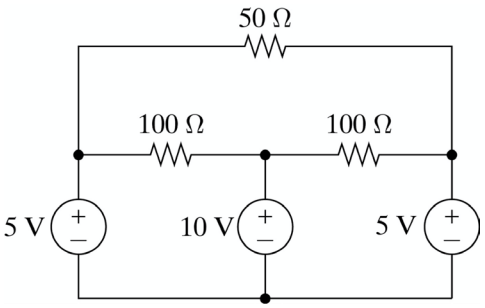
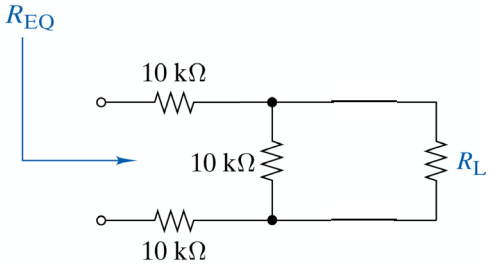
**ENG EK 307: Electric Circuits, Fall 2025**
**Problem Set 2**
**Due Wednesday 9/17/2025 by 11:59pm**

Reading: *Alexander and Sadiku* (AS), Sections 1.6, 2.1-2.9, and 3.1-3.2

1. (15 points) For the circuit shown at right,
   a. Assign a voltage and current variable to every element, observing the passive sign convention.
   b. Use KVL to find the voltage across each resistor.
   c. Use Ohm's law to find the current through each resistor.
   d. Use KCL to find the current through each voltage source.
   e. For each of the three voltage sources, indicate whether power is being delivered or absorbed.

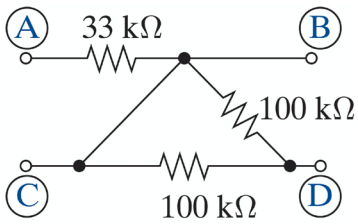



2. (10 points) For the circuit shown at right,
   a. Select a value of $R_L$ so that $R_{EQ}$ = 25 kΩ.
   b. Repeat for $R_{EQ}$ = 20 kΩ.

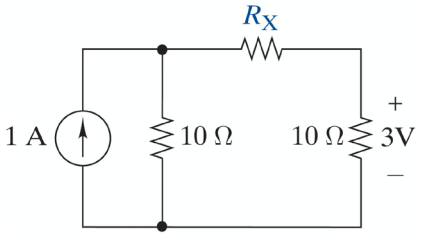



3. (10 points) Using no more than four 1-kΩ resistors, show how the following equivalent resistors can be constructed: 2 kΩ, 500 Ω, 1.5 kΩ, 333 Ω, 250 Ω, and 400 Ω.

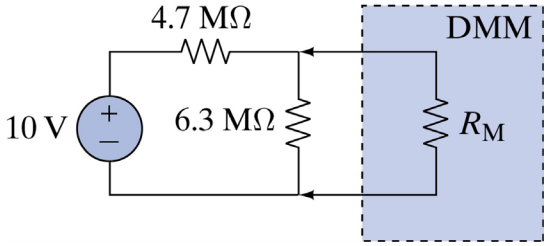
4. (10 points) For the circuit shown, find the equivalent resistance between terminals A-B, A-C, A-D, B-C, B-D, and C-D.



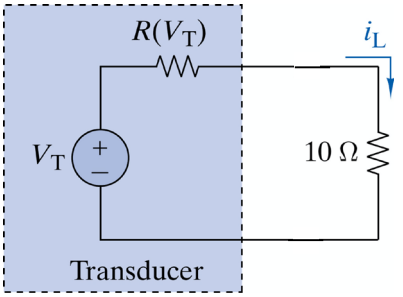

5. (10 points) For the circuit shown at right, use current division to find *R*x so that the output voltage is 3V as shown.



6. (15 points) Ideally, a voltmeter has infinite internal resistance and can be placed across any device to read the voltage without affecting the result. A particular digital multimeter (DMM) is connected across the circuit shown in the Figure at right. The expected voltage was 5.73 V. However, the DMM reads 3.81 V. The large, but finite, internal resistance of the DMM was "loading" the circuit and causing a wrong measurement to be made. Find the value of the internal resistance of this DMM.




7. (15 points) The circuit at right shows an active transducer whose resistance $R(V_T)$ varies with the transducer voltage $V_T$ as $R(V_T) = 0.5\ V_T^2 + 1$. The transducer supplies a current to a 10-Ω load. At what voltage will the load current $i_L$ equal 100 mA?




8. (15 points) This problem concerns the node-voltage method. See textbook Section 3-2 (Example 3-2 in particular).

For the circuit shown,

(a) Choose a ground node, label the remaining essential nodes, and write a set of node-voltage equations.
(b) Collect terms and rewrite your equations in the form Ax=b, where x is a column vector containing the unknown node voltages, and A is a matrix whose elements are functions of the resistor values.
(c) Solve for vx and ix when $R_1 = R_2 = R_3 = R_4 = 1$ kΩ, $v_S$ = 20 V, and $i_S$ = 1 mA.