ECE 209 — Exam # 1

Estimated time for completion: <1.25 hour
28 September 2017

Rules of the Exam

Rule 1: The examination period begins at 9:30am on Thursday 28 September 2017 and ends at 10:45pm on Thursday 28 September 2017.

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.

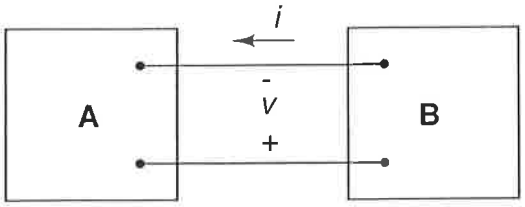
Rule 5: Show all work - answers without supporting work will not receive credit.

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.



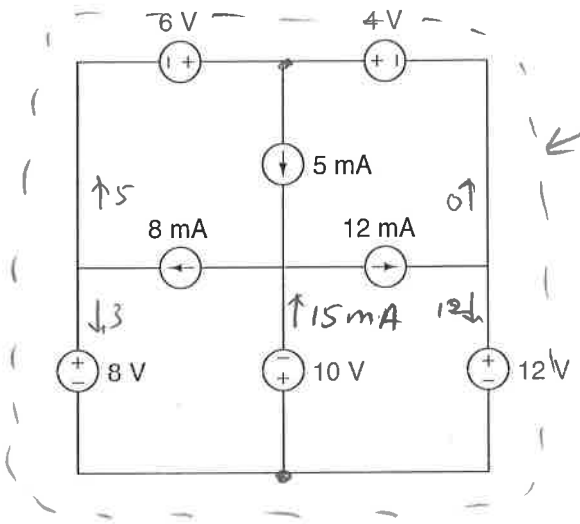
For each set of values of i and v in the table below, calculate the value of the power associated with circuit **A** and circuit **B**.

$P = -v \times i$ $P = v \times i$

Condition	i	v	Power for Circuit **A**	Power for Circuit **B**
1	-10 A	5 V	50 W	-50 W
2	5 A	2 V	-10 W	10 W
3	12 A	-2 V	24 W	-24 W

Problem 2 (20 points)

Consider the circuit below:



← KVL around loop

$-6+4+12-8 \neq 0$

Is the interconnection valid (yes/no)? no

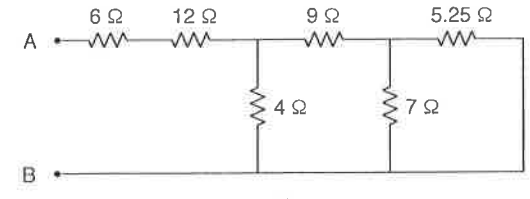
If the interconnection is valid, identify the voltage and current sources that generate power by circling them in the figure above.

If the circuit is not valid, explain why:

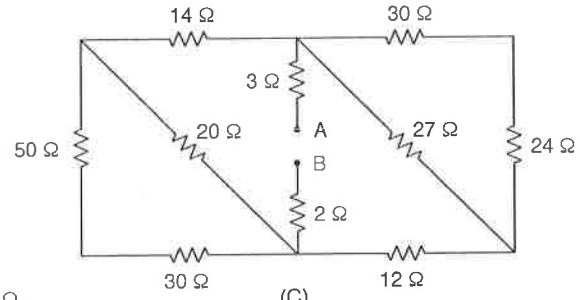
Problem 3 (30 points)

Consider the three series and parallel resistor combinations below:

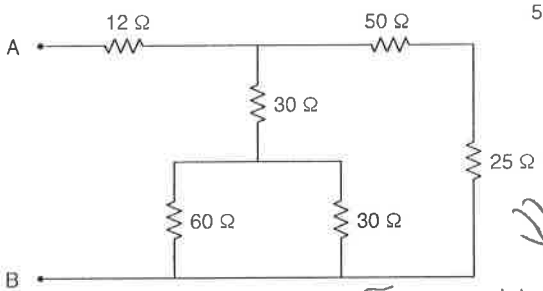
$R_{AB} = [((5.25 \| 7) + 9) \| 4] + 18 = 21\,\Omega$



(A)



(C)



(B) $R_{AB} = [(50+25) \| (30 + 30 \| 60)] + 12$

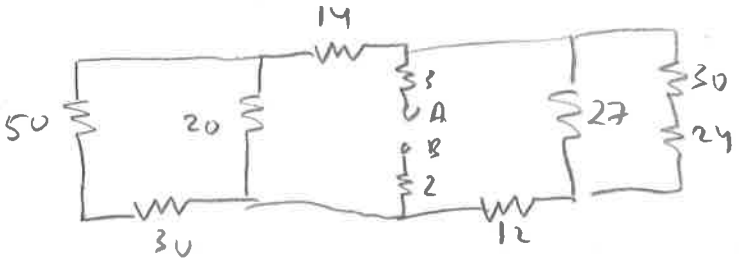
$= 30 + 12 = 42\,\Omega$

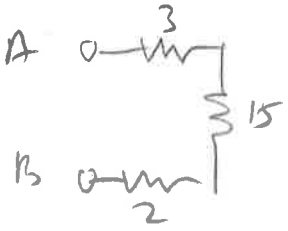
For circuits (A), (B), and (C) calculate R_{ab}, the equivalent resistance between terminals A and B:

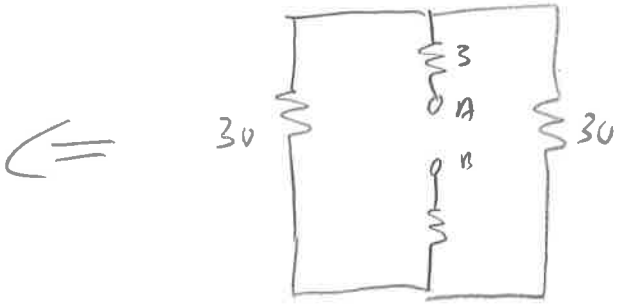
R_{ab} for circuit (A): $21\,\Omega$

R_{ab} for circuit (B): $42\,\Omega$

R_{ab} for circuit (C): $20\,\Omega$

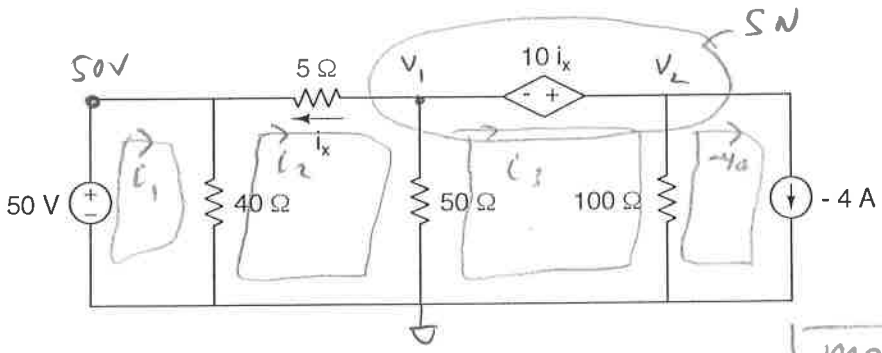






Problem 4 (30 points)

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



Power associated with the 50 V independent source? 37.5W

Power associated with the -4 A independent source? -320W

Power associated with the $10i_x$ dependent voltage source? 64W

Power associated with the 40Ω resistor? 62.5W

Power associated with the 5Ω resistor? 20 W

Power associated with the 50Ω resistor? 72W

Power associated with the 100Ω resistor? 64W

How much power is generated in the circuit? 320W

How much power is dissipated or absorbed in the circuit? 320W

NODAL ANALYSIS

SN

$$\begin{cases} V_2 - V_1 = 10 i_x \\ \frac{V_1 - 50}{5} + \frac{V_1}{50} + \frac{V_2}{100} - 4 = 0 \\ i_x = \frac{V_1 - 50}{5} \end{cases}$$

Solve $V_1 = 60V$, $V_2 = 80V$, $i_x = 2A$

mesh Analysis

$40(i_1 - i_2) - 50 = 0$

$5 i_2 + 50(i_2 - i_3) + 40(i_2 - i_1) = 0$

$-10 i_x + 100(i_3 + 4) + 50(i_3 - i_2) = 0$

$i_x = -i_2$

Solve

$i_1 = -3/4$ A

$i_2 = -i_x = -2$ A

$i_3 = -\frac{16}{5}$ A

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