

**MAE140 - Linear Circuits - Fall 11**  
**Midterm, October 27**

**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**

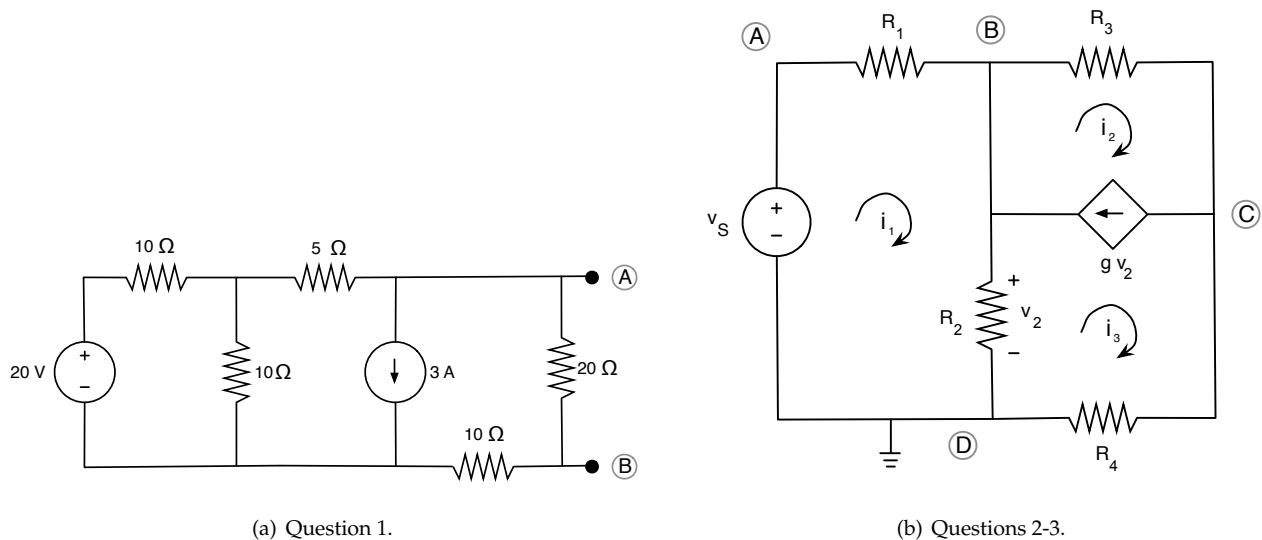


Figure 1: Circuits for questions 1-3

**1. Equivalent circuits**

**Part I:** [2 points] Turn off all the sources in the circuit of Figure 1(a) and find the equivalent resistance as seen from terminals A and B.

**Part II:** [3 points] Find the Thévenin equivalent as seen from terminals A and B.

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

**Part III:** [1 point] Find the power absorbed by a  $40\ \Omega$  resistor that is connected to terminals A and B.

**2. Node voltage analysis**

[6 points] Formulate node-voltage equations for the circuit in Figure 1(b). Use the node labels A, B, C provided in the figure and clearly indicate how you handle the presence of a voltage source. The final equations must depend only on unknown node voltages and the value  $v_S$ . **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(b). Use the mesh currents shown in the figure and clearly indicate how you handle the presence of a dependent current source. The final equations should only depend on the unknown mesh currents and the source value  $v_S$ . **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(b) and node C was the ground (instead of D), describe what would you do in Question 2 to take care of the voltage source using node voltage analysis. **Do not write or solve any equations!**