1) The circuit below is known as a resistive voltage divider

\[ V_{\text{in}} \quad R_1 \quad \quad V_{\text{out}} \quad R_2 \]

a) Assuming \( V_{\text{in}} \) is an ideal voltage source, derive an equation for \( V_{\text{out}} \)

b) Suppose I wanted to measure the voltage at \( V_{\text{out}} \) with a voltmeter.
   
   i) Would I want the voltmeter to have a low or high resistance? Why?

   ii) Redraw the circuit above to include the resistance of the voltmeter, and derive an equation for \( V_{\text{out}} \) as a function of the resistance of the voltmeter.
c) In the above analysis, you have assumed that \( V_{\text{in}} \) is an ideal voltage source. Suppose, instead of the voltage source, I use a Norton current source to drive the voltage divider as follows:

![Circuit Diagram]

Derive an equation for \( V_{\text{out}} \) as a function of the various component values above.

2) Consider the following circuit:

![Circuit Diagram]
a) Calculate current $I_y$ using nodal analysis (you can leave your answer in a simplified set of equations; no need to find a final answer).

b) Similarly, calculate current $I_y$ using mesh analysis (just set up the equations; no need to calculate the final solution).

c) Ignoring your personal preference, would you recommend nodal or mesh analysis for the analysis of this circuit? Why?
d) Analyze the circuit above to find $I_y$ using superposition (again, just show the equations; no need to calculate a final solution).

![Circuit Diagram]

\[ \text{(Equation for } I_y \text{ using superposition)} \]

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e) Replace the dependent current source with a 2A constant current source. Derive the matrix equation to be solved if this circuit were to be solved by inspection.

![Circuit Diagram]

\[ \text{(Matrix equation for the modified circuit)} \]