Name _____

EE/EET 2240

Exam #2

Thursday, October 25, 2018

LIBR B03 and TAB 115, 9:30AM – 10:45AM

[closed book – one one-sided 8½"×11" page of notes and calculator allowed, nothing else]

1. Determine the value of z in the system of equations shown below.

Please check your work; there will be no partial credit on this problem.

$$\begin{bmatrix} 2 & 5 & 1 \\ 3 & 1 & 7 \\ 0 & 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -7 \\ 28 \\ 35 \end{bmatrix}$$

Using Cramer's Rule:

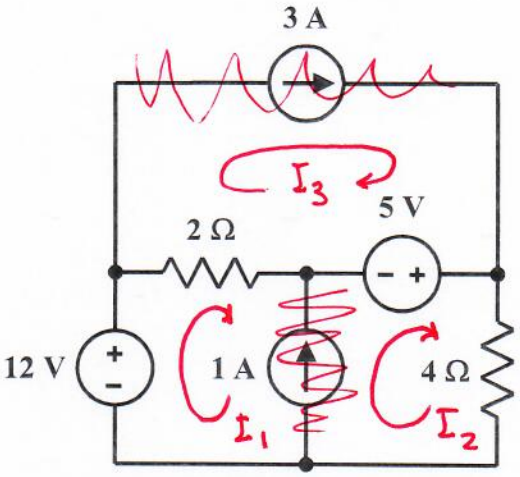
$$z = \frac{\begin{vmatrix} 2 & 5 & -7 \\ 3 & 1 & 28 \\ 0 & 2 & 35 \end{vmatrix}}{\begin{vmatrix} 2 & 5 & 1 \\ 3 & 1 & 7 \\ 0 & 2 & 5 \end{vmatrix}} = \frac{70 + 0 - 42 - 0 - 525 - 112}{10 + 0 + 6 - 0 - 75 - 28}$$

$$= \frac{-609}{-87} = 7$$

2. Use the ***mesh analysis*** method to formulate a system of simultaneous linear equations representing the circuit shown below. Express the equations in the matrix form discussed in class.

Show the details of your work in a neat and orderly fashion, including how you defined the mesh currents.

Do not make substitutions nor attempt to solve the equations.



$I_2 - I_1 = 1$ (constraint from 1A source)

$I_3 = 3$ (constraint from 3A source)

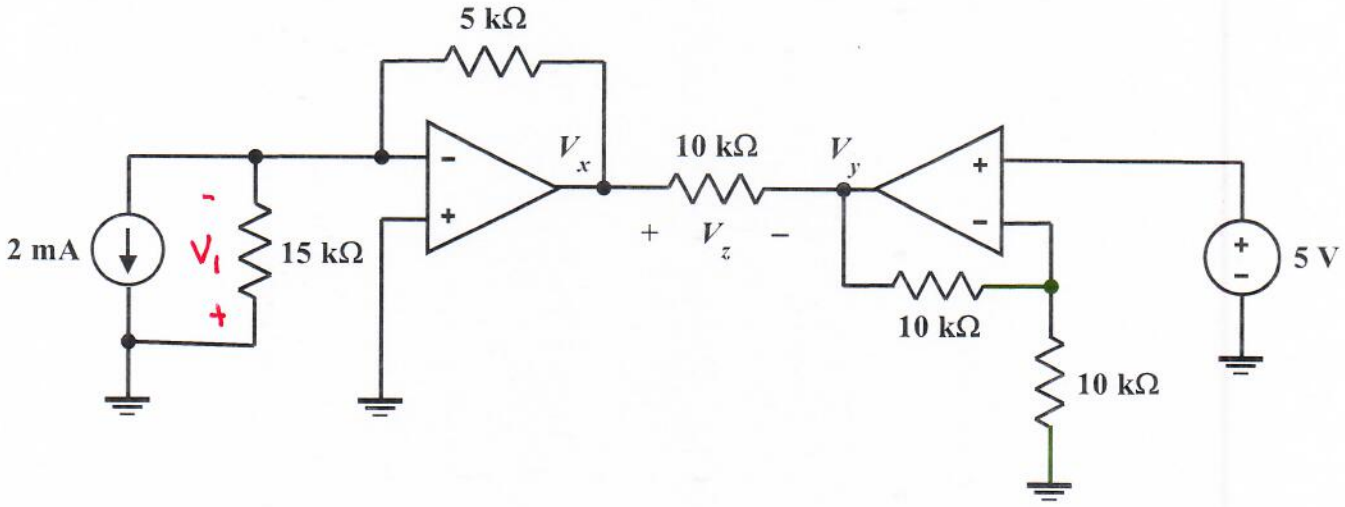
$-12 + 2(I_1 - I_3) - 5 + 4I_2 = 0$ (KVL from I_1/I_2 supermesh)

In matrix form:

$$\begin{bmatrix} -1 & 1 & 0 \\ 0 & 0 & 1 \\ 2 & 4 & -2 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ 17 \end{bmatrix}$$

3. Determine the numerical values of V_x, V_y and V_z.

Show the details of your work in a neat and orderly fashion, and define all symbols or variables you use in your solution.



$V_1 = 30\ V$

$V_x = -\frac{5k\Omega}{15k\Omega}(-V_1)$

$= 10\ V$

$V_y = \left(1 + \frac{10k\Omega}{10k\Omega}\right)(5V)$

$= 10\ V$

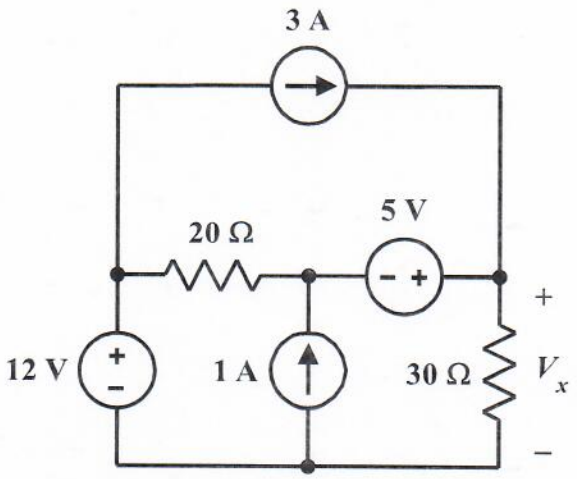
$V_z = V_x - V_y$

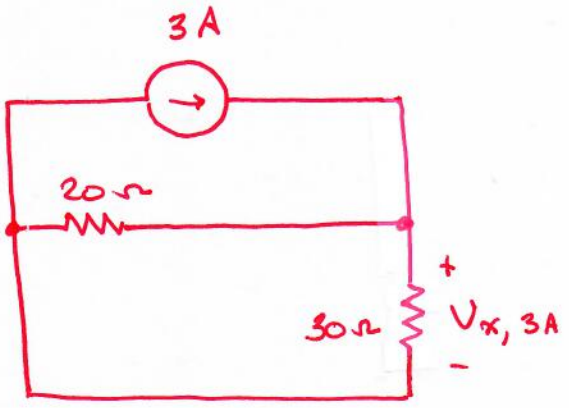
$= 10 - 10$

$= 0\ V$

4. Assume the superposition method is to be used to determine the voltage V_x. Determine the contribution from the 3 A independent current source.

Show the details of your work in a neat and orderly fashion.





$30\Omega \| 20\Omega = \frac{600}{50} = 12\Omega$

$V_{x,3A} = (12\Omega)(3A) = 36V$