EE 261 **Spring 2025** **Homework 3–Handwritten**

Due Wednesday, Jan. 29, 2024 by 11:59 p.m.

NOTE: This is only the "handwritten" portion of Homework 3. There are also problems you must do online via the Mastering site. For this handwritten portion, you must submit a PDF scan of your work at Canvas. Please ensure your work is contained in a single file and is legible.

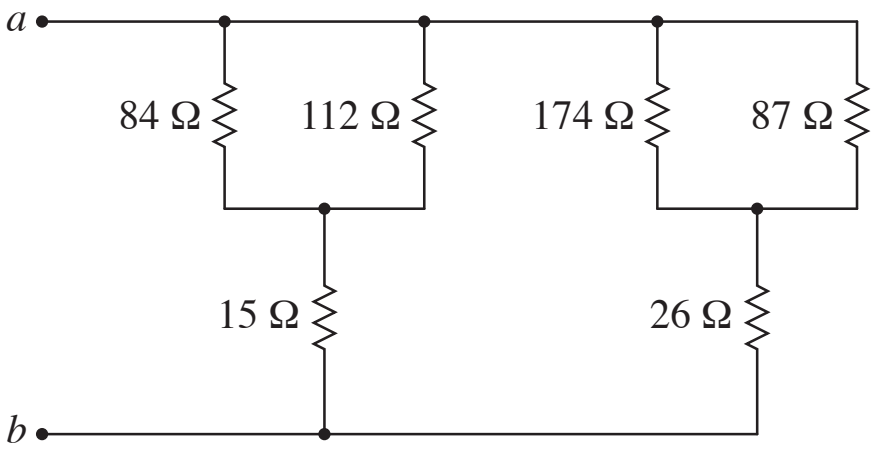
For this assignment, you must complete the problems on the following pages which made up the first exam in this course from a previous semester. You may print this file and show your work on these pages as you would for the exam, or you may provide your solution on separate paper (or via some other document-capture technique that shows your work).

Shown below are the rules that pertained to this exam, but you are free to treat this assignment like any other homework assignment. These rules are provided merely so that you can become familiar with them as the rules for your exam on Jan. 31 will be similar or the same.

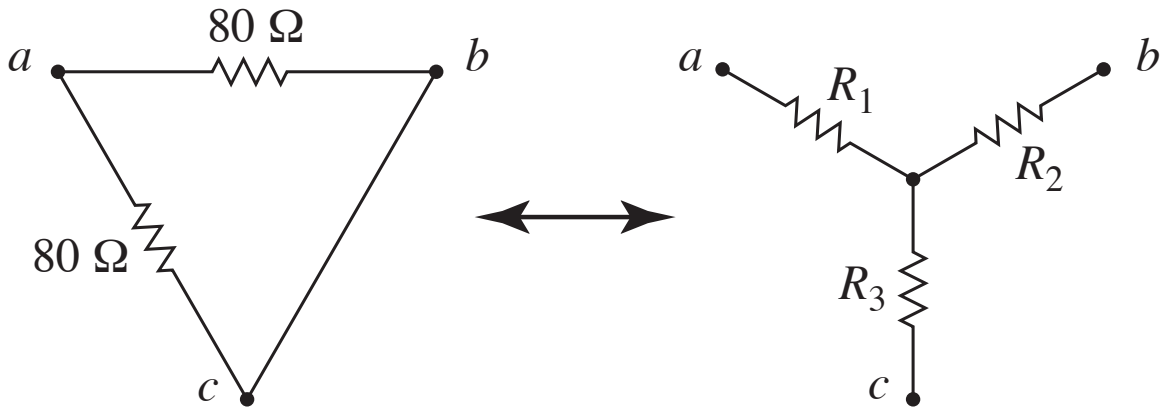
The rules:

- Relax!
- Closed book.
- Closed notes except you are allowed one sheet (front and back) of notes (whether handwritten or typeset or some combination thereof).
- All work must be your own. Merely *looking* at the work of others is cheating and may carry all the consequences associated with cheating. Focus on doing your best while completely ignoring your classmates.
- **No work, no credit.** Show your work.
- **Neatness counts.** If I can't easily read it, you won't get credit.
- You may use the "standard" scientific functions of a calculator. Programmed calculations are not permitted. (A programmable calculator is allowed, but you are not allowed to program it or use pre-installed programs.)
- No cell phones or other electronic devices (other than a calculator).
- If you submit your test before 50 minutes from the start of the exam, the number of incorrect points will be multiplied by three. Take your time and check your work!
- The value of each question is indicated within brackets, e.g., [10]. (Questions with equal value are not necessarily of equal difficulty.)

For question 1:

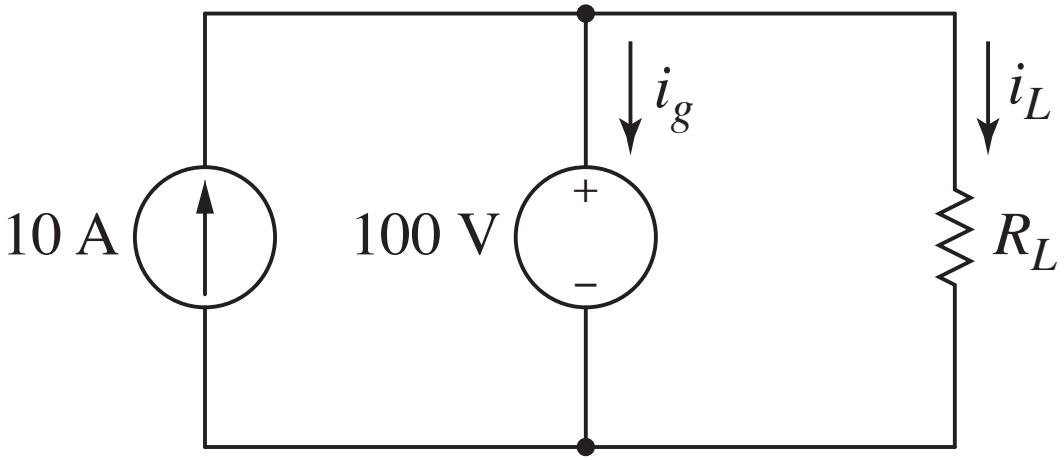


For question 2:



1. **[12]** For the arrangement of resistors shown at the top of the previous page, what is the equivalent resistance between the nodes a and b? (To receive credit, show all your work.)

2. **[8]** Initially a circuit had three $80\ \Omega$ resistors in a Δ configuration between nodes a, b, and c. However, a short appeared across the resistor that connected nodes b and c so this portion of the circuit now appears as shown in the figure on the left of the previous page (the resistor that had connected nodes b and c can now be ignored, replaced with a wire). If we want to model this portion of the circuit with a Y configuration, as shown on the right, what would be the values of the resistors R_1, R_2, and R_3? (Hint: There are a couple of ways to approach this problem. You can use the transformation equations, but you don't need to.)


10 A
100 V
+
–
i_g
i_L
R_L

3. The following questions pertain to the circuit on the previous page. When asked for a power, consumed power is positive and delivered power is negative.

   (a) **[6]** Regardless of the value of R_L (but assuming it is not zero), what is the power associated with the current source?

   (b) Assume $R_L = 1\ \Omega$. Provide the following:

      i. **[4]** $i_L =$

      ii. **[4]** $i_g =$

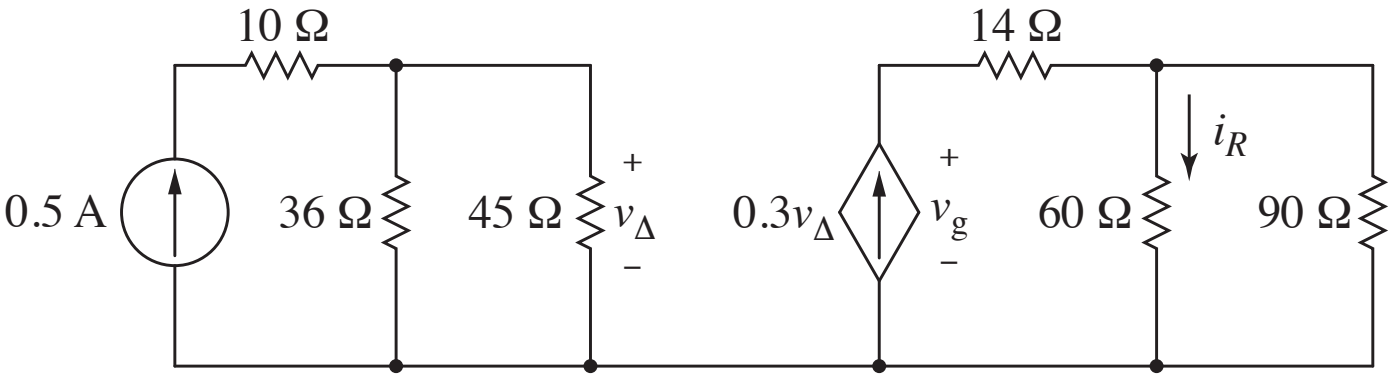
      iii. **[4]** Power associated with the voltage source.

   (c) Assume $R_L = 100\ \Omega$. Provide the following:

      i. **[4]** $i_L =$

      ii. **[4]** $i_g =$

      iii. **[4]** Power associated with the voltage source.


10 Ω
14 Ω
0.5 A
36 Ω
45 Ω
+
v_Δ
−
$0.3v_\Delta$
+
v_g
−
60 Ω
i_R
90 Ω

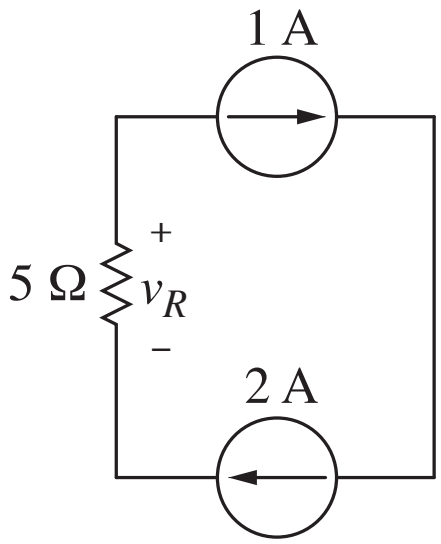
4. The following questions pertain to the circuit shown on the previous page which contains a voltage-controlled *current* source.

   (a) **[6]** What is the voltage v_Δ?

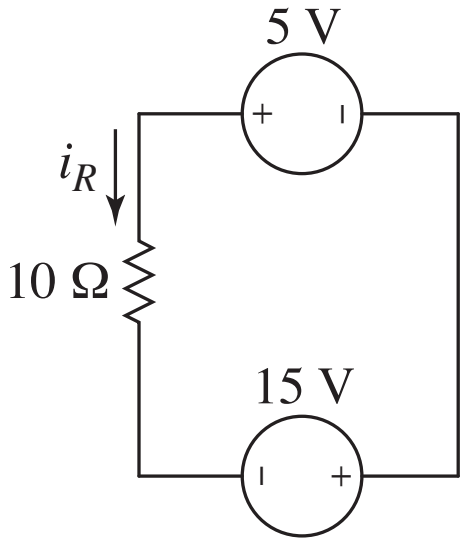
   (b) **[6]** What is the current i_R?

   (c) **[6]** What is the voltage v_g?

   (d) **[6]** What is the power associated with the independent current source? (Use negative for delivered power and positive for consumed power.)



(a)

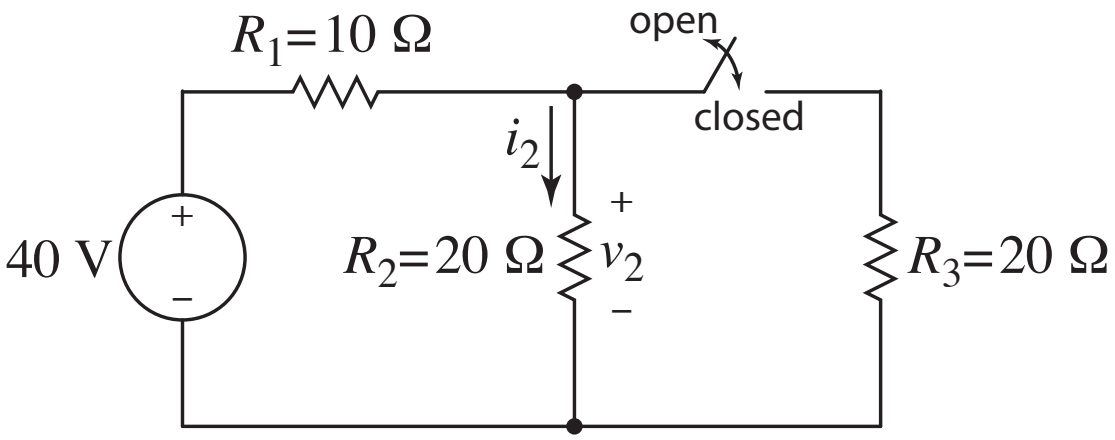


(b)

5. The following questions pertain to the corresponding circuits on the previous page.

   (a) **[8]** If circuit (a) is valid, provide v_R. If not, explain why it is an invalid circuit.

   (b) **[8]** If circuit (b) is valid, provide i_R. If not, explain why it is an invalid circuit.


$R_1 = 10\ \Omega$
open
closed
i_2
+
40 V
−
$R_2 = 20\ \Omega$
+
v_2
−
$R_3 = 20\ \Omega$

6. In the circuit shown on the previous page, the switch can be open (creating an open circuit) or closed (creating a short circuit). The answers to the following questions are independent of the values of the voltage source and resistors. These values are provided in case they help you think about the behavior of this circuit (you could replace them with any other non-zero values and the answers would be unchanged).

   (a) **[5]** Assume the goal is to maximize the power delivered by the voltage source. Should the switch be open or closed? Provide justification for your answer. (Your justification may provide numeric values, but that is not required.)

   (b) **[5]** Assume the goal is to maximize the power consumed by resistor R_2. Should the switch be open or closed? Provide justification for your answer. (Your justification may provide numeric values, but that is not required.)