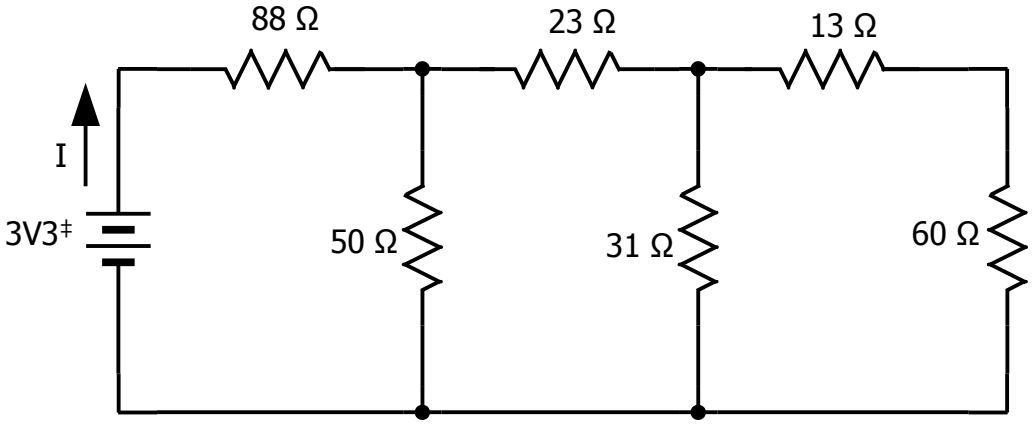
ECE3 Summer 2021
Practice Problems 1

1. Using your knowledge of series and parallel equivalents that you learned on p. 23 of the Week 1 lab, determine the current I.



60 Ω and 13 Ω are in series.

$R_{eq1} = 60+13 = 73\,\Omega$

R_{eq1} and 31 Ω are in parallel.

$$R_{eq2} = \frac{73 \cdot 31}{73+31} = 21.8\,\Omega$$

R_{eq2} and 23 Ω are in series.

$R_{eq3} = 23+21.8 = 44.8\,\Omega$

R_{eq3} and 50 Ω are in parallel.

$$R_{eq4} = \frac{44.8 \cdot 50}{94.8} = 23.6\,\Omega$$

R_{eq4} and 88 Ω are in series

$R_{tot} = R_{eq4}+88 = 111.6\,\Omega$

$$I = \frac{3.3\ \text{V}}{111.6\,\Omega} = 0.0296\ \text{A}$$

‡ 3V3 is shorthand for 3.3 V. You will see this often on schematics.

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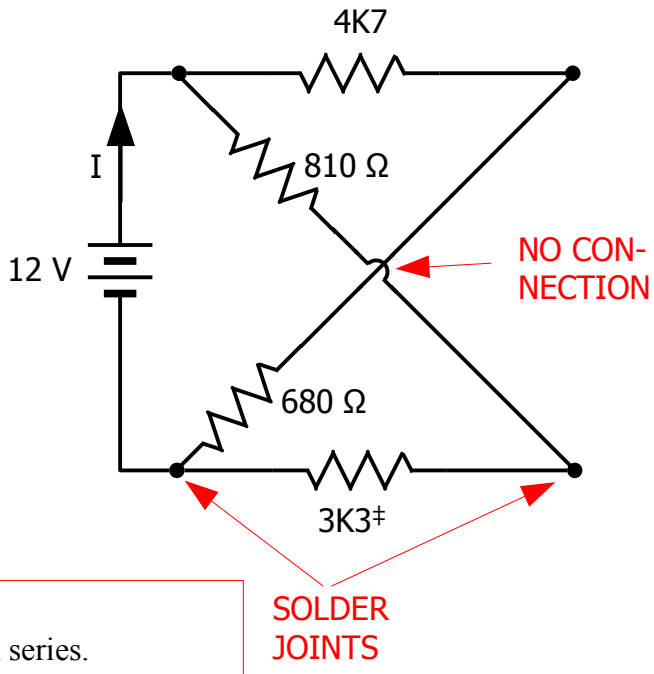
2. Using your knowledge of series and parallel equivalents, determine the value of I.



4K7 and 680 Ω are in series. 3K3 amd 810 Ω are in series.

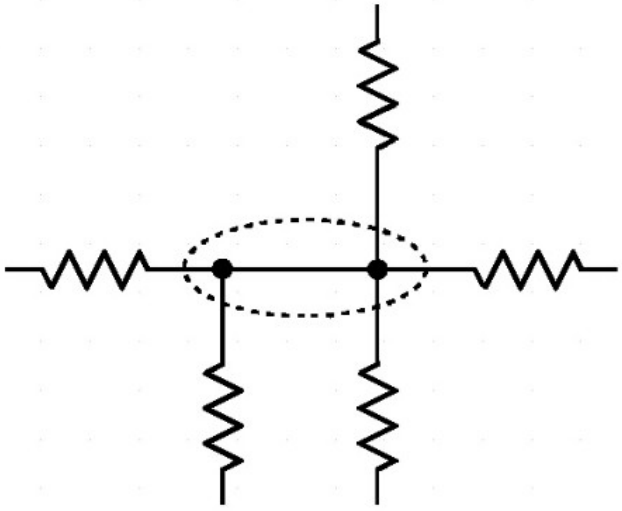
$4.7e3 + 0.68e3 = 5.38e3\,\Omega$

$3.3e3 + 0.81e3 = 4.11e3\,\Omega$

$5.38e3$ and $4.11e3$ are in parallel. $R_P = \dfrac{5.38e3 \cdot 4.11e3}{9.49e3} = 2.33e3\,\Omega$

$I = \dfrac{12}{2.33e3} = 0.00515\ \text{A} = 5.15\ \text{mA}$

3. This question may require a little digging on your part.



The circuit fragment inside the dotted ellipse is:

Choose one answer.

- a. not a node
- b. 1 node
- c. 2 nodes

‡ 3K3 is shorthand for 3.3KΩ. You will see this often on schematics.

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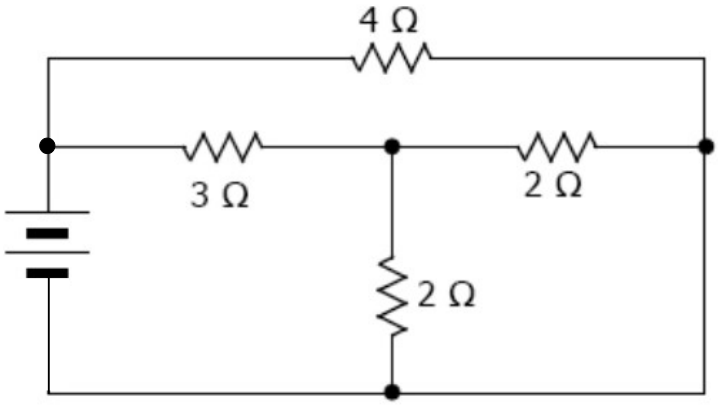
4.



This circuit can be reduced to a voltage source and one resistor. What is the value of that one final resistor?

Challenge: try to do this one in your head: no paper/pencil, no calculator/computer. If you understand series and parallel, you can do it.

The two 2 Ω resistors are in parallel. Therefore:
$R_{22} = 1\,\Omega$
R_{22} and 3 Ω resistor are in series.
$R_{223} = 4\Omega$
R_{223} and 4 Ω resistor are in parallel.
So $R_{tot} = 4||4 = 2\,\Omega$

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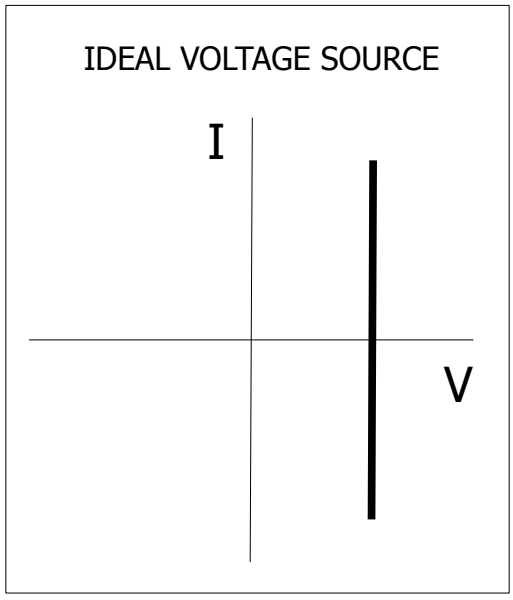
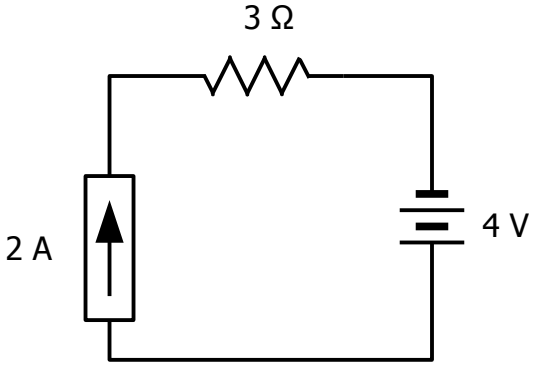
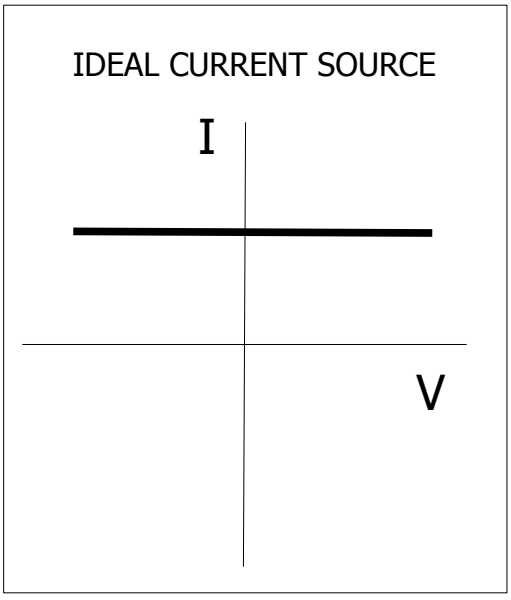


5. Study the Khan Academy post on Passive Sign Convention. Then, using your knowledge of the I-V curves for voltage and current sources as explained in the YouTube videos, plus your knowledge of the Passive Sign Convention, determine if the 4 V battery is providing or absorbing power.





Providing; current is leaving the + end of the battery.

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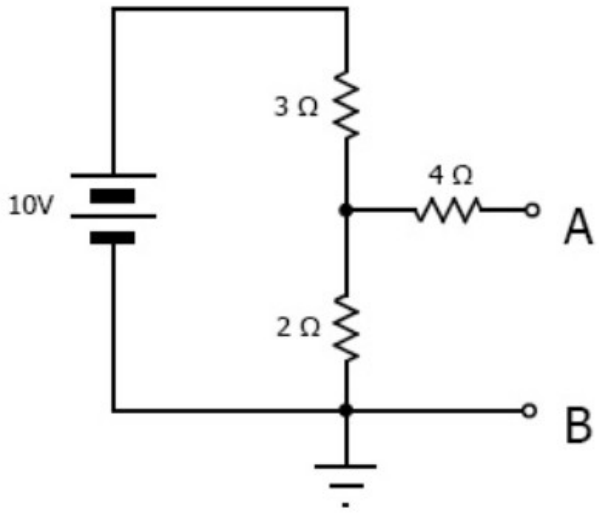
6. What is the voltage across the 4 Ω resistor? NOTE: you may consider this to be a trick question, but it has real meaning.

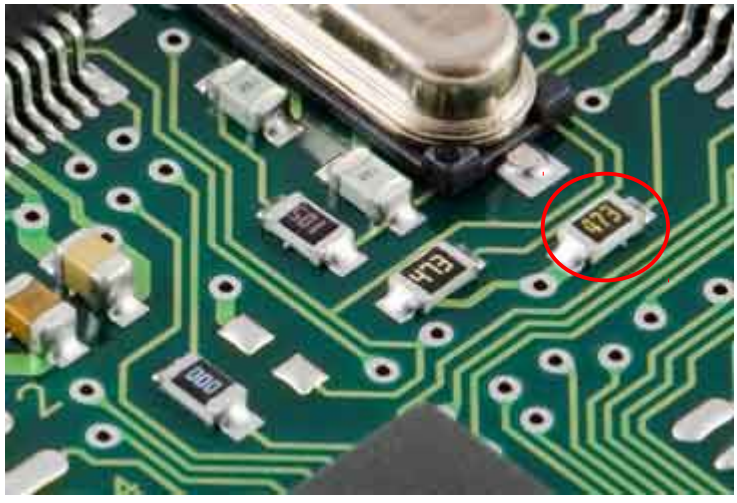
There can be no current through 4 Ω.
So there can be no voltage across 4 Ω.



Choose one answer.

- a. 2.67 V
- b. 0.00 V
- c. 5.71 V
- d. 10.00 V
- e. 4.00 V

7. This is the picture of a surface mount resistor (labeled 473) on a PC board. Assuming that the three numbers correspond to the first three colors of a regular resistor, what is the resistance of this surface mount resistor?



$47*10^3$, or 47 KΩ

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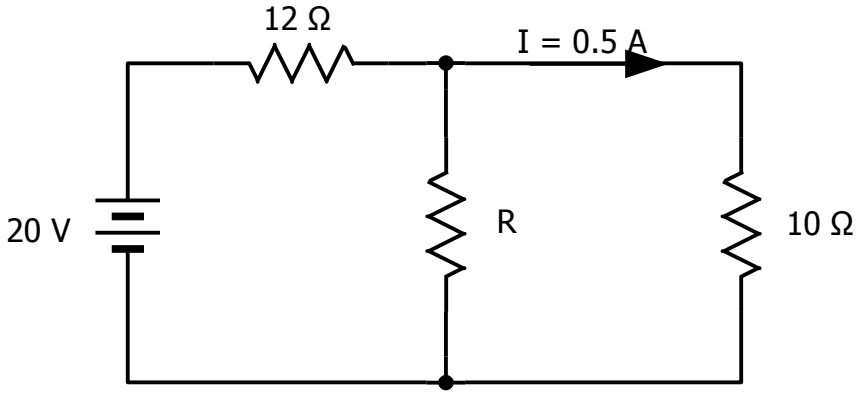
8. Using your knowledge of series and parallel equivalents plus the Voltage Divider equation, determine the value of R.



R and 10 Ω are in parallel. Therefore.

$$R_P = \frac{10R}{10+R}$$

R_P and 12 Ω are in series

$$R_{tot} = 12 + R_P$$

By Voltage Divider Equation,

$$V_R = 20\left(\frac{R_P}{12+R_P}\right)$$

But $V_R = I(10) = 5$ V

So $\frac{R_P}{12+R_P} = \frac{5}{20} = \frac{1}{4}$

$$R_P = 4 = \frac{10R}{10+R}$$

$$R = 6.67\ \Omega$$