

Last Name: \_\_\_\_\_

Lecture Section: \_\_\_\_\_

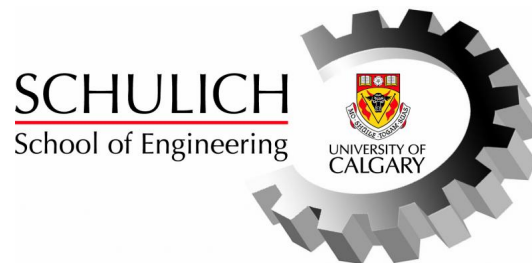
First Name: \_\_\_\_\_

**L01** - Pouyan (Yani) Jazayeri

**L02** - Norm Bartley

**L03** - Denis Onen

**L04** - Anis Haque



ENGG 225 - Fundamentals of Electrical Circuits and Machines

## Midterm Examination

Thursday, February 27, 2020

Time: 7:00 - 9:00 PM

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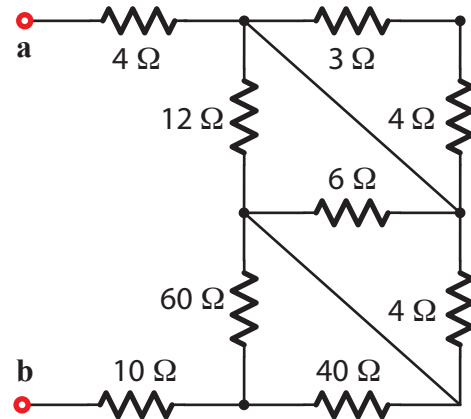
### Instructions:

- Time allowed is 2 hours.
  - The examination is closed-book.
  - Only calculators sanctioned by the Schulich School of Engineering (Casio FX-260, Casio FX-300MS, or TI-30XIIS) are permitted in the examination.
  - The maximum number of marks is 40, 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.
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UCID: \_\_\_\_\_

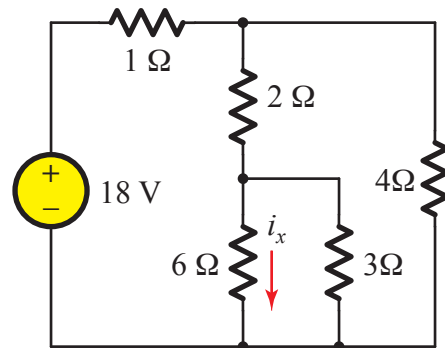
1. [15 marks.] Parts (a)-(e) below each have an identical weighting of three marks. Please answer the questions in the boxes provided.

(a) [3] In the circuit at right, find the total equivalent resistance  $R_{ab}$  between the terminals **a** and **b**.



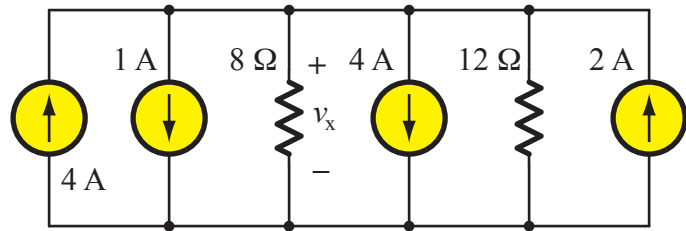
Answer:  $R_{ab} =$

(b) [3] In the circuit at right, find the current  $i_x$ .



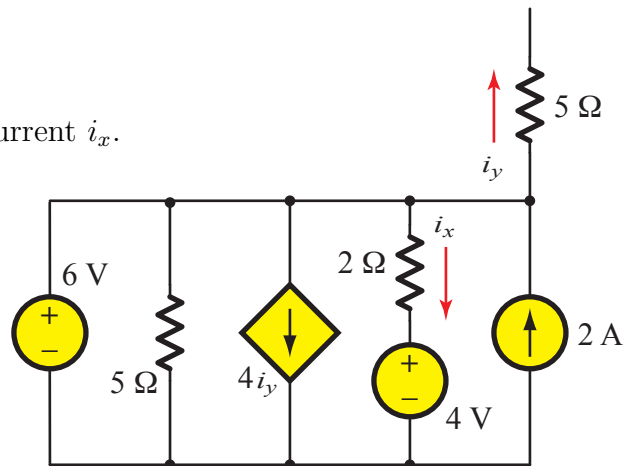
Answer:  $i_x =$

(c) [3] Calculate the voltage  $v_x$  in the circuit at right.



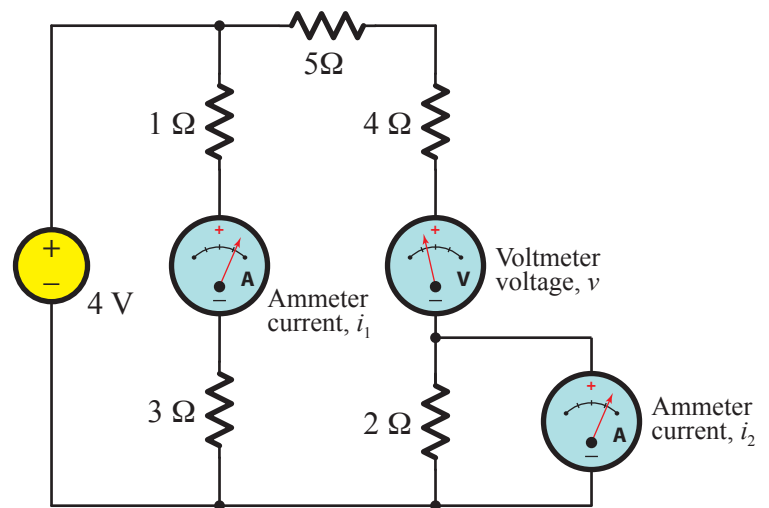
Answer:  $v_x =$

(d) [3] In the circuit at right, calculate the current  $i_x$ .



Answer:  $i_x =$

- (e) [3] In the circuit at right, assume that the voltmeter and ammeters are ideal. Give the voltmeter's reading  $v$ , and the two ammeter readings  $i_1$  and  $i_2$ .

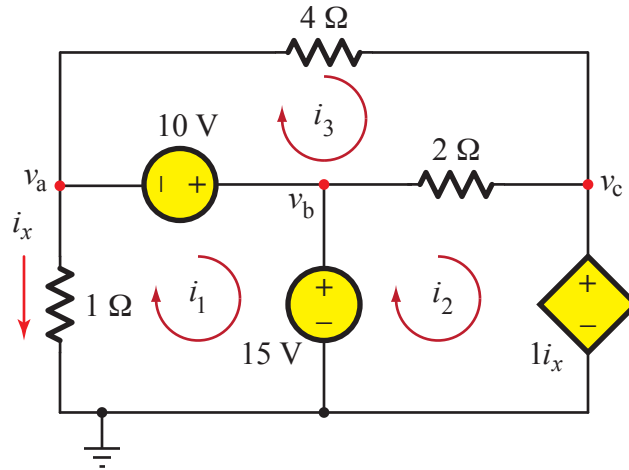


Answer:  $v =$

Answer:  $i_1 =$

Answer:  $i_2 =$

2. [11 marks.] Consider the circuit below.



- (a) [8] Determine the mesh currents  $i_1, i_2, i_3$ .
- (b) [3] Using your answers to part (a), calculate the node voltages  $v_a, v_b, v_c$ .

**Mesh currents** (*Ampères*)

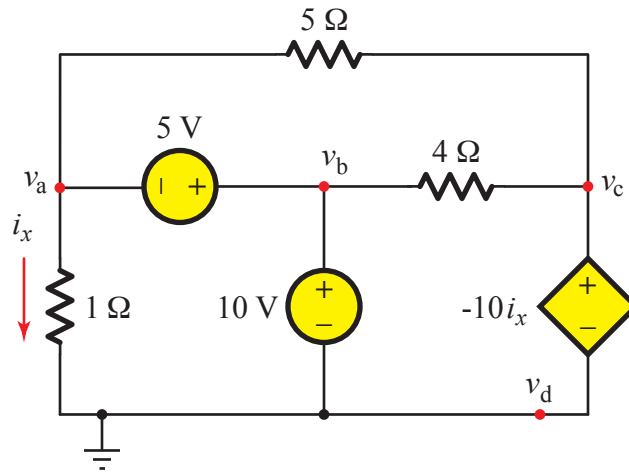
Parameter	Value
$i_1$	
$i_2$	
$i_3$	

**Node voltages** (*Volts*)

Parameter	Value
$v_a$	
$v_b$	
$v_c$	

*(Question 2, additional workspace ...)*

3. [14 marks.] Consider the circuit below.



- (a) [8] Use the node-voltage method to solve for the node voltages  $v_a, v_b, v_c$ .
- (b) [6] Using your answers to part (a), calculate the power in all the circuit elements, and confirm energy balance.

**Node voltages (Volts)**

Parameter	Value
$v_a$	
$v_b$	
$v_c$	
$v_d$	

**Power (Watts)**

Parameter	Value
$p_{1\Omega}$	
$p_{4\Omega}$	
$p_{5\Omega}$	
$p_{10V}$	
$p_{5V}$	
$p_{-10i_x}$	
<b>Total</b>	

*(Question 3, additional workspace ...)*

*(Please do not write in this space.)*

<b>#1 (15)</b>	<b>#2 (11)</b>	<b>#3 (14)</b>	<b>Total (40)</b>