Operating on Matrices
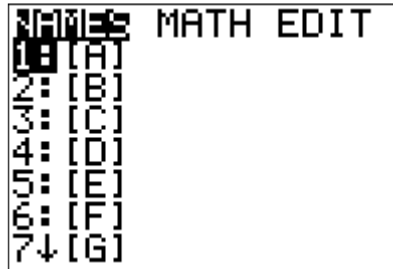
Name _____
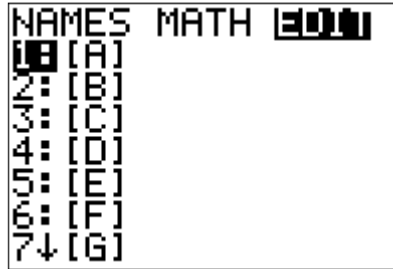
Class _____

Part 1 – Adding and Subtracting Matrices
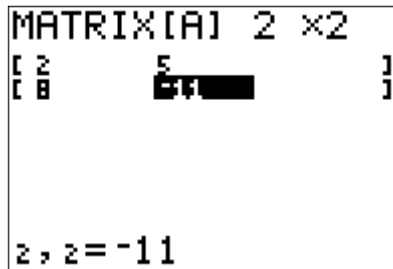
The matrix functions can be accessed by pressing [2nd] [MATRIX] (pictured at the right).

To enter the matrix $\begin{bmatrix} 2 & 5 \\ 8 & -11 \end{bmatrix}$ into your calculator,

select **EDIT** by using the arrow keys and choosing a matrix (labeled [A], [B], etc.). Select **1:[A]**.

Now the dimensions (rows × columns) need to be entered along with the values of each cell.

Enter the matrix $\begin{bmatrix} 1 & 0 \\ -3 & 7 \end{bmatrix}$ as outlined above, but store this in matrix [B].

Now, find [A] + [B]. To do this, return to the home screen by pressing [2nd] [QUIT] and then entering [2nd] [MATRIX] [ENTER] [+] [2nd] [MATRIX] [2] [ENTER] as pictured to the right. Record your answer below in question 1a.
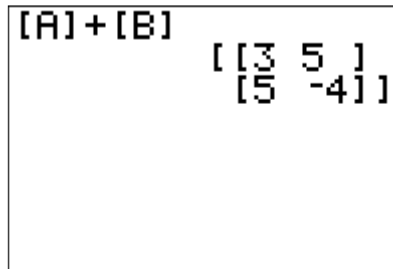
1. Enter the following examples into your handheld. Record the results for each exercise.

    a. $\begin{bmatrix} 2 & 5 \\ 8 & -11 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ -3 & 7 \end{bmatrix}$

    b. $\begin{bmatrix} 2 & 3 \\ 10 & -1 \end{bmatrix} - \begin{bmatrix} 4 & 9 \\ -5 & 2 \end{bmatrix}$

c. $\begin{bmatrix} 4 \\ 9 \end{bmatrix} + \begin{bmatrix} 1 & -6 \\ -2 & 8 \end{bmatrix}$

d. $\begin{bmatrix} 7 & -9 \\ -3 & 4 \end{bmatrix} - \begin{bmatrix} 6 & -5 & 0 \\ -1 & 0 & 3 \end{bmatrix}$

2. When can matrices be added or subtracted?

3. How does the error message help figure out the rule to add and subtract matrices?

4. What is the rule to add and subtract matrices?

Part 2 – Multiplying Matrices

Multiply two matrices in the same manner as adding or subtracting. As you complete the examples, you should think about the dimensions of the two matrices multiplied together and the answer.

5. Enter the following examples into your handheld. Record the results for each exercise.

a. $\begin{bmatrix} 4 & -3 \\ -1 & 7 \end{bmatrix} \cdot \begin{bmatrix} 1 & 3 \\ 8 & 5 \end{bmatrix}$

b. $\begin{bmatrix} 1 & 9 \end{bmatrix} \cdot \begin{bmatrix} -1 \\ -4 \end{bmatrix}$

c. $\begin{bmatrix} 2 \\ 7 \end{bmatrix} \cdot \begin{bmatrix} -3 & 5 \end{bmatrix}$

d. $\begin{bmatrix} 2 & 5 & 7 \\ -4 & 11 & -8 \\ -6 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 3 & 6 & 10 \\ 0 & -1 & 1 \\ 7 & 1 & 5 \end{bmatrix}$

e. $\begin{bmatrix} -2 & 0 \\ 8 & 4 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 5 \\ 9 \end{bmatrix}$

6. What were the dimensions of the matrices that could be multiplied?

7. If the matrices could be multiplied, what were the dimensions of the result?

8. If an $a \times b$ matrix is multiplied by a $c \times d$ matrix, what must be true in order to get an answer?
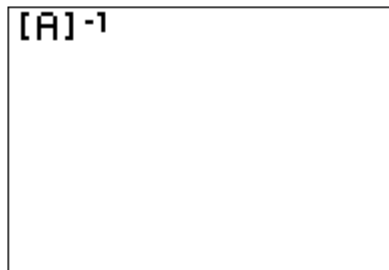
Part 3 – Inverses and Determinants of Matrices

Finding the Inverse of a Matrix

To find the inverse of a matrix, press $\boxed{x^{-1}}$ after selecting the entered matrix as pictured to the right.

`[A]⁻¹`

Try the following example:

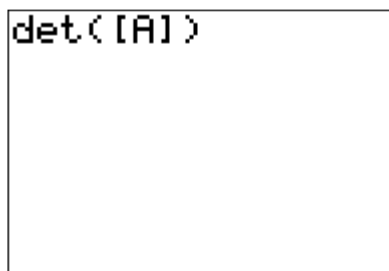$$\begin{bmatrix} 2 & -1 \\ 7 & 11 \end{bmatrix}^{-1}$$

Finding the Determinant of a Matrix

To find the determinant of a matrix, begin by going to the matrix menu (press $\boxed{\text{2nd}}$ $\boxed{\text{MATRIX}}$). Now use the arrow keys to highlight **MATH** and select **1:det(**. Then select the desired matrix from the matrix window.

`det([A])`

Try the following example:

$$\det\left(\begin{bmatrix} 2 & -1 \\ 7 & 11 \end{bmatrix}\right)$$

9. Find the inverse and determinant of each matrix.

	Inverse	Determinant
a. $\begin{bmatrix} 4 & 2 \\ 6 & 3 \end{bmatrix}$		
b. $\begin{bmatrix} 1 & 2 & 3 \\ -1 & 1 & 2 \\ 0 & 4 & -2 \end{bmatrix}$		
c. $\begin{bmatrix} 1 & 2 \\ -3 & 3 \end{bmatrix}$		
d. $\begin{bmatrix} 2 \\ 8 \end{bmatrix}$		
e. $\begin{bmatrix} 2 & -1 & 7 \end{bmatrix}$		

10. What are the dimensions of the matrices that have determinants? Inverses?

11. Does the determinant affect whether a matrix has an inverse? If so, how?

Operating on Matrices

Practice Problems

Use your calculator to complete the following problems.

1. $\begin{bmatrix} 10 & 19 \\ -8 & 22 \end{bmatrix} + \begin{bmatrix} 17 & 5 \\ -3 & -9 \end{bmatrix}$

2. $\begin{bmatrix} 0 & 1 \\ 3.5 & 2.4 \end{bmatrix} - \begin{bmatrix} -1.7 & 1.3 \\ 1.1 & -0.2 \end{bmatrix}$

3. $\begin{bmatrix} \frac{1}{4} & 6 \\ -2 & -\frac{2}{5} \end{bmatrix} + \begin{bmatrix} -1 & \frac{9}{4} \\ 0 & \frac{1}{7} \end{bmatrix}$

4. $\begin{bmatrix} 4.6 & 5 \\ 2 & 8 \end{bmatrix} - \begin{bmatrix} -4 & -13 \\ -3 & -23 \end{bmatrix}$

5. $\begin{bmatrix} 0 & -2 \\ -1 & 10 \end{bmatrix} \bullet \begin{bmatrix} -3 & 2 \\ 7 & -1 \end{bmatrix}$

6. $\begin{bmatrix} 1 & 2 \\ -1 & -2 \end{bmatrix} \bullet \begin{bmatrix} 2 \\ -2 \end{bmatrix}$

7. $\begin{bmatrix} 1 \\ 3 \\ 7 \end{bmatrix} \bullet \begin{bmatrix} 2 & 0 & 1 \\ 4 & 4 & 4 \\ 2 & 9 & 7 \end{bmatrix}$

8. $\begin{bmatrix} 2 \\ 1 \\ -\frac{1}{8} \end{bmatrix} \bullet \begin{bmatrix} 9 & -7 & 3 \end{bmatrix}$

9. $\begin{bmatrix} 2 & -1 \\ 1 & -2 \end{bmatrix} \bullet \begin{bmatrix} \frac{2}{3} & -\frac{1}{3} \\ \frac{1}{3} & -\frac{2}{3} \end{bmatrix}$

10. Find the inverse of: $\begin{bmatrix} 2 & -1 \\ 1 & -2 \end{bmatrix}$

11. Find the inverse of: $\begin{bmatrix} 5 & 2 & 1 & 8 \end{bmatrix}$

12. Find the determinant of: $\begin{bmatrix} 1 & 2 & 4 \\ 2 & -3 & 5 \\ 0 & -1 & 0 \end{bmatrix}$

13. Find the inverse of: $\begin{bmatrix} 1 & 2 & 4 \\ 2 & -3 & 5 \\ 0 & -1 & 0 \end{bmatrix}$

14. Divide: $\dfrac{\begin{bmatrix} -5 & 3 \\ 2 & -1 \end{bmatrix}}{\begin{bmatrix} 3 & 2 \\ -1 & -6 \end{bmatrix}}$

15. Divide: $\dfrac{\begin{bmatrix} 1 & 5 & 4 \\ 2 & -1 & 5 \\ -2 & -3 & 1 \end{bmatrix}}{\begin{bmatrix} 3 & 7 & -4 \\ 2 & -3 & -2 \\ 1 & -1 & 2 \end{bmatrix}}$