Matrix Concepts – Matrices on Calculators*

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Abstract

This module explains using and solving matrices on a calculator.

Many modern graphing calculators have all the basic matrix operations built into them. The following is a brief overview of how to work with matrices on a TI-83, TI-83 Plus, TI-84, or TI-84 Plus.

The calculator has room to store up to ten matrices at once. It refers to these matrices as [A], [B], and so on, through [J]. Note that these are **not** the same as the 26 lettered memories used for numbers.

The following steps will walk you through the process of entering and manipulating matrices.

1. Hit the `MATRX` button. On a TI-83, this is a standalone button; on a TI-83 Plus, you first hit `2nd` and then `MATRIX` (above the x^{-1} button). The resulting display is a list of all the available matrices. (You have to scroll down if you want to see the ones below `[G]`.)

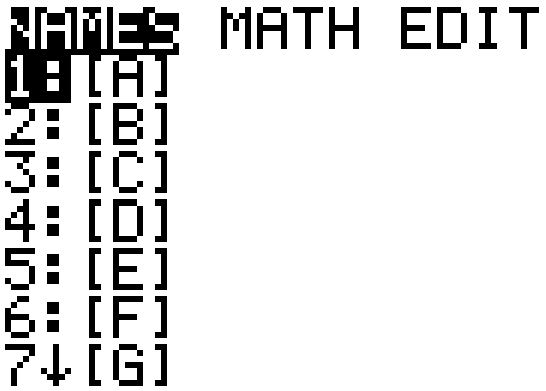

Figure 1

2. Hit the **right arrow key** `[U+25BA]` twice, to move the focus from `NAMES` to `EDIT`. This signals that you want to create, or change, a matrix.

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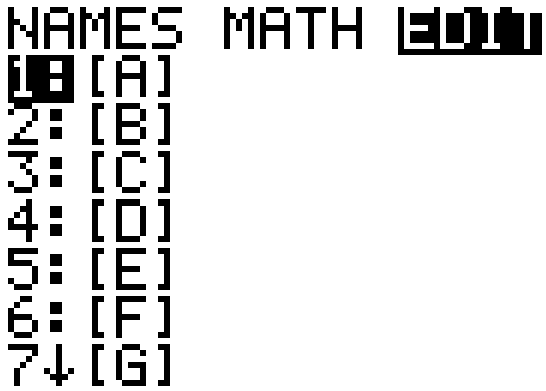

Figure 2

3. Hit the number `1` to indicate that you want to edit the **first** matrix, `[A]`.
4. Hit `4 ENTER 3 ENTER` to indicate that you want to create a 4x3 matrix. (4 rows, 3 columns.)

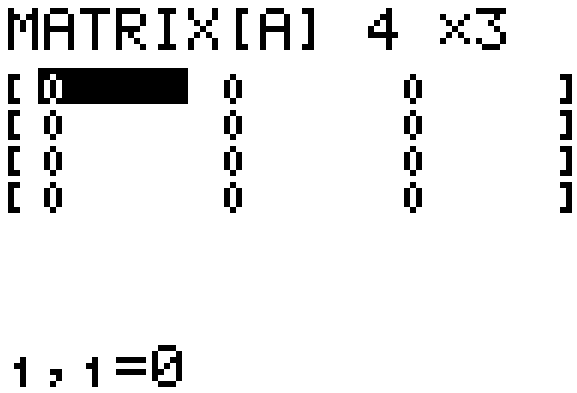

Figure 3

5. Hit

```
1  ENTER 2  ENTER 3  ENTER
4  ENTER 5  ENTER 6  ENTER
7  ENTER 8  ENTER 9  ENTER
10 ENTER 11 ENTER 12 ENTER
```

This fills in the matrix with those numbers (you can watch it fill as you go). If you make a mistake, you can use the arrow keys to move around in the matrix until the screen looks like the picture below.

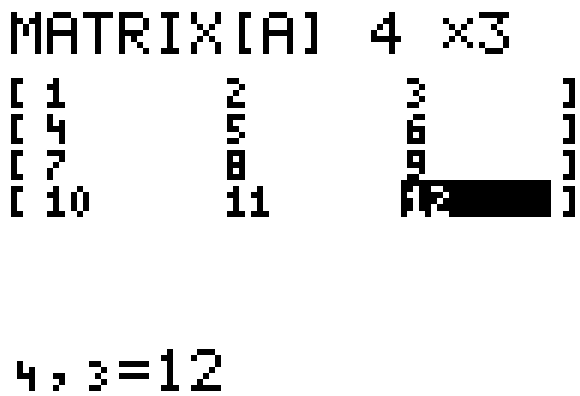

Figure 4

6. Hit `2nd Quit` to return to the main screen.
7. Return to the main matrix menu, as before. However, this time, do **not** hit the right arrow to go to the `EDIT` menu. Instead, from the NAMES menu, hit the number `1`. This puts `[A]` on the main screen. Then hit `ENTER` to display matrix `[A]`.

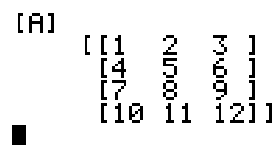

Figure 5

8. Go through the process (steps 1-7) again, with a few changes. This time, define matrix `[B]` instead of matrix `[A]`. (This will change step 3: once you are in the `EDIT` menu, you will hit a `2` instead of a 1.) Define `[B]` as a 3x2 matrix in step 4. Then, in step 5, enter the following numbers:

$$\begin{bmatrix} 10 & 40 \\ 20 & 50 \\ 30 & 60 \end{bmatrix} \tag{1}$$

When you are done, and have returned to the main screen and punched 2 in the NAMES menu (step 7), your main screen should look like this:

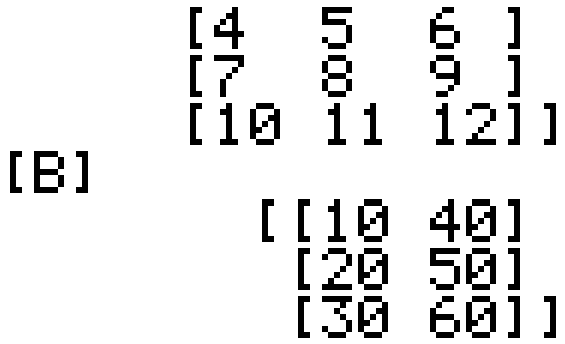

Figure 6

9. Now, type the following keys, watching the calculator as you do so. TI-83 Plus users should always remember to hit `2nd MATRIX` instead of just `MATRX.MATRX 1 + MATRX 2`

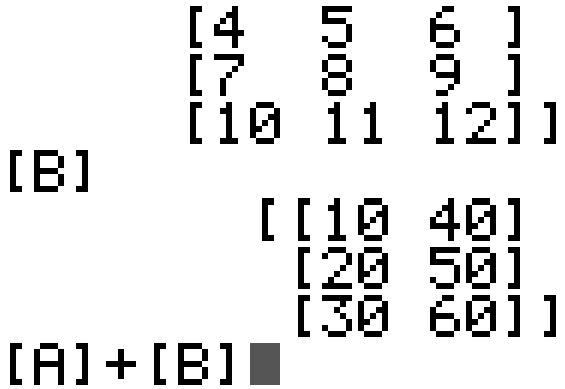

Figure 7

This instructs the computer to add the two matrices. Now hit `ENTER`

Figure 8

Hey, what happened? You asked the computer to add two matrices. But these matrices have **different dimensions**. Remember that you can only add two matrices if they have the same dimensions—that is, the same number of rows as columns. So you got an "Error: Dimension Mismatch." Hit `ENTER` to get out of this error and return to the main screen.

10. Now try the same sequence without the + key: `MATRX 1 MATRX 2 ENTER`

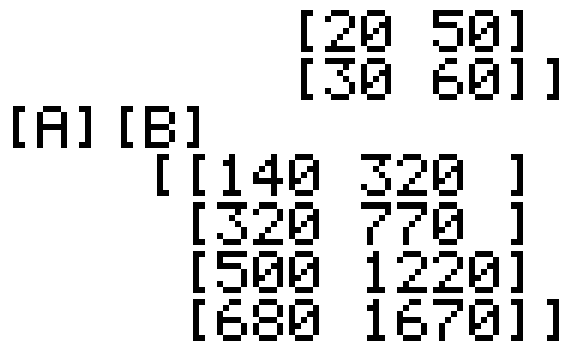

Figure 9

This instructs the calculator to **multiply** the two matrices. This is a legal multiplication—in fact, you may recognize it as the multiplication that we did earlier. The calculator displays the result that we found by hand: $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix} \begin{bmatrix} 10 & 40 \\ 20 & 50 \\ 30 & 60 \end{bmatrix} = \begin{bmatrix} 140 & 320 \\ 320 & 770 \\ 500 & 1220 \\ 680 & 1670 \end{bmatrix}$

11. Enter a third matrix, matrix [C]= $\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$. When you confirm that it is entered correctly, the screen should look like this:

Figure 10

Now type `MATRX 3 x-1 ENTER`

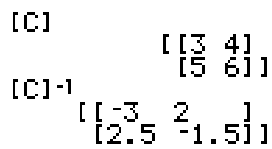

Figure 11

This takes the **inverse** of matrix [C]. Note that the answer matches the inverse matrix that we found before.

12. Type `MATRX 3 x-1 MATRX 3 ENTER`

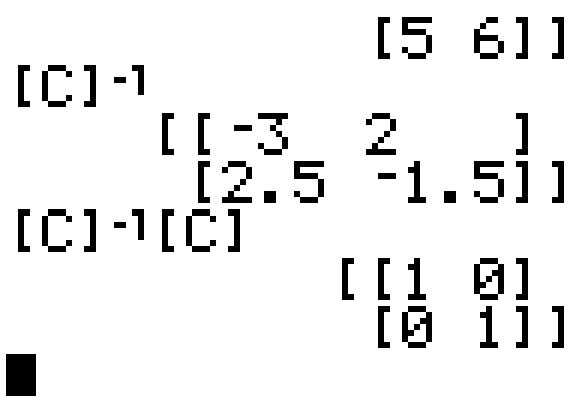

Figure 12

This instructs the calculator to multiply matrix [C]-1 times matrix [C]. The answer, of course, is the

2×2 identity matrix [I].