

MAE140 - Linear Circuits - Winter 09
Midterm, February 5

Instructions

- (i) This exam is open book. You may use whatever written materials you choose, including your class notes and textbook. You may use a hand calculator with no communication capabilities
- (ii) You have 70 minutes
- (iii) Do not forget to write your name, student number, and instructor

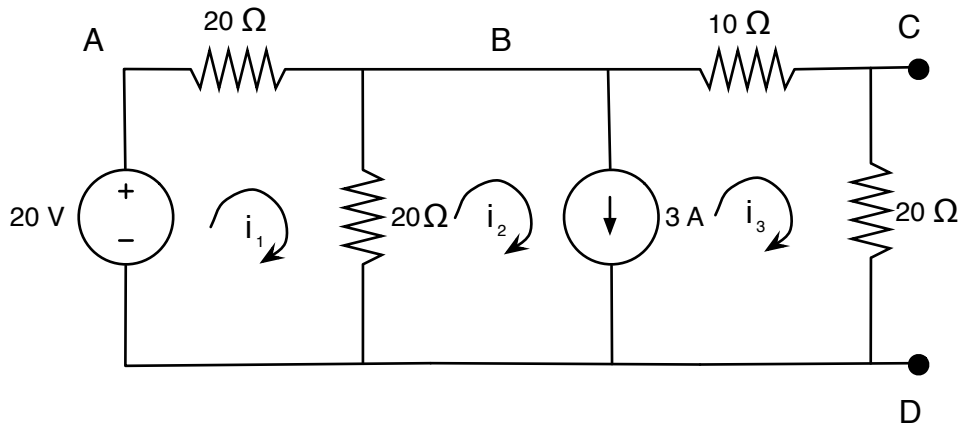


Figure 1: Circuit for questions 1-4.

1. Equivalent circuits

Part I: [2 points] Turn off all the sources in the circuit of Figure 1 and find the equivalent resistance as seen from terminals C and D.

Part II: [3 points] Find the Thévenin equivalent as seen from terminals C and D.

Hint: If you want, you can use the result obtained in Part I

Part III: [1 point] Find the power absorbed by a $9\ \Omega$ resistor that is connected to terminals C and D.

2. Nodal voltage analysis

[6 points] Assuming that the node labeled D is the ground node (reference), formulate node-voltage equations for the circuit in Figure 1. Use the node labels provided in the figure and clearly indicate how you handle the presence of a voltage source, the final equations, and the unknowns they must be solved for. **Do not modify the circuit or the labels.** No need to solve any equations!

3. Mesh current analysis

[6 points] Formulate mesh-current equations for the circuit in Figure 1. Use the mesh currents shown in the figure and clearly indicate how you handle the presence of a current source, the final equations, and the unknowns they must be solved for. **Do not modify the circuit or the labels.** **Do not use any source transformation.** No need to solve any equations! *Hint: Use a supermesh*

4. Bonus question

[1 point] If you were allowed to use source transformations in the circuit of Figure 1, describe what you would do in order to avoid having to use a supermesh in Question 3? **Do not write or solve any equations!**