Fundamentals of Engineering Design (FED) 101- LCA

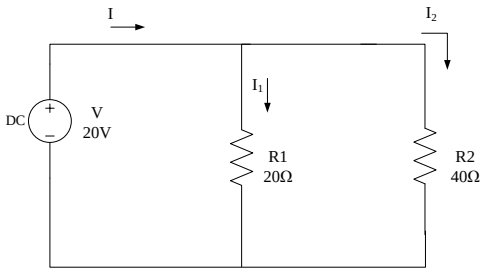
Test 1

Student name:

Student ID number:

Please provide complete and clear answers.

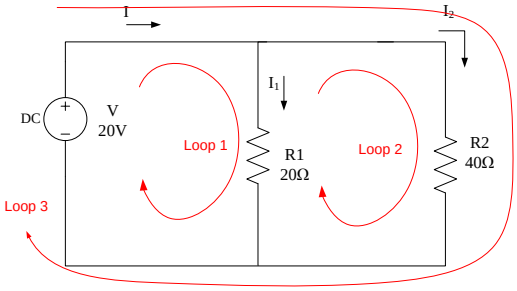
Consider the circuit shown, where R1=20Ω, R2=40Ω.



1. Calculate the current I_1 (3 points)
2. Calculate the current I_2 (3 points)
3. Find R_{eq} and calculate the current I (4 points)

Solution:

1. First, we identify the loops in the circuit.



Applying Kirchoff's Voltage Law to loop 1:

$$V - V_{R1} = 0$$
$$V_{R1} = V = 20V$$

Applying Ohm's Law to R_1

$$V_{R1} = I_{R1}R1$$
$$I_{R1} = \frac{V_{R1}}{R1} = \frac{20V}{20\Omega} = 1A$$

2. We can use either Loop 2 or Loop 3. Applying KVL to Loop 2.

$$V_{R1} - V_{R2} = 0$$
$$20V - V_{R2} = 0$$
$$V_{R2} = 20V$$

Applying Ohm's Law

$$V_{R2} = I_{R2}R2$$
$$I_{R2} = \frac{V_{R2}}{R2} = \frac{20V}{40V} = 0.5A$$

3. First determine the equivalent resistance of the circuit

$$R_{eq} = \frac{R1R2}{R1 + R2} = \frac{20 * 40}{20 + 40} = 13.33\Omega.$$

Applying Ohm's Law

$$V = IR_{eq}$$
$$I = \frac{V}{R_{eq}} = \frac{20V}{13.33\Omega} = 1.5A$$

Notice that even though the voltage drops across both resistors were equal, the currents were different.