

Armstrong State University
Engineering Studies
MATLAB Marina – Linear Algebraic Equations Exercises

1. Perform the following matrix operations by hand and verify your results using MATLAB's matrix operations.

$$U = \begin{pmatrix} 9 \\ 1 \end{pmatrix} \quad V = \begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix} \quad W = \begin{pmatrix} 5 & -2 \\ 1 & 4 \\ 8 & 2 \end{pmatrix}$$

- Transpose of W , i.e. determine W'
 - Multiply V and U , i.e. determine $V*U$
 - Multiply W and V , i.e. determine $W*V$
 - Determine the inverse of V (do this with MATLAB only), i.e. determine $\text{inv}(V)$
 - Multiply the inverse of V and U , i.e. determine $\text{inv}(V) * U$
2. Determine which of the following MATLAB operations are syntactically legal operations on the vectors and matrices v , w , x , A , B , C , and D below.

$$v = [4 \quad 3 \quad 2 \quad 1] \quad w = [5 \quad -2 \quad 0 \quad 0] \quad x = \begin{bmatrix} 2 \\ 1 \\ 0 \\ 2 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 1 & -2 \\ 3 & 7 & 0 \end{bmatrix} \quad C = \begin{bmatrix} 5 \\ 8 \end{bmatrix} \quad D = [8]$$

- $A*B$
 - $A.*B$
 - $A*A$
 - $B*C$
 - $C*B$
 - $B*D$
 - A^2
 - $A.^2$
 - $2*v$
 - $v*w$
 - $v/5$
 - $v./w$
 - $w*x$
 - $w.*x$
 - $B+C$
 - $w-D$
3. Write a MATLAB program that will:
- Create a 4 by 4 identity matrix named $I4$. Hint, use MATLAB's `eye` function.

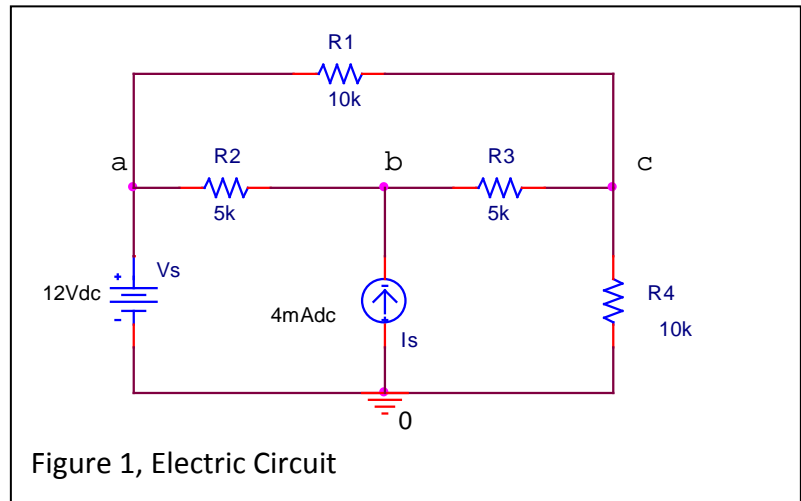
- Change the values of the second row of \mathbf{I} to all 1s and save the result in the variable \mathbf{D} .
 - Change the values of the fourth column of \mathbf{D} to all -2s and save the result back in the variable \mathbf{D} .
4. Write a MATLAB program that will solve the following system of equations for $x = [x_1, x_2, x_3]$ using both matrix inverse and Gaussian elimination (back division).
- $$5.7x_1 - 2.3x_2 + 0.9x_3 = 30.1$$
- $$-2.5x_1 + 1.3x_2 = -12.6$$
- $$8.0x_1 + 4.2x_2 - 7.5x_3 = 1.1$$
5. Analysis of electric circuits consisting of linear time-invariant elements yields systems of linear equations that need to be solved to determine the voltages and currents in the circuit. Write a MATLAB program to determine the node voltages for the circuit of Figure 1. Node voltage analysis resulted in the following equations.

$$v_a = V_s = 12V$$

$$\frac{v_a - v_b}{R_2} + I_s + \frac{v_c - v_b}{R_3} = 0$$

$$\frac{v_a - v_c}{R_1} + \frac{v_b - v_c}{R_3} + \frac{0 - v_c}{R_4} = 0$$

$$I_s = 4mA$$



6. Write a MATLAB function named `myTranspose` that will duplicate the operation of the transpose operator. The function should take the matrix to transpose as its argument and return the transpose of the matrix. Do not use the transpose operator to solve this problem; instead use iteration to exchange the rows and columns of the matrix. Test your `myTranspose` function for a row vector, a column vector and a 4 by 2 matrix.

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