Name : Jonathan Manczak Section: M4 CWRU e-mail: JMM57

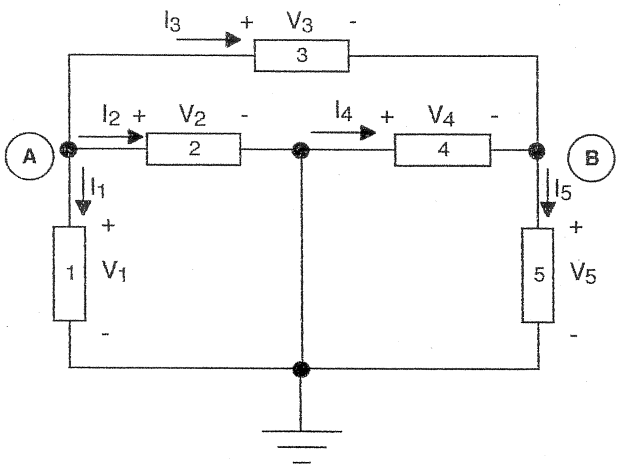
CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/21/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

Problem 1 (10 points)

16/20



Consider the five element circuit shown above. You measure the electrical parameters shown below for each circuit element. . Complete this table and indicate whether each device is absorbing (**A**) or delivering (**D**) power. Current is defined to be positive when it flows into the positive terminal of the device.

Device	Voltage	Current	Power	A/D
1	+30 V	-10A	-300W	D
2	+30V	4 A	+ 120 W	A
3	+50 V	6 A	+300 W	A
4	+20V	4 A	+80 W	A
5	-20 V	10A	-200W	D

$P = iV$ ① $i = \frac{P}{V} = \frac{-300}{30} = -10A$

② $V = \frac{P}{i} = \frac{120}{4} = +30V$

④ $V = \frac{P}{i} = \frac{80}{4} = +20V$

⑤ $i_5 = i_4 + i_3 = 6 + 4 = 10A$

$P = iV = 10A \cdot -20V = -200W$

Name : Jonathan Manczak Section: MA CWRU e-mail: JMM57

Problem 2 (10 points)

(a) An automobile battery is charged at a constant rate of 10000 milliamperes for 20 kiloseconds. Assume the charger keeps the battery voltage at a constant 0.012 kilovolts . What is the total energy in megajoules supplied to the battery?

$W = \int p\,dt$

ANSWER: ~~A~~ megajoules

$C = \frac{dq}{dt}$ $10000 \times 10^{-3} = \frac{Q}{2 \times 10^{3}}$ ~~$Q = 2 \times 10^{5}$~~

(b) An electrical power plant supplies 0.800kilovolts and 12000 milliamperes to operate an electric motor. The power plant is supplying how many kilowatts?

ANSWER: 9.6 kilowatts

$P = IV = 12000 \times 10^{-3} \cdot 800 \times 10^{3}$

Name : Daniel Donato Section: MN CWRU e-mail: dpd11

CASE WESTERN RESERVE UNIVERSITY
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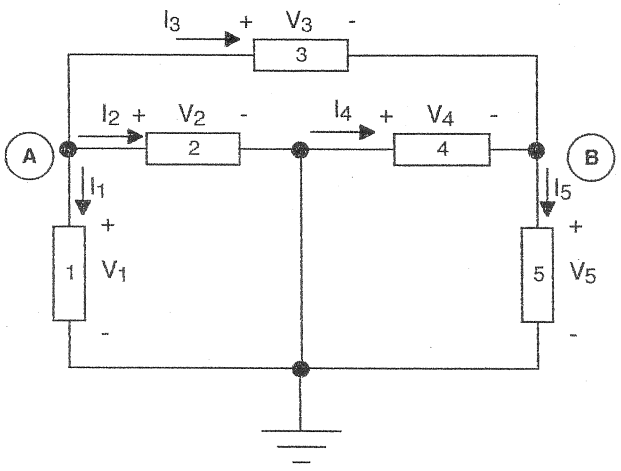
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/21/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

Problem 1 (10 points) 20/20+



-20

Consider the five element circuit shown above. You measure the electrical parameters shown below for each circuit element. . Complete this table and indicate whether each device is absorbing (**A**) or delivering (**D**) power. Current is defined to be positive when it flows into the positive terminal of the device.

Device	Voltage	Current	Power	A/D
1	+30 V	-10A	-300W	D
2	+30V	4 A	+ 120 W	A
3	+50 V	6 A	+300 W	A
4	20V	4 A	+80 W	A
5	-20 V	10A	-200W	D

$I_5 = I_2 + I_4 =$

Name : Daniel Donato Section: MN CWRU e-mail: dpd11

Problem 2 (10 points)

(a) An automobile battery is charged at a constant rate of 10000 milliamperes for 20 kiloseconds. Assume the charger keeps the battery voltage at a constant 0.012 kilovolts . What is the total energy in megajoules supplied to the battery?

ANSWER: 2.4 megajoules

120 · 20000
2400000J

10A 20000s

V = 12V

P = 12 · 10 = 120W

(b) An electrical power plant supplies 0.800kilovolts and 12000 milliamperes to operate an electric motor. The power plant is supplying how many kilowatts?

ANSWER: 9.6 kilowatts

800V 12A

12(800) = 9600W = 9.6×10^3

Name : Chad Kaschube Section: MA CWRU e-mail: cwk1

CASE WESTERN RESERVE UNIVERSITY
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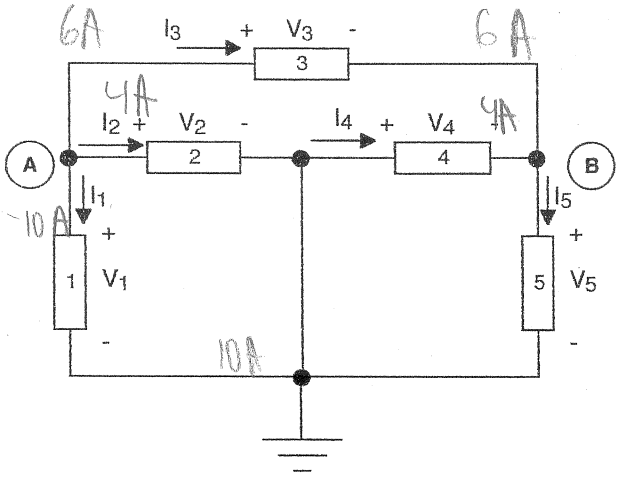
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/21/05

17/20

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

Problem 1 (10 points)



Consider the five element circuit shown above. You measure the electrical parameters shown below for each circuit element. . Complete this table and indicate whether each device is absorbing (**A**) or delivering (**D**) power. Current is defined to be positive when it flows into the positive terminal of the device.

P = iv

Device	Voltage	Current	Power	A/D
1	+30 V	-10A	-300W	D
2	+30V	4 A	+ 120 W	A
3	+50 V	6 A	+300 W	A
4	+20V	4 A	+80 W	A
5	-20 V	+10A	-200W	~~A~~

$I_{in} = I_{out}$ 10 = 10A

Name : Chad Kaschube Section: MA CWRU e-mail: cwk1

Problem 2 (10 points)

$i = 10$ Amps $\quad$ 20,000 seconds
$V = 12$ Volts

(a) An automobile battery is charged at a constant rate of 10000 milliamperes for 20 kiloseconds. Assume the charger keeps the battery voltage at a constant 0.012 kilovolts . What is the total energy in megajoules supplied to the battery?

ANSWER: 2.4 megajoules

$10 \cdot 12 = 120$ W

$120 (20{,}000) =$

2400000 Joules

mega $= 10^6$

(b) An electrical power plant supplies 0.800kilovolts and 12000 milliamperes to operate an electric motor. The power plant is supplying how many kilowatts?

ANSWER: 9.6 kilowatts

$V =$ 800 Volts

$I =$ 12 Amps

$800 \cdot 12 = 9600$ Watts $= 9.6$ kilowatts

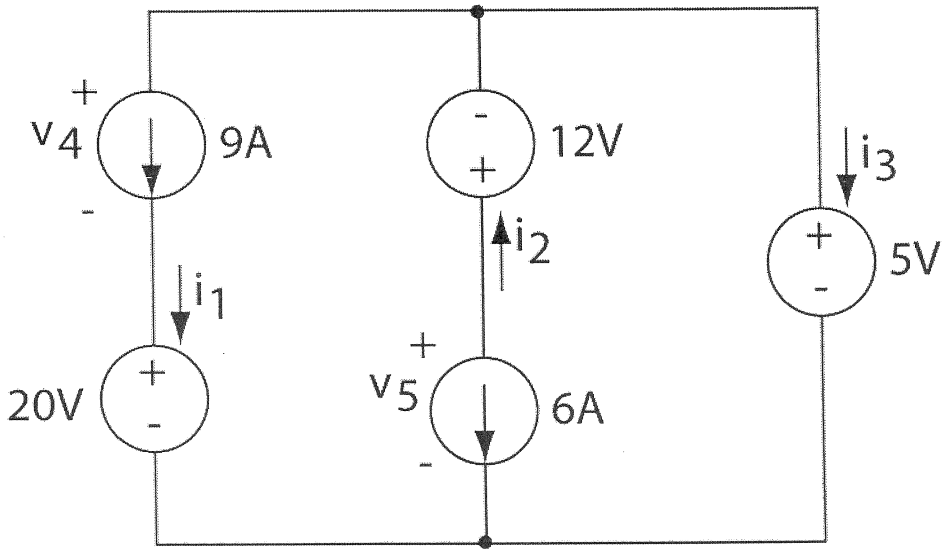
Name : Kevin Engel Section: TA CWRU e-mail: kte1

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/28/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

Problem 1 (10 points) – CONNECTION CONSTRAINTS
Answer the following questions for the circuit below. Be sure to follow the sign conventions indicated.



19/20

(a) Determine the indicated currents through the voltage sources.

I1= 9 A amperes

I2= -6 A amperes

-1

(b) What is the current through the 5 volt voltage source.

I3= -15 amperes

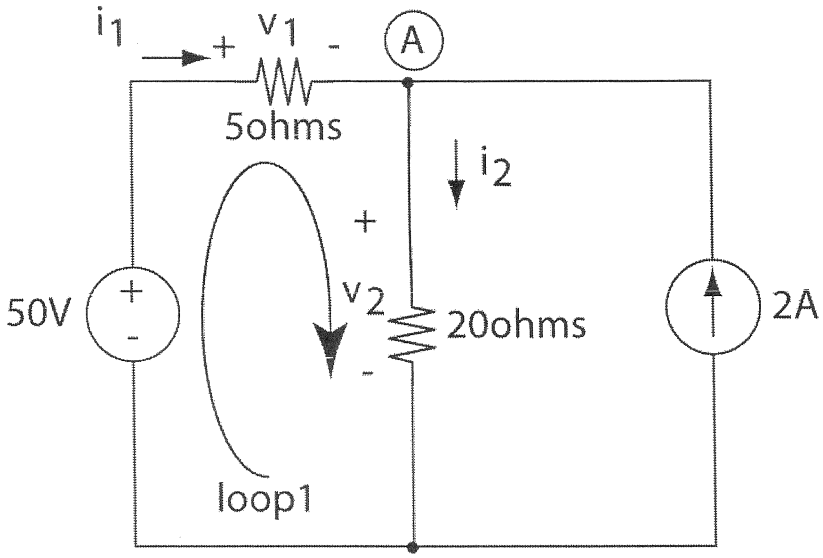
(c) What is the voltage across each current source?

V4= -15 volts

V5= 17 volts

Name : Kevin Engel / Section: TA CWRU e-mail: kte1

Problem 2 (10 points) COMBINED CONSTRAINTS



(a) How many nodes are in the above circuit? # nodes = 3 ✓

(b) Write the Kirchoff's Current Law equation for all the currents at node A. Your answer should be in terms of given circuit parameters, i.e., i1, i2, etc.

$2 + i_1 = i_2$ ✓

(c) Write the Kirchoff's Voltage Law equation for loop 1. Your answer should be in terms of given circuit parameters, i.e., i1, i2, etc.

$-50 + v_1 + v_2 = 0$ ✓

(d) What are the values of i1 and i2?

I1= .4 amperes ✓

I2= 2.4 amperes

$v_1 + v_2 = 50$

$5 i_1 + 20 i_2 = 50$

$i_1 + 4 i_2 = 10$

$i_2 - i_1 = 2$

$v_2 = \frac{12}{5}$ $\quad i_1 = \frac{2}{5}$

Name : Aaron Johnston-Pecks Section: 9A CWRU e-mail: acj7

CASE WESTERN RESERVE UNIVERSITY
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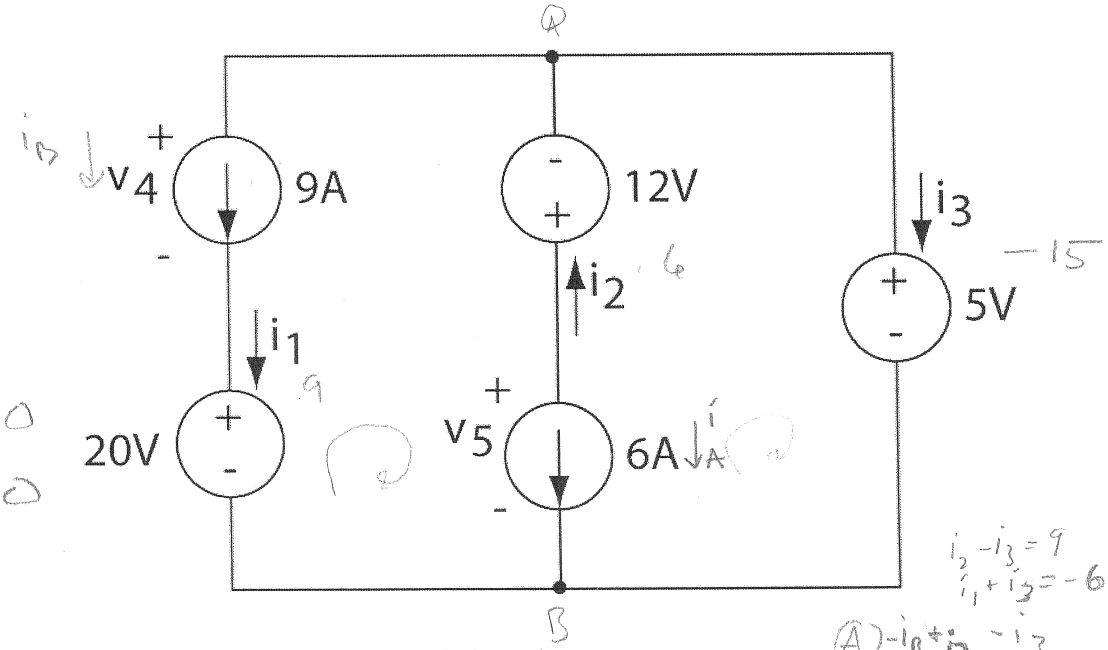
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/28/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

13/20

Problem 1 (10 points) – CONNECTION CONSTRAINTS
Answer the following questions for the circuit below. Be sure to follow the sign conventions indicated.



$-9 + i_2 - i_3 = 0$
$i_1 + 6A + i_3 = 0$
$i_3 = -15A$
$i_2 = 6$

$i_2 - i_3 = 9$
$i_1 + i_3 = -6$
(A) $-i_B + i_2 - i_3 = 0$
(B) $i_1 + i_A + i_3 = 0$
$-20 - V_4 - 12V + V_5 = 0$
$-V_5 + 12V + 5V = 0$
$V_5 = 17V$
$V_4 = -15V$
$-12 + 17 - V_4$
$-15 = V_4$

(a) Determine the indicated currents through the voltage sources.

I1= 9A amperes

I2= 6A amperes

(b) What is the current through the 5 volt voltage source. -1

I3= -15A amperes

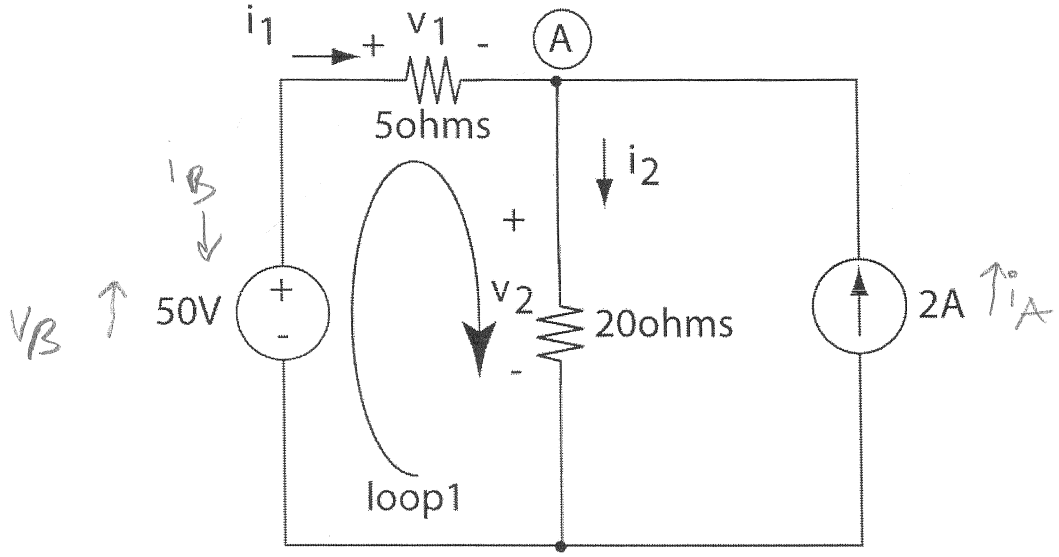
(c) What is the voltage across each current source?

V4= -15V volts

V5= 17V volts

Name : Aaron Johnston-Peck Section: TA CWRU e-mail: axj7

Problem 2 (10 points) COMBINED CONSTRAINTS



(a) How many nodes are in the above circuit? # nodes = 3

(b) Write the Kirchoff's Current Law equation for all the currents at node A. Your answer should be in terms of given circuit parameters, i.e., i1, i2, etc.

$i_1 - i_2 + i_A = 0$

(c) Write the Kirchoff's Voltage Law equation for loop 1. Your answer should be in terms of given circuit parameters, i.e., i1, i2, etc.

$-V_B + V_1 + V_2 = 0$

(d) What are the values of i1 and i2?

I1= 2 amperes

I2= 2 amperes

$V_1 + V_2 = 50V$

$i_1 R_1 + i_2 R_2 = 50V$

$i_1 - i_2 + 2 = 0$

$i_2 = i_1 + 2$

$i_2 - 2 + i_B = 0$

$25 = i_2$

$i_1 + i_B = 0$

Name : Neil Friedrich Section: TA CWRU e-mail: NJF4

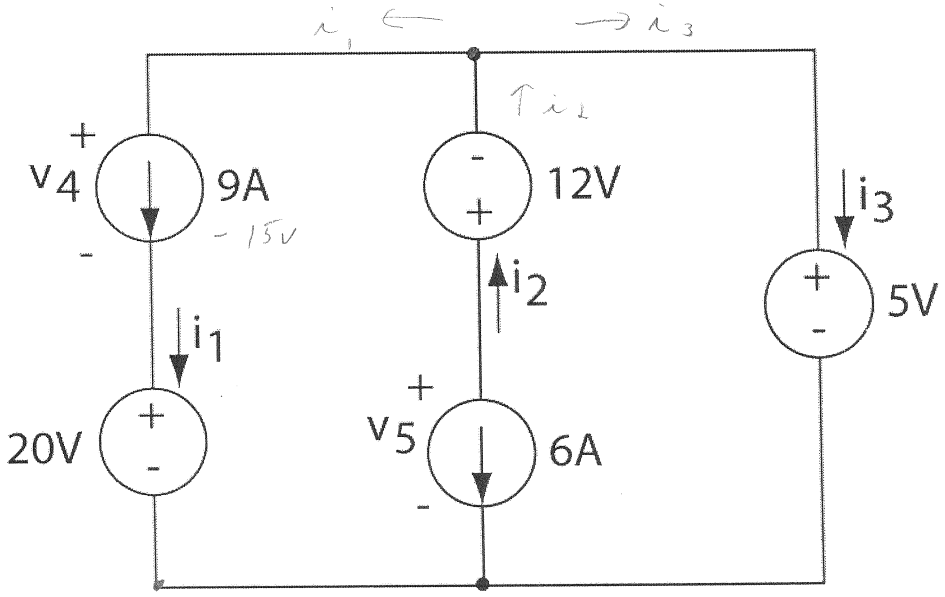
CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 1 1/28/05

20/20

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

Problem 1 (10 points) – CONNECTION CONSTRAINTS
Answer the following questions for the circuit below. Be sure to follow the sign conventions indicated.



(a) Determine the indicated currents through the voltage sources.

I1= 9A amperes

I2= -6A amperes

(b) What is the current through the 5 volt voltage source.

I3= -15A amperes ✓ KCL $-i_1 + i_2 - i_3 = 0$

$-9A + -6A - i_3 = 0$

$i_3 = -15A$

(c) What is the voltage across each current source?

V4= -15v volts

V5= 17v volts KVL $-10v - V_4 + 5v = 0$

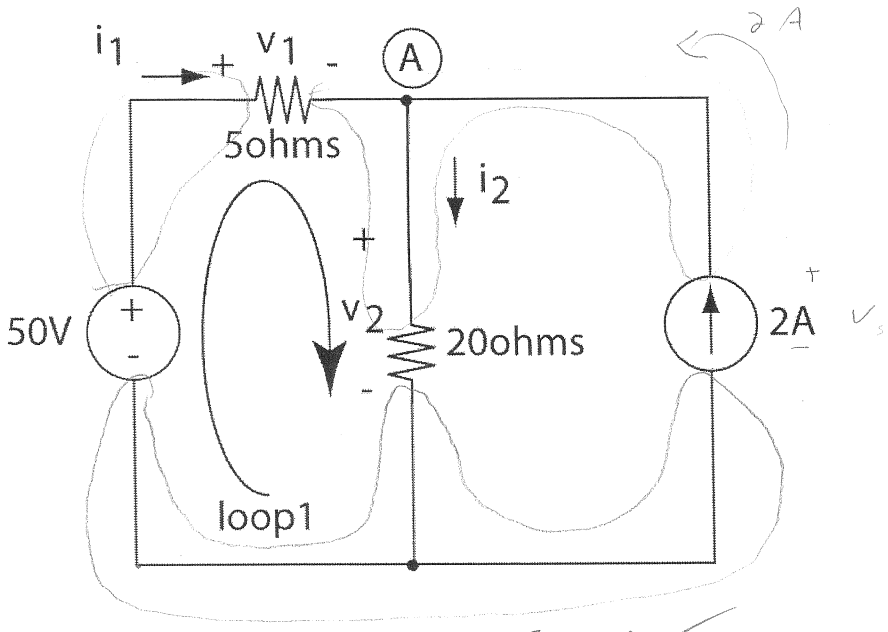
$-15v = V_4$

$-10v + 15v - 12v + V_5 = 0$

$V_5 = 17v$

Name : Mel Friedrich Section: T1 CWRU e-mail: MTF9

Problem 2 (10 points) COMBINED CONSTRAINTS



(a) How many nodes are in the above circuit? # nodes = 3

(b) Write the Kirchoff's Current Law equation for all the currents at node A. Your answer should be in terms of given circuit parameters, i.e., i1, i2, etc.

$$i_1 - i_2 + 2A = 0$$

(c) Write the Kirchoff's Voltage Law equation for loop 1. Your answer should be in terms of given circuit parameters, i.e., ~~i1~~ v1, v2, etc.

$$-50v + V_1 + V_2 = 0$$

(d) What are the values of i1 and i2?

KVL

$i_1 = i_2 - 2A$

$-50v + i_1\,5\Omega + i_2\,20\Omega = 0$

$-50v + (i_2 - 2)5 + i_2\,20 = 0$

$-50v + 5i_2 - 10 + 20i_2 = 0$

$25i_2 = 60$

$i_2 = 2.4A$

$i_1 - 2.4 + 2 = 0$

$i_1 = .4A$

I1= .4A amperes

I2= 2.4 amperes

Name : Stanley Shelton Section: ME CWRU e-mail: SKE135

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

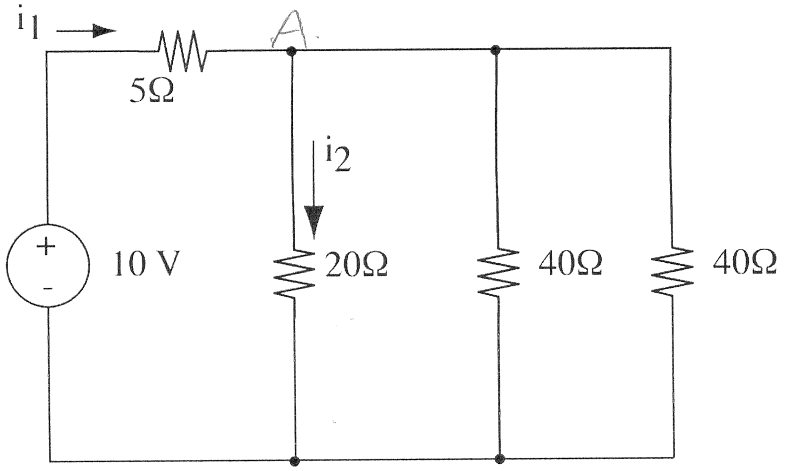
Quiz No. 3 2/4/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
STATE ALL ASSUMPTIONS

EQUIVALENT CIRCUITS. VOLTAGE AND CURRENT DIVISION

1. (10 points) Determine the current i_2 going through the 20Ω resistor in the circuit shown below.

i_2=_____ amperes

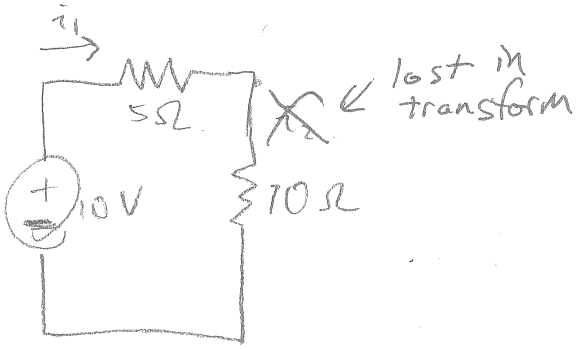


b

9/20

$\frac{1}{x} = \frac{1}{20} + \frac{1}{40} + \frac{1}{40}$

$\frac{1}{x_{Req}} = \frac{1}{10} = x_{Req} = 10\Omega$



lost in transform

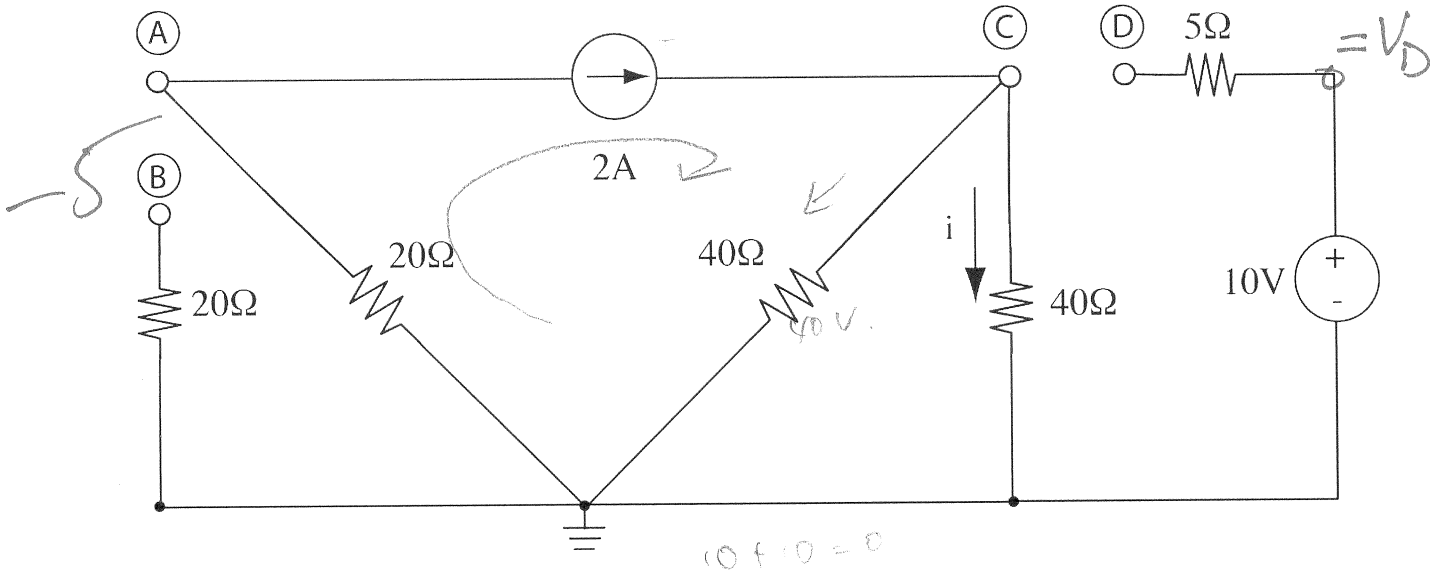
$V = IR$

$I = \frac{V}{R} \quad \frac{10V}{10\Omega} = 1A$

Name : Stanley Shu Chen Lo Section: ME CWRU e-mail: SXL255

COMBINED CONSTRAINTS

2. (10 points) Determine the numerical values of the indicated parameters for the circuit shown below. Be sure to observe the indicated current direction and voltage polarity in your answer.



V_D, the voltage at point D with respect to ground	~~10V~~
i, the current through the vertical 40Ω resistor (note the indicated direction)	~~A~~
V_C, the voltage at point C with respect to ground	40V
V_B, the voltage at point B with respect to ground	$\frac{1}{5}V = $ ~~0.2V~~
V_A, the voltage at point A with respect to ground	-40V

$V_C = I R_{eqD}$

$V_C = 2(20)$

$= 40V$

$\frac{1}{R_{eq}} = \frac{1}{40} + \frac{1}{40}$

$\frac{1}{R_{eq}} = \frac{1}{20}$

~~$V_D = V_C$~~ because V_D is not a close circuit, so current will not go there.

V_B is a open circuit, so no current go through, but V_B = ground ; 0!!!

For KVL, $+V_C + V_A = 0$

$40 + V_A = 0$

$V_A = -40$.

$V_B = [I R_{eqD}] = \left[2\left(\frac{1}{20} + \frac{1}{40} + \frac{1}{40}\right)\right]$

$= 2\left(\frac{1}{10}\right)$

$V_B = \frac{2}{40}$

Name : Jennifer M. Andy Section: ME CWRU e-mail: jma20

CASE WESTERN RESERVE UNIVERSITY
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ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 3 2/4/05

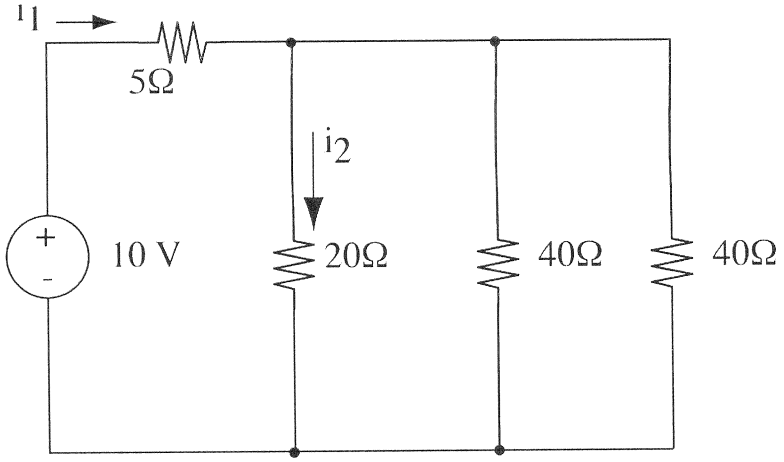
PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
STATE ALL ASSUMPTIONS

EQUIVALENT CIRCUITS. VOLTAGE AND CURRENT DIVISION

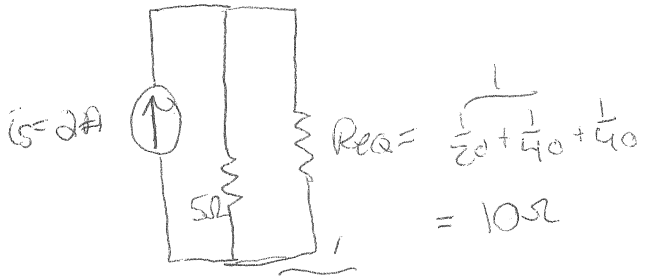
11/20

1. (10 points) Determine the current i_2 going through the 20Ω resistor in the circuit shown below.

i_2= i_3 amperes



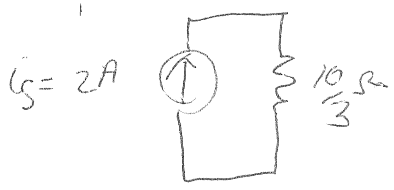
$i_1 = \frac{10V}{5\Omega} = 2A$



$R_{eq} = \frac{1}{\frac{1}{20}+\frac{1}{40}+\frac{1}{40}}$

$= 10\Omega$

$R_{eq}' = \frac{1}{10}+\frac{1}{5} = \frac{10}{3}$



$V = \frac{20}{3}V$.

$V = i_2 R$

$i_2 = \frac{(\frac{20}{3})V}{20\Omega}$

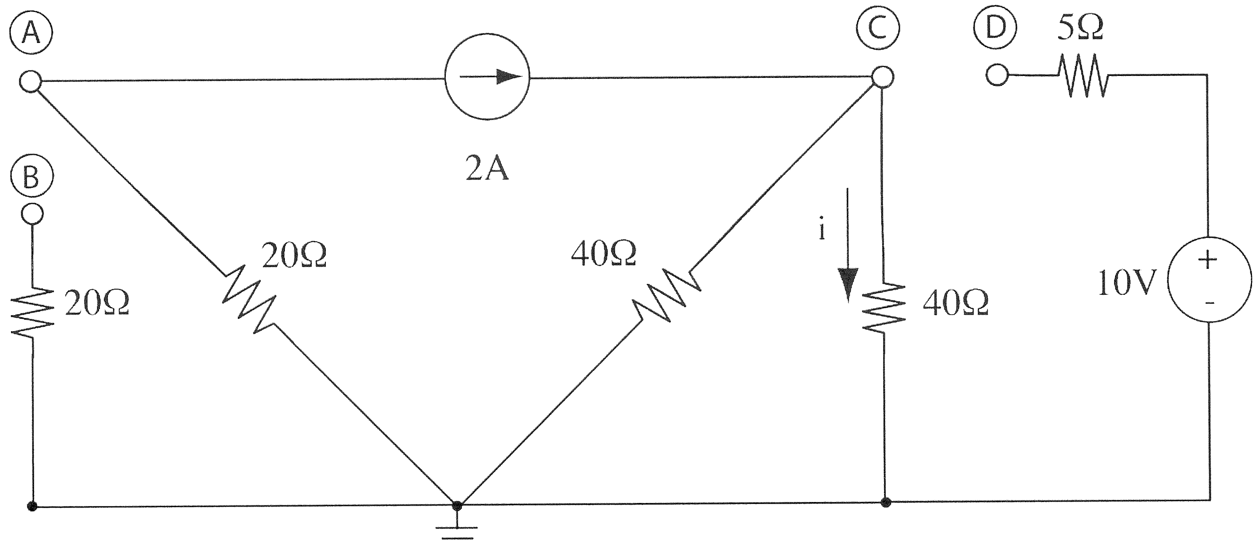
$i_2 = \frac{1}{3}A$

Name: Jenn Andy Section: ME CWRU e-mail: jma20

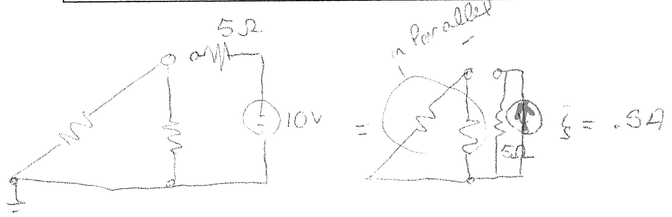
COMBINED CONSTRAINTS

2. (10 points) Determine the numerical values of the indicated parameters for the circuit shown below. Be sure to observe the indicated current direction and voltage polarity in your answer.

-9

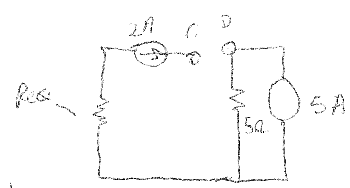


V_D, the voltage at point D with respect to ground	~~.5A~~
i, the current through the vertical 40Ω resistor (note the indicated direction)	~~1/3 A~~
V_C, the voltage at point C with respect to ground	~~40/3 V~~ (13.33V)
V_B, the voltage at point B with respect to ground	~~0~~
V_A, the voltage at point A with respect to ground	−40 V



$i = V_C/R = \frac{(40/3)}{40}$

$i = 1/3\,A$



Resistors in Parallel

$R_{eq} = \frac{1}{\frac{1}{20}+\frac{1}{20}+\frac{1}{40}+\frac{1}{40}}$

$= 20/3\ \Omega$

$V_C = i R_{eq}$

$= (2A)(20/3)\Omega$

$V_C = 40/3\ V$

Node A

$\rightarrow$ (2A)

(i_A)

$KCL = i_A - 2A = 0$

$i_A = 2A$

$V_A = i_A R$

$= (2A)(20\Omega)$

$= 40V$

Name : [illegible] Section: [illegible] CWRU e-mail: [illegible]

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ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 3 2/4/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
STATE ALL ASSUMPTIONS

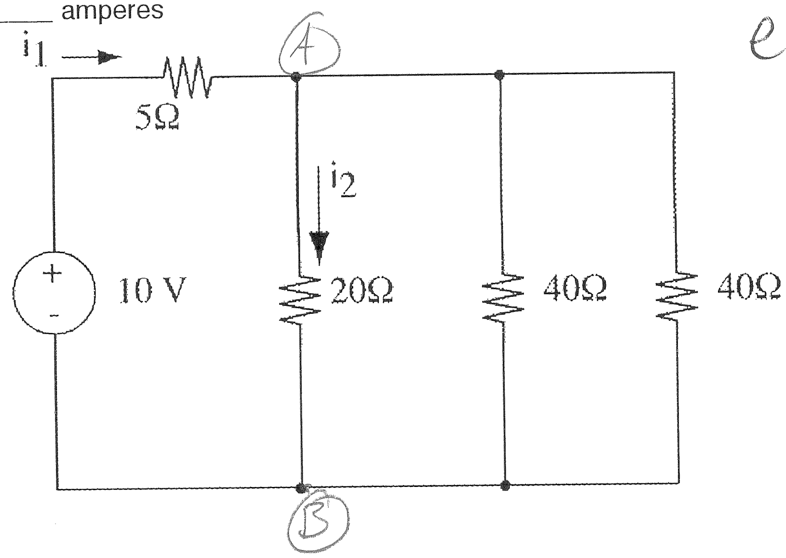
EQUIVALENT CIRCUITS. VOLTAGE AND CURRENT DIVISION

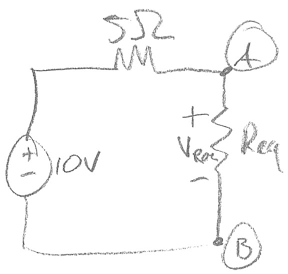
1. (10 points) Determine the current i_2 going through the 20Ω resistor in the circuit shown below.

i_2= 1/3 amperes

excellent

20/20





$\frac{1}{R_{eq}} = \frac{1}{20} + \frac{1}{40} + \frac{1}{40} = \frac{4}{40} = \frac{1}{10}$

$R_{eq} = 10\Omega$

$i_1 = \frac{V}{5+10} = 1.5\ A$

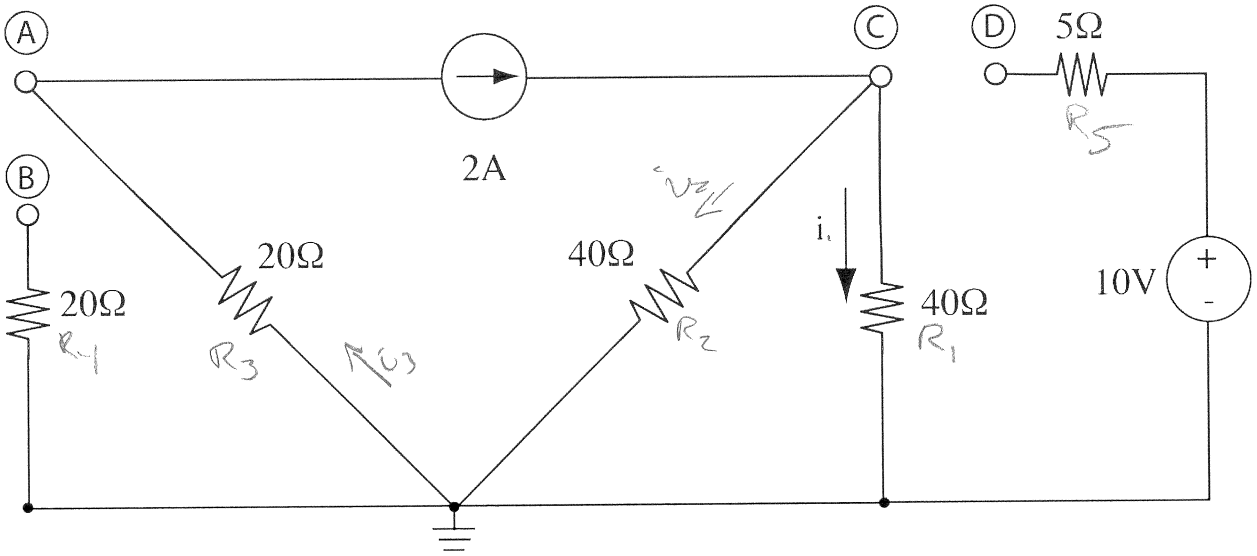
$V_{REQ} = \frac{2}{3} V = \frac{20}{3}$

$i_2 = \frac{V_{Req}}{20\Omega} = \frac{20/3}{20} = \boxed{\frac{1}{3}\ A}$

Name : Dan Pawlowski Section: ME CWRU e-mail: dfp4

COMBINED CONSTRAINTS

2. (10 points) Determine the numerical values of the indicated parameters for the circuit shown below. Be sure to observe the indicated current direction and voltage polarity in your answer.



V_D, the voltage at point D with respect to ground	10 V
i, the current through the vertical 40Ω resistor (note the indicated direction)	1 A ✓
V_C, the voltage at point C with respect to ground	40 V
V_B, the voltage at point B with respect to ground	0 V
V_A, the voltage at point A with respect to ground	−40 V

C: $2A - i_1 - i_2 = 0$ $\quad i_1 = i_2$

$i_1 = 1A$

$V_C = i_1 R_1 = 40V$

A: $-2A + i_3 = 0$

$i_3 = 2A$

$-V_A = i_3 R_3 = (2A)(20\Omega)$

Name : Cathy Ruczko Section: TE CWRU e-mail: cgr8

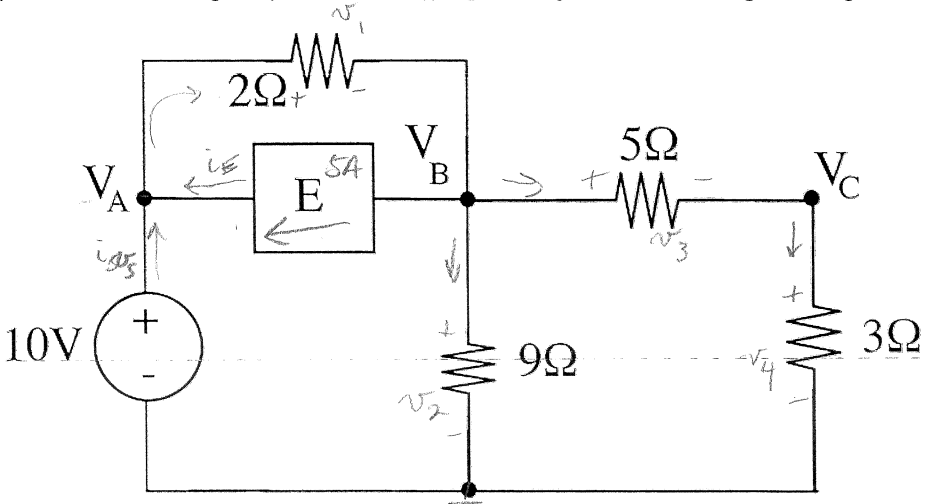
Quiz No. 4 2/11/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
STATE ALL ASSUMPTIONS

14/20

NODE VOLTAGE ANALYSIS

1. (10 points) Write node voltage equations for V_A, V_B and V_C for the following circuit given that



(a) E is a 5 volt voltage source with the plus reference on the left.

NODE	Node Voltage Equations
A	$-\frac{1}{2}V_A + (1+\frac{1}{2})V_B + 0\,V_C = 0$
B	$\frac{1}{2}+1\,V_A + (\frac{1}{2}-\frac{1}{9}-\frac{1}{5})V_B + \frac{1}{5}V_C = 0$
C	$0\,V_A + \frac{1}{5}V_B + (\frac{1}{5}+\frac{1}{3})V_C = 0$

2

A: $i_{v_s} + i_E = i_1$ B: $i_1 = i_E + i_2 + i_3$ C: $i_3 = i_4$

$i_{v_s} + v_B - v_A = \frac{v_A - v_B}{R_1}$ $\frac{v_A - v_B}{R_1} + \frac{v_B - v_A}{R_2} + \frac{v_B - v_C}{R_3}$ $\frac{v_B - v_C}{R_3} = \frac{v_C}{R_4}$

(b) E is a 5 ampere current source with the reference arrow pointing left.

NODE	Node Voltage Equations
A	$(\frac{1}{2})V_A + (1-\frac{1}{2})V_B + 0\,V_C = 0$
B	$(\frac{1}{2}+1)V_A + (\frac{1}{2}-1-\frac{1}{9}-\frac{1}{5})V_B + (\frac{1}{5})V_C = 0$
C	$0\,V_A + \frac{1}{5}V_B + (\frac{1}{5}+\frac{1}{3})V_C = 0$

2

$v_A + \frac{v_A}{R_1} = \frac{v_A - v_B}{R_1}$ A: $i_E + i_{v_s} = i_1$ B: $i_1 = i_E + i_2 + i_3$

$i_{v_s} = i_1 - i_E$ $\frac{v_B - v_A}{2} = v_B - v_A + \frac{v_B}{9} + \frac{v_B - v_C}{5}$

$v_A - 0 = \frac{v_B - v_A}{R_1} - (v_B - v_A)$

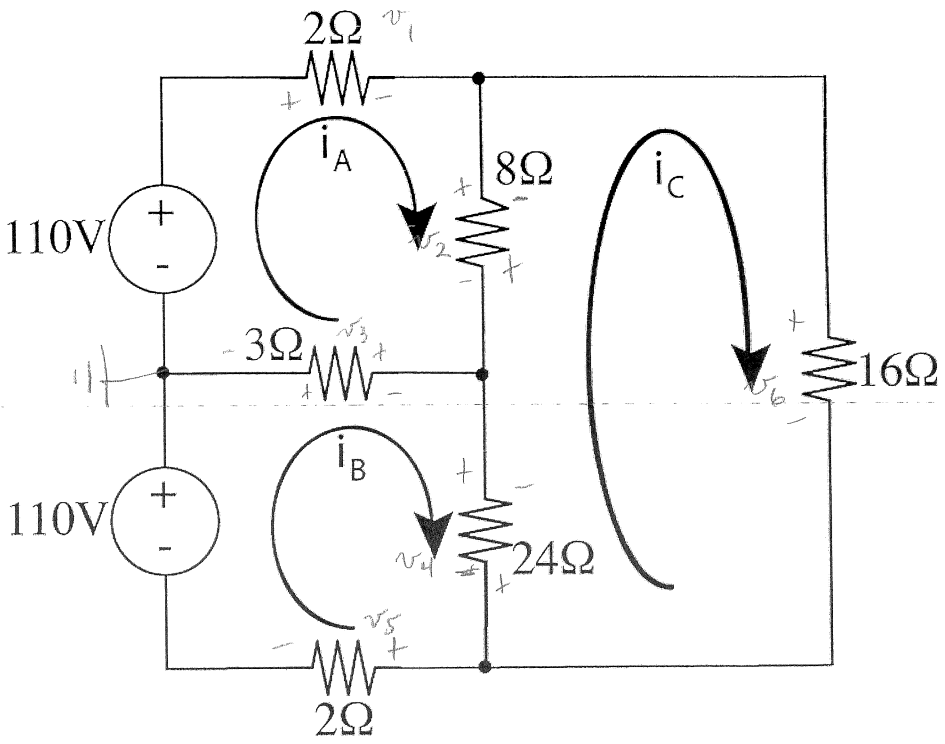
$v_A - (\frac{v_B - v_A}{R_1}) + (v_B - v_A) = 0$

Name : Cathy Ruczko Section: TE CWRU e-mail: cgr8

MESH CURRENT ANALYSIS

2. (10 points) The circuit shown below is a DC model of a residential power distribution circuit. Use the mesh current method to write equations for the indicated currents.

10



MESH	Mesh Current Equations
A	13 i_A + (-3) i_B + (-8) i_C = 110
B	-3 i_A + 29 i_B + (-24) i_C = 110
C	-8 i_A + (-24) i_B + 48 i_C = 0

A: $-110 + v_1 + v_2 + v_3 = 0$ B: $-110 + v_3 + v_4 + v_5 = 0$ C: $v_4 + v_2 + v_6 = 0$

A: $-110 + i_A 2 + i_A 8 - i_C 8 + i_A 3 - i_B 3 = 0$

$-110 + i_B 3 - i_A 3 + i_B 24 - i_C 24 + i_B 2$

$i_C 24 - i_B 24 + i_C 8 - i_A 8$

$+ i_C 16 = 0$

24
8
16

Name : Brent Wise Section: TE CWRU e-mail: bew4

Quiz No. 4 2/11/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE

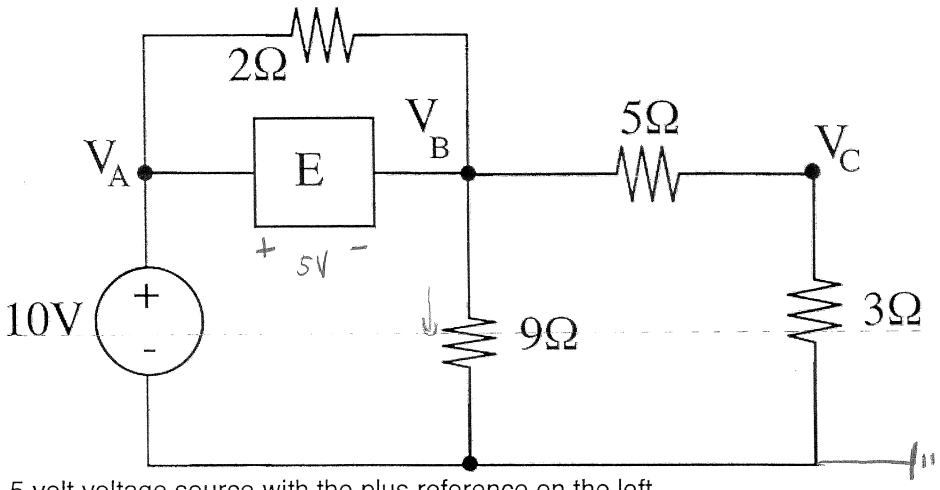
STATE ALL ASSUMPTIONS

20/20

10

NODE VOLTAGE ANALYSIS

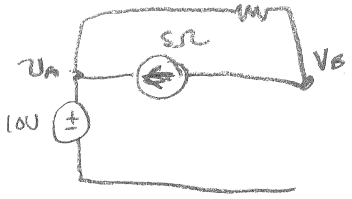
1. (10 points) Write node voltage equations for V_A, V_B and V_C for the following circuit given that



(a) E is a 5 volt voltage source with the plus reference on the left.

NODE	Node Voltage Equations
A	$1\ V_A + 0\ V_B + 0\ V_C = 10V$
B	$1\ V_A + -1\ V_B + 0\ V_C = -5V$
C	$0\ V_A + -\frac{1}{5}S\ V_B + \frac{8}{15}S\ V_C = 0$

3+5



(b) E is a 5 ampere current source with the reference arrow pointing left.

NODE	Node Voltage Equations
A	$1\ V_A + 0\ V_B + 0\ V_C = 10V$
B	$\frac{1}{2}S\ V_A + \frac{73}{90}S\ V_B + -\frac{1}{5}S\ V_C = -5A$
C	$0\ V_A + -\frac{1}{5}S\ V_B + \frac{8}{15}S\ V_C = 0$

$\frac{1}{5}+\frac{1}{9}+\frac{1}{2}$

$\frac{18}{90}+\frac{10}{90}+\frac{45}{90}$

$\frac{73}{90}$

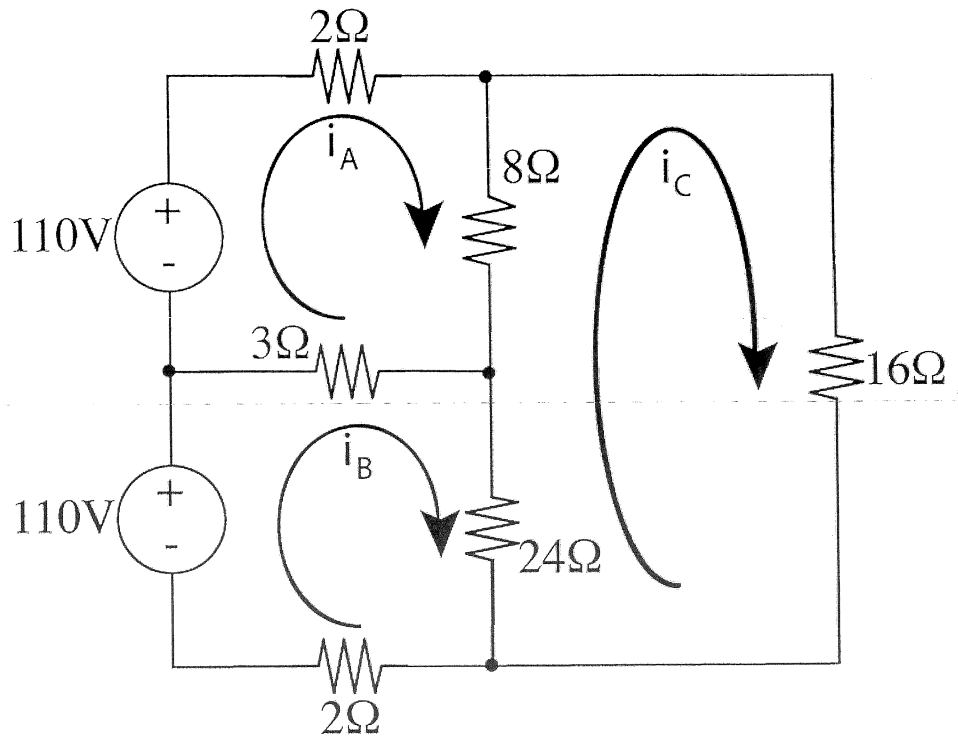
$\frac{1}{5}+\frac{1}{3}$

Name : Brent Wise Section: TE CWRU e-mail: bwi4

MESH CURRENT ANALYSIS

2. (10 points) The circuit shown below is a DC model of a residential power distribution circuit. Use the mesh current method to write equations for the indicated currents.

10



MESH	Mesh Current Equations
A	13Ω i_A + -3Ω i_B + -8Ω i_C = 110V
B	-3Ω i_A + 29Ω i_B + -24Ω i_C = 110V
C	-8Ω i_A + -24Ω i_B + 48Ω i_C = 0

Name : Nick Denissen Section: TE CWRU e-mail: nad11

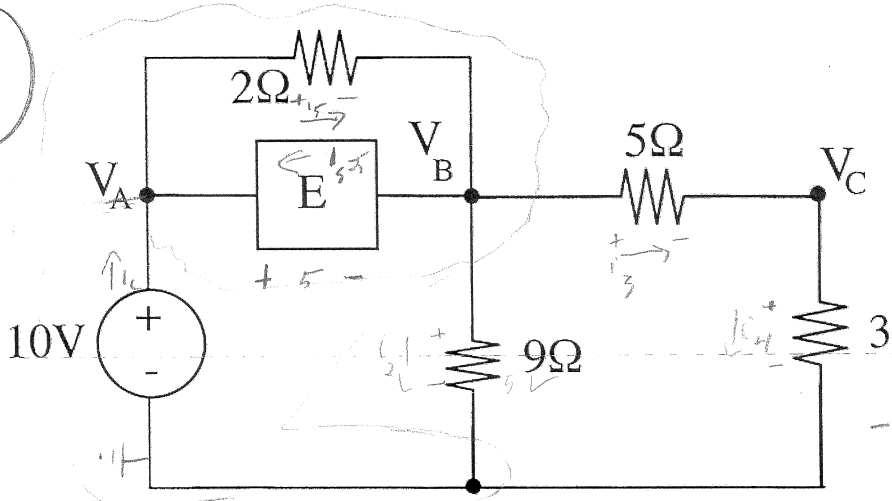
Quiz No. 4 2/11/05

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE
STATE ALL ASSUMPTIONS

12/20

NODE VOLTAGE ANALYSIS

1. (10 points) Write node voltage equations for V_A, V_B and V_C for the following circuit given that



(a) E is a 5 volt voltage source with the plus reference on the left.

NODE	Node Voltage Equations
A	$1\,V_A + 0\,V_B + 0\,V_C = 10$
B	$0\,V_A + -\frac{1}{5}\,V_B + \frac{8}{15}\,V_C = 5$
C	$0\,V_A + -\frac{1}{5}\,V_B + \frac{8}{15}\,V_C = 0$

$V_A = 10$ V, C grounded, below and no other sources

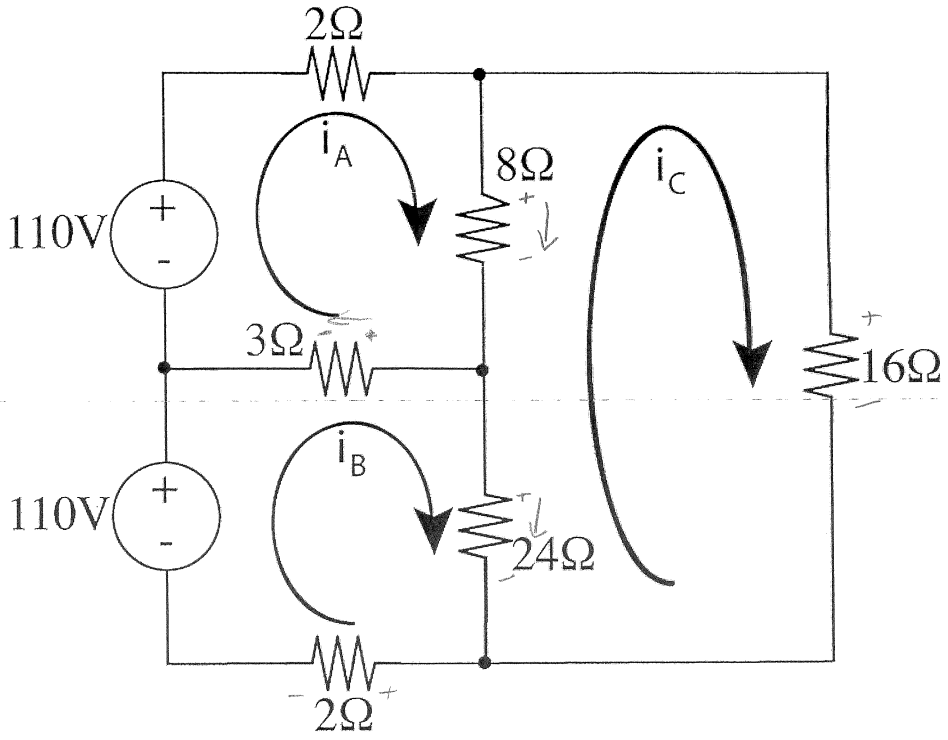
(b) E is a 5 ampere current source with the reference arrow pointing left.

NODE	Node Voltage Equations
A	$1\,V_A + 0\,V_B + 0\,V_C = 10$
B	$\frac{1}{2}\,V_A + \frac{7}{10}\,V_B + \frac{1}{5}\,V_C = 5$
C	$0\,V_A + -\frac{1}{5}\,V_B + \frac{8}{15}\,V_C = 0$

Name : _____ Section:_____ CWRU e-mail:_____

MESH CURRENT ANALYSIS

2. (10 points) The circuit shown below is a DC model of a residential power distribution circuit. Use the mesh current method to write equations for the indicated currents.



MESH	Mesh Current Equations
A	13 i_A + −3 i_B + −8 i_C = 110
B	−3 i_A + 27 i_B + −24 i_C = 110
C	−8 i_A + −24 i_B + 48 i_C = 0

A: $-110 + 2i_A + 8(i_A - i_C) + 3(i_A - i_B) = 0$

$2i_A + 8i_A - 8i_C + 3i_A - 3i_B = 110$

$13i_A - 3i_B - 8i_C$

C: $-24(i_C - i_B) - 8(i_C - i_A) + 16i_C = 0$

B: $-110 - 3(i_B - i_A) + 24(i_B - i_C) + 2i_B = 0$

$110 = 23i_B + 3i_A - 24i_C$

Name : Stephen J Hill Section: WA CWRU e-mail: sjh21

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

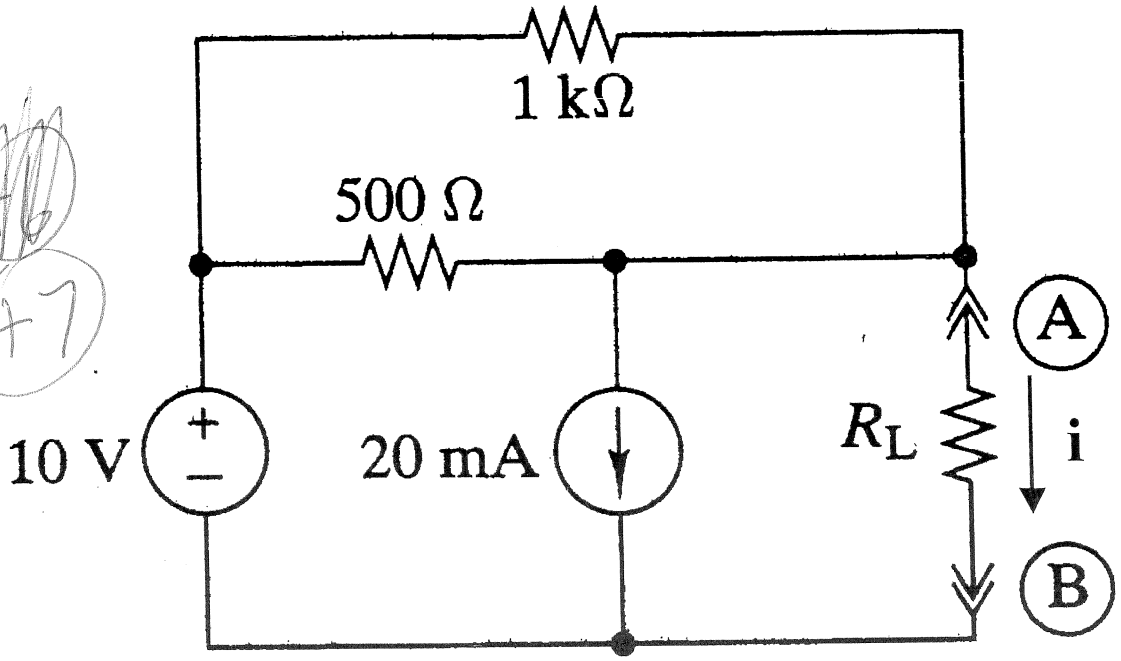
17/20

Quiz No. 5 **2/20/04**

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE. BE SURE TO STATE ANY ASSUMPTIONS

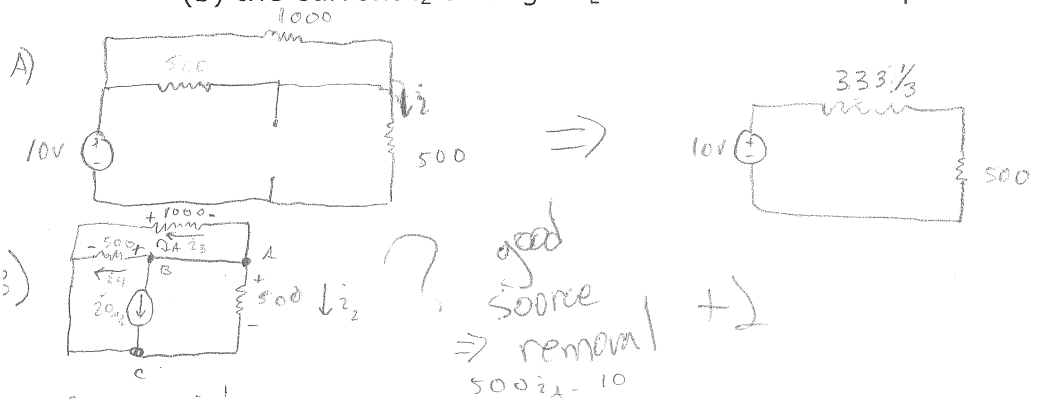
LINEARITY - SUPERPOSITION

1. (10 points) Assume R_L=500Ω. Using superposition determine



(a) the current i_1 through R_L from the 10 volts source. i_1= .012 A

(b) the current i_2 through R_L from the 20 milliampere source. i_2= -.013 A



$V_L = \frac{500}{500+333\frac{1}{3}} * 10V = 6.0V$

$i_1 = \frac{V}{R} = \frac{6.0V}{500\Omega}$

$i_1 = .012A$

good source ⇒ removal +)

$500 i_A - 10$

$1000 i_A + 500(i_A - .02) = 0$ $i_A = .00667 A$

$500 i_2 + 1000 i_A = 0$

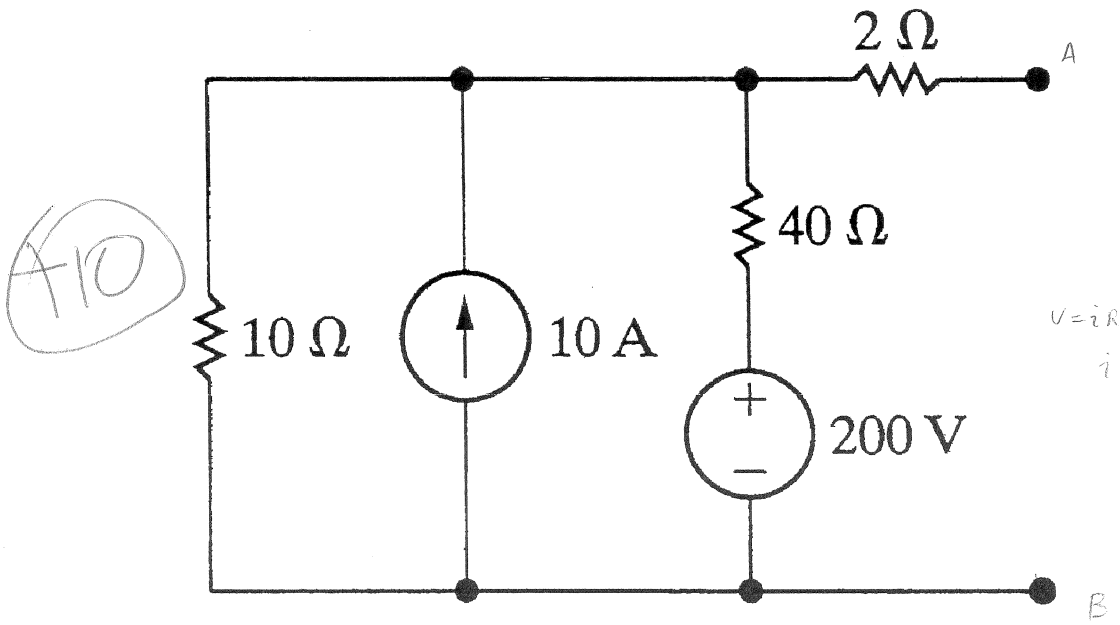
$i_2 = -2 i_A$

$i_2 = -.013A$

Name : Stephen J Hill Section: WA CWRU e-mail: sjh21

2. (10 points) What is the Thevenin equivalent of the circuit shown below.

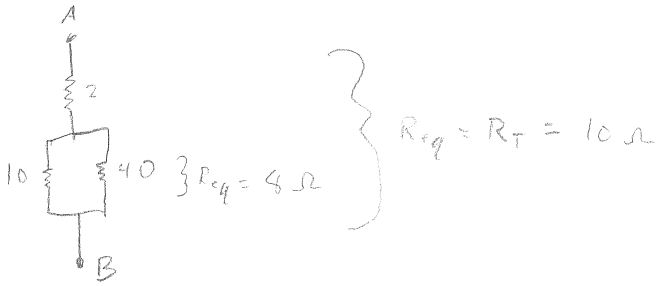
V_T= 120 V R_T= 10 Ω



+10

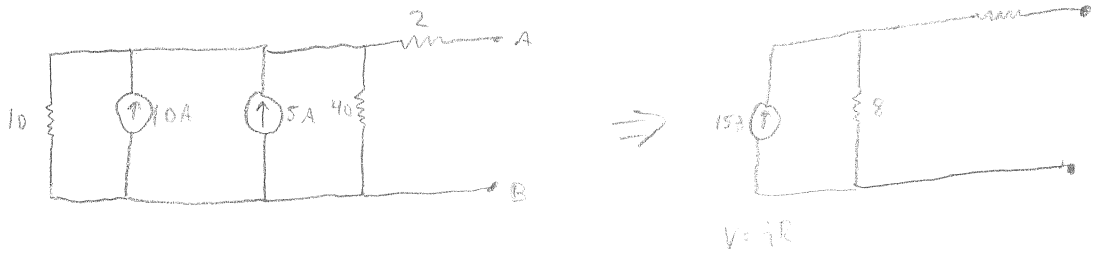
$V = iR$

$i = \frac{V}{R} = \frac{200}{40} = 5\ A$

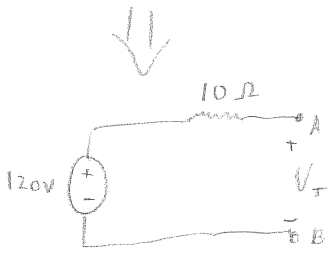


$R_{eq} = R_T = 10\ \Omega$

$R_{eq} = 4\ \Omega$



$V = iR$



Name : Perry Twyford Section: WA CWRU e-mail: pdt3

CASE WESTERN RESERVE UNIVERSITY
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ENGR 210. Introduction to Circuits and Instruments (4)

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Quiz No. 5 **2/20/04**

20

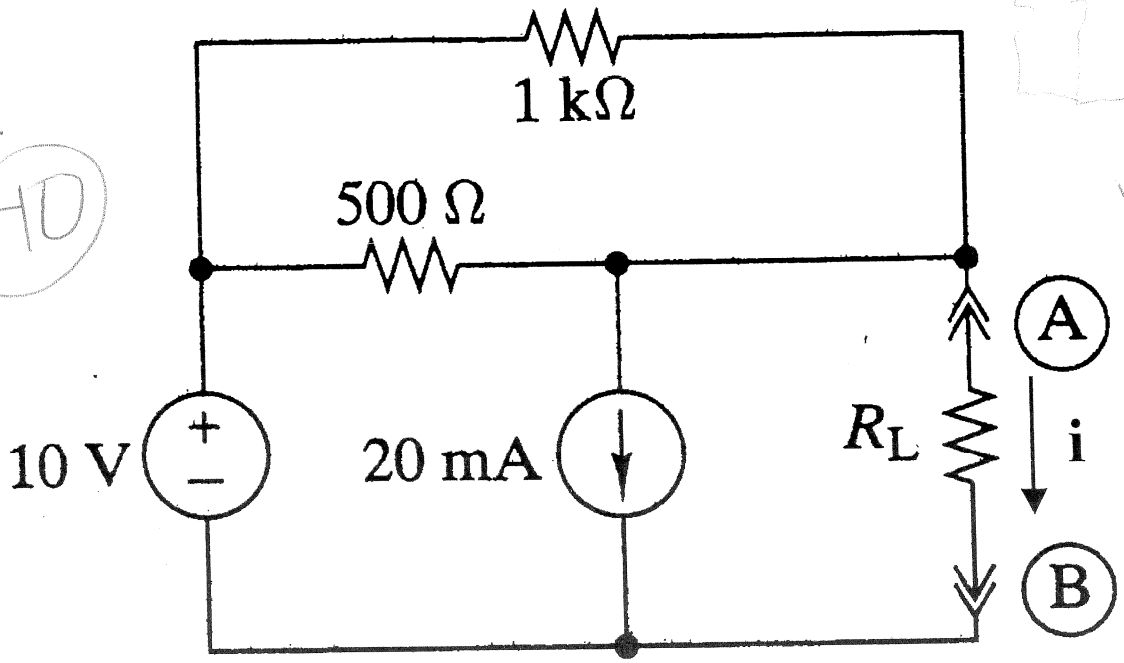
PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE. BE SURE TO STATE ANY ASSUMPTIONS

Great!

HD

LINEARITY - SUPERPOSITION

1. (10 points) Assume R_L=500Ω. Using superposition determine

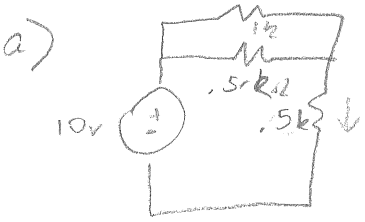


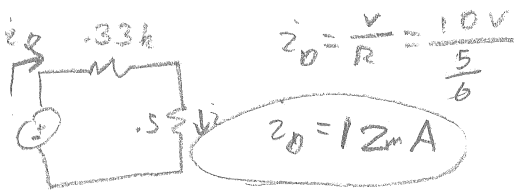
(a) the current i_1 through R_L from the 10 volts source. i_1= 12 mA

12.04

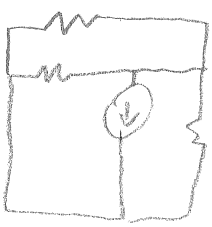
(b) the current i_2 through R_L from the 20 milliampere source. i_2= −8mA

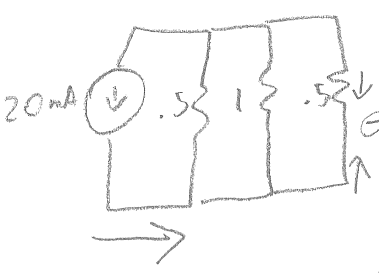
a)





b)





Current divider

$i = \frac{\frac{1}{.5}}{\frac{1}{.5}+\frac{1}{.5}+\frac{1}{1}} i_0$

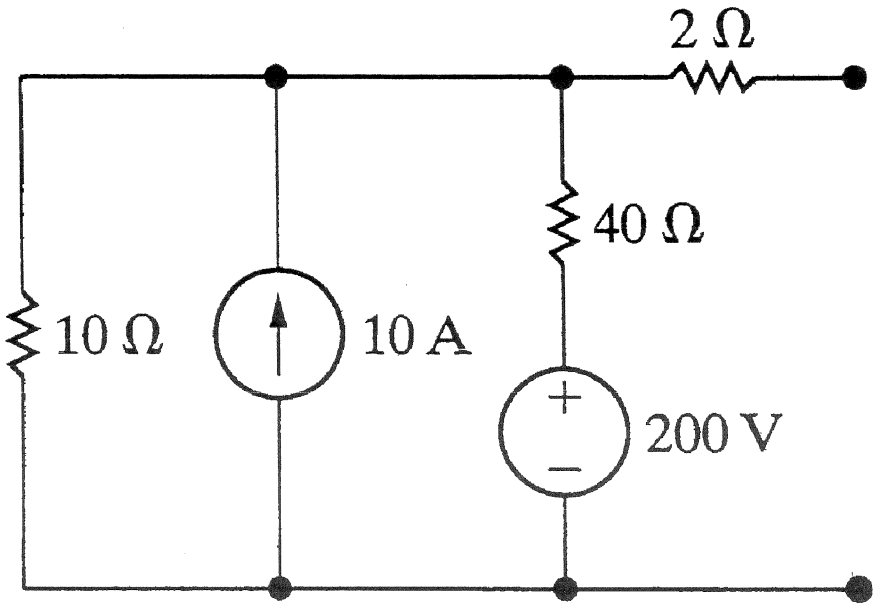
$i = -8mA$

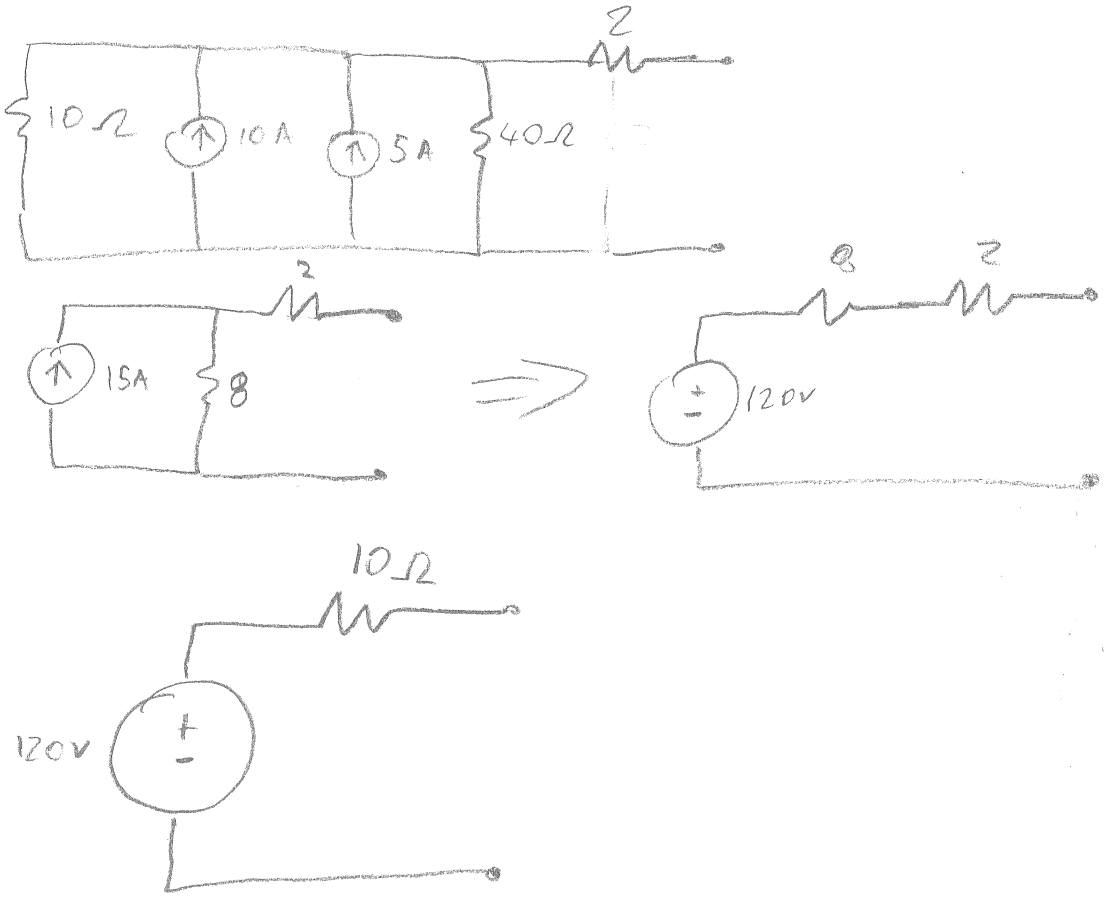
Name : Perry Twyford Section: WA CWRU e-mail: pdt3

2. (10 points) What is the Thevenin equivalent of the circuit shown below.

V_T= 120 V R_T= 10 Ω

+10





Name : Emily Sershon Section: WA CWRU e-mail: ecs57

CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

14 WT
20

Quiz No. 5 **2/20/04**

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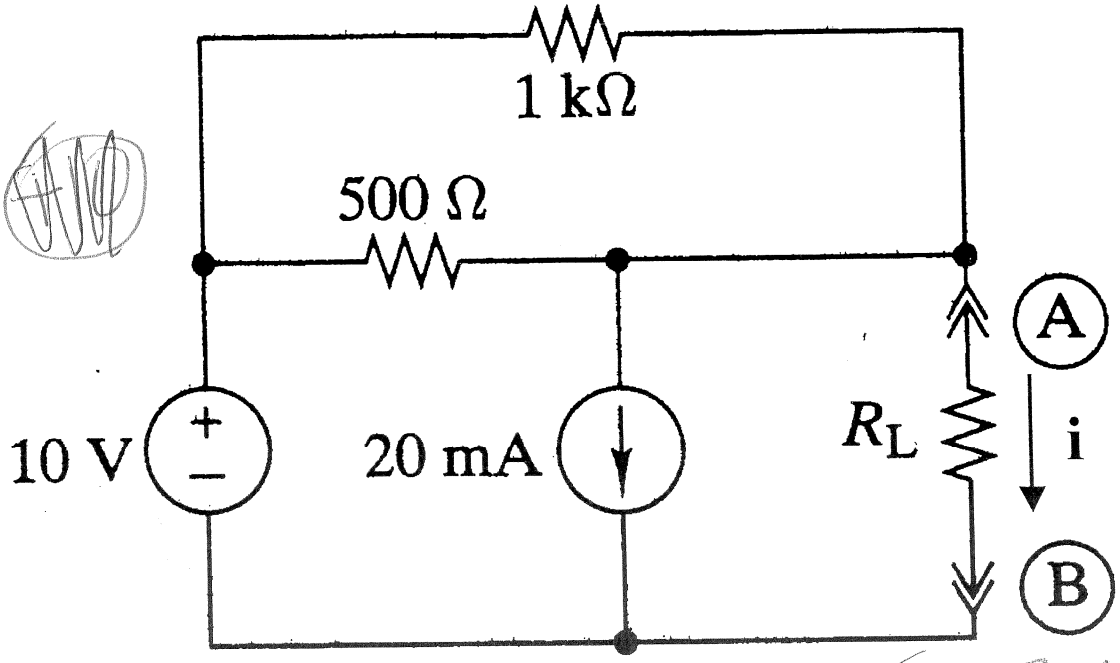
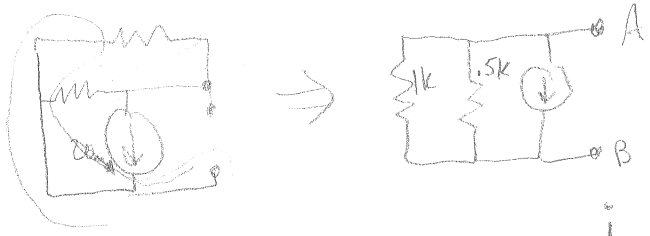
LINEARITY - SUPERPOSITION

1. (10 points) Assume R_L=500Ω. Using superposition determine



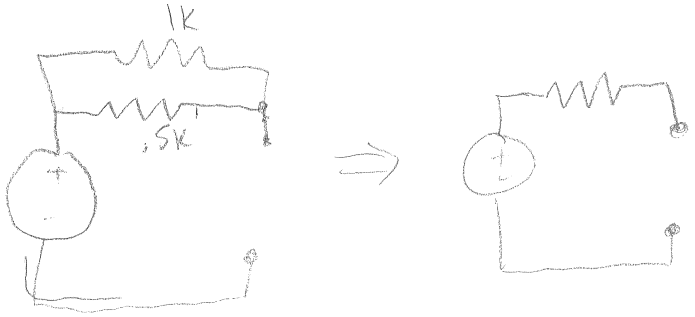
(a) the current i_1 through R_L from the 10 volts source. $i_{1=}$ 6V ⇒ 12mA

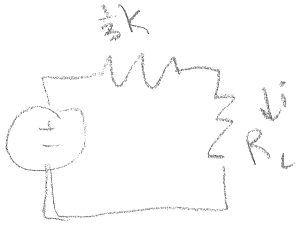
(b) the current i_2 through R_L from the 20 milliampere source. $i_{2=}$ -8mA



$i = 8$

$i_s + 3V + 2V = 0$ $i_s = -5V$ $V = 4$ $i = \frac{V}{.5k}$





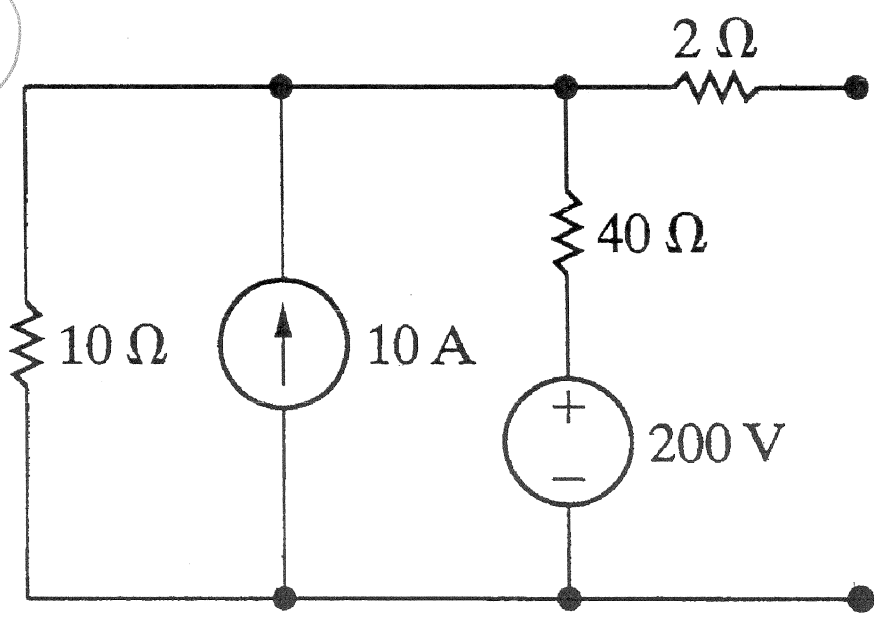
$V_L = \frac{R_L}{\frac{1}{3}k + R_L} V_s$

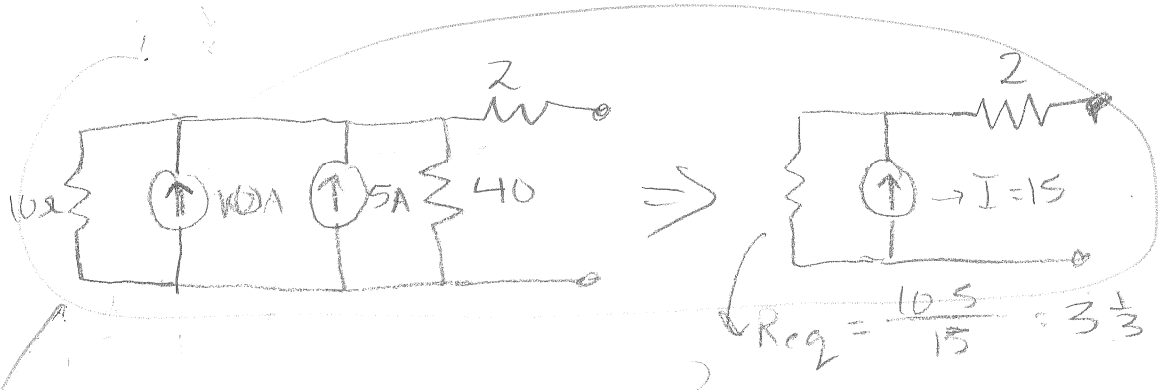
$\frac{1/2}{5/6}(10) = 6$

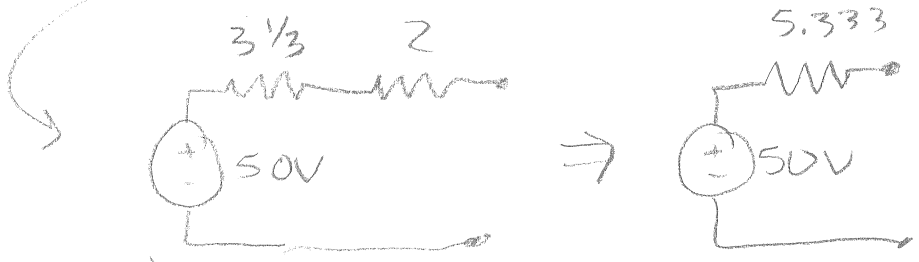
Name : Emily Sorsher Section: WA CWRU e-mail: ecs7

2. (10 points) What is the Thevenin equivalent of the circuit shown below.

V_T= 50V R_T= 16/3 Ω







good idea

check your Req equations > math -2

remember Norton/Thevenin conversion rules -3