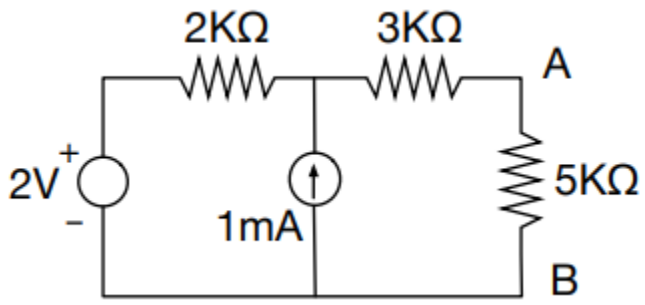
ELEC 2501 Assignment

1. A problem statement reads "The charge entering the positive terminal of an element is given by the expression $q(t) = -8e^{-3t}mC$. The power delivered to the element is $p(t) = 1.2e^{-2t}W$. Compute the current in the element and the voltage across the element." Without solving the problem describe in your own words what you understand about the problem to be solved.

The problem asks to compute the current in the element by taking the derivative of the charge equation given with respect to time. Furthermore, the problem also asks to compute the voltage across the element by using both the power delivered to the element equation and the current in the element equation found. The voltage across the element is simply the power delivered to the element divided by the current in the element.

2. Consider the following circuit:



Find the current in the 5KW resistor (both magnitude and direction).

a) **Describe the different approaches you can take to solve this problem and which one you would pick and why.**
There are two different approaches that could be taken to solve this problem, one being nodal analysis and the other mesh analysis. The one that I will use is the nodal analysis method as it will require a lesser number of equations to solve. Furthermore, mesh analysis is better used when the circuit consists of only voltage sources or is dominant with voltage sources. Since there is a current source in this circuit, we are better suited to use nodal analysis.

b) **Describe the assumptions you need to make in order to solve the problem and the impact they will have on your solution.**
The only assumption that needs to be made in order to solve this problem is that the current source of 1mA is applied to the 5kΩ resistor. The impact that this will have on the solution is that the answer will be slightly different by a factor of 2.

c) Solve the problem.

$$\frac{V-2}{2k} + (-1mA) + \frac{V}{8k} = 0$$

$$V\left(\frac{1}{2k} + \frac{1}{8k}\right) = \frac{2}{2k} + 1mA$$

$$V\left(\frac{5}{8k}\right) = 2mA$$

$$V = 3.2V$$

$$I = \frac{V}{8k} = \frac{3.2V}{8k} = 0.4mA$$

d) Comment on the results you obtained in 2.c. Do you think they make sense? Why do you think so?

The result of 0.4mA obtained in 2c) makes sense as the resistor and current direction are downwards, meaning that the power in the circuit is always being absorbed.