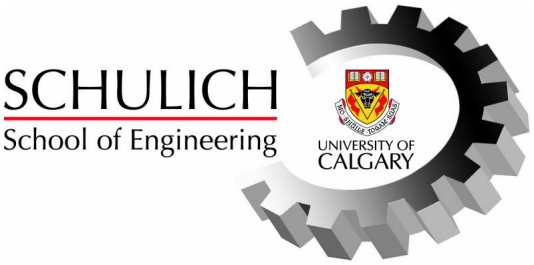
Name: _____ *Lecture Section:* _____

L01 - *Norm Bartley*
L02 - *Brent Maundy*
L03 - *Pouyan (Yani) Jazayeri*
L04 - *Anis Haque*



ENGG 225 - Fundamentals of Electrical Circuits and Machines

Midterm Examination

Thursday, February 26, 2015
Time: 7:00 - 8:30 PM

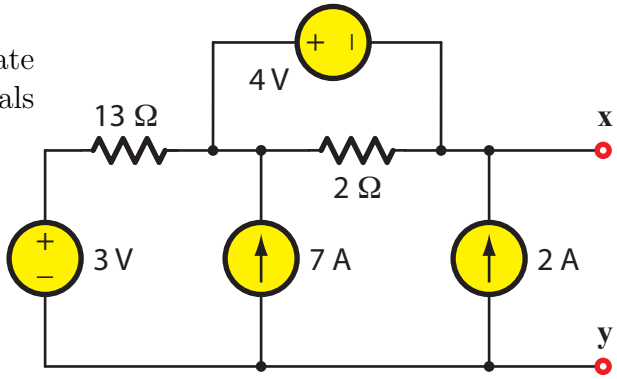
Instructions:

- Time allowed is 90 minutes.
- The examination is closed-book.
- Only calculators sanctioned by the Schulich School of Engineering are permitted in the examination.
- The maximum number of marks is 50, as indicated; please attempt all questions. The midterm examination counts 25% toward the final grade.
- Please use a pen or heavy pencil to ensure legibility.
- Please answer questions in the spaces provided; if space is insufficient, please use the back of the pages.
- Please show your work; where appropriate, marks will be awarded for proper and well-reasoned explanations.

UCID: _____

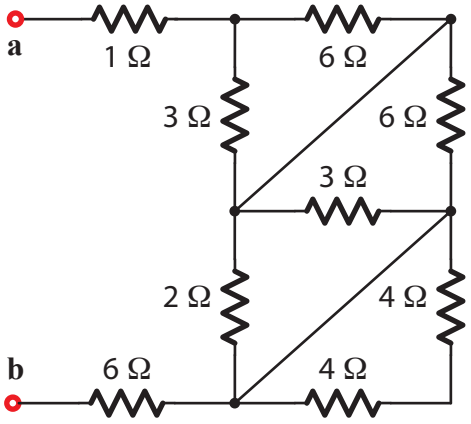
1. **[18 marks.]** Parts (a)-(f) below each have an identical weighting of three marks. Please answer the questions in the boxes provided.

(a) **[3]** For the circuit given at right, calculate the Thévenin resistance R_t at the terminals **x** and **y**.



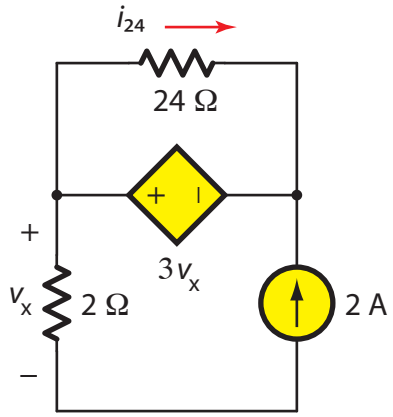
Answer: $R_t =$

(b) **[3]** In the circuit at right, determine the equivalent resistance R_{eq} as seen at the terminals **a** and **b**.



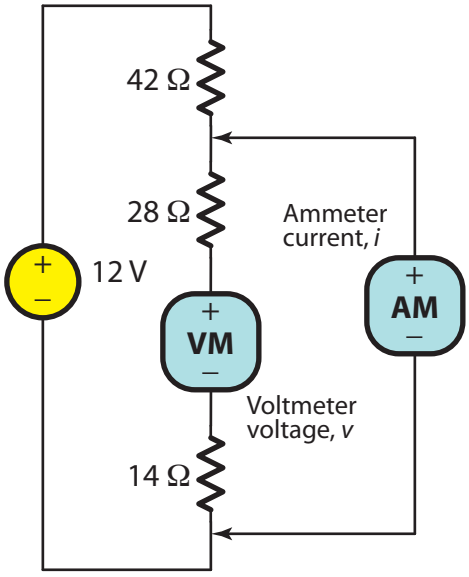
Answer: $R_{eq} =$

(c) **[3]** In the circuit at right, determine the current i_{24} through the 24 Ω resistor.



Answer: $i_{24} =$

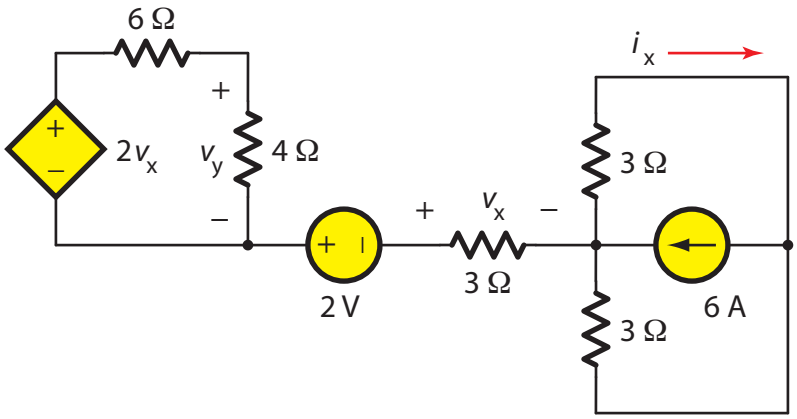
(d) **[3]** Suppose that a student in ENGG 225 has designed the voltage divider circuit shown at right, and is about to test the circuit with a voltmeter and an ammeter. However, the student accidentally connects them both *incorrectly*. What will be the voltage reading v, and current reading i in the circuit as shown.



Answer: $v =$

Answer: $i =$

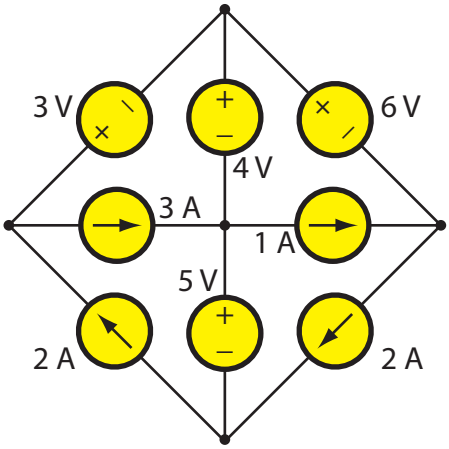
(e) **[3]** In the circuit at right, find v_y and i_x.



Answer: $v_y =$

Answer: $i_x =$

(f) **[3]** Determine the power p_{4v} in the 4 V source.



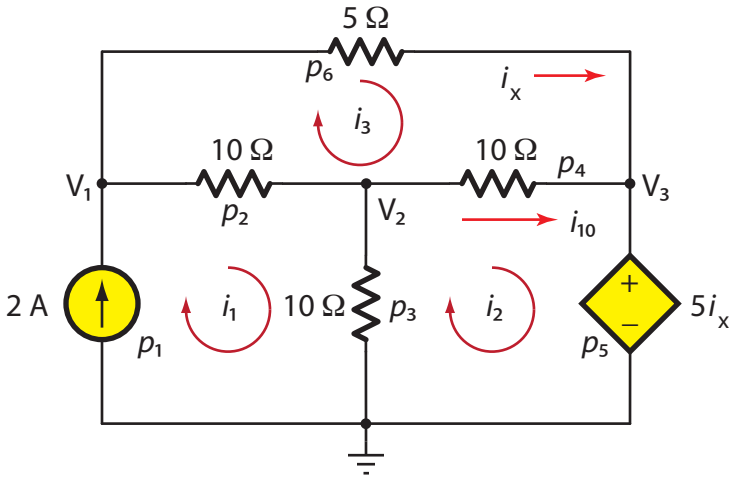
Answer: $p_{4v} =$

2. [**16 marks.**] Consider the circuit below.

   (a) [**6**] Write down the mesh-current equations with the unknown mesh currents as the only variables.

   (b) [**4**] Solve for the mesh currents and find i_{10}.

   (c) [**6**] Using your mesh currents from part (b), calculate the power in all circuit elements (p_1 p_2, p_3, p_4, p_5, p_6). (If you have not solved part (b), you can assume non-zero values for the mesh currents. Clearly state your assumptions.)



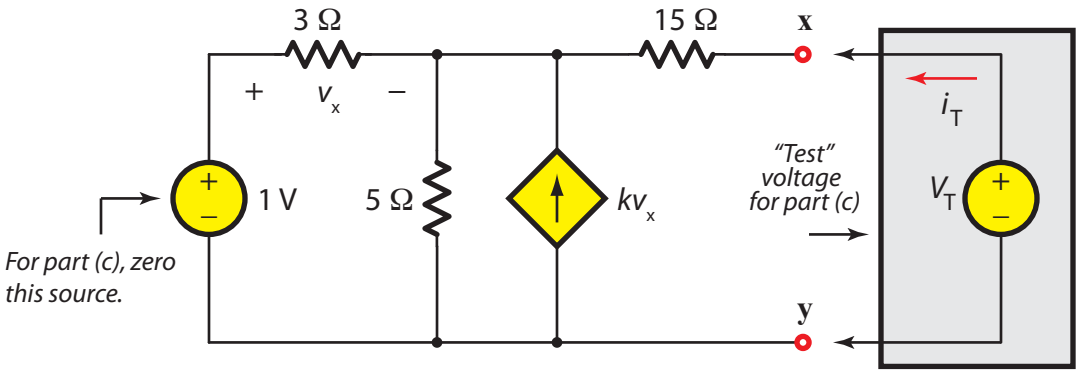
(Question 2, additional workspace ...)

3. **[16 marks.]** Consider the circuit below.

   (a) **[7]** Assuming that $k = \frac{2}{3}$, determine the Thévenin equivalent circuit as seen to the left of the terminals **x** and **y**.

   (b) **[4]** Calculate the value of k such that the short-circuit current $i_{sc} = 0$ A.

   (c) **[5]** Now connect a "test" voltage source V_T to the circuit's terminals as shown, and *zero* the 1-V source (i.e., replace the 1-V source with a short circuit). Using whatever value of k you calculated in part (b), determine the ratio of V_T to the test current i_T.



(Question 3, additional workspace ...)

(Please do not write in this space.)

#1 *(18)*	**#2** *(16)*	**#3** *(16)*	**Total** *(50)*