

Matrices on the Graphing Calculator

Entering a Matrix with the TI-83 or TI-84 Plus matrix editor

To enter a matrix on the TI-83, press **MATRIX**. On the TI-84, go to **(2nd) MATRIX**, **EDIT**, and select the matrix you would like to edit. Enter the number of rows then columns in your matrix. Press **ENTER** and you will be able to enter the numerical entries into the matrix. To retrieve your matrix on the Home Screen, go to **MATRIX NAMES** and select the matrix you have just entered.

Entering a Matrix from the home screen

Although you can enter a matrix on the TI-84 (Plus) or TI-89 (or other TI calculators) using the matrix editor, you may find it more convenient to enter it on the home screen. To Enter the matrix

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix}$$

type the following sequence: **[[2,3,1,1] [1,1,1,3] [3,4,2,4]]**. Press **Enter** and you will see your matrix in the home screen. Notice that the brackets enclose the rows of the matrix. To input $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ you would enter **[[1] [2]]**. To store this matrix with a variable name, press the store key **(STO →)** and name the matrix. For example, on the TI-84 you will choose a name from the matrix name menu.

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \text{ (STO →) } [A].$$

or on the TI-89 you name the matrix with the alphanumeric keys

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \text{ (STO →) } a1.$$

Elementary Row Operations

1. To interchange 2 rows:

TI-89: **(2nd) Math, Matrix , Row ops, rowSwap(**

TI-84-Plus: **(2nd) Matrx, math, rowSwap(**

To swap row 1 with row 2 in our matrix above, enter **rowSwap(a1,1,2)**, or **rowSwap([A],1,2)**.
i.e. **rowSwap(matrix name, row number, row number)**.

2. To multiply a row by a scalar:

TI-89: Use command `mRow (`

TI-84-Plus: Use command `*row (`

To multiply row 1 by -2, enter `mRow (-2, a1, 1)` or `*row (-2, [A], 1)` i.e. `mRow (scalar, matrix name, row number)`

3. To multiply a row by a scalar and add to another row:

TI-89: Use command `mRowAdd (`

TI-84-Plus: Use command `*row+ (`

To multiply row 1 by -2, add it to row 2 and store the result in row 2, enter `mRowAdd (-2, a1, 1, 2)` or `*row+ (-2, A, 1, 2)`

i.e. `mRowAdd (scalar, matrix name, row to be multiplied, row to be added to and stored in).`

Using These Operations to Find Equivalent Matrices

Note this is shown using the TI-89 notation. You would do the operations similarly on the TI-83 or 84 Plus.

1. First swap rows 1 and 2: `rowSwap (a1, 1, 2)`

$$a1 = \begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow[r_2 \leftarrow r_1]{r_1 \rightarrow} \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow{\text{STO} \rightarrow} a2$$

(Notice that it is stored in a different variable. It is a good idea to keep a “copy” of the original matrix stored in one name and all the equivalent matrices in another in case you make a mistake and have to start over.)

2. Add -2 times row 1 to row 2 and put it in row 2: `mRowAdd (-2, a2, 1, 2)`

$$a2 = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow{-2r_1 + r_2 \rightarrow r_2} \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & 1 & -1 & -5 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow{\text{STO} \rightarrow} a2$$

3. Add -3 times row 1 to row 3, and put in row 3: `mRowAdd (-3, a2, 1, 3)`

$$a2 = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow{-3r_1 + r_3 \rightarrow r_3} \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & 1 & -1 & -5 \\ 0 & 1 & -1 & -5 \end{bmatrix} \xrightarrow{\text{STO} \rightarrow} a2$$

4. Add -1 times row 2 to row 3, and put in row 3: `mRowAdd (-1, a2, 2, 3)`

$$a2 = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 3 & 4 & 2 & 4 \end{bmatrix} \xrightarrow{-1r_2 + r_3 \rightarrow r_3} \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & 1 & -1 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix} \xrightarrow{\text{STO} \rightarrow} a2$$

Shortcuts

1. `ref(a1)` puts the matrix `a1` in row echelon form:

$$\text{ref}(a1) = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & 1 & -1 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

2. `rref(a1)` puts the matrix `a1` in reduced row echelon form:

$$\text{rref}(a1) = \begin{bmatrix} 1 & 0 & 2 & 8 \\ 0 & 1 & -1 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$