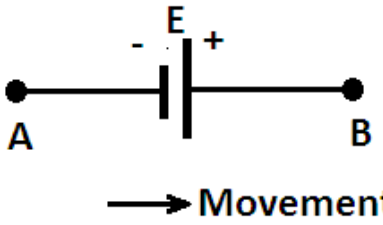
Basic Electrical Technology

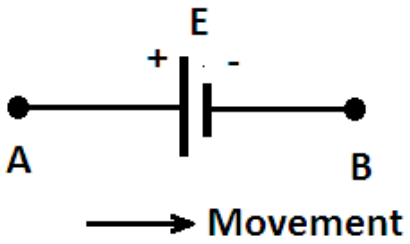
LECTURE 4 – 30 OCTOBER 2021

- NETWORK REDUCTION

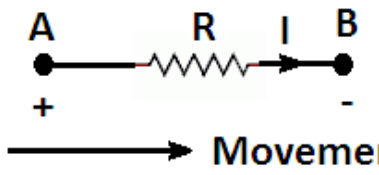
Sign Convention for Kirchoff's Voltage Law (KVL)



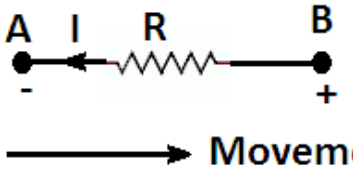
Rise in potential, because we are going negative terminal of the battery to postive terminal.
Therefore, EMF = + E



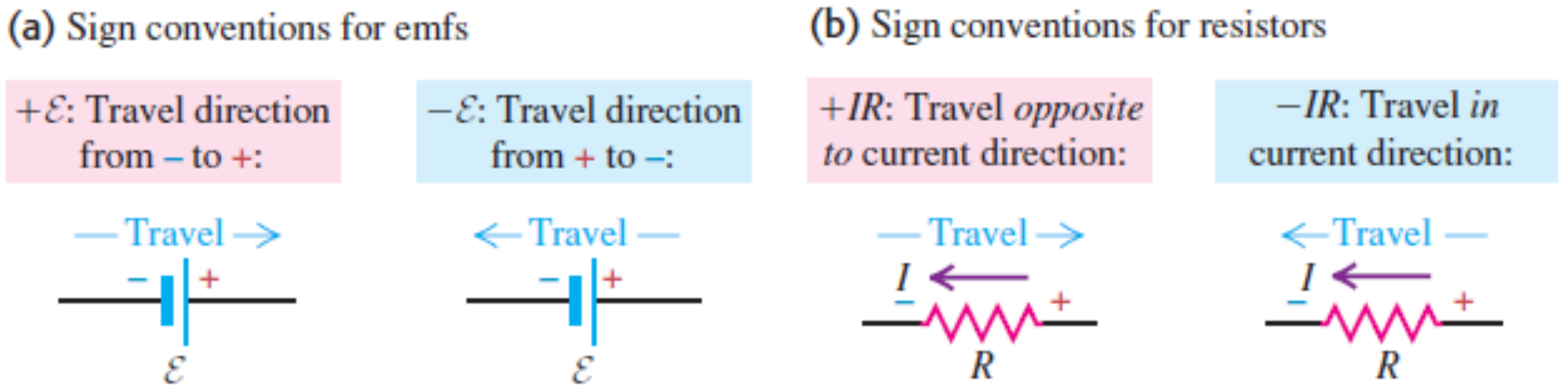
Fall in potential, because we are going postive terminal of the battery to negative terminal.
Therefore, EMF = - E



Fall in potential, because we are going in the direction of current.
Therefore, voltage drop = - IR



Rise in potential, because we are going in opposite direction of current.
Therefore, voltage drop = + IR



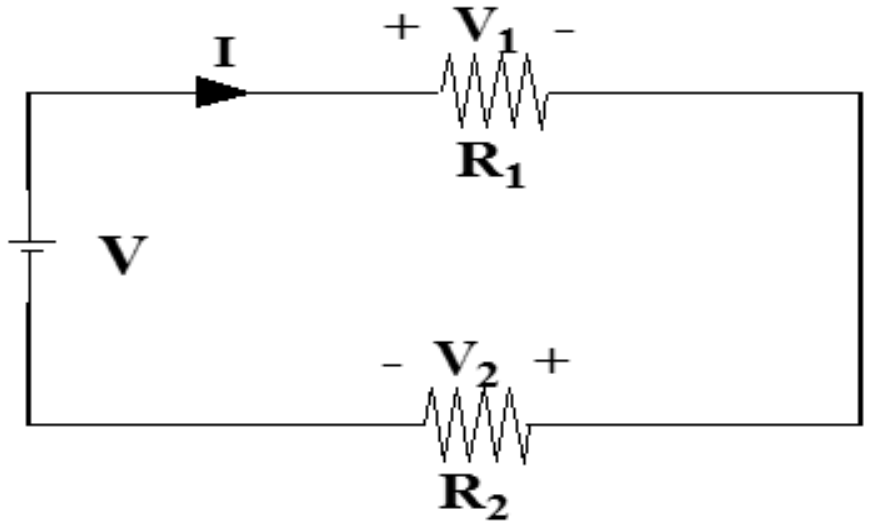
Voltage Division (in Series Circuit)

$$V = V_1 + V_2$$

$$V = V_1 + V_1 \frac{R_2}{R_1}$$

$$V_1 = V \frac{R_1}{R_1 + R_2}$$

$$V_2 = V \frac{R_2}{R_1 + R_2}$$



Current Division (in Parallel Circuit)

$$I = I_1 + I_2$$

$$I = I_1 + I_1 \frac{R_1}{R_2}$$

$$I_1 = I \frac{R_2}{R_1 + R_2}$$

$$I_2 = I \frac{R_1}{R_1 + R_2}$$

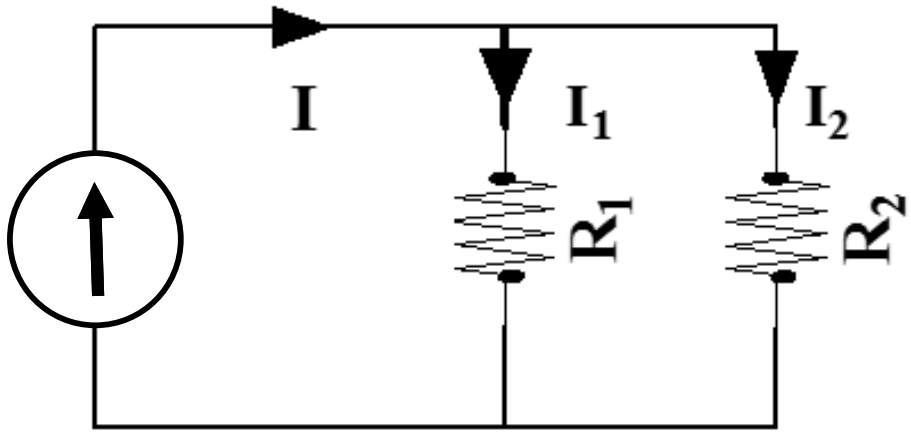
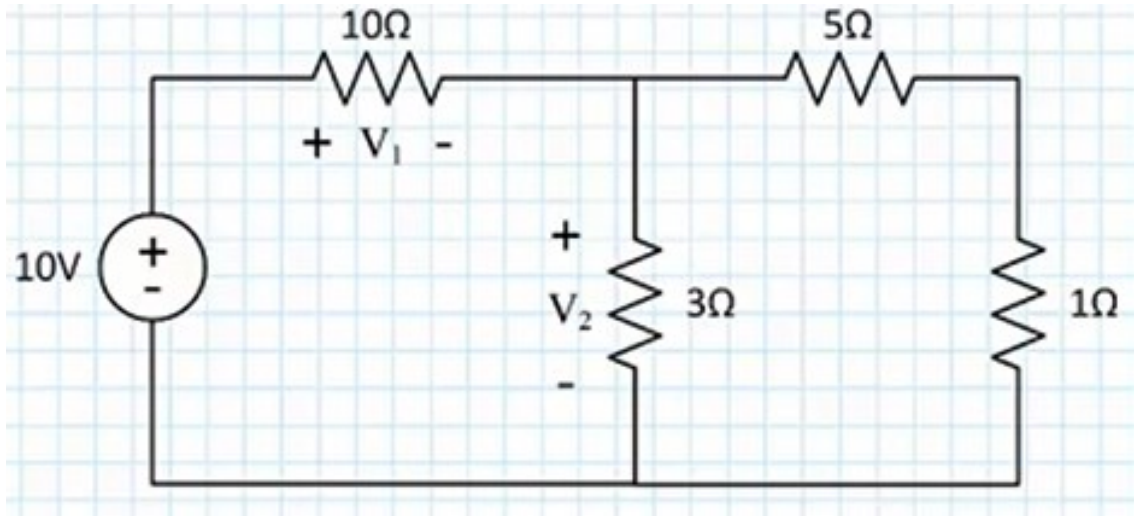


Illustration 1

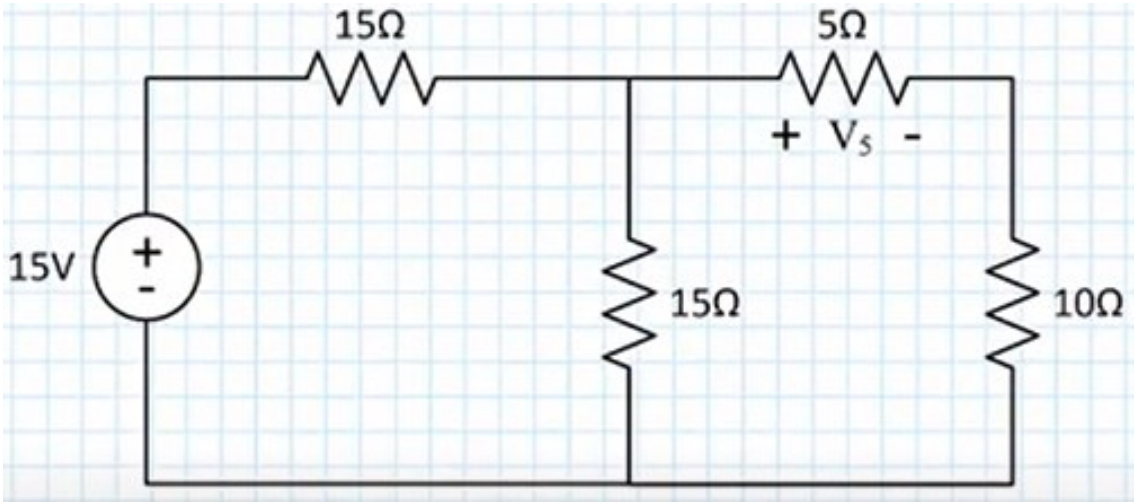
Find voltage V_1 and V_2 as marked in the given circuit using voltage division rule.



Ans: 8.333 V and 1.667 V

Illustration 2

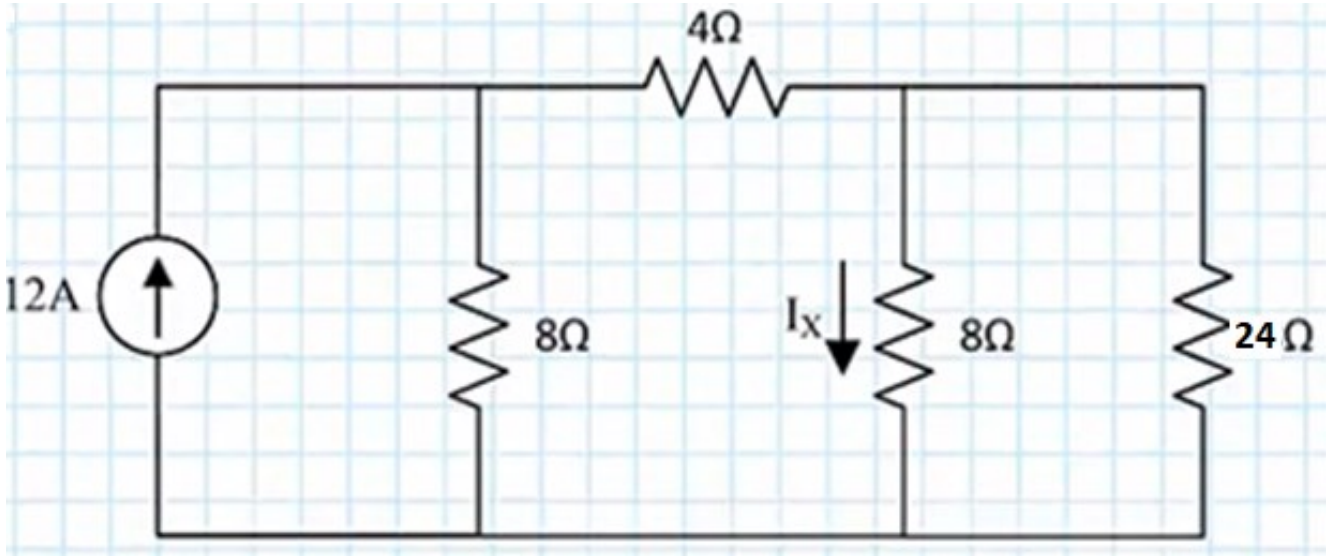
Find voltage V_5 as marked in the given circuit using voltage division rule.



Ans: 1.667 V

Illustration 3

Find current I_x as marked in the given circuit using current division rule.



Ans: 4 A

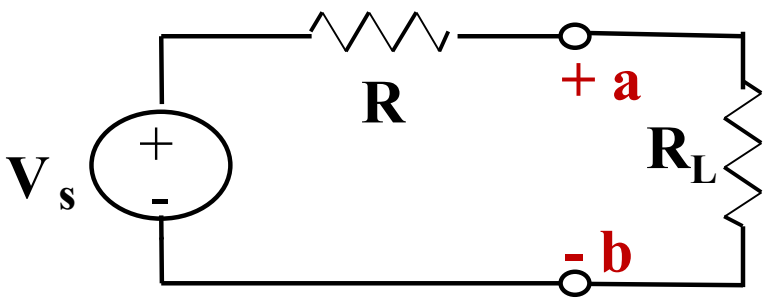
Source Transformation

NETWORK REDUCTION TECHNIQUE

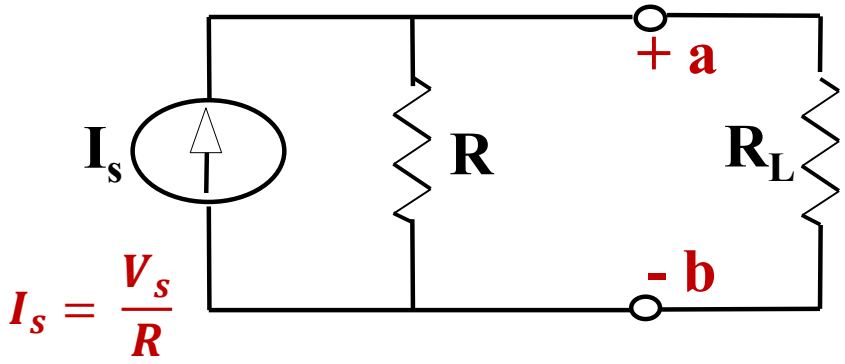
Source Transformation

Source Transformation

Practical Voltage source



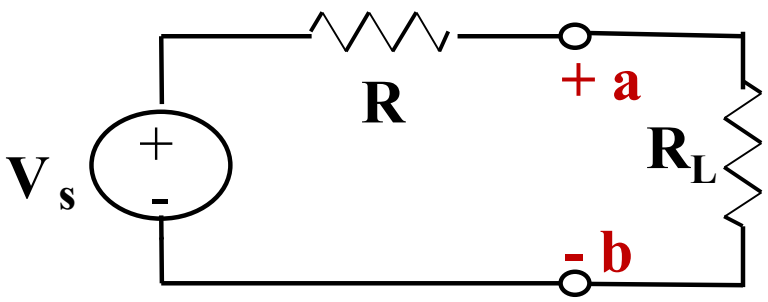
Practical Current source



$$I_s = \frac{V_s}{R}$$

Source Transformation

Practical Voltage source



$$V_s = R \times I_s$$

Practical Current source

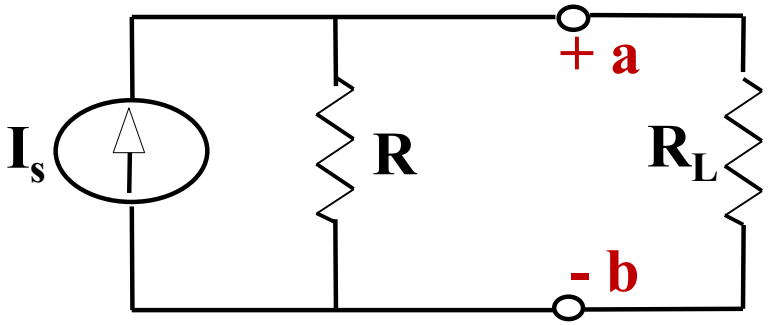
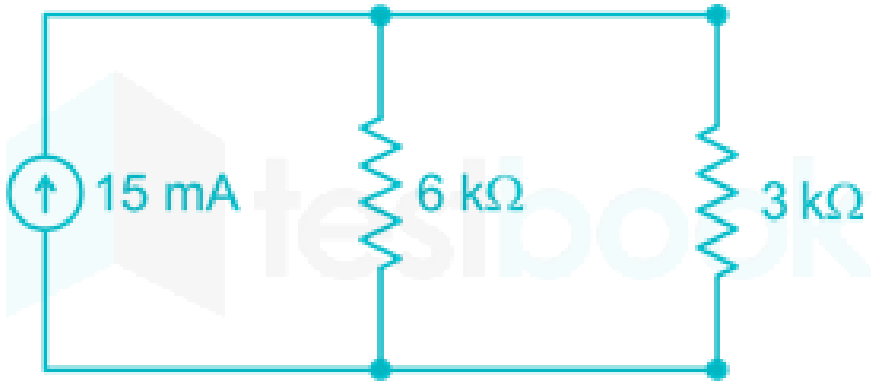


Illustration 4

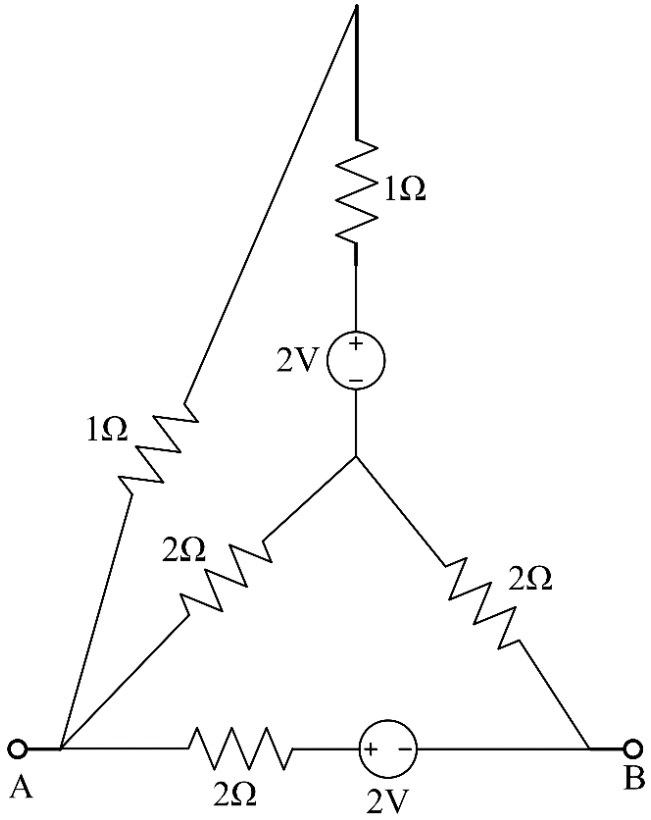
Find current in 6 KΩ resistor by converting current source to a voltage source.



Ans: 5 mA

Illustration 5

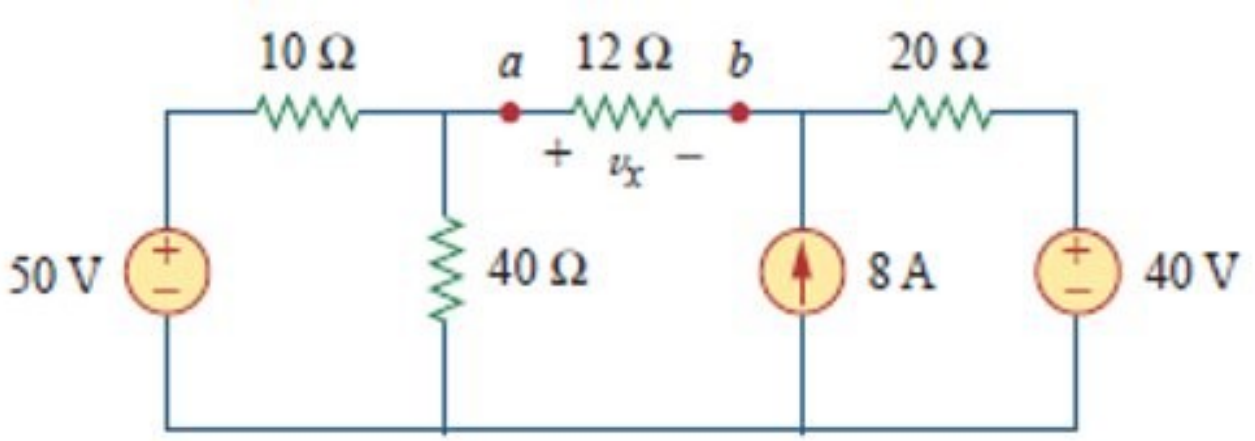
Reduce the following circuit to a current source in parallel with a resistor across the terminals A & B.



Ans. 1.33 A (from B to A) in parallel with 1.2 Ohms

Illustration 6

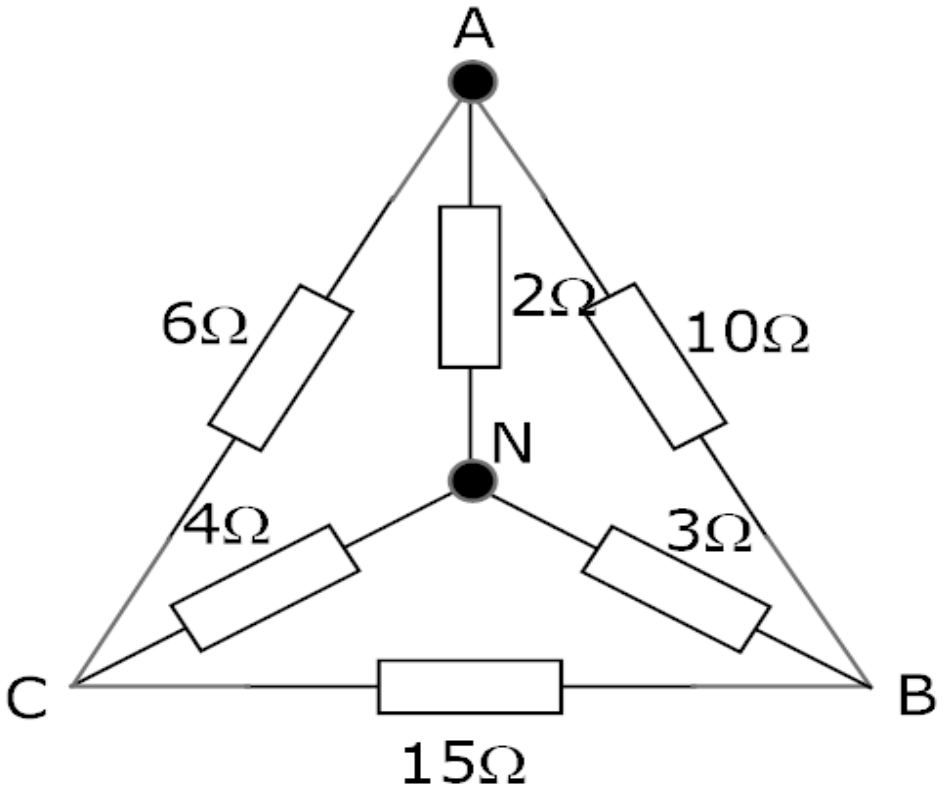
Find the voltage across 12 Ω resistor (i.e., V_x) by source transformation method.



Ans. - 48 V

Homework 1

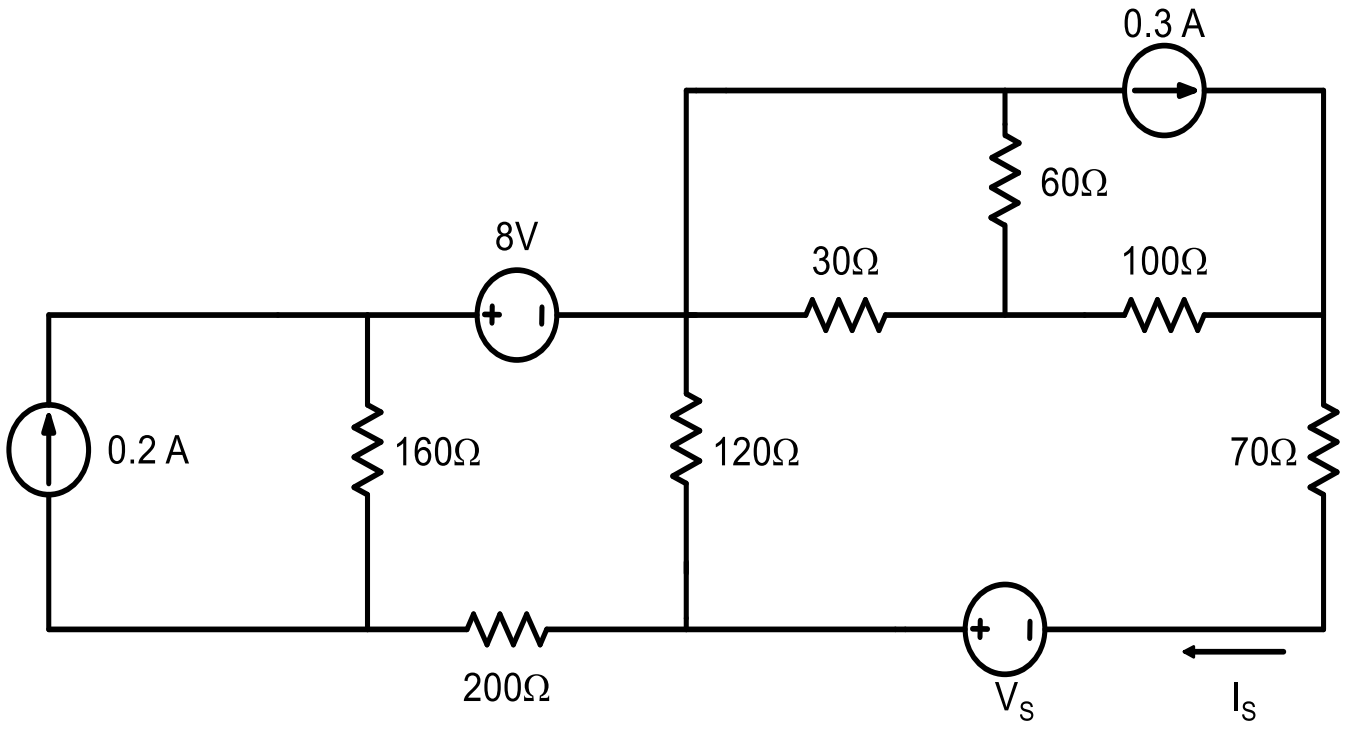
Calculate the equivalent resistance across the terminals A and N.



$R_{AN} = 1.4741\ \Omega$

Homework 2

In the circuit shown, compute the value of V_S needed to deliver a current of I_S = 0.25 A using source transformation.

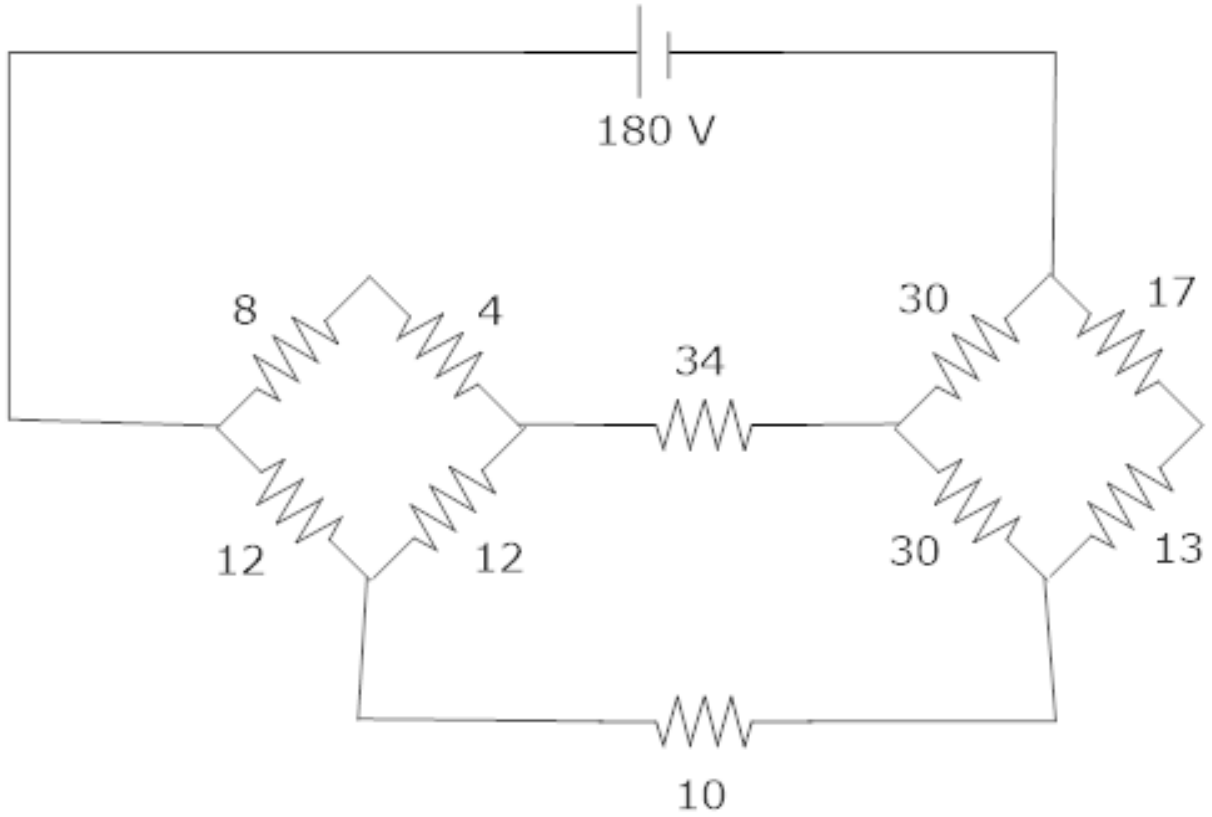


Ans: $V_s = 28\ V$

Quiz Time (Ungraded)

Quiz Question

Determine current flowing through 10 Ohm resistor. All resistances are in Ohms.



Ans. 4 A