Math 111 – Matrices on the TI-89/TI-92

1. Entering Matrices

To enter the two matrices \( A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix} \) and \( B = \begin{bmatrix} 2 & -1 \\ -1 & -8 \end{bmatrix} \)

Press APPS 6 [DATA/MATRIX EDITOR] 3 [NEW]. You should see a menu.

Set the TYPE to MATRIX, and name the variable \( a \).

Enter the dimensions of \( A \): Row Dimension: 2 and Column Dimension: 2 then \( \text{ENTER} \)

Enter the first row: \( 1 \text{ ENTER} -1 \text{ ENTER} \), (1, 1 = 1, 1, 2 = -1)

Enter the second row: \( 2 \text{ ENTER} -1 \text{ ENTER} \), (2, 1 = 2, 2, 2 = -1)

After entering the matrix completely exit: \( 2\text{nd} \text{ QUIT} \)

Press \( 2\text{nd} \text{ MATRIX} \) [EDIT] again to enter the second matrix, calling it \( b \).
Notice that you can edit any entry by using the up- and down-arrow keys.

2. To display a matrix on the screen

On the HOME screen: Press \( a \text{ ENTER} \), then \( b \text{ ENTER} \)

3. Solving Systems of Equations

You can obtain the reduced row echelon form of an augmented matrix by pressing the following on the HOME screen:

\( 2\text{nd} \text{ MATH} 4[\text{Matrix}] 4[\text{ref()} \text{ matrix name} \text{ ENTER} \)

This gives a simple way of solving a system of linear equations.

If you have a row in the form \( \begin{bmatrix} 0 & 0 & \ldots & 0 & : & c \end{bmatrix} \) \((c \neq 0)\) at the bottom of the matrix, there is NO SOLUTION.

If you have a row of the form \( \begin{bmatrix} 0 & 0 & \ldots & 0 & : & 0 \end{bmatrix} \) at the bottom, the system is DEPENDENT and has infinite solutions.

You can use this to check your answers, but you still need to be able to do this by hand.
Examples:

1. One Solution: \( x + y + z = 6 \)  
   Matrix form: \[
   \begin{bmatrix}
   1 & 1 & 1 & 6 \\
   0 & 1 & 3 & 11 \\
   \end{bmatrix}
   \]
   Solution: \((1, 2, 3)\), found by using back substitution.

2. No Solutions: \( 2x - 2y + 6z = 7 \)  
   Matrix: \[
   \begin{bmatrix}
   -2 & -2 & 6 & 7 \\
   3 & -1 & 5 & 14 \\
   \end{bmatrix}
   \]
   ref: \[
   \begin{bmatrix}
   1 & -2 & 2 & 4 \\
   0 & 0 & 1 & 0 \\
   0 & 0 & 0 & 0 \\
   \end{bmatrix}
   \]

3. Infinite Solutions: \( 5x - 10y + 5z = 20 \)  
   Matrix: \[
   \begin{bmatrix}
   5 & -10 & 5 & 20 \\
   -2 & 4 & -2 & -8 \\
   \end{bmatrix}
   \]
   ref: \[
   \begin{bmatrix}
   3 & -3 \\
   6 & -3 \\
   \end{bmatrix}
   \]

4. Matrix Math Functions

   1. Addition: \( a + b \)  

   2. Subtraction: \( a - b \)  

   3. Scalar Multiplication: \( 3a \) or \( 3 \times a \)  

   4. Multiplication: \( ab \) or \( a \times b \)  

   5. Inverse: \( a \) \( \text{2nd} \) \( \text{X}^{-1} \)

Answers:

1. \[
   \begin{bmatrix}
   3 \\
   1 \\
   \end{bmatrix}
   \]
2. \[
   \begin{bmatrix}
   -1 & 0 \\
   3 & 7 \\
   \end{bmatrix}
   \]
3. \[
   \begin{bmatrix}
   3 & -3 \\
   6 & -3 \\
   \end{bmatrix}
   \]
4. \[
   \begin{bmatrix}
   3 & 7 \\
   5 & 6 \\
   \end{bmatrix}
   \]
5. \[
   \begin{bmatrix}
   -1 & 1 \\
   -2 & 1 \\
   \end{bmatrix}
   \]

If an operation is not possible, you will get an error message.