ELEC 2110

Electric Circuit Analysis

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Section 002

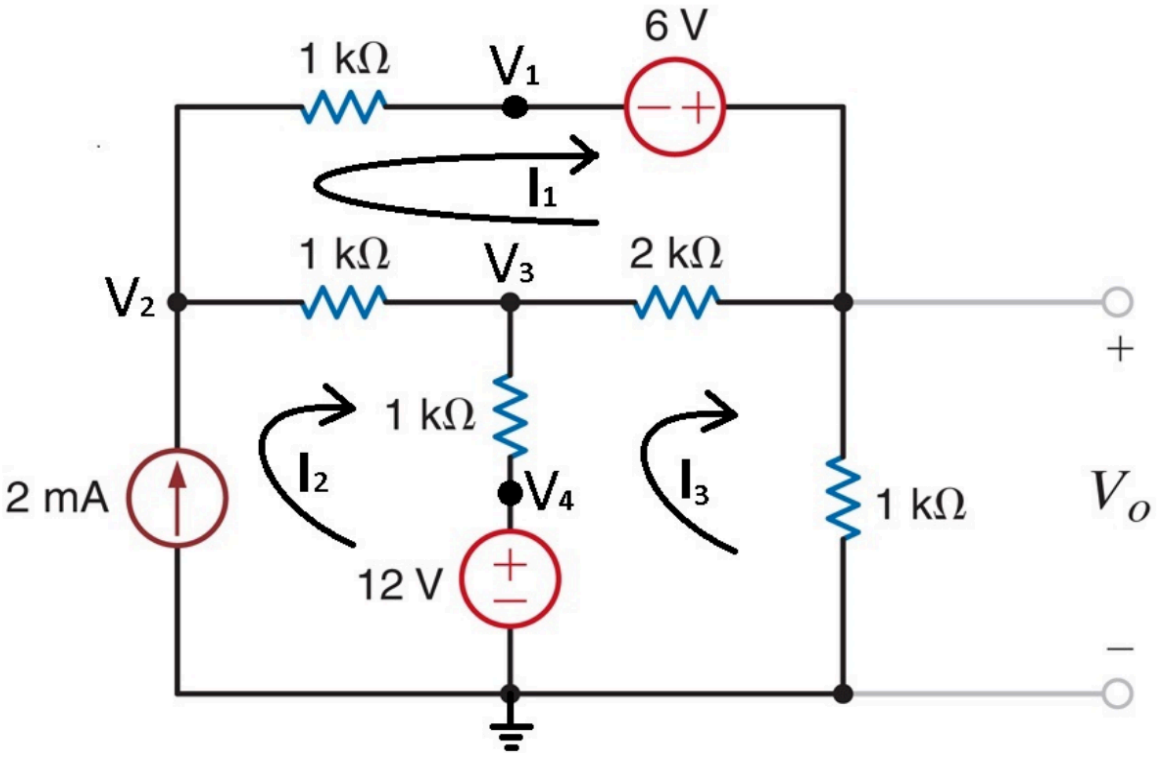
DC Mesh and Nodal Analysis

Introduction

This lab tasks the student with using Nodal and Mesh analysis to solve multiple circuits. The student will be given a circuit and told to use Nodal and Mesh analysis on each one. Also, use MATLAB to solve the matrix equations.

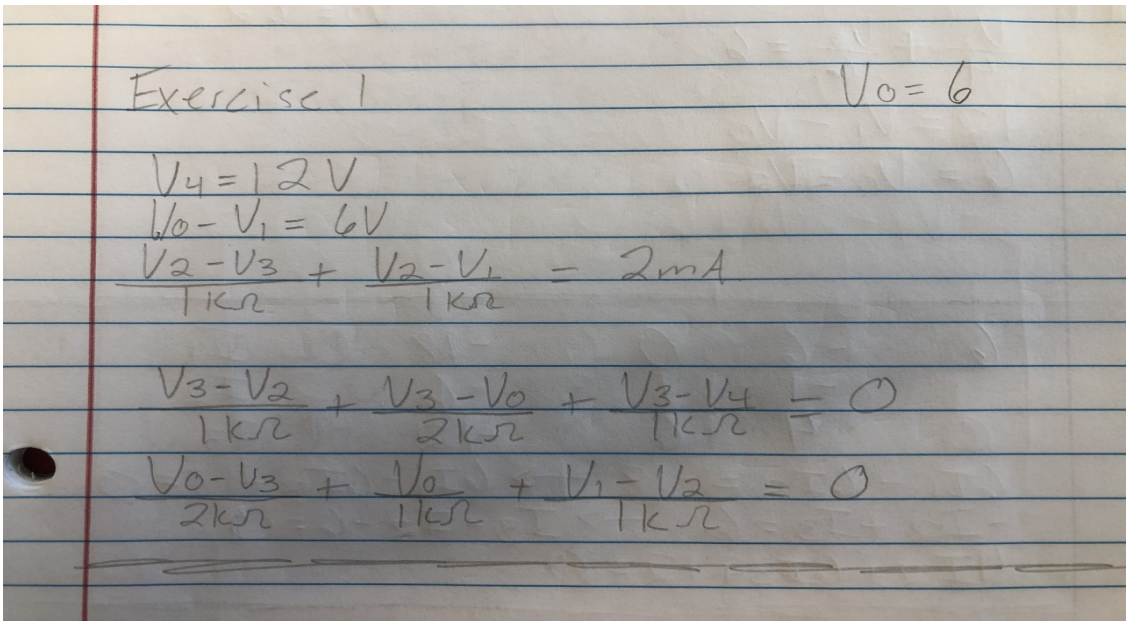
Exercise 1

Analyze the circuit given using Nodal and Mesh analysis.



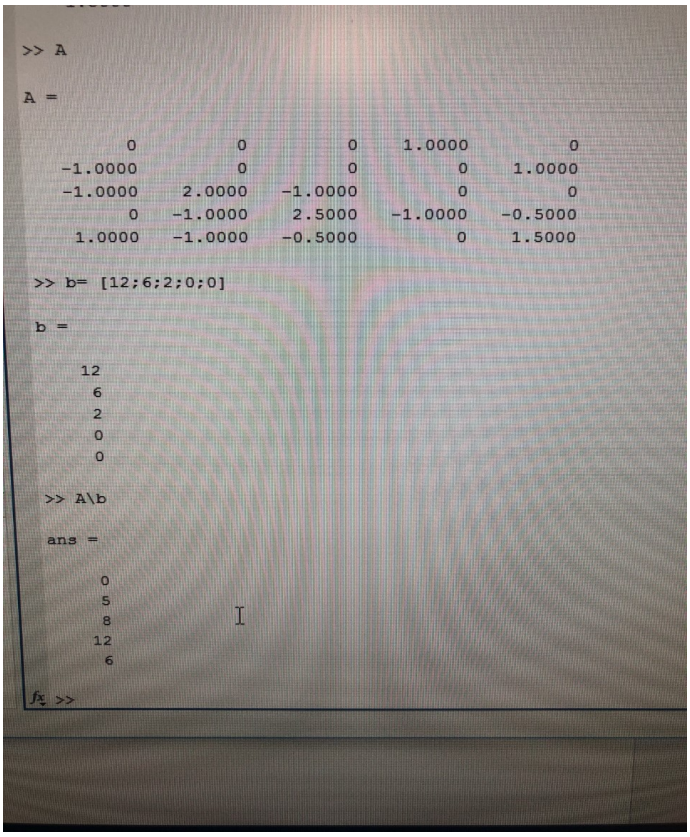
(1)

Circuit 1



(2)

Nodal Analysis equations



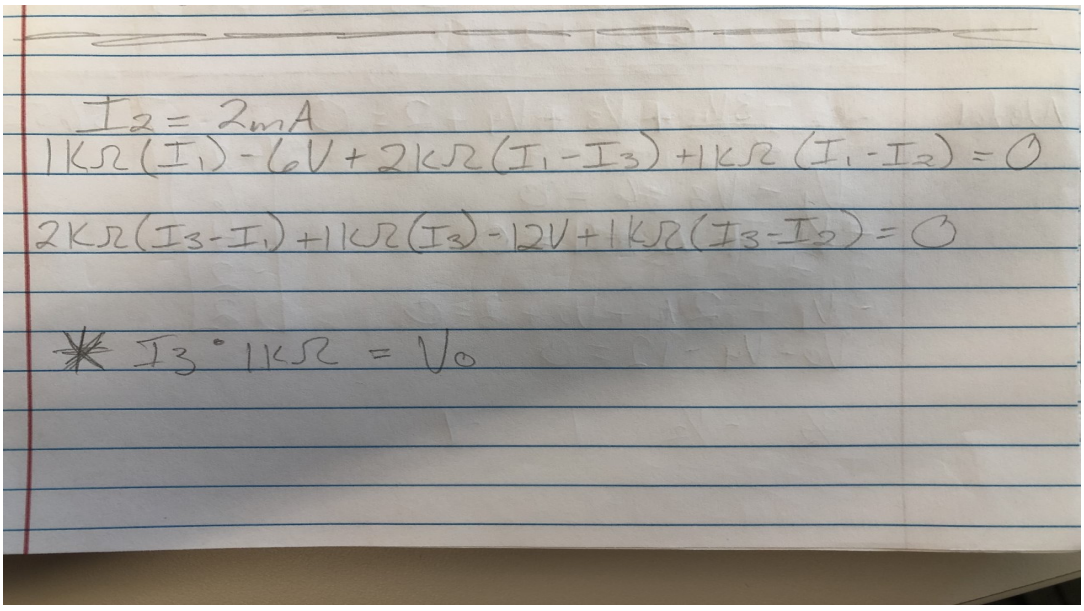
(3)

Matrix Code and Answer

Nodal Summary Table

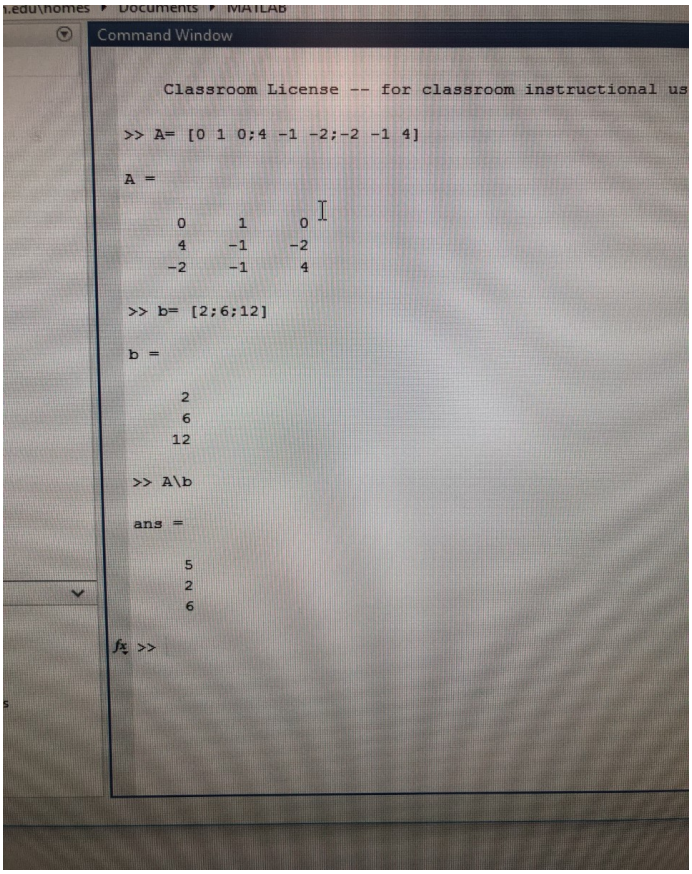
V1	0V
V2	5V
V3	8V
V4	12V
Vo	6V

Mesh Analysis



(4)

Mesh Analysis equations



(5)

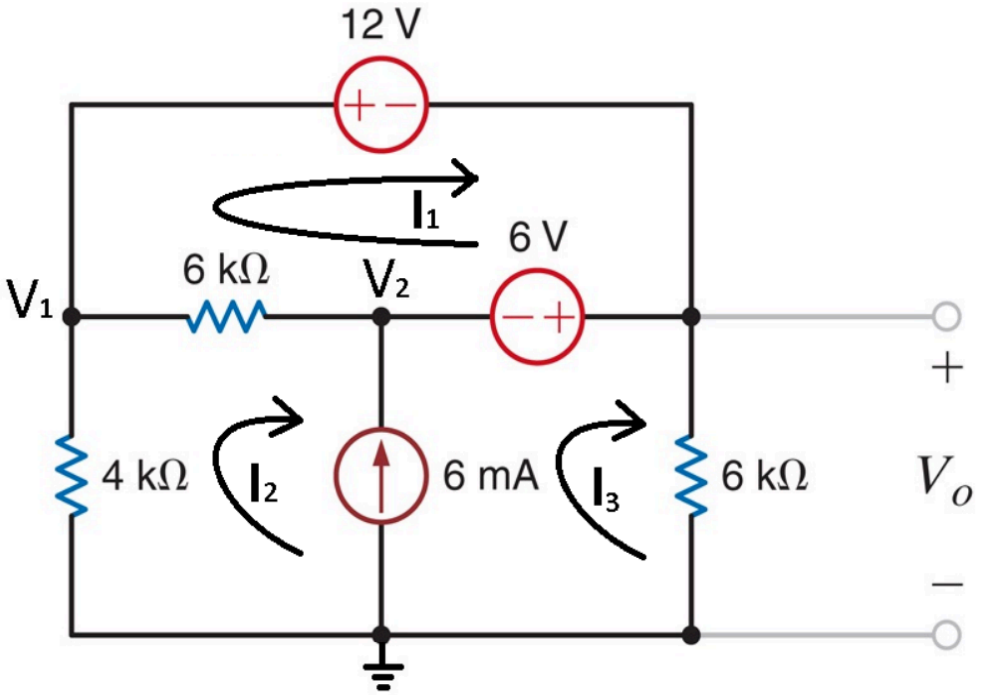
Matrix Code and Answer

Mesh Summary Table

I1	5mA
I2	2mA
I3	6mA
I3*1KOhms = Vo	= 6*1 = 6V

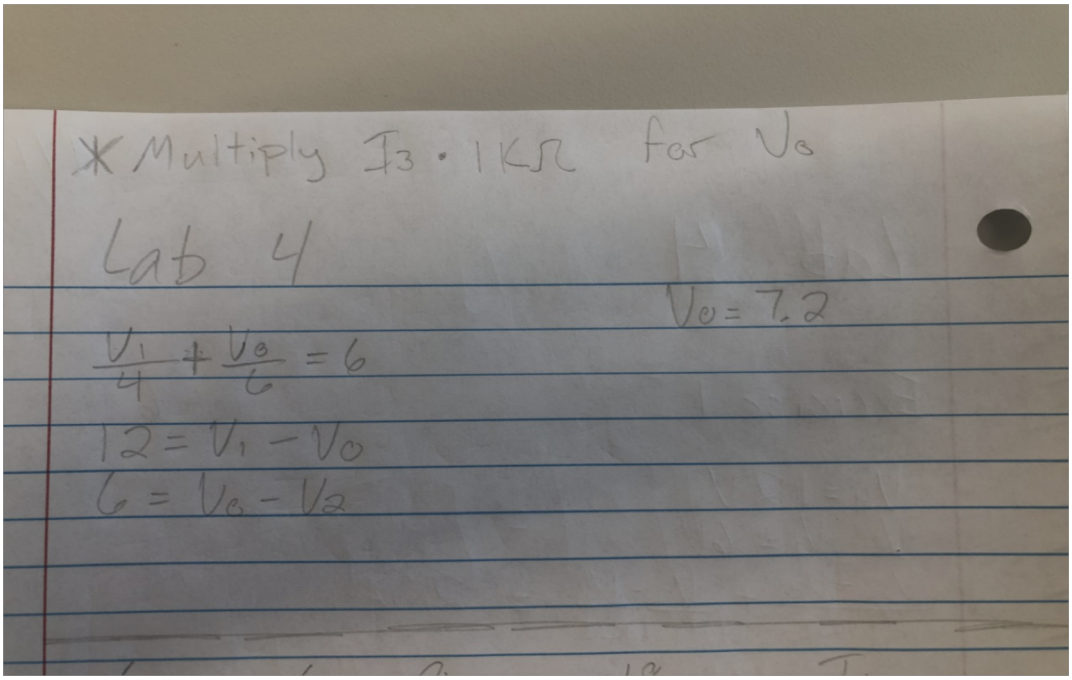
Exercise 2

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.



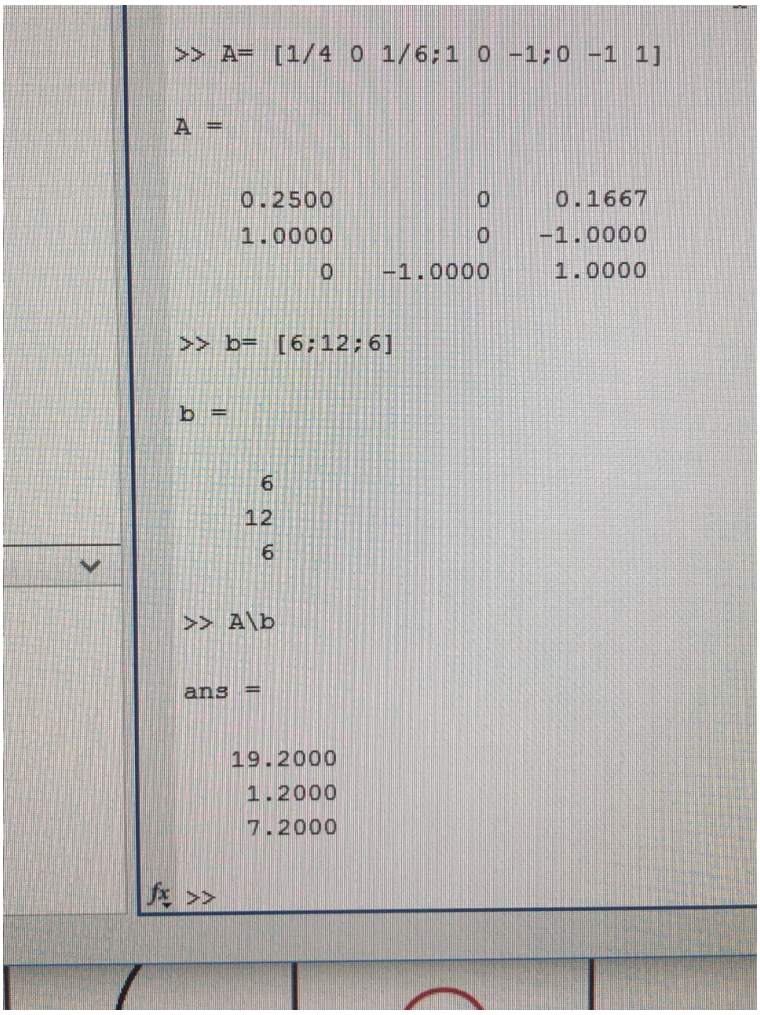
(6)

Circuit 2



(7)

Nodal Analysis equations



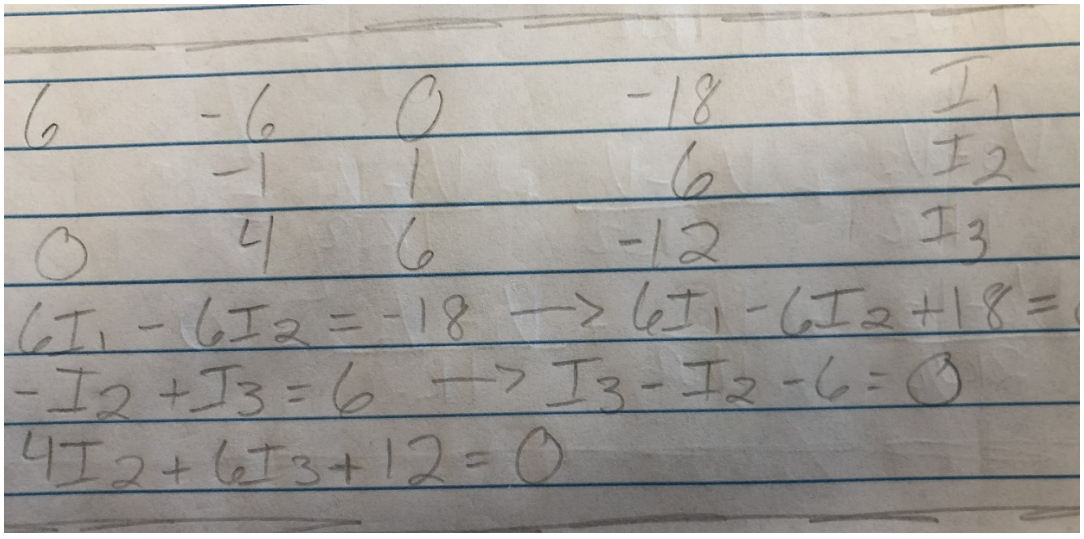
(8)

Matrix Code and Answer

Nodal Summary Table

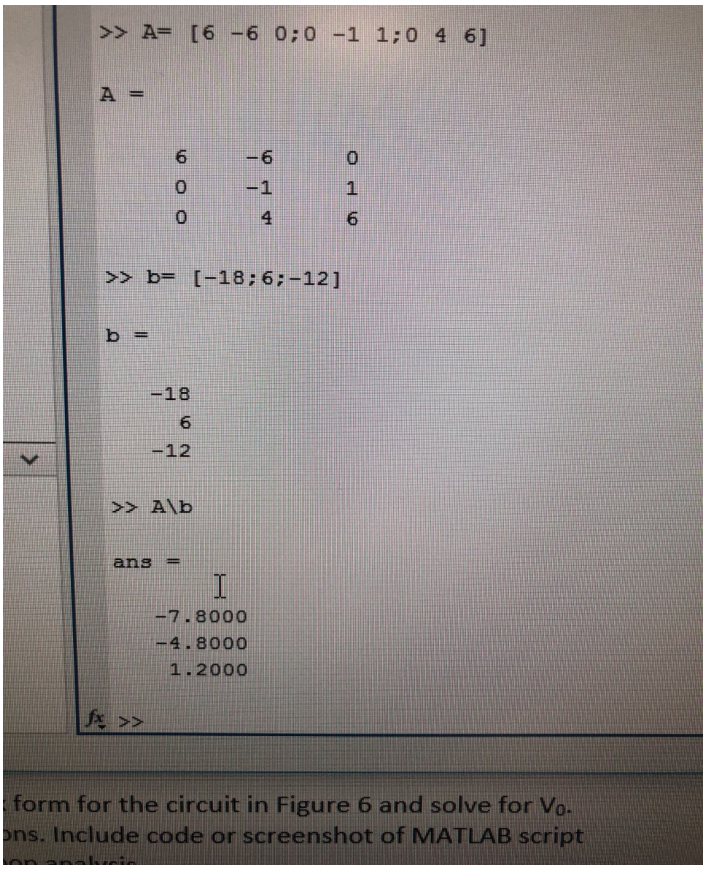
V1	19.2V
V2	1.2V
Vo	7.2V

Mesh Analysis



(9)

Mesh Analysis equations



(10)

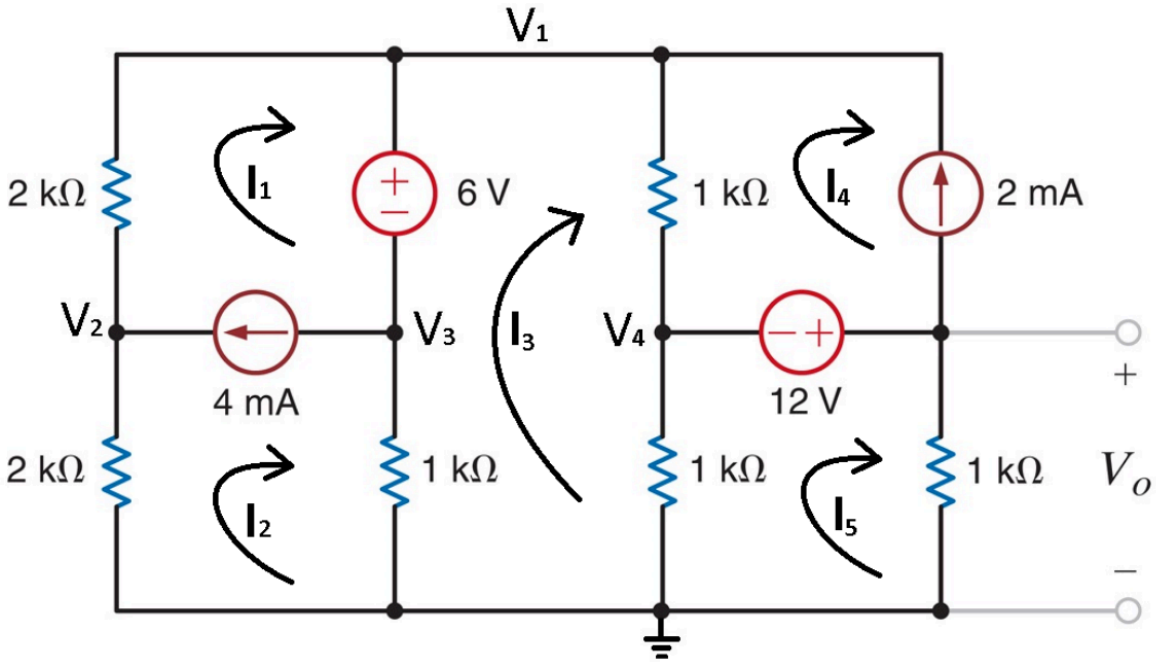
Matrix Code and Answer

Mesh Summary Table

I1	-7.8mA
I2	-4.8mA
I3	1.2mA
(I3*1)+6 = Vo	= (1.2*1)+6 = 7.2V

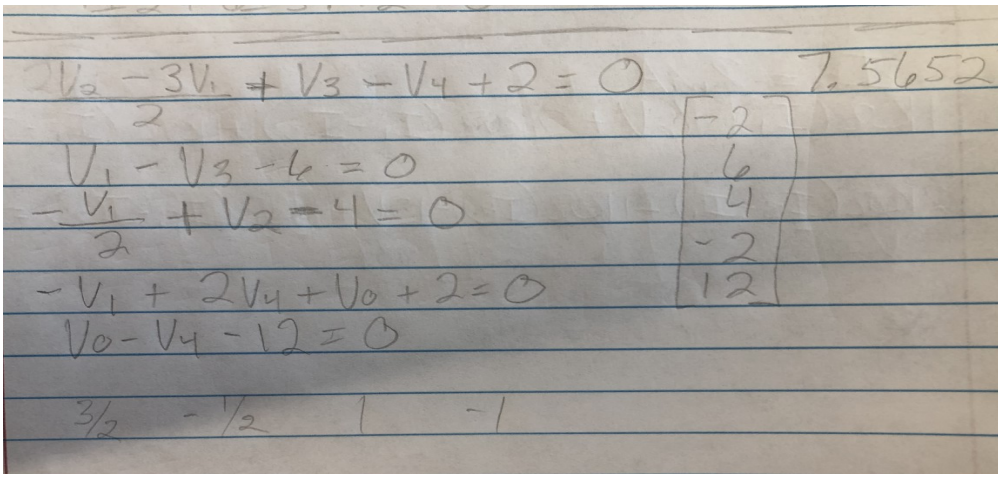
Exercise 3

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.



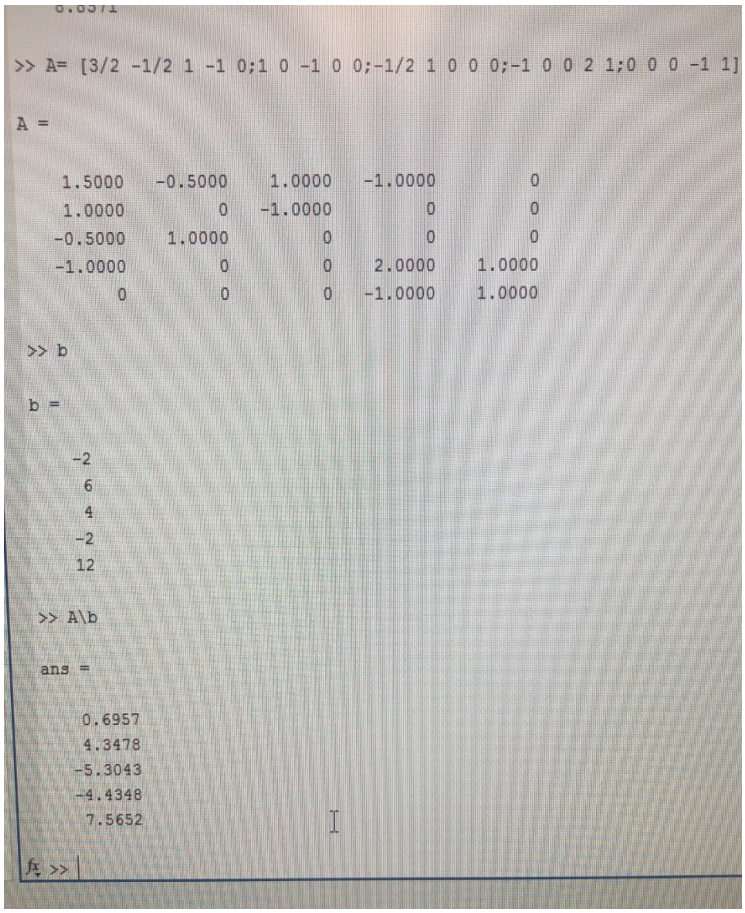
(11)

Circuit 3



(12)

Nodal Analysis equation



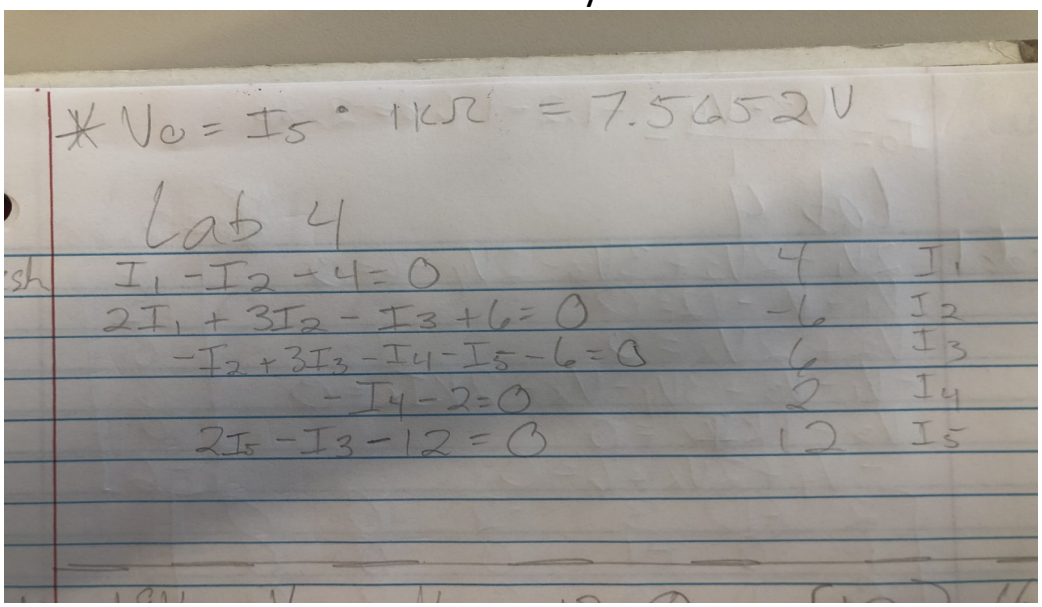
(13)

Matrix Code and Answer

Nodal Summary Table

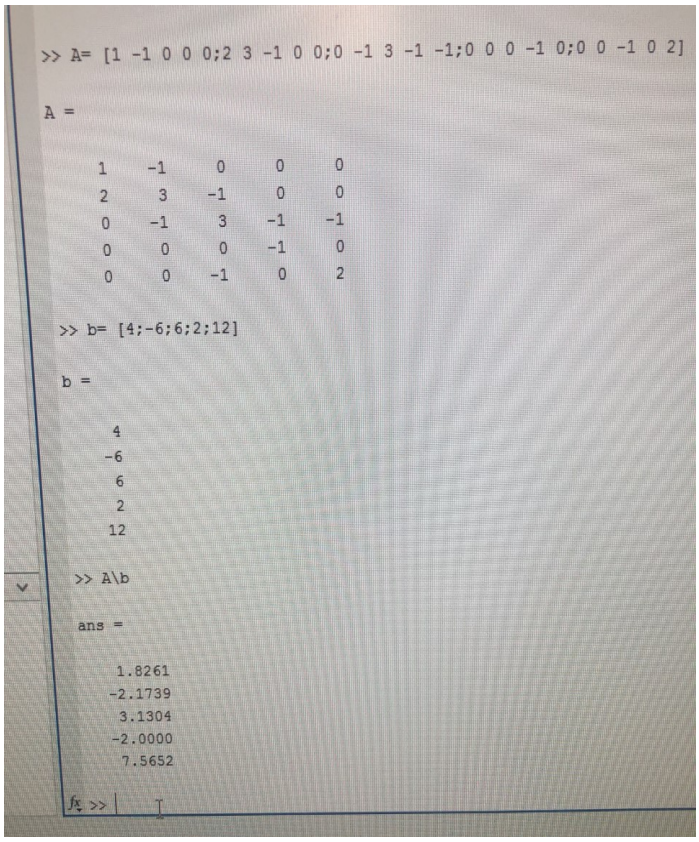
V1	0.6957V
V2	4.3478V
V3	-5.3043V
V4	-4.4348V
Vo	7.5652V

Mesh Analysis



(14)

Mesh Analysis equations



(15)

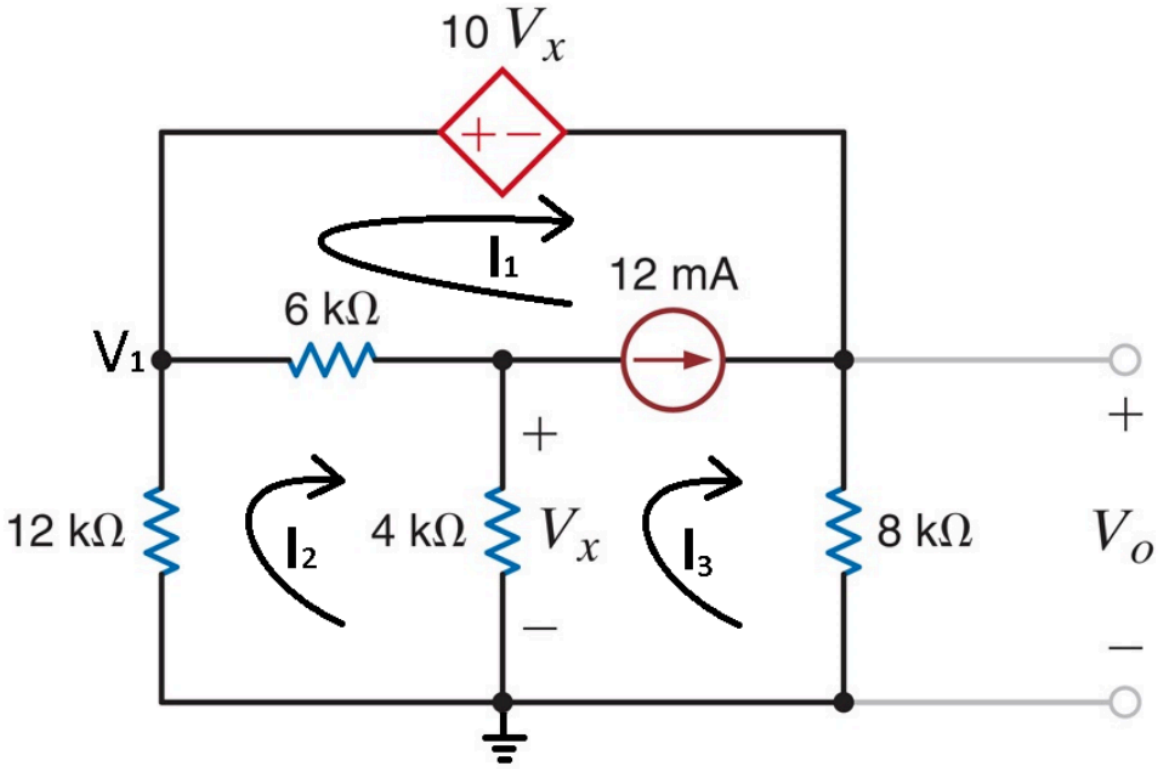
Matrix Code and Answer

Mesh Summary Table

I1	1.8261mA
I2	-2.1739mA
I3	3.1304mA
I4	-2.0mA
I5	7.5652mA
Vo = I5*1KOhm	= 7.5652*1 = 7.5652V

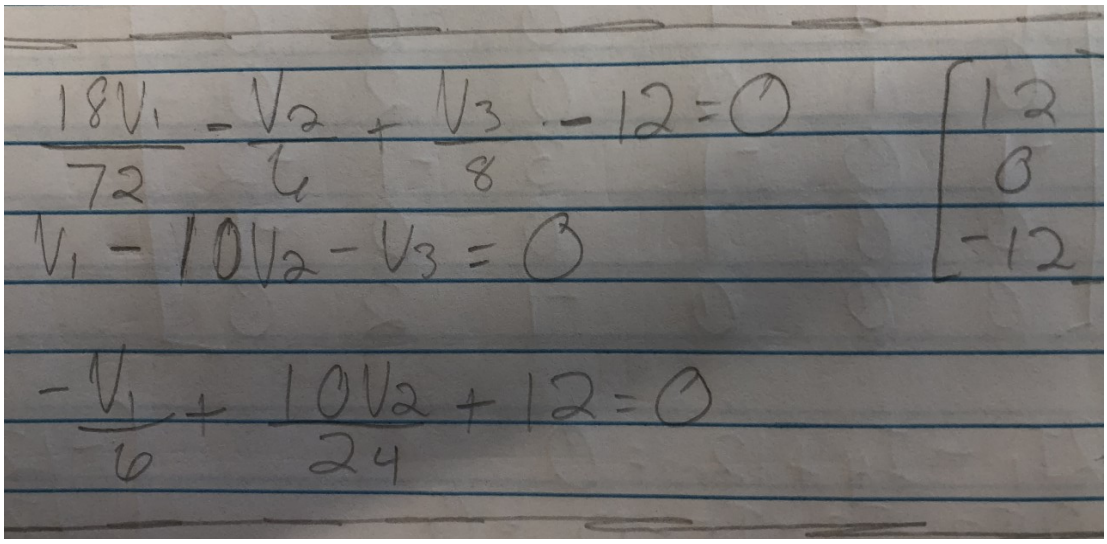
Exercise 4

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.



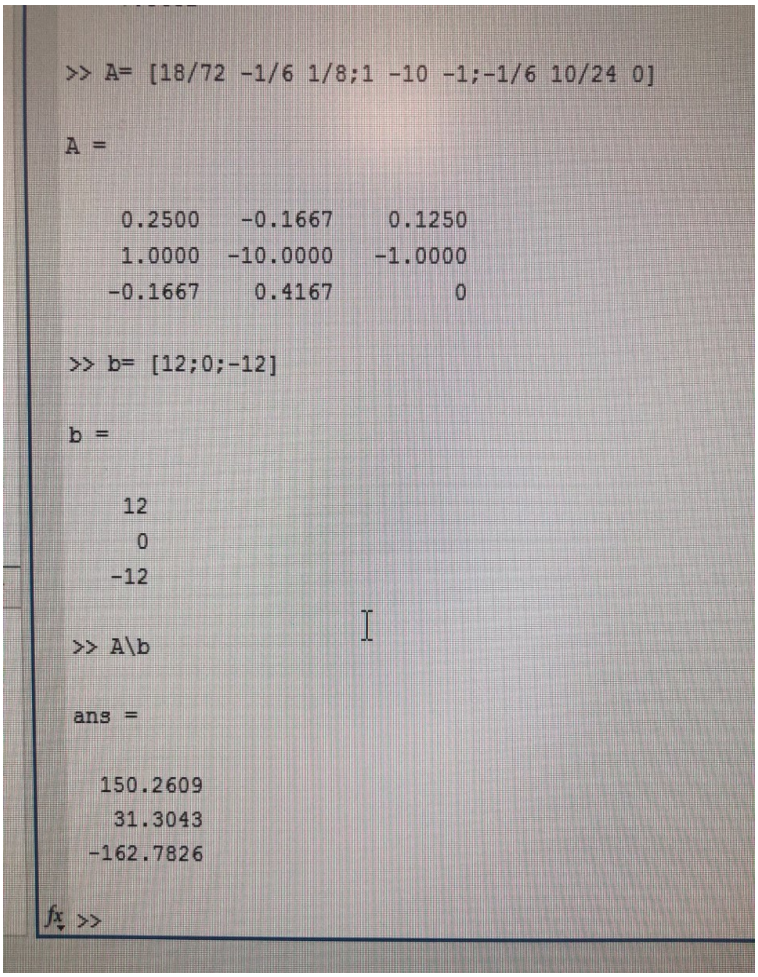
(16)

Circuit 4



(17)

Nodal Analysis equations



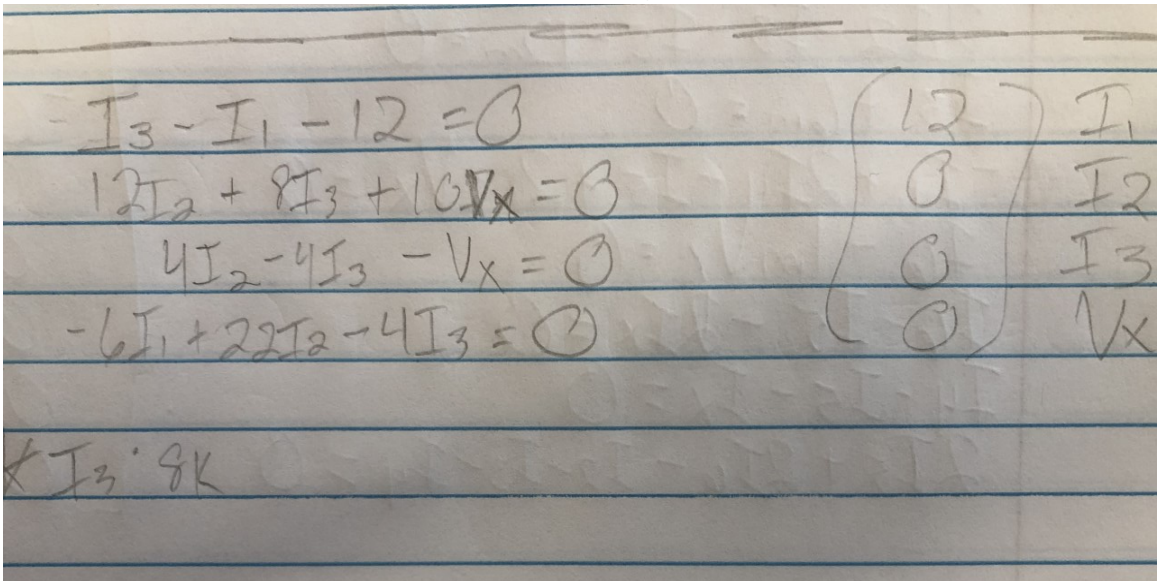
(18)

Matrix Code and Answer

Nodal Summary Table

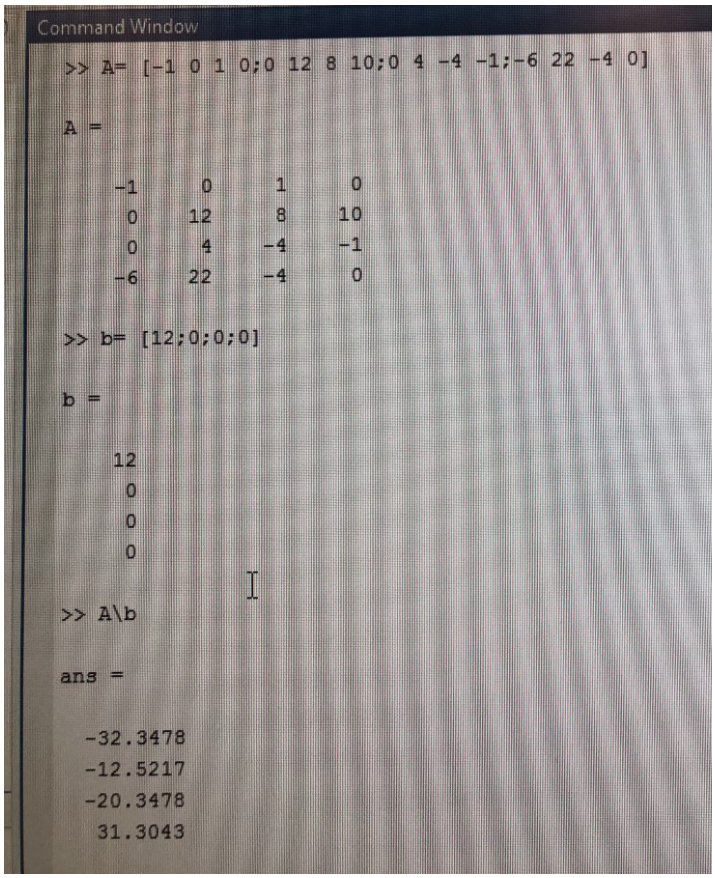
V1	150.2609V
Vx	31.3043V
Vo	-162.7826V

Mesh Analysis



(19)

Mesh Analysis equations



(20)

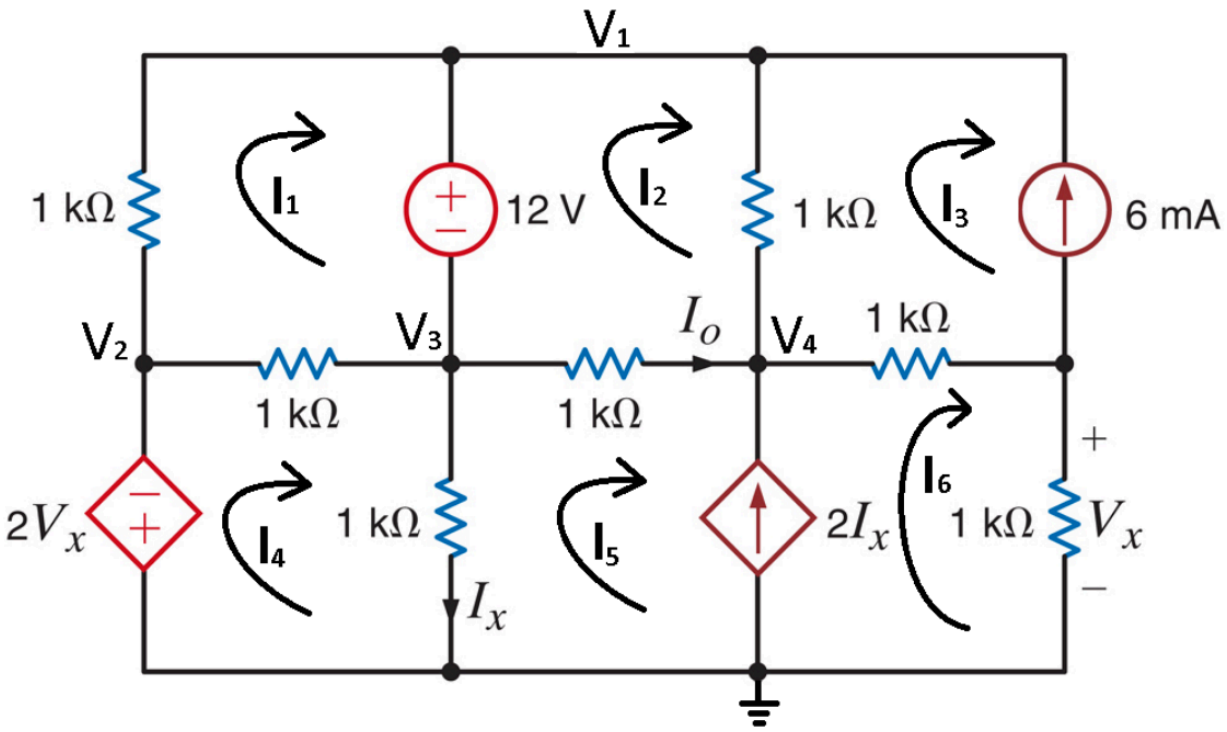
Matrix Code and Answer

Mesh Summary Table

I1	-32.3478mA
I2	-12.5217mA
I3	-20.3478mA
Vx	31.3043V
Vo = (I3*8k)	= -20.3478*8k = -162.7826V

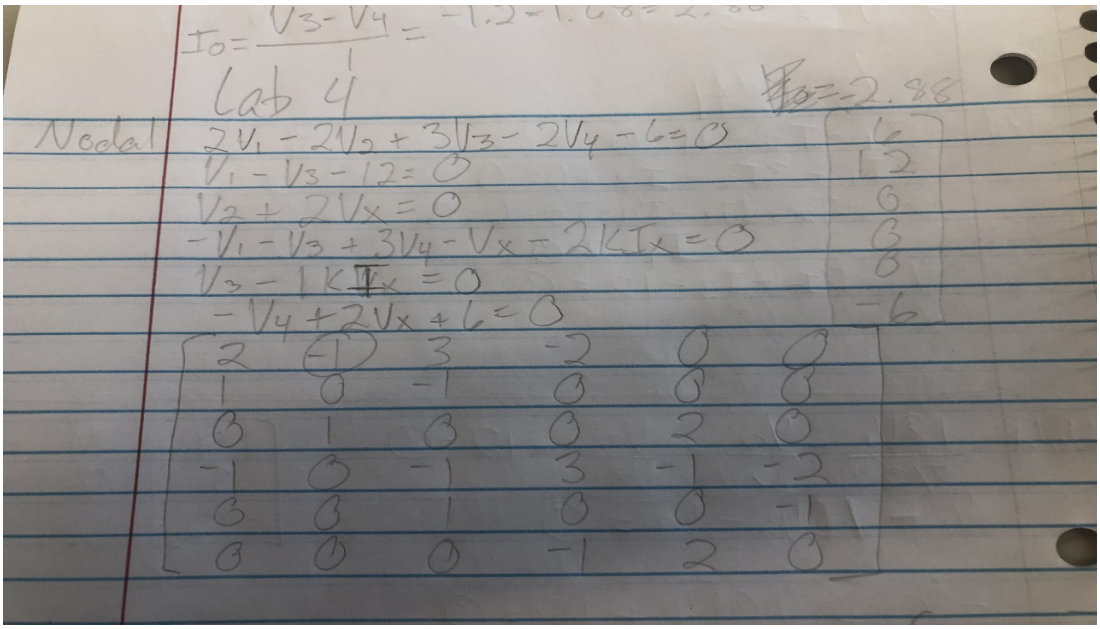
Exercise 5

Given a new circuit, use Nodal and Mesh analysis to find voltage and current.



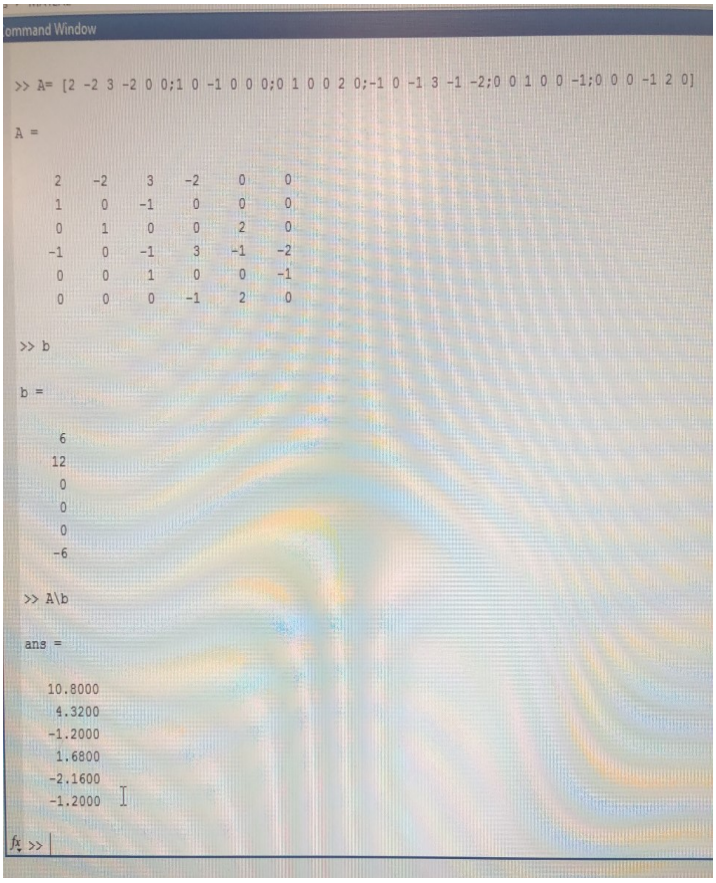
(21)

Circuit 5



(22)

Nodal Analysis equations



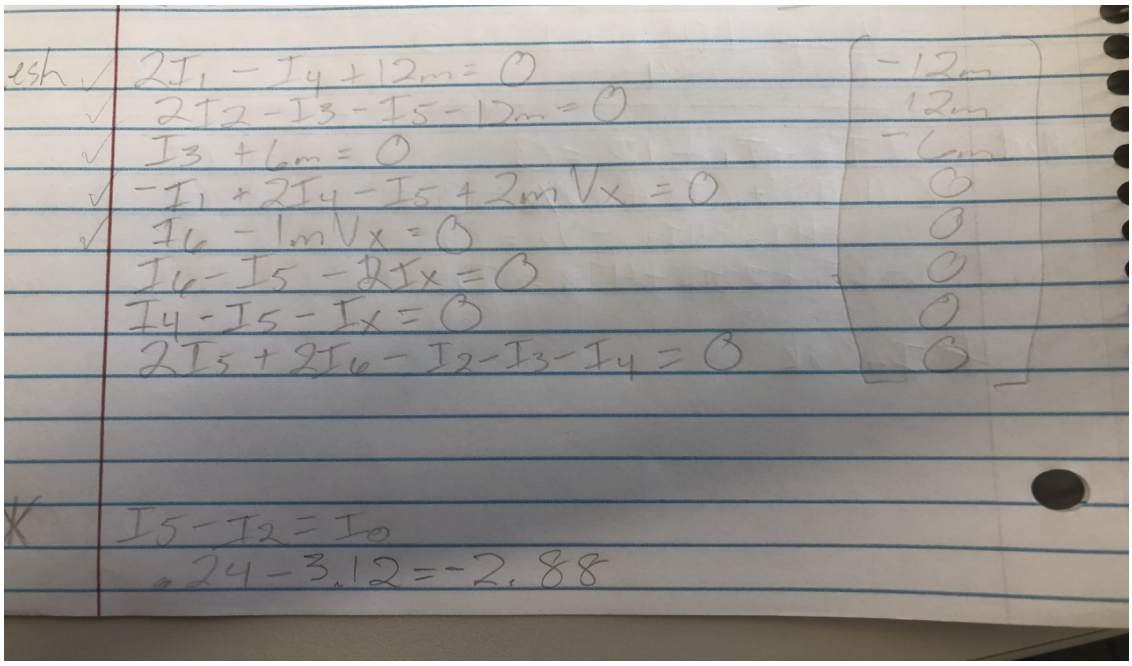
(23)

Matrix Code and Answer

Nodal Summary Table

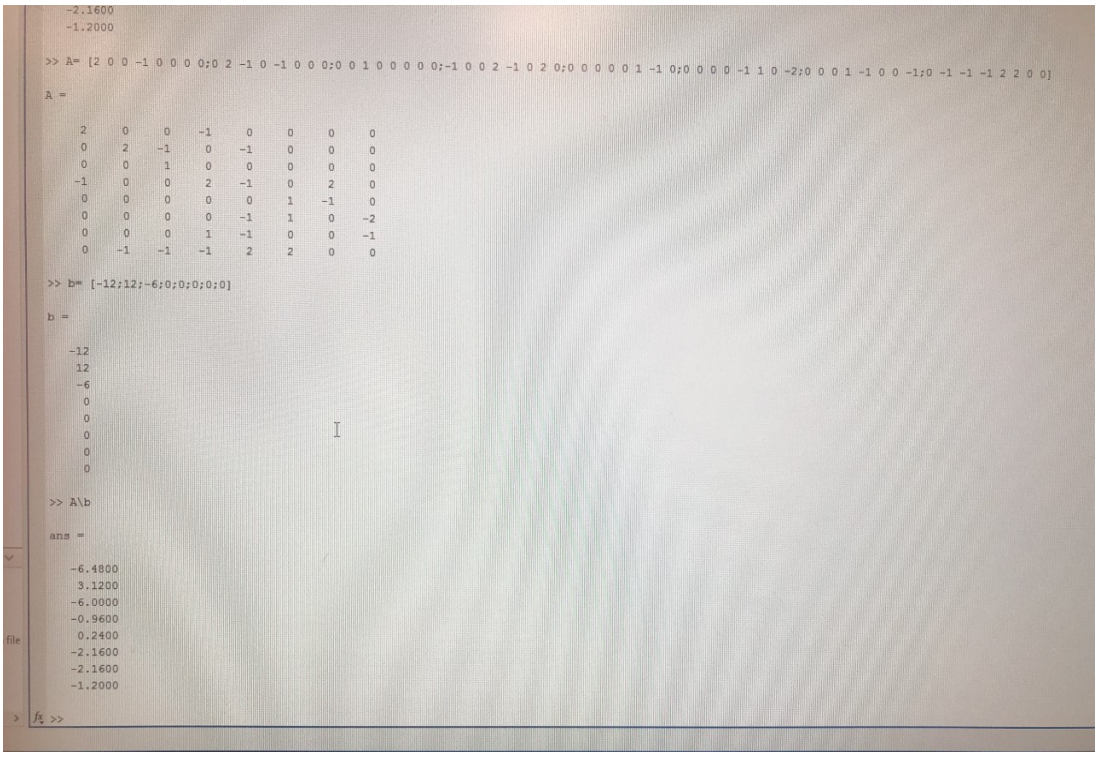
V1	10.8V
V2	4.32V
V3	-1.2V
V4	1.68V
Vx	-2.16V
Ix	-1.2mA
Io = (V3-V4)/1k	= (-1.2 – 1.68)/1 = -2.88mA

Mesh Analysis



(24)

Mesh Analysis equations



(25)

Matrix Code and Answer

Mesh Summary Table

I1	-6.48mA
I2	3.12mA
I3	-6.00mA
I4	-0.96mA
I5	0.24mA
I6	-2.16mA
Vx	-2.16V
Ix	-1.2mA
Io = I5 – I2	= 0.24 – 3.12 = -2.88mA

Bibliography

1. Circuit 1 given to analyze for exercise 1
2. Hand-written Nodal Analysis equations for exercise 1
3. Multisim matrix of answer for Nodal analysis exercise 1
4. Hand-written Mesh Analysis equations for exercise 1
5. Multisim matrix of answer for Mesh analysis exercise 1
6. Circuit 2 given to analyze for exercise 2
7. Hand-written Nodal Analysis equations for exercise 2
8. Multisim matrix of answer for Nodal analysis exercise 2
9. Hand-written Mesh Analysis equations for exercise 2
10. Multisim matrix of answer for Mesh analysis exercise 2
11. Circuit 3 given to analyze for exercise 3
12. Hand-written Nodal Analysis equations for exercise 3
13. Multisim matrix of answer for Nodal analysis exercise 3
14. Hand-written Mesh Analysis equations for exercise 3
15. Multisim matrix of answer for Mesh analysis exercise 3
16. Circuit 4 given to analyze for exercise 4
17. Hand-written Nodal Analysis equations for exercise 4
18. Multisim matrix of answer for Nodal analysis exercise 4
19. Hand-written Mesh Analysis equations for exercise 4
20. Multisim matrix of answer for Mesh analysis exercise 4
21. Circuit 5 given to analyze for exercise 5
22. Hand-written Nodal Analysis equations for exercise 5
23. Multisim matrix of answer for Nodal analysis exercise 5
24. Hand-written Mesh Analysis equations for exercise 5
25. Multisim matrix of answer for Mesh analysis exercise 5