ECE 209 — Exam # 1

Estimated time for completion: <1.25 hour
29 September 2016

Rules of the Exam

Rule 1: The examination period begins at 11:00am on Thursday 29 September 2016 and ends at 12:15pm on Thursday 29 September 2016.

Rule 2: There are four problems.

Rule 3: The exam is closed book and closed notes. You may have an 8.5" x 11" sheet of paper with notes and a calculator.

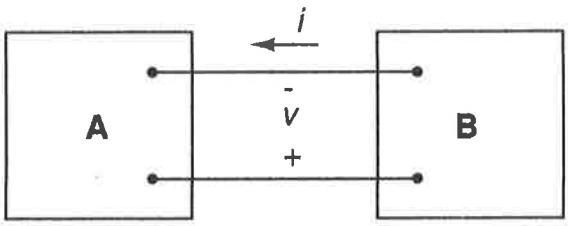
Rule 4: To receive full credit for an answer include the units along with the numerical answer.

Rule 5: Show all work - answers without supporting work will not receive credit.

Answer Key
Name

Problem 1 (20 points)

Two electric circuits, represented by boxes **A** and **B**, are connected as shown in the figure below. The reference direction for the current i and the reference polarity of the voltage v are also shown.

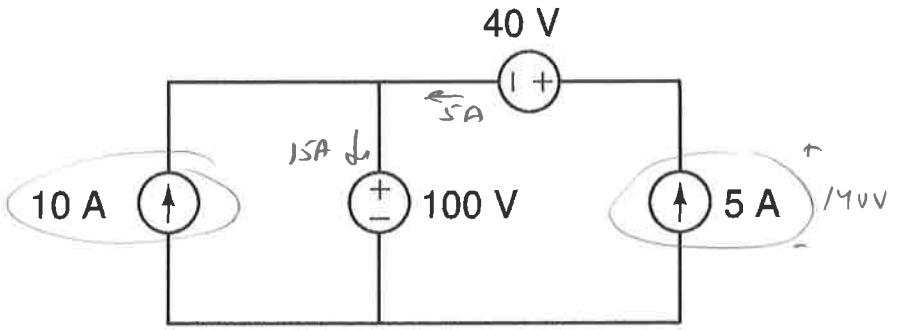


For each set of values of i and v in the table below, calculate the absolute value of the power associated with circuit **B** and indicate if circuit **B** is generating or absorbing power.

Condition	i	v	|Power|	Generating or Absorbing
1	10 A	5 V	50w	Absorbing
2	5 A	-24 V	120w	Generating
3	-12 A	24 V	288w	Generating
4	-2.5 A	-1 V	2.5w	Absorbing

Problem 2 (20 points)

Consider the circuit below:



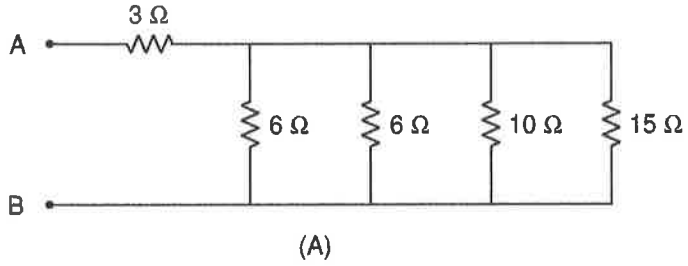
Is the interconnection valid (yes/no)? Yes

If the interconnection is valid, identify the voltage and current sources that generate power by circling them in the figure above.

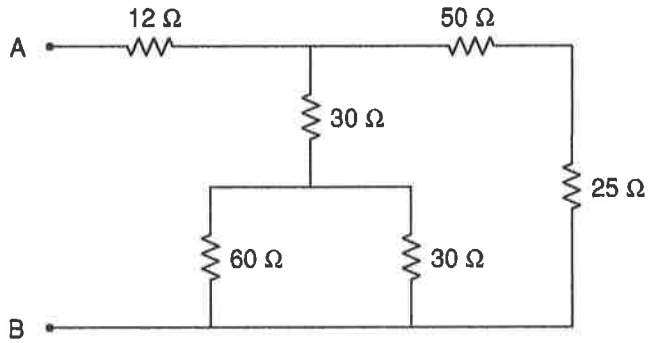
If the circuit is not valid, explain why:

Problem 3 (30 points)

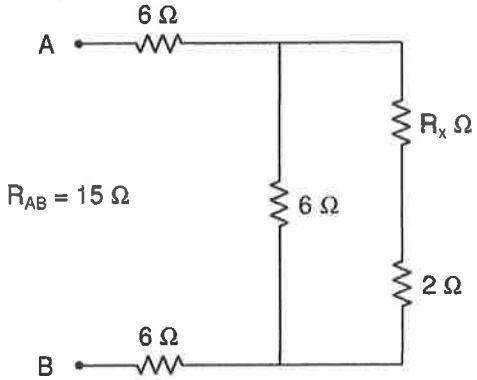
Consider the three series and parallel resistor combinations below:



(A)



(B)



(C)

For circuits (A) and (B), calculate R_{ab}, the equivalent resistance between terminals A and B:

R_{ab} for circuit (A): 5Ω

R_{ab} for circuit (B): 42Ω

$15||10||16||6+3$

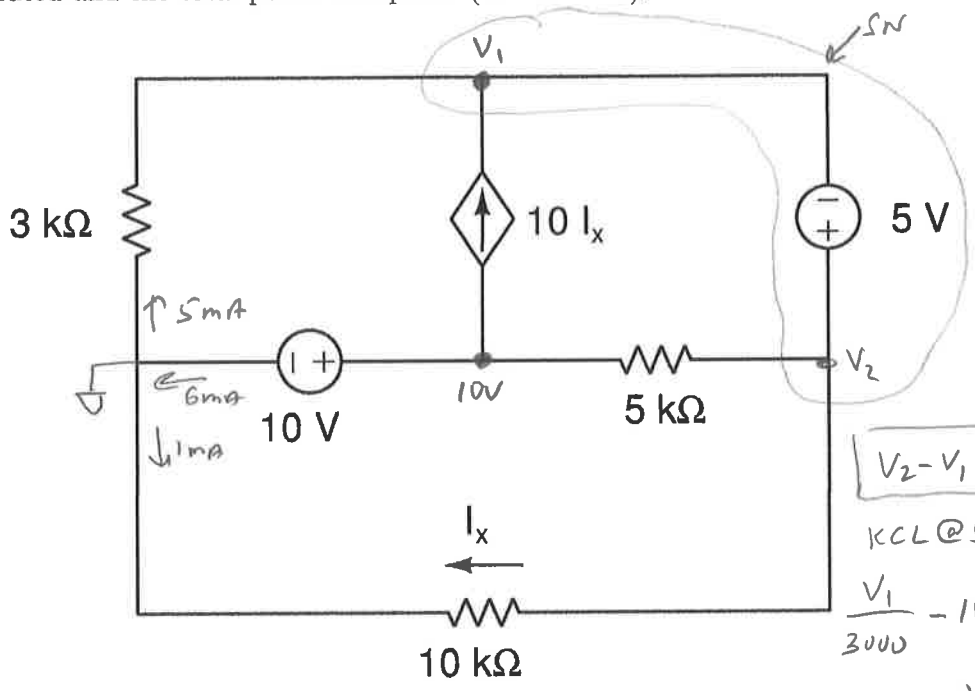
$25||50+12$

For circuit (C), calculate the value of R_x that produces an equivalent resistance between terminals A and B of 15Ω.

R_x for circuit (C): 4Ω

Problem 4 (30 points)

In the circuit shown below, calculate the power associated with each circuit component, the total power generated and the total power dissipated (or absorbed).



$V_2 - V_1 = 5V$

KCL@SN:

$\frac{V_1}{3000} - 10i_x + \frac{V_2 - 10}{5000} + \frac{V_2}{10000} = 0$

$i_x = \frac{V_2}{10,000}$

$i_x = -1mA$

$V_1 = -15V$

$V_2 = -10V$

Power associated with the 5 V independent source? 25 mW

Power associated with the 10 V independent source? 60 mW

Power associated with the $10I_x$ dependent current source? −250 mW

Power associated with the 3kΩ resistor? 75 mW

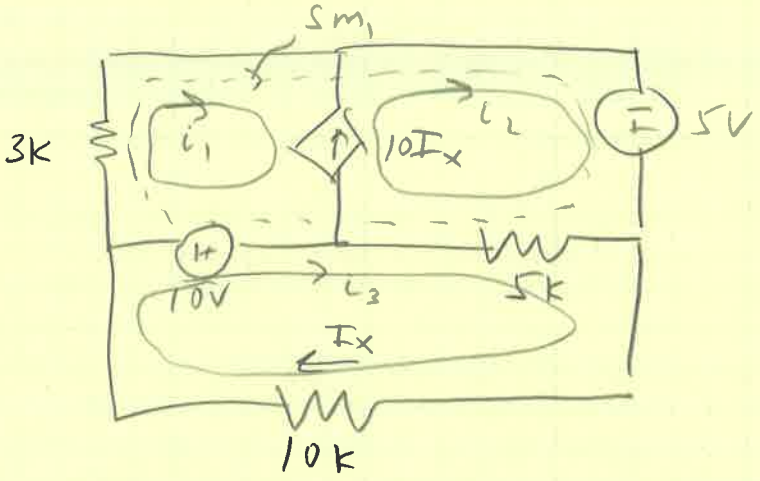
Power associated with the 5kΩ resistor? 80 mW

Power associated with the 10kΩ resistor? 10 mW

How much power is generated in the circuit? 250 mW

How much power is dissipated or absorbed in the circuit? 250 mW

Problem 4 by mesh



$I_x = i_3$

sm: Constraint: $i_2 - i_1 = 10 i_3$

KVL $-5 + 5000(i_2 - i_3) + 10 + 3000 i_1 = 0$

KVL @ i_3 : $-10 + 5000(i_3 - i_2) + 10,100 i_3 = 0$

3 equations; 3 unknowns

$i_1 = +5\,mA$

$i_2 = -5\,mA$

$i_3 = -1\,mA$