

# 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  $\boxed{\text{MATRX}}$ . On the TI-84, go to  $\boxed{2\text{nd}}$   $\boxed{\text{MATRX}}$ ,  $\boxed{\text{EDIT}}$ , and select the matrix you would like to edit. Enter the number of rows then columns in your matrix. Press  $\boxed{\text{ENTER}}$  and you will be able to enter the numerical entries into the matrix. To retrieve your matrix on the Home Screen, go to  $\boxed{\text{MATRX NAMES}}$  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  $\boxed{\text{Enter}}$  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  $\boxed{\text{STO} \rightarrow}$  and name the matrix. For example, on the TI-84 you will choose a name from the matrix name menu.

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \boxed{\text{STO} \rightarrow} [A].$$

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

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \boxed{\text{STO} \rightarrow} a1.$$

## Elementary Row Operations

1. To interchange 2 rows:

TI-89:  $\boxed{2\text{nd}}$   $\boxed{\text{Math}}$ ,  $\boxed{\text{Matrix}}$ ,  $\boxed{\text{Row ops}}$ ,  $\boxed{\text{rowSwap}}$ (

TI-84-Plus:  $\boxed{2\text{nd}}$   $\boxed{\text{Matrx}}$ ,  $\boxed{\text{math}}$ ,  $\boxed{\text{rowSwap}}$ (

To swap row 1 with row 2 in our matrix above, enter  $\text{rowSwap}(a1, 1, 2)$ , or  $\text{rowSwap}([A], 1, 2)$ .

i.e.  $\text{rowSwap}(\text{matrix name}, \text{row number}, \text{row number})$ .

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)`

$$a1 = \begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 1 & 1 & 3 \\ 3 & 4 & 2 & 4 \end{bmatrix} \begin{matrix} r_1 \rightarrow \\ \leftarrow r_2 \end{matrix} \longrightarrow \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & 3 & 1 & 1 \\ 3 & 4 & 2 & 4 \end{bmatrix} \boxed{\text{STO} \rightarrow} a2$$

( 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)`

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

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

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

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

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

## Shortcuts

1.  $\text{ref}(a_1)$  puts the matrix  $a_1$  in row echelon form:

$$\text{ref}(a_1) = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & 1 & -1 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

2.  $\text{rref}(a_1)$  puts the matrix  $a_1$  in reduced row echelon form:

$$\text{rref}(a_1) = \begin{bmatrix} 1 & 0 & 2 & 8 \\ 0 & 1 & -1 & -5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$