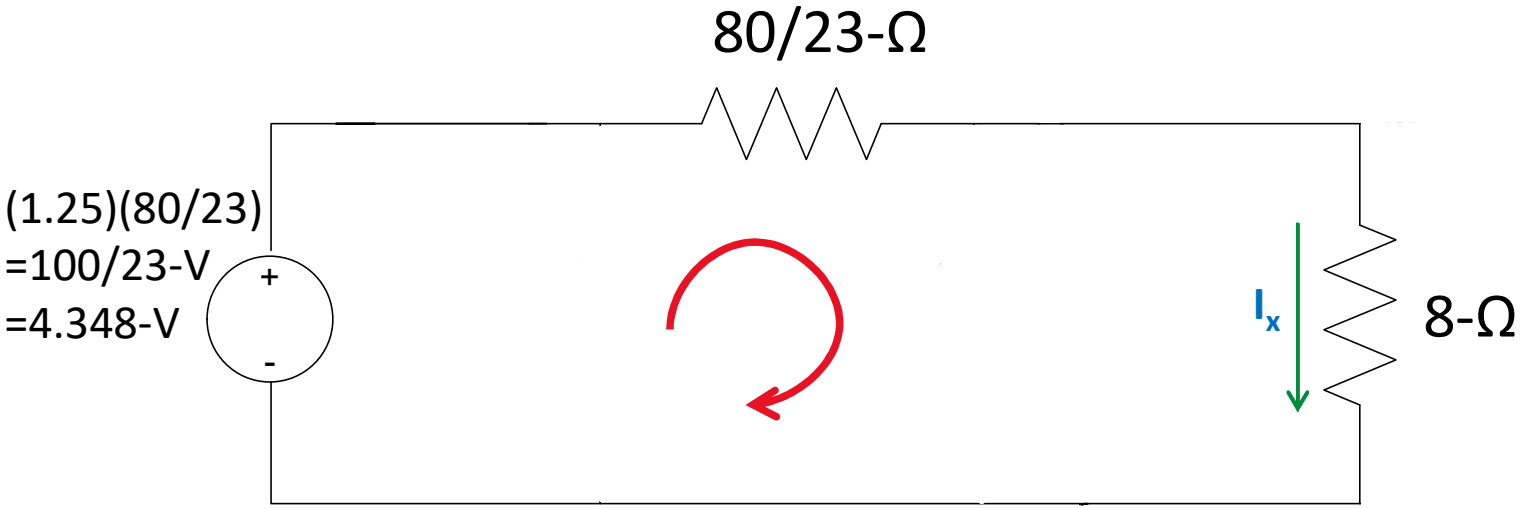
Step 5



Step 6



Step 7



KVL

$-4.348 + I_x(80/23) + I_x(8) = 0$

$$I_x = \frac{4.348}{\left(\frac{80}{23}\right)+8} = 0.3788\ A$$

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