KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE 201 Major Exam I

TIME: 08:00P.M. – 09:30 P.M.

DATE: Monday October 30, 2006

Key Solution

Student's Name: _____

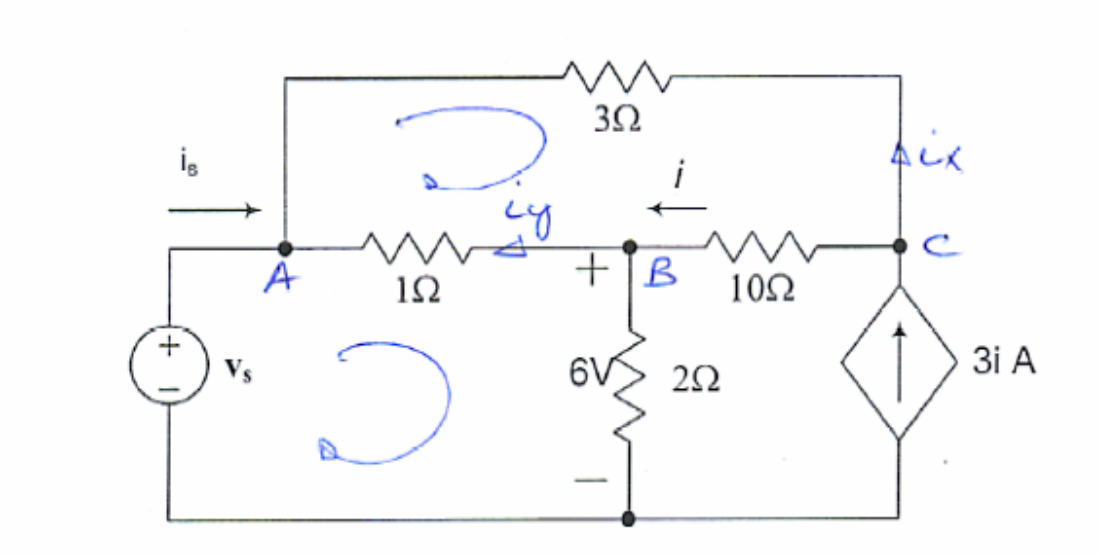
Student's I.D. Number: _____

Section Number: _____

Serial Number: _____

	Grade	Max. Grade
Problem 1		5
Problem 2		5
Problem 3		5
Total		15

Problem 1 (5 Points)



(a) Find $\mathbf{i_s}$ for the circuit shown.
(b) Find $\mathbf{v_s}$ for the circuit shown.

Use Ohm's LAW, KCL, and KVL only.
Do not use Mesh or Nodal Analysis

Solution:

Apply KCL at C: $+i - 3i + i_x = 0 \Rightarrow i_x = 2i$

" " " B: $i_y + \frac{6}{2} - i = 0 \Rightarrow i_y = i - 3$

Apply KVL in the upper loop:

$-3(2i) + 10i + (i-3)\times 1 = 0 \Rightarrow 5i = 3 \Rightarrow i = 0.6A$

Apply KCL at A:

$-i_s - (i-3) - 2i = 0 \Rightarrow i_s = 1.2A$

Apply KVL at the bottom left loop

$v_s = -(i-3)\times 1 + 6 \Rightarrow v_s = 8.4V$

ANSWERS: $i_s = 1.2A$.

$v_s = 8.4V$

Problem 2 (5 Points)

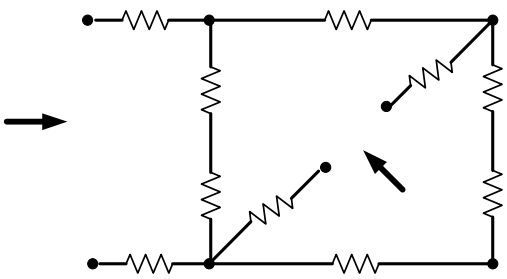


Figure (1)

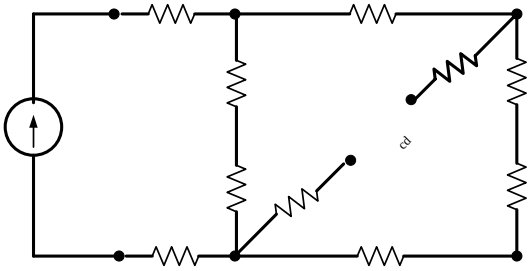


Figure (2)

(a) For the circuit shown in Figure (1), calculate the equivalent resistance R_{ab}.

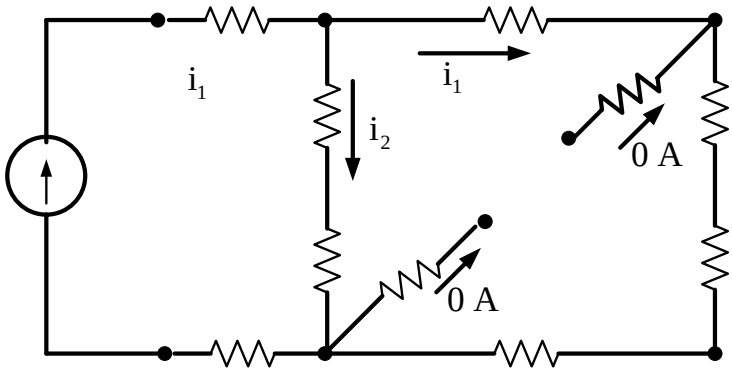
(b) For the circuit shown in Figure (1), calculate the equivalent resistance R_{cd}.

(c) For the circuit shown in Figure (2), calculate the voltage V_{cd} .

Solution

(a) $R_{ab} = 5 + \left[(2+4+6+8) \parallel (14+10)\right] + 12 = \mathbf{27.9\,\Omega}$

(b) $R_{cd} = 3 + \left[(2+14+10) \parallel (4+6+8)\right] + 9 = \mathbf{22.63\,\Omega}$



(c) $i_1 = \dfrac{(14+10)}{(14+10)+(2+4+6+8)}10 = \dfrac{60}{11} = 5.45$ A

$i_2 = \dfrac{(2+4+6+8)}{(2+4+6+8)+(14+10)}10 = \dfrac{50}{11} = 4.45$ A

KVL on the upper loop

$2i_1 + 3(0) - v_{cd} + 9(0) - 24i_2 = 0$

$\Rightarrow v_{cd} = 2i_1 - 24i_2 = 2\left(\dfrac{60}{11}\right) - 24\left(\dfrac{50}{11}\right) = \dfrac{-1080}{11} = -98.18$

OR KVL on the lower loop

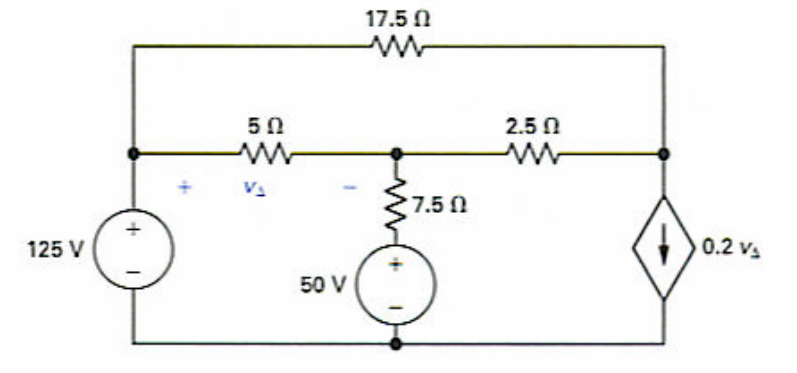
10 A

$v_{cd} + 3(0) + 18i_1 + 9(0) = 0$

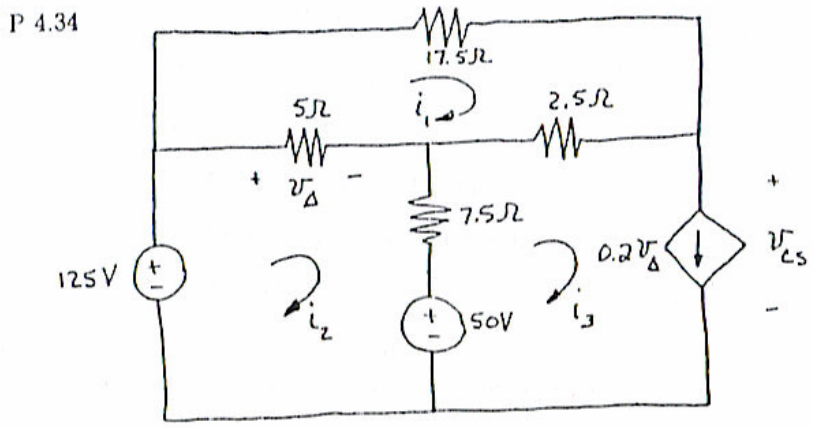
$\Rightarrow v_{cd} = -18i_1 = -18\left(\dfrac{60}{11}\right) = \dfrac{-1080}{11} = -98.18$

Problem 3 (5 Points)

For the circuit shown below, use **mesh analysis** to find the power (absorbed or delivered) by each of the three sources.



Solution



Mesh equations:

$$25i_1 - 5i_2 - 2.5i_3 = 0$$

$$75 = -5i_1 + 12.5i_2 - 7.5i_3$$

Constraint equations:

$$i_3 = 0.2v_\Delta$$

$$v_\Delta = 5(i_2 - i_1)$$

Solving, $i_1 = 3.6$ A; $i_2 = 13.2$ A; $i_3 = 9.6$ A

$$v_{cs} = 125 - v_\Delta - 2.5(i_3 - i_1) = 125 - 48 - 2.5(9.6 - 3.6) = 62 \text{ V}$$

$$p_{vc} = (62)(9.6) = 595.2 \text{ W (abs)}$$