Math 1410 Lyryx Lab 2
University of Lethbridge, Spring 2015

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1. Solve the following system of equations:

$$\begin{array}{rcrcrcrcr} 2x_1 & + & 2x_2 & - & 8x_3 & + & 6x_4 & = & -12 \\ -2x_1 & & & + & 8x_3 & - & 6x_4 & = & 8 \\ x_1 & & & - & 4x_3 & + & 3x_4 & = & -4 \end{array}$$

2. Solve the following homogeneous system of linear equations. If the system has no solution, demonstrate this by giving a row-echelon form of the augmented matrix of the system.

$$\begin{array}{rcrcrcr} 5x_1 & - & 5x_2 & - & 5x_3 & = & 0 \\ x_1 & - & x_2 & - & x_3 & = & 0 \\ -2x_1 & + & 3x_2 & + & 5x_3 & = & 0 \end{array}$$

3. Solve the following homogeneous system of linear equations. If the system has no solution, demonstrate this by giving a row-echelon form of the augmented matrix of the system.

$$\begin{array}{rcrcrcr} 2x_1 & + & 8x_2 & + & 8x_3 & = & 0 \\ 2x_1 & + & 8x_2 & + & 8x_3 & = & 0 \\ -x_1 & - & 4x_2 & - & 4x_3 & = & 0 \end{array}$$

4. Solve the following homogeneous system of linear equations. If the system has no solution, demonstrate this by giving a row-echelon form of the augmented matrix of the system.

$$\begin{array}{rcrcrcrcr} 2x_1 & + & 8x_2 & + & 6x_3 & + & 4x_4 & = & 0 \\ x_1 & + & 4x_2 & + & 6x_3 & + & 5x_4 & = & 0 \\ -2x_1 & - & 8x_2 & - & 7x_3 & - & 2x_4 & = & 0 \\ -2x_1 & - & 8x_2 & - & 4x_3 & - & 3x_4 & = & 0 \end{array}$$

5. Determine the values of a for which the following system of linear equations has no solution, a unique solution, or infinitely many solutions. For each case, you can answer "Always", "$a =$ _____", or "$a \neq$ _____".

$$\begin{array}{rcrcrcl} ax_1 & - & 9x_2 & - & 6x_3 & = & 0 \\ -2x_1 & + & 6x_2 & + & 6x_3 & = & 0 \\ 2x_1 & - & 6x_2 & - & 7x_3 & = & 0 \end{array}$$

No Solutions:

Unique Solution:

Infinitely Many Solutions:

6. Find the row-echelon form of the matrix A, and give its rank:

$$A = \begin{bmatrix} 2 & -4 & 4 \\ -1 & 2 & 3 \\ 1 & -2 & -1 \\ 3 & 6 & -3 \end{bmatrix}$$

7. Consider the following matrices:

$$A = \begin{bmatrix} 3 \\ 2 \\ -2 \end{bmatrix} \quad B = \begin{bmatrix} 9 \\ 8 \\ -5 \end{bmatrix} \quad C = \begin{bmatrix} 0 \\ 2 \\ 1 \end{bmatrix}$$

For each of the following matrices, determine whether it can be written as a linear combination of the matrices A, B, and C. If not, answer "No". If it can, write your linear combination using the matrix names above.

$$V_1 = \begin{bmatrix} -3 \\ 4 \\ 1 \end{bmatrix} \quad V_2 = \begin{bmatrix} 0 \\ -2 \\ -1 \end{bmatrix} \quad V_3 = \begin{bmatrix} 15 \\ 8 \\ -11 \end{bmatrix}$$

8. Compute the following matrix sum:

$$\begin{bmatrix} -6 & 0 \\ 5 & 10 \\ -10 & 3 \\ 2 & -7 \\ 0 & -6 \end{bmatrix} + \begin{bmatrix} 2 & 10 \\ -1 & -1 \\ 6 & 2 \\ -1 & 0 \\ 5 & 3 \end{bmatrix} =$$

9. Compute the following scalar multiple:

$$-3 \begin{bmatrix} -4 & -1 & 0 & -5 & 3 \\ -9 & 10 & 1 & -9 & -9 \end{bmatrix} =$$

10. Express the following system of linear equations as a vector equation and as a matrix equation:

$$\begin{array}{rcrcl} -6x_1 & - & 6x_2 & = & 5 \\ -6x_1 & - & 10x_2 & = & -6 \end{array}$$

Number of variables:

Vector equation: $x_1 \begin{bmatrix} ? \\ ? \end{bmatrix} + x_2 \begin{bmatrix} ? \\ ? \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$

Matrix equation: $\begin{bmatrix} ? & ? \\ ? & ? \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$