

**MAE140 - Linear Circuits - Fall 2017**  
**Midterm, November 2nd**

**Instructions**

1. 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.
2. You have 70 minutes.
3. Write your answers on your “Blue Book”.
4. Do not forget to write your name, student number, and instructor.
5. This exam has 4 questions, for a total of 20 points.

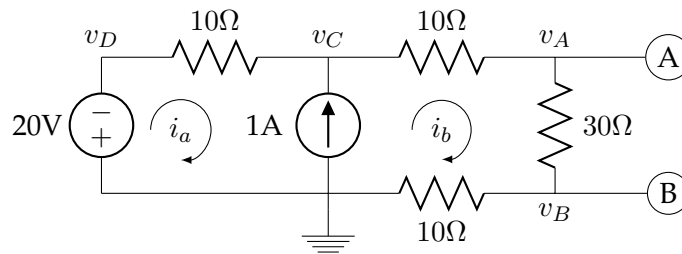


Figure 1: Circuit for Questions 1, 2, and 3

**1. Equivalent Circuits**

- (a) (5 points) Use circuit reduction to find the Thevenin and Norton equivalent circuits as seen from terminals (A) and (B).

**2. Node Voltage Analysis**

- (a) (4 points) Formulate node-voltage equations for the circuit in Fig. 1. Use the node-voltages and labels provided in the figure and clearly indicate the final equations and circuit variable unknowns. Make sure your final equations involve only node-voltages.
- (b) (1 point) Explain how you could solve for the mesh-current  $i_a$  after having calculated the node-voltages.

**3. Mesh Current Analysis**

- (a) (4 points) Formulate mesh-current equations for the circuit in Fig. 1. Use the mesh-currents and labels provided in the figure and clearly indicate the final equations and circuit variable unknowns. Make sure your final equations involve only mesh-currents.
- (b) (1 point) Explain how you could solve for the node voltage  $v_C$  after having calculated the mesh-currents.

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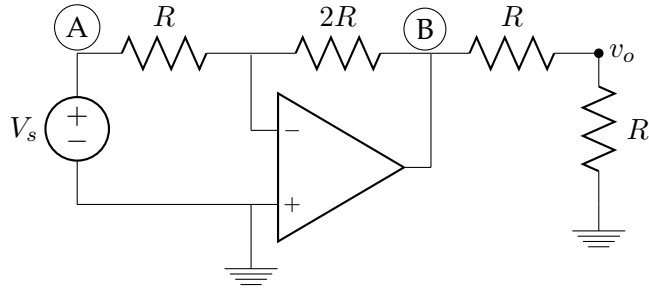


Figure 2: Circuit for Question 4

#### 4. OpAmp Circuit

- (a) (2 points) Calculate the voltage gain from  $V_s$  to  $v_o$  on the OpAmp circuit from Fig. 2.
- (b) (3 points) Replace the inverting OpAmp circuit by a non-inverting OpAmp circuit connected between nodes (A) and (B) so that the voltage gain from  $V_s$  to  $v_o$  has the same magnitude as you calculated in part (a).