

ECSE 2010
Electric Circuits
Exam 1
Spring 2004

Name

Solutions - [Signature]

Section Number (please circle one)

1

MTR
10-12

2

MWR
4-6

3

MTR
2-4

Problem No.	Pts.	Score
1	20pts	X/20
2	20pts	X/20
3	20pts	X/20
4	20pts	X/20
5	20pts	X/20
Total	100pts	X/100

Young

Qi

Jeff

Ali

Young

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Please Note:

- * Place all your answers in the spaces provided.
- * You MUST show your work to receive any credit.

Problem 1 (20pts)

Name Solutions - [Signature]

Section Number (please circle one)

1

2

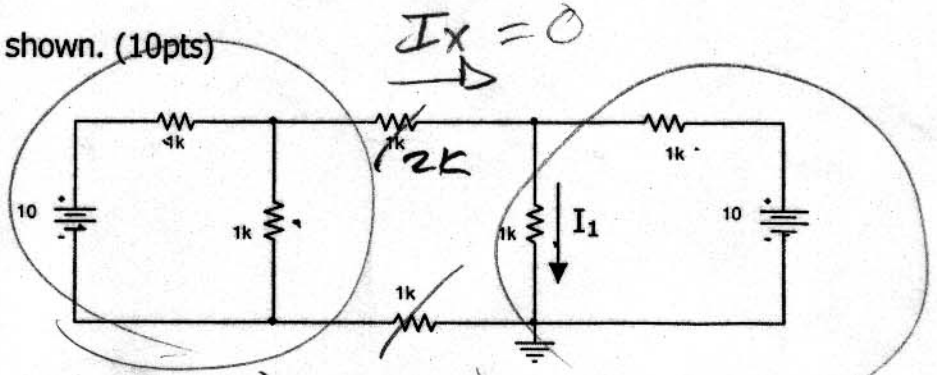
3

MTR
10-12

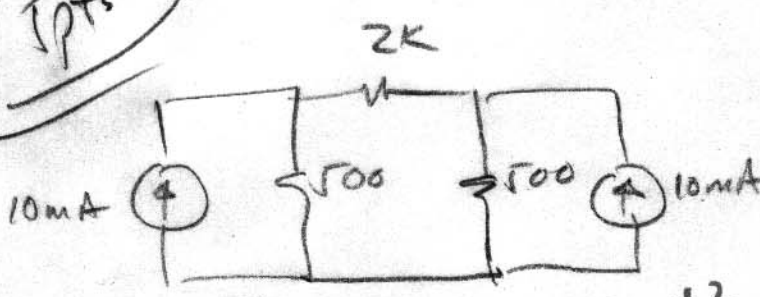
MWR
4-6

MTR
2-4

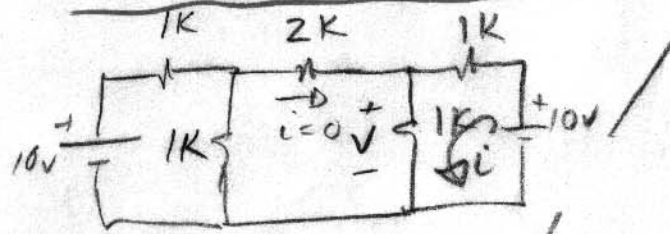
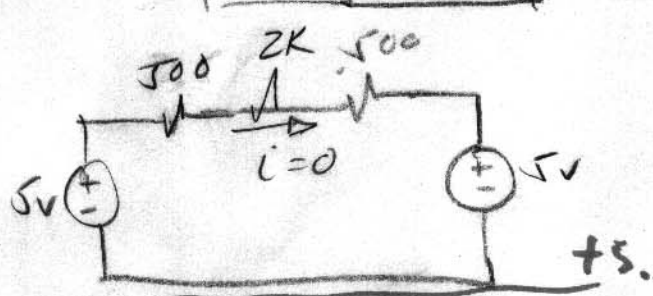
a.) Find I_1 for the circuit shown. (10pts)



1pts



SAME CKT!
Balanced Condition



Therefore; $I_x = 0!$
 $I_1 = \frac{10V}{2k} = 5mA$
1pts

$$10V \cdot \frac{1k}{2k} = 5V$$

$$I_1 = \frac{5V}{1k}$$

$$I_1 = 5mA$$

Super position
0.833mA
+
4.17mA
||
5mA.

I_1	5mA
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Problem 1 (cont)

Name Jim - Solutions

Section Number (please circle one)

1

2

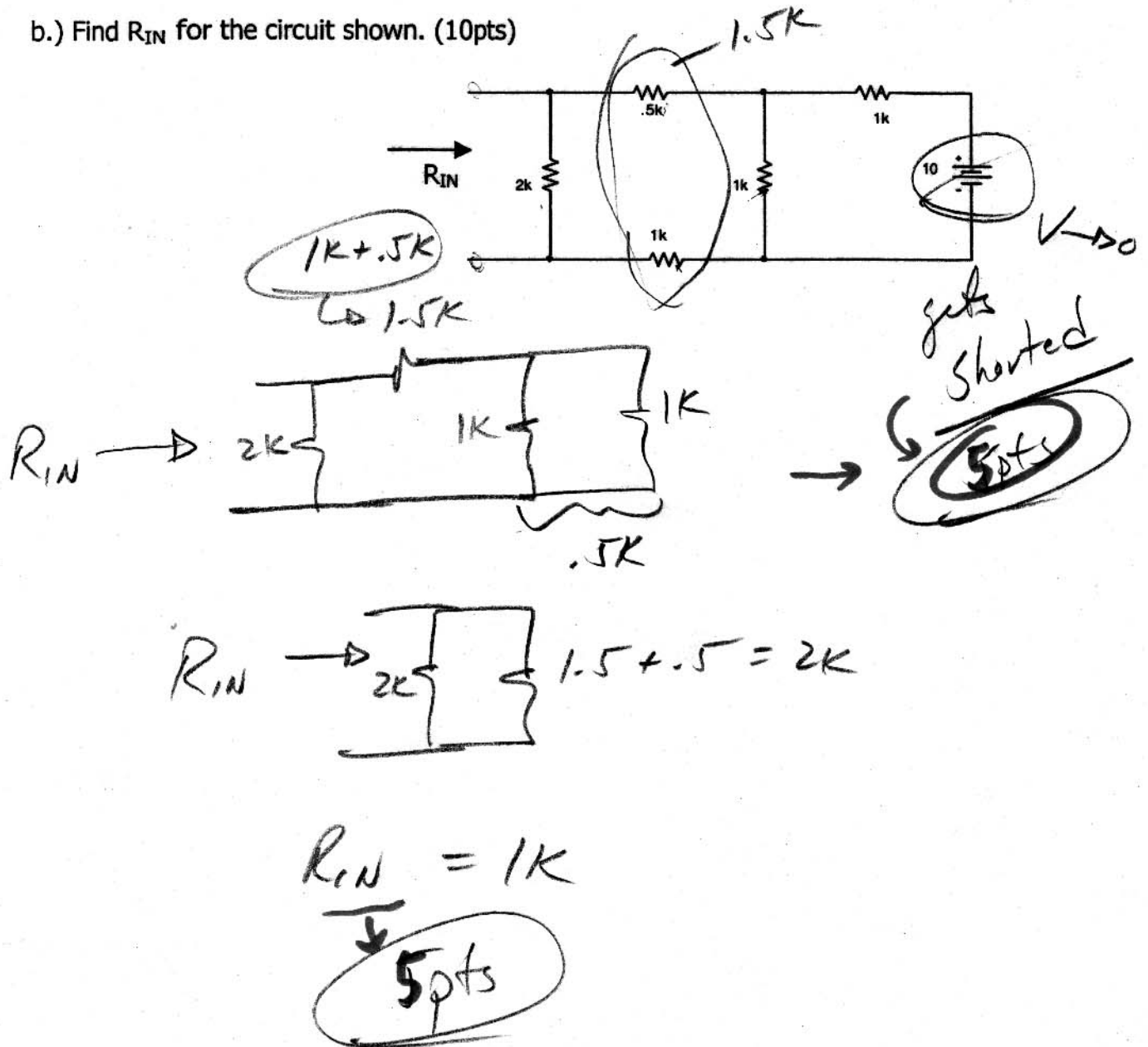
3

MTR
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2-4

b.) Find R_{IN} for the circuit shown. (10pts)



R_{IN}	1K
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Problem 2 (20pts)

Name Solutions *[Signature]*

Section Number (please circle one)

1

2

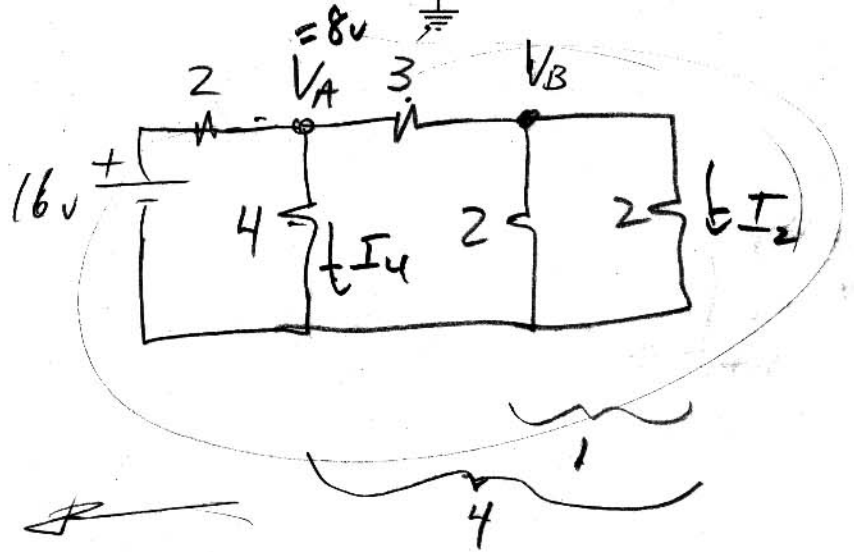
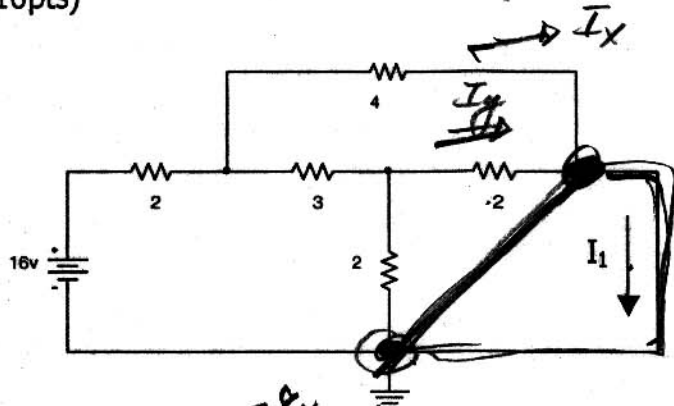
3

MTR
10-12

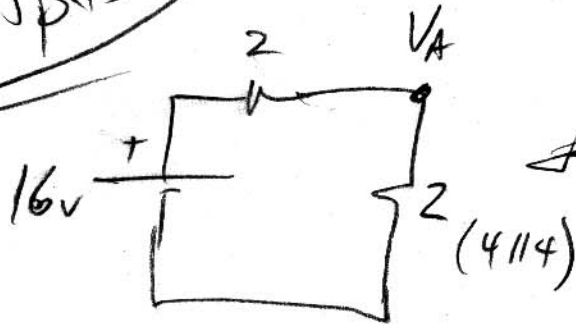
MWR
4-6

MTR
2-4

a.) Find I_1 for the circuit shown. (10pts)



7pts



$$V_A = \frac{2}{2+2} \times 16 = 8V$$

$$V_B = \frac{1}{1+3} V_A = \frac{1}{4} \times 8 = 2V$$

$$I_1 = I_x + I_y \quad \text{and} \quad I_x = \frac{V_A}{4} = 2A$$

7pts

$$I_y = \frac{V_B}{2} = 1A$$

I_1	3A
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$$I_1 = 2 + 1 = 3A$$

Problem 2 (cont)

Name Solutions Day

Section Number (please circle one)

1

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MTR

MWR

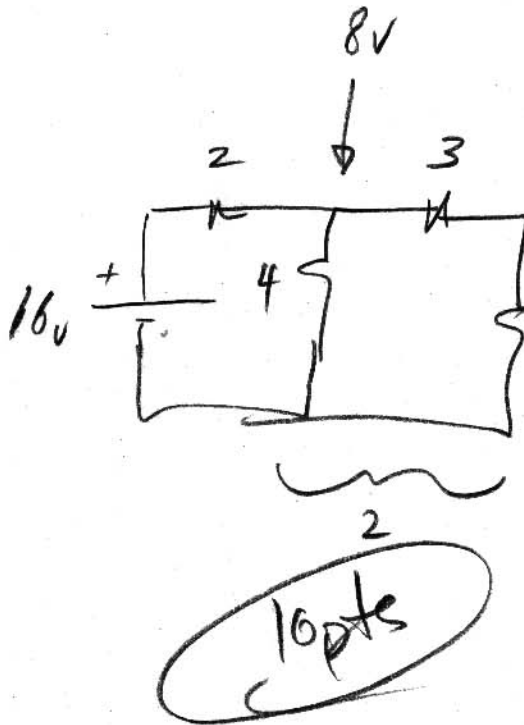
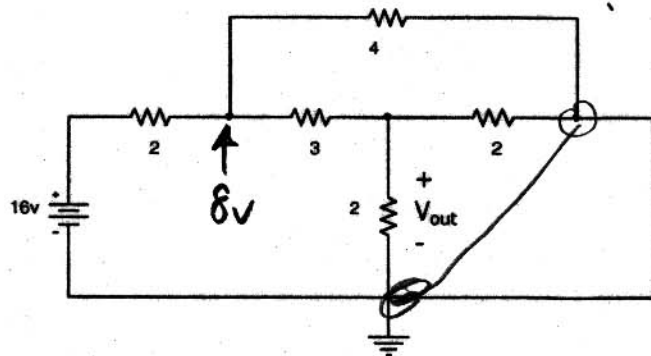
MTR

10-12

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2-4

b.) Find V_{out} in the circuit shown. (10pts)



$$V_{out} = V_{across} \underline{2/2}$$

$$V_{out} = \frac{1}{1+3} \times 8V = \underline{\underline{2V}}$$

$V_{out}(t)$	2V
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Problem 3 (20pts)

Name Solutions - Du

Section Number (please circle one)

1

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MWR

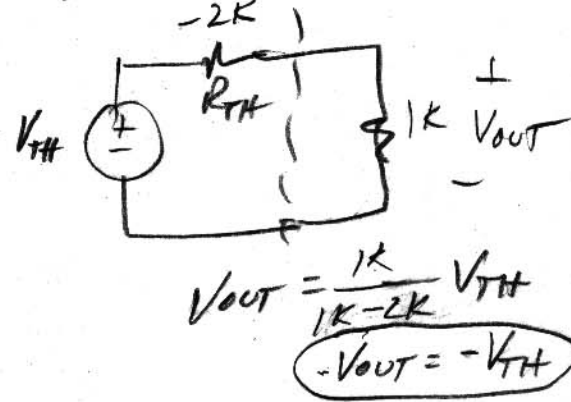
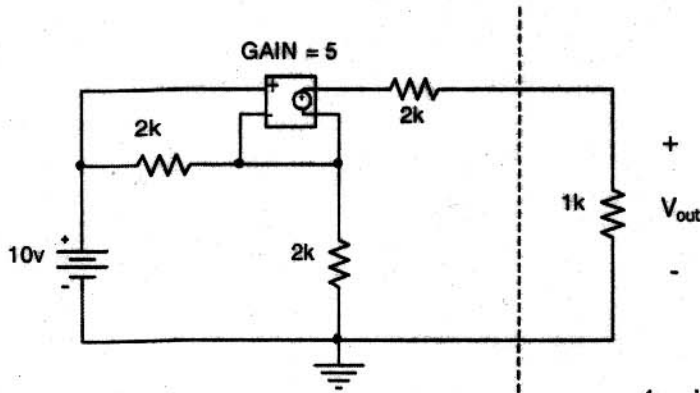
MTR

10-12

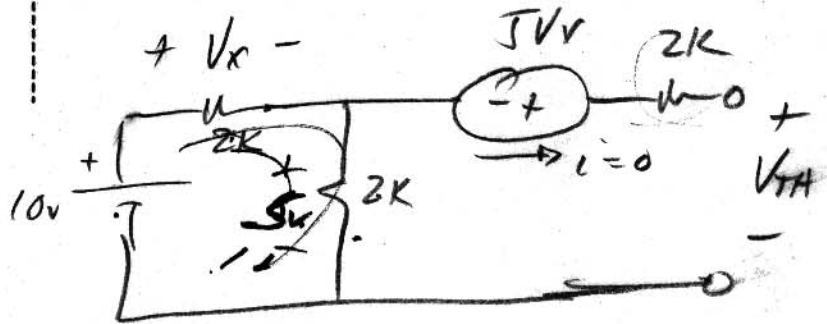
4-6

2-4

Find the Thevenin equivalent (to the left of the dashed line) for the circuit shown below and then use it to find V_{out} .



$V_{TH} = V_{open\ circuit}$

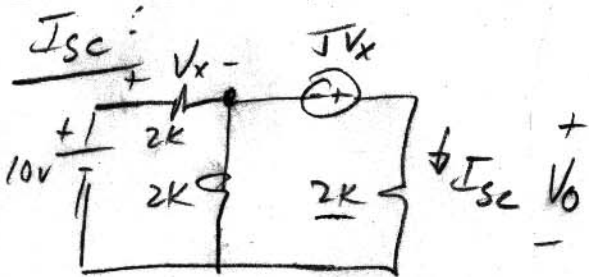


$V_x = 10V \frac{2}{2+2} = 5V$

$5V_x = 25V$

$V_{TH} = 10V - V_x + 5V_x = 30V$
 (= 10 + 4Vx = 10 + 20)

V_{th}	30V	5pts
R_{th}	-2K	10pts
V_{out}	-30V	5pts



$V_o = 10V - V_x + 5V_x = 10 + 4V_x$

$I_{sc} = \frac{10 + 4V_x}{2K}$

$I_{sc} = \frac{V_x}{2K} - \frac{(10 - V_x)}{2K}$

$I_{sc} = \frac{2V_x - 10}{2K} = \frac{10 + 4V_x}{2K}$

$2V_x = -20; V_x = -10V$

$I_{sc} = \frac{10 - 40}{2K} = \frac{-30}{2K} = -15mA$
 $R_{TH} = \frac{V_{oc}}{I_{sc}} = \frac{30}{-15mA} = -2K$

Problem 4 (20pts)

Name Solutions [Signature]

Section Number (please circle one)

1

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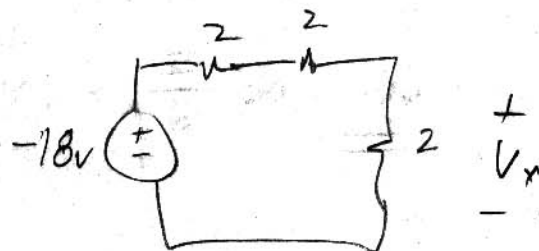
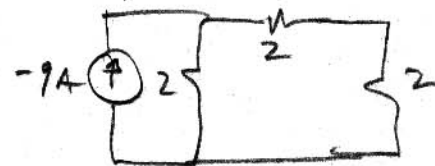
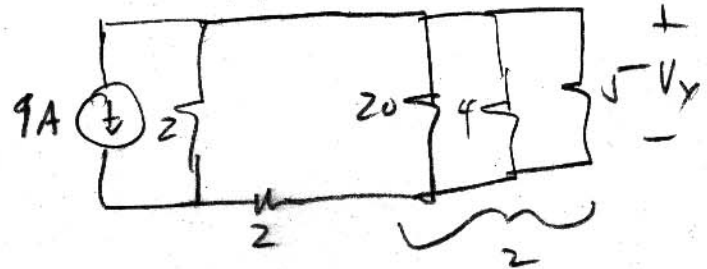
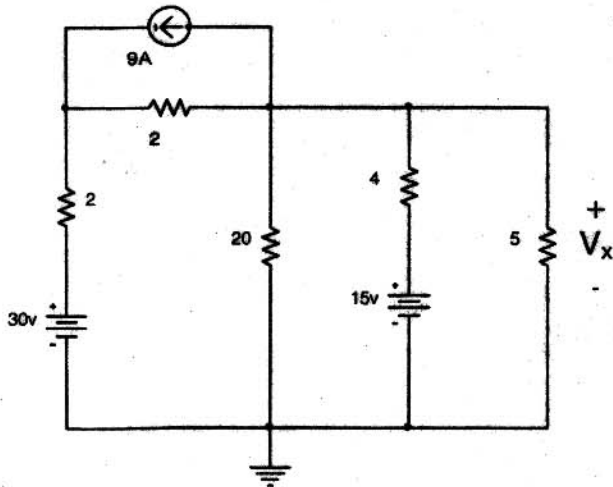
3

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10-12

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a.) Find the amount that each source contributes to V_x for the circuit shown below using superposition. (12pts)

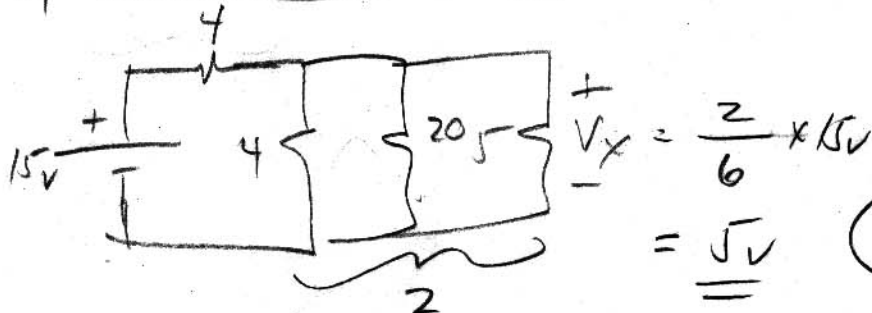
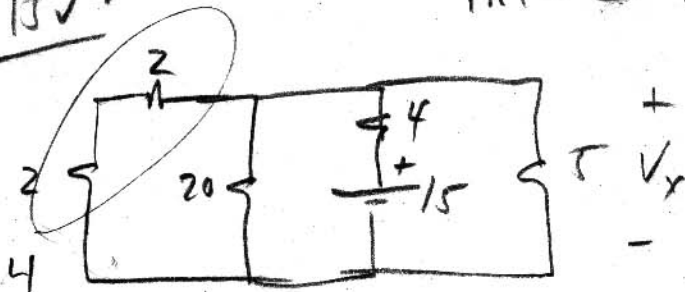


$20 \parallel 5 = 4 \quad V_x = \frac{2}{6} \times 30$

$V_x = \frac{2}{6} \times -18v = -6v$

$4 \parallel 4 = 2 \quad V_x = \underline{\underline{10v}}$

15v:



$V_x(30v)$	10v	4pts
$V_x(15v)$	5v	4pts
$V_x(9A)$	-6v	4pts

$V_{TOT} = 15 - 6 = \underline{\underline{9v}}$

Problem 4 (cont.)

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2

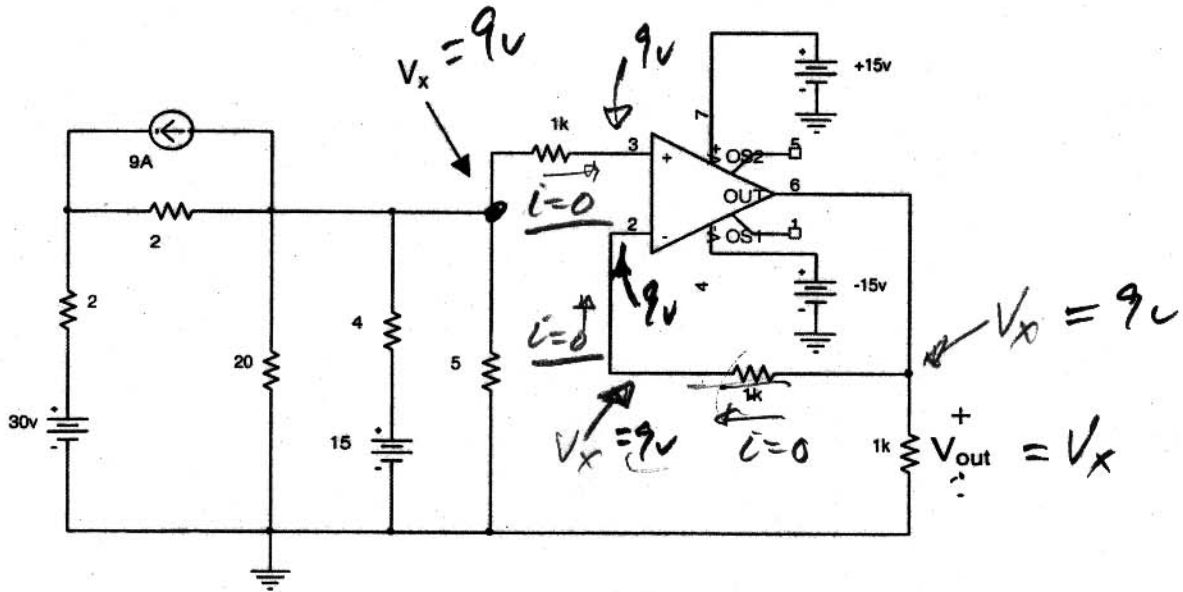
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b.) Find V_x and V_{out} for the circuit shown below. (8pts)



$$V_x = V_{30} + V_{9A} + V_{15} = 10 + 5 - 6V = \underline{\underline{9V}}$$

$$V_{out} = V_x \text{ since } i_{id} = 0$$

V_x	9V
V_{out}	9V

4pts
4pts

Problem 5 (20pts)

Name Solutions 

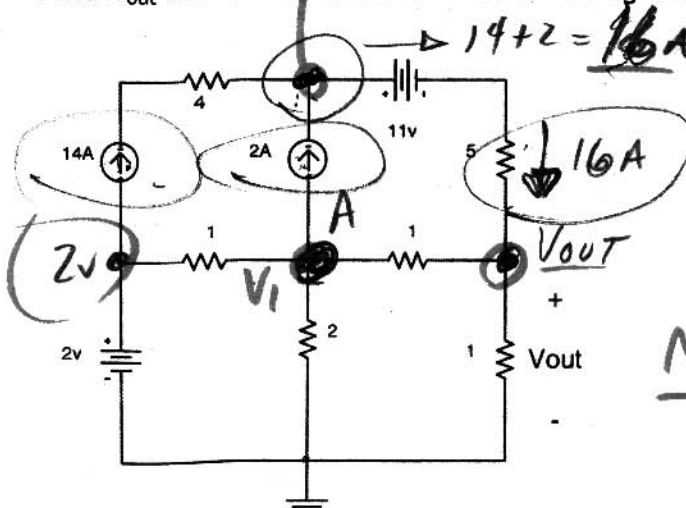
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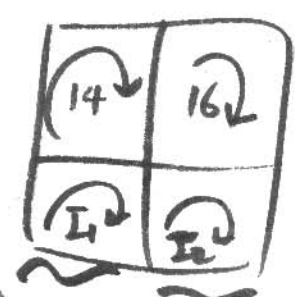
Find V_{out} for the circuit shown below using either mesh or nodal analysis.



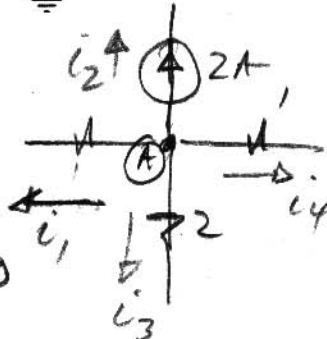
if set initial setting correctly $\rightarrow +5$.

Mesh

Node



At A:



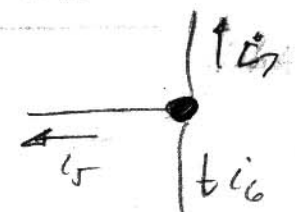
$$i_1 + i_2 + i_3 + i_4 = 0$$

$$\frac{V_A - 2V}{1} + 2A + \frac{V_A}{2} + \frac{V_A - V_{out}}{1} = 0$$

$$2(V_A - 2V) + 2(2A) + V_A + 2(V_A - V_{out}) = 0$$

$$2V_A - 4V + 4 + V_A + 2V_A - 2V_{out} = 0$$

At Vout:



$$i_5 + i_6 + i_7 = 0$$

$$\frac{V_0 - V_A}{1} + \frac{V_0}{1} + (-16) = 0$$

$$2V_0 - V_A = 16$$

$$-V_A + 2V_0 = 16$$

10pts

10pts

$$V_0 = 2.5 V_A$$

$$5V_A - 2V_{out} = 0$$

$$V_{out} = \frac{5V_A}{2} = \frac{5(4)}{2}$$

V_{out}	$+10V$
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$$5V_A - 2V_0 = 0$$

$$-V_A + 2V_0 = 16$$

$$4V_A = 16 ; V_A = 4V$$