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Enter your name and UIN at the top of the first page of your work paper.

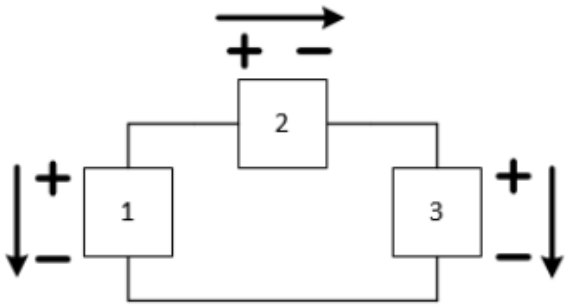
In ECE 110, there are several ways students will submit assessments, each providing pros and cons from an educational perspective. PrairieLearn is great to allow students to gain practice with large numbers of problems. Since these problems are auto-graded, they allow the instructor to put more time into developing good problems and less time into grading while also providing the student with immediate feedback. Since the student's handwritten solution is not collected for grading, the student can also work more quickly on these problems without concern for penmanship or clarity of the problem-solving process. This last point is also exactly why PrairieLearn can't be the only assessment. Engineers need to not only be able to solve technical problems, they need to be able to communicate those solutions to other engineers and the public at large. When you apply for an internship, a permanent job, or graduate school, the recruiter will ask about your ability to communicate in both oral and written formats. ECE 110 will assist in building your oral communication skills through regular video submissions created individually by each student. ECE110 will also help develop your written communication skills through written (submitted via GradeScope) lab write-ups, homework, and other assessments.

Show your written solution to the problems below (which are similar to two problems from the corresponding PrairieLearn assignment). You must show all your work and the work must be your own (do not collaborate, copy, or share your solution with other students). The graders will expect to see:

- The problem re-written, including any circuit schematic, etc., with parts, polarities, etc. labeled as needed for clarity in the solution in your own handwriting.
- The circuit redrawn, even if a circuit diagram is already given in the problem.
- A solution that defines the steps and is easy to follow.
- An answer with no clear work shown will receive no credit!
- When showing your work, make sure to include
    - All equations you are using.
        - Make sure to give the general equation first with variables before plugging in numbers.
        - Label equations as necessary. For example: "Ohms Law: V=IR"
    - All units for values that you are using.
    - Significant figures relevant to the problem.
    - Clearly state any assumptions you make including but not limited to: voltages, currents, series or parallel resistors, direction of current, polarity of voltage.
    - Clearly state any approximations you have used to simplify your work.
- Please box the final answer that you submit as correct.

1.

The polarities of the voltage and current for elements 1-3 are shown in the figure below.



$V_1 = 18\ V$

$V_3 = 37\ V$

$I_2 = 19\ A$

Use Kirchhoff's Voltage Law to determine the voltage V_2 in the circuit above.

$V_2 =$ [ ] V

(within three significant digits)

Use Kirchhoff's Current Law to determine the current I_1 in the circuit above.

$I_1 =$ [ ] A

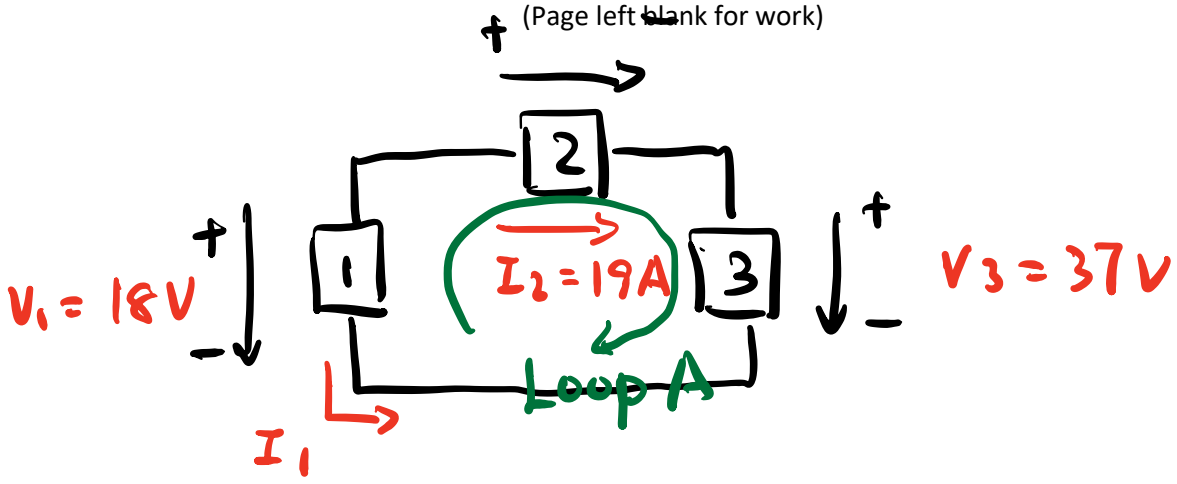
(within three significant digits)

Use Kirchhoff's Current Law to determine the current I_3 in the circuit above.

$I_3 =$ [ ] A

(within three significant digits)

(Page left blank for work)



(1) Look at the Loop A, we see

$$V_2 + V_3 - V_1 = 0V$$

$$V_2 + 37V - 18V = 0V$$

$$\boxed{V_2 = -19.0V} \quad (3\ S.D.)$$

(2) Look at the node A, we have

current out ↘ ↙ current in

$$I_1 + I_2 = 0A$$

$$I_2 + 19A = 0A$$

$$\boxed{I_1 = -19.0A} \quad (3.\ S.D.)$$

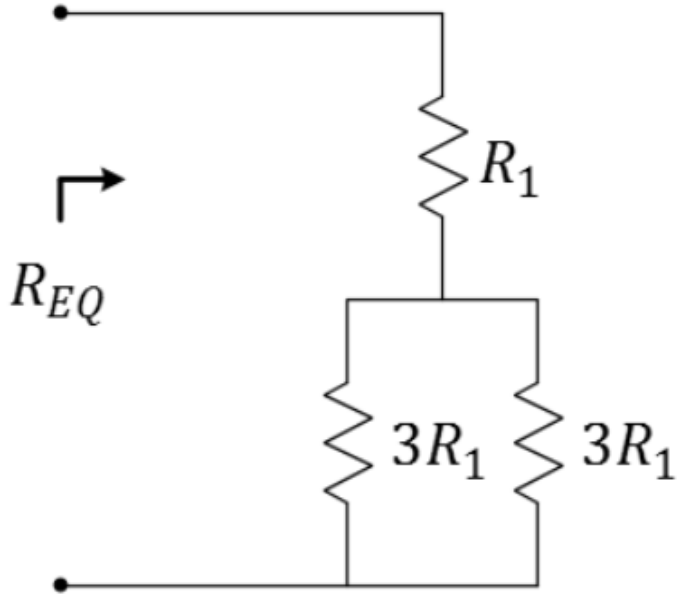
(3) Similar as (2), look at node C

$$I_2 = \boxed{I_3 = 19.0A} \quad (3.\ S.D.)$$

I_2: ↑ current in

I_3: ↖ current out

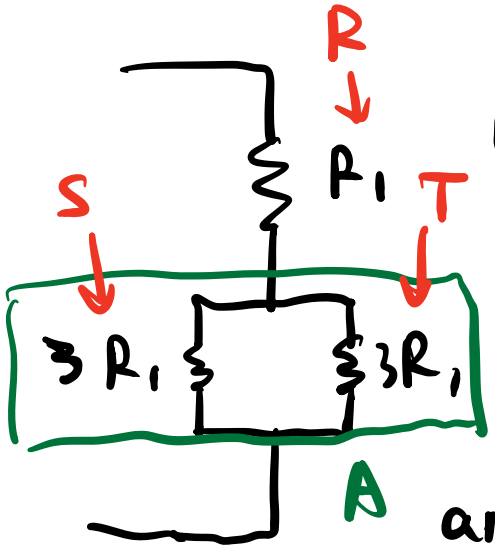
2.



Find the value of R_1 that makes $R_{eq} = 17.5\ Ohm$.

$R_1 =$ [ ] Ohm

(within three significant digits)



To find the Req. look at part A. The effective resistance for part A, R_A is:

$$\frac{1}{R_A} = \frac{1}{3R_1} + \frac{1}{3R_1}$$

since the resistor S and T are in parallel. Therefore,

$$R_A = \frac{9R_1^2}{6R_1} = 1.5R_1$$

Look at the circuit.

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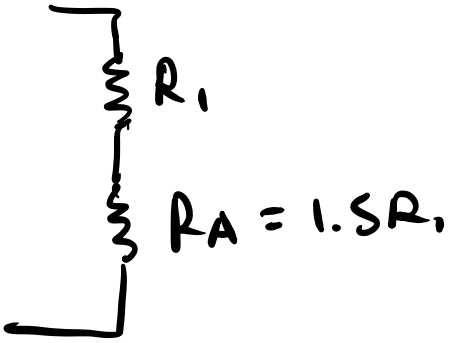
the circuit is now equivalent to this:



where the R_A is the effective resistance for part A. It's now evident that R_1 and R_A are in series, therefore:

$$R_{eq} = R_1 + R_A = 2.5R_1$$

$$R_1 = \frac{R_{eq}}{2.5} = \frac{17.5\,\Omega}{2.5} = \boxed{7.00\,\Omega}$$

(3. S. D.)