

**MAE 140 – Linear Circuits – Fall 2008**  
**Midterm**

**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.

**Question 1 — Equivalent Circuits**

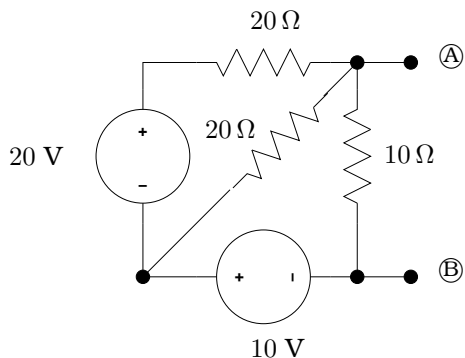


Figure 1: Circuit for Question 1

**Part (i)** [6 marks] Use source transformations and association of resistors to find the Norton equivalent to the circuit in Fig. 1 as seen from terminals A and B.

**Part (ii)** [2 marks] Find the power absorbed or delivered by a 5V voltage source whose + and – terminals are connected to terminals A and B, respectively.

**Question 2 — Nodal Analysis**

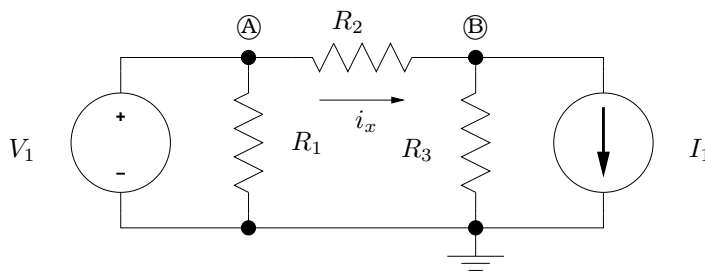


Figure 2: Circuit for Question 2

**Part (i)** [4 marks] Formulate node-voltage equations for the circuit in Fig. 2. Use the node voltages indicated in the figure and clearly indicate the final equations and the unknowns they must be solved for. You do not have to solve any equations!

**Part (ii)** [2 marks] Show how you can use the answer to part (i) to find the value of the current  $i_x$  indicated in Fig. 2.

**Part (iii)** [2 marks] What changes in your answer to parts (i) and (ii) if the current source  $I_1$  is replaced by a voltage source  $V_2$  whose – terminal is connected to the ground?

### Question 3 — Op-Amp Circuit Analysis

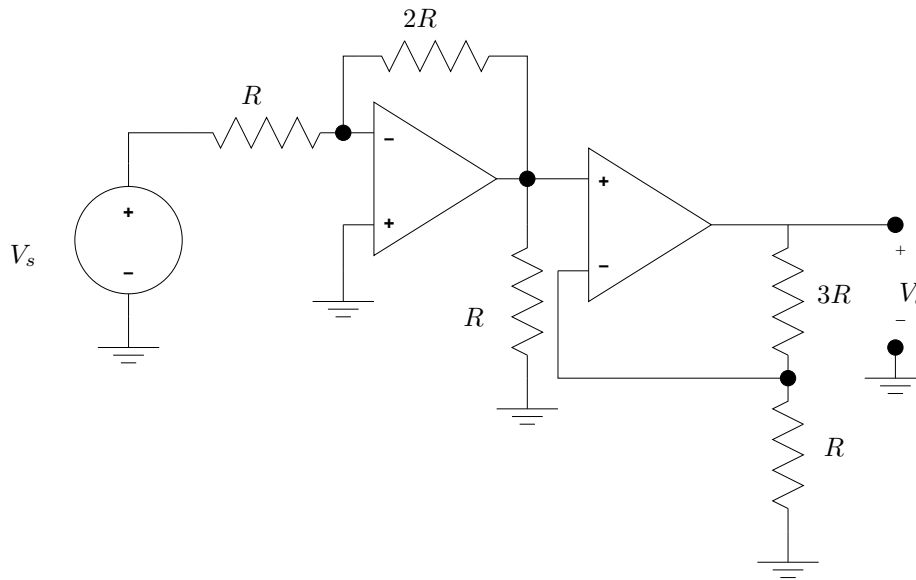


Figure 3: Circuit for Question 3

**Part (i)** [4 marks] Identify parts of the circuit in Fig. 3 that correspond to basic Op-Amp blocks studied in class.

**Part (ii)** [4 marks] Find the voltage gain  $V_o/V_s$ .

### Question 4 — Bonus question

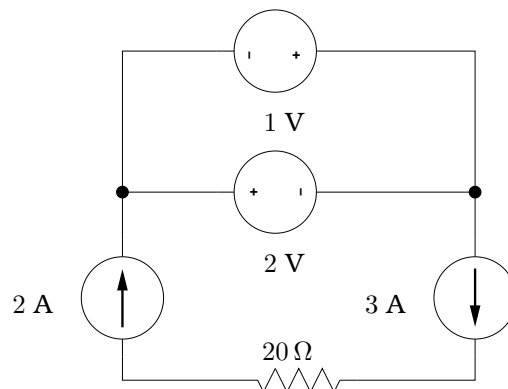


Figure 4: Circuit for Question 4

[4 marks] What is wrong with the circuit in Fig. 4? Hint: there are two problems.