TEXAS INSTRUMENTS

Matrices for the TI-73

Getting Started
- Start here

How To…
- Find Installation Instructions
- Move Between Matrix Application Screens
- View and Edit a Matrix
- Use Matrices with Expressions
- Display and Copy Matrices
- Use Math Functions with Matrices
- Use the Matrix MTH Operations
- Delete a Matrix

More Information
- Uninstalling the Application from the TI-73
- Error Recovery
- Customer Support

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Where to Find Installation Instructions

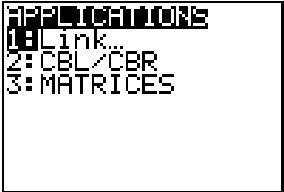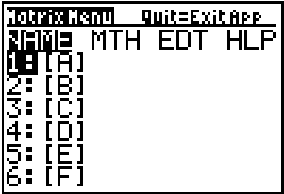You can find detailed instructions on installing Flash applications at education.ti.com/guides.
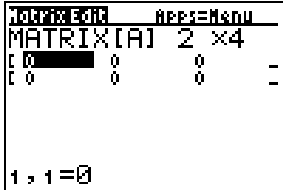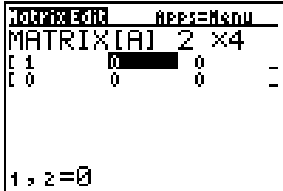
Getting Started: Systems of Linear Equations

Use the Matrices application to solve the system of linear equations:

$X + 2Y + 3Z = 3$
$2X + 3Y + 4Z = 3$

Enter the coefficients as elements in a matrix, and then use **rref(** to find the reduced row-echelon form.

Steps	**Keystrokes**	**Display**
1. Run the Matrices application.	[APPS], highlight **MATRICES** and press [ENTER], then press any key	
2. Display the MATRIX EDT menu, and select the **[A]** matrix.	▶ ▶ 1	

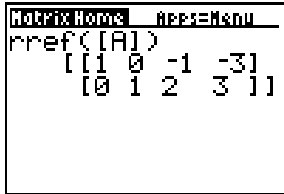| Steps	Keystrokes	Display
3. Define a 2×4 matrix. The rectangular cursor indicates the current element. Ellipses (**...**) indicate additional columns beyond the screen.	2 ENTER 4 ENTER	MATRIX EDIT APPS=Menu MATRIX[A] 2 ×4 [0 0 0 [0 0 0 1,1=0
4. Enter **1** for the first element. The rectangular cursor moves to the second column of the first row.	1 ENTER	MATRIX EDIT APPS=Menu MATRIX[A] 2 ×4 [1 0 0 [0 0 0 1,2=0
5. Complete the first row for $X + 2Y + 3Z = 3$.	2 ENTER 3 ENTER 3 ENTER	MATRIX EDIT APPS=Menu MATRIX[A] 2 ×4 _ 2 3 3] _ 3 4 3] 2,4=3
6. Enter the second row for $2X + 3Y + 4Z = 3$.	2 ENTER 3 ENTER 4 ENTER 3 ENTER	
7. Display the Matrix Home screen.	APPS CLEAR	

Steps	Keystrokes	Display
8. Clear the screen, if necessary.	CLEAR	Matrix Home APPS=Menu rref(
9. Display the MATRIX MTH menu. Press ▲ to wrap to the end of the menu, and then select **B:rref(**.	APPS ▶ ▲ ▲▲▲▲▲▲ ENTER	

10. Display the MATRIX NAME menu and select matrix **[A]**. Then complete the calculation. The reduced row-echelon form of the matrix is:
 	
$1X + 0Y - 1Z = {}^-3$ so
$X = {}^-3 + Z$
 	
$0X + 1Y + 2Z = 3$ so
$Y = 3 - 2Z$
	APPS 1
	) ENTER
		Matrix Home APPS=Menu
		rref([A])
		    [[1 0 -1 -3]
		     [0 1 2 3]]

Running or Quitting the Application

Running the Application
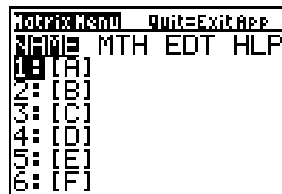
After installing the application:

1. Press APPS.

2. Select the **Matrices** application. An informational screen appears.
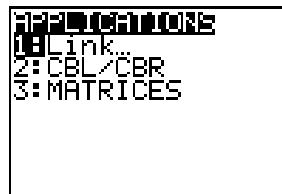
Note If you ever need technical support, you may need the version number shown on this screen.

3. Press any key to display the Matrix Menu screen.

Quitting the Application

To exit the Matrices application and return to the TI-73 Home screen, either:

- Press [2nd] [QUIT].

  – or –

- On the Matrix Menu screen, highlight **HLP**. Then select **2:Quit**.
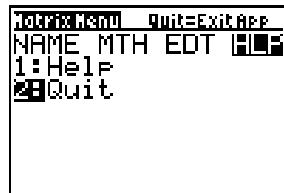
Any matrices or other variables that you stored while using the Matrices application are retained in memory. Matrices are stored as application variables (App vars). After quitting the application, you cannot use a stored matrix from the TI-73 Home screen; you must run the Matrices application to access a matrix or perform a matrix calculation.

Matrices Application Screens and How to Move Between Them

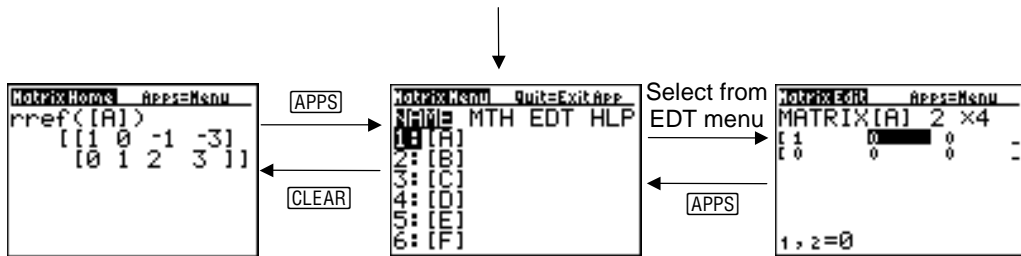The three primary screens used in the Matrices application are shown below. Notice the keys used to move from one screen to another.

The Matrices application starts on this screen.

The **Matrix Home** screen replaces the normal TI-73 Home screen. Use this screen to perform all calculations while running the Matrices application. From this screen, you can also access most of the normal TI-73 menus.

The **Matrix Menu** screen lets you access menus to:

- Select matrix names for use in a calculation
- Select matrix math operations.
- Edit or create a matrix.
- View online Help.

The **Matrix Edit** screen lets you edit an existing matrix or create a new one.

Viewing Online Help

To view online Help, highlight **HLP** on the Matrix Menu screen. Then select **1:Help**.
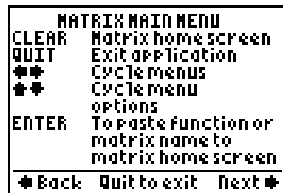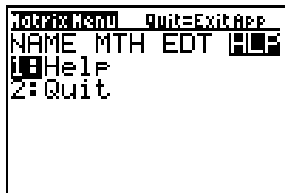
Press ▶ (next) and ◀ (back) to move through the Help, one page at a time. On the last page, ▶ returns to the Matrix Menu screen.

At any time, press [2nd] [QUIT] to exit Help and return to the Matrix Menu screen.

Defining a Matrix

What Is a Matrix?

A matrix is a two-dimensional array. You can define, display, or edit a matrix using the Matrix Edit screen. You can also define a matrix directly in an expression. The Matrices application for the TI-73 has six matrix variables, **[A]** through **[F]**. A matrix, depending on available memory, can have up to 100 elements in any arrangement of rows and columns (with a maximum of 99 individual rows or columns). You can store only real numbers in a matrix.

Defining a New Matrix

Before you can define or edit a matrix in the editor, you must select the matrix name. From the Matrix Home screen:

1. Press [APPS] ▶ ▶ to display the MATRIX EDT menu (not MATRIX NAME).

NAME lets you select the name of an existing matrix for use in a calculation, not for creating or editing. (You can perform a matrix calculation only on the Matrix Home screen.)
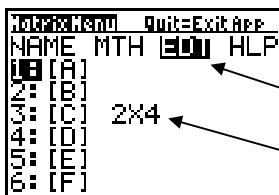
EDT lets you select a matrix to create or edit.

Matrix [C] is already defined as a 2x4 matrix.

2. Select the matrix you want to define. Use $\boxed{\blacktriangledown}$ or $\boxed{\blacktriangle}$ to highlight the corresponding number and then press $\boxed{\text{ENTER}}$, or press that number key. The Matrix Edit screen is displayed.

```
MATRIX EDIT    APPS=Menu
MATRIX[A]  1 ×1
[ 0              ]
```
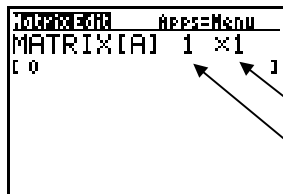
Sets the number of columns, up to 99.

Sets the number of rows, up to 99.

When you edit or create a matrix, the cursor highlights the number of rows.

3. Accept or change the number of rows.

- To accept the value, press $\boxed{\text{ENTER}}$.

- To change the value, type the number of rows and then press $\boxed{\text{ENTER}}$.

The cursor moves to the number of columns.

4. Accept or change the number of columns. When you press ENTER, the cursor moves to the first matrix element.
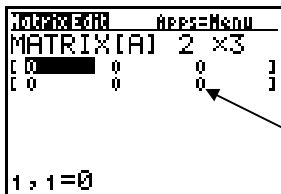
In a new matrix, all elements are zero.

5. Type the value (or an expression) for each element and press ENTER, one row at a time. Each time you press ENTER, the cursor moves to the next element in the row. At the end of a row, the cursor moves to the next row.

To change a value, use ◄, ►, ▼, and ▲ to highlight that element and then enter a new value (or press ENTER and then edit the current value).

6. After entering the last element, press APPS to return to the Matrix Menu screen. You can then press CLEAR to display the Matrix Home screen.

Viewing and Editing a Matrix on the Matrix Edit Screen

Viewing an Existing Matrix

On the Matrix Edit screen, select the matrix. As necessary, use the cursor keys to move the rectangular cursor from one matrix element to the next.

Dimensions of the matrix.

Ellipses (...) in the left or right column indicate additional columns.

↑ or ↓ in the right column indicates additional rows

The full value of the highlighted element is shown on the bottom line.

When the rectangular cursor highlights an element (and an edit cursor is not shown on the bottom line), you can use the following keys:

Key	Description
◀ or ▶	Moves the cursor within the current row.
▼ or ▲	Moves the cursor within the current column. • On the first row, ▲ moves the cursor to the number of columns • On the number of columns, ▲ or ◀ moves the cursor to the number of rows.

Key	Description
[ENTER] or [CLEAR] or any entry character	Lets you edit the highlighted element, and activates the edit cursor on the bottom line of the screen.
	• [ENTER] retains the current value in the bottom line so that you can modify it.
	• [CLEAR] clears the bottom line so you can enter a new value.
	• Any entry character clears the bottom line and places that character on the line.

Editing a Matrix Element

To edit a matrix element, you must first activate the edit cursor.

1. Select the matrix from the Matrix Edit menu, and then enter or accept the number of rows and columns.

2. Press [◄], [▲], [►], and [▼] to highlight the element.

3. Press either [ENTER], [CLEAR], or an entry key to activate the edit cursor on the bottom line.

4. Change the value of the matrix element using the editing keys described below. You can enter an expression, which is evaluated when you move the cursor to another element.

Note   If you edit a value by mistake and want to restore the original value, press [CLEAR] [ENTER].

5. Press $\boxed{\text{ENTER}}$, $\boxed{\blacktriangle}$, or $\boxed{\blacktriangledown}$ to move to another element.

When the edit cursor is shown on the bottom line, use the following keys to edit the value:

Key	Description
$\boxed{\blacktriangleleft}$ or $\boxed{\blacktriangleright}$	Moves the edit cursor within the value.
$\boxed{\blacktriangledown}$ or $\boxed{\blacktriangle}$	Stores the value displayed on the bottom line to the matrix element; deactivates the edit cursor and moves the rectangular cursor within the column.
$\boxed{\text{ENTER}}$	Stores the value displayed on the bottom line to the matrix element; deactivates the edit cursor and moves the rectangular cursor to the next row element.
$\boxed{\text{CLEAR}}$	Clears the value on the bottom line.
Any entry character	Places that character at the location of the edit cursor.
$\boxed{\text{2nd}}$ $[\text{INS}]$	Activates the insert cursor.
$\boxed{\text{DEL}}$	Deletes the character under the edit cursor.

Using Matrices with Expressions on the Matrix Home Screen

Using a Matrix in an Expression

To use a matrix in an expression, either:

- Copy the name of an existing matrix from the MATRIX NAME menu.

- Type the matrix elements directly from the keyboard.

An expression can perform a maximum of two operations that create or return a matrix. For example:

[[1,2] [3,4]] → **[A]**   and   **[[1,2] [3,4]]** ∗ **3**

are valid because they contain two matrix operations (the input matrix is created in the calculator's memory, and so is the resulting output matrix).

If an expression has three or more such operations, an error occurs. In most cases, however, you can perform the operations successfully by breaking them into separate pieces. For example:

An error occurs for:	Instead, enter:
[[1,2] [3,4]] + [[5,6] [7,8]]	[[1,2] [3,4]] → [A] [[5,6] [7,8]] → [B] [A] +[B]
augment([[1,2] [3,4]] , [[5,6] [7,8]])	[[1,2] [3,4]] → [A] [[5,6] [7,8]] → [B] augment([A] , [B])
identity(3) * randM(3,3)	identity(3) → [A] randM(3,3) → [B] [A] * [B]

Note These expressions cause an error because they contain three matrix operations (two input matrices and one result matrix).

Typing a Matrix Directly from the Keyboard

On the Matrix Home screen, use the syntax:

[[*element$_{1,1}$***,...,***element$_{1,n}$***],...,[***element$_{m,1}$***,...,***element$_{m,n}$***]]**

Use **[** (press Y=) to begin the matrix.

Use **[ ]** to enclose the elements for each row. Use commas to separate the elements. An element can be an expression.

Note: At the start, **[[** begins the matrix and then begins the first row.

Use **]** (press WINDOW) to end the matrix.

Note: The closing **]]** are not necessary at the end of an expression or preceding → (STO▶).

Any expressions are evaluated when you press ENTER. For example:

The commas that you must enter to separate elements are not displayed on output.

To store a matrix directly to a matrix variable, use STO▶. For example:

Select the matrix from the Matrix NAME menu or type it directly. Press Y= and WINDOW to type **[** and **]**.

Accessing a Specified Matrix Element

On the Matrix Home screen, you can store a value to, or recall a value from, a specified matrix element. The element must be within the defined matrix dimensions. Use the syntax:

[_matrix_**] (**_row,column_**)**
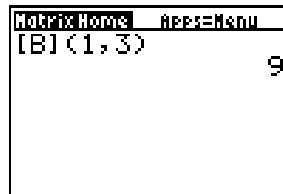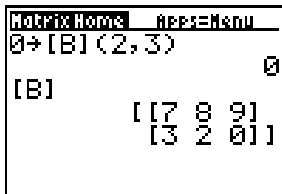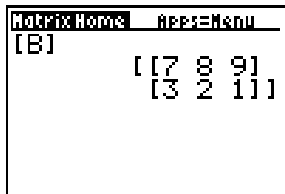
Displaying and Copying Matrices on the Matrix Home Screen

Displaying a Matrix

To display the contents of a matrix on the Matrix Home screen, select the matrix from the MATRIX NAME menu and then press ENTER.

```
Matrix Home   APPS=Menu
[A]
            [[7 8 9]
             [3 2 1]]
```
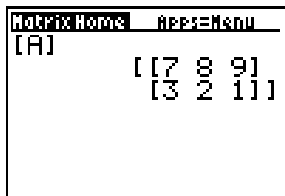
If the matrix is too large to be displayed on the screen, press ▶, ◀, ▼, and ▲ to scroll the matrix.

```
Matrix Home   APPS=Menu
...1.12   2.34    ↑
...7.78   8.89    ...
...12.3   13.4    ...
...17.78  18.89   ...
...22.143 23.987
...26     27      ↓
```
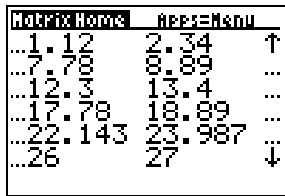
↑ or ↓ in the right column indicates additional rows.

Ellipses (...) in the left or right column indicate additional columns.

Copying One Matrix to Another

To copy a matrix:

1. Press APPS to display the MATRIX NAME menu.

2. Select the name of the matrix you want to copy. You can either use ▼ and ▲ to highlight the number to the left of the matrix name and then press ENTER, or simply press the corresponding number key.

3. Press STO▶.

4. Press APPS again and select the name of the new matrix to which you want to copy the existing matrix.

5. Press ENTER to copy the matrix.

```
Matrix Home   APPS=Menu
[A]→[B]
              [[7 8 9]
               [3 2 1]]
```
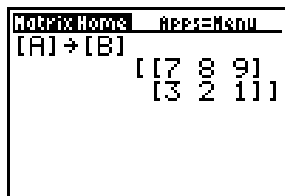
Using Math Functions with Matrices

You can use matrices with many of the math functions on the TI-73 keyboard, the MATH menu, the MATH NUM menu, and the = and ≠ relational operations available from the Text Editor. However, the dimensions must be appropriate. Each of the functions below creates a new matrix; the original matrix remains the same.

+ (Add), − (Subtract), * (Multiply)

To add (+) or subtract (−) matrices, the dimensions must be the same. The answer is a matrix in which the elements are the sum or difference of the individual corresponding elements.

matrixA+*matrixB*
matrixA−*matrixB*

To multiply (×) two matrices, the column dimension of *matrixA* must match the row dimension of *matrixB*.

matrixA∗*matrixB*

Matrix Home APPS=Menu	Matrix Home APPS=Menu

[A]
 	
       [[2 2]
        [3 4]]
[B]
 	
       [[0 5]
        [4 3]]
	[A]+[B]
	
	       [[2 7]
	        [7 7]]
	[A]∗[B]
	
	      [[8 16]
	      [16 27]]

Multiplying a *matrix* by a *value* or a *value* by a *matrix* returns a matrix in which each element of *matrix* is multiplied by *value*.

matrix∗value
value∗matrix

```
Matrix Home   Apps=Menu
[A]
                [[2 2]
                 [3 4]]
```

```
Matrix Home   Apps=Menu
[A]*3
                [[6 6 ]
                 [9 12]]
```

⁻ (Negation)
[(-)]

Returns a matrix in which the sign of every element is changed (reversed).

⁻matrix

```
Matrix Home   Apps=Menu
[A]
                [[2 ⁻2]
                 [3 4 ]]
⁻[A]
                [[⁻2 2 ]
                 [⁻3 ⁻4]]
```

abs(MATH NUM menu

Returns a matrix containing the absolute value of each element of *matrix*.

abs(*matrix***)**

```
Matrix Home    APPS=Menu
[C]
        [[23   -69]
         [-25  -14]]
abs([C])
        [[23  69]
         [25  14]]
```

round(MATH NUM menu

Returns a matrix in which every element in *matrix* is rounded to #*decimals* (≤ 9). If *#decimals* is omitted, the elements are rounded to 10 digits.

round(*matrix***)**
round(*matrix***,***#decimals***)**

```
Matrix Edit     APPS=Menu
MATRIX[A]  2 ×2
[ 1.259   2.33   ]
[ 3.662   4.123  ]
```

```
Matrix Home    APPS=Menu
round([A],2)
        [[1.26  2.33]
         [3.66  4.12]]
```

⁻1 (Inverse)

2nd [x⁻¹]

Inverts a square *matrix* (^-1 is not valid). The determinant cannot equal zero.

matrix ⁻¹

```
Matrix Edit    Apps=Menu
MATRIX[A] 2 ×2
[1      2      ]
[3      4      ]
```

```
Matrix Home    Apps=Menu
[A]⁻¹
        [[-2   1  ]
         [1.5  -.5]]
```

Powers

To raise a matrix to a power, *matrix* must be square. You can square (x^2), cube (³ from MATH menu), or raise a matrix to any integer *power* (⌃ *power*) between 0 and 255.

matrix ²
matrix ³
matrix^*power*

```
Matrix Edit    Apps=Menu
MATRIX[A] 2 ×2
[1      2      ]
[3      4      ]
```

```
Matrix Home    Apps=Menu
[A]³
        [[37  54 ]
         [81  118]]
[A]^5
     [[1069  1558]
      [2337  3406]]
```

Relational Operations
2nd [TEXT]

To compare two matrices using the relational operations = and ≠ (available from the Text Editor), they must have the same dimensions. The = and ≠ operations perform an element-by-element comparison between *matrixA* and *matrixB*. Other relational operations are not valid with matrices.

matrixA=*matrixB* returns 1 if every comparison is true, or 0 if any comparison is false.

matrixA≠*matrixB* returns 1 if at least one comparison is false, or 0 if no comparison is false.

— False
— True

iPart(, fPart(MATH NUM menu

iPart(and **fPart(** return a matrix containing the integer part and the fractional part, respectively, of each element of *matrix*.

iPart(*matrix***)**
fPart(*matrix***)**

```
Matrix Home   Apps=Menu
[D]
  [[2      3.333]
   [100.5 47.15]]
```

```
Matrix Home   Apps=Menu
iPart([D])
     [[2    3 ]
      [100 47]]
fPart([D])
     [[0   .333]
      [.5  .15 ]]
```

int(CATALOG

Returns a matrix containing the greatest integer of each element of *matrix*.

int(*matrix*)

```
Matrix Home   Apps=Menu
[A]
  [[2    -2   ]
   [2.55 -2.55]]
int([A])
     [[2 -2]
      [2 -3]]
```

For a negative non-integer, **int(** returns the integer that is one less than the integer part of the number. To return the exact integer part, use **iPart(** instead.

Using the Matrix MTH Operations

To display the Matrix MTH menu, press $\boxed{\text{APPS}}$ $\boxed{\blacktriangleright}$.

NAME **MTH** EDT HLP	
1: det(	Calculates the determinant.
2: T	Transposes the matrix.
3: dim(	Returns the matrix dimensions.
4: Fill(	Fills all elements with a constant.
5: identity(	Returns the identity matrix.
6: randM(	Returns a random matrix.
7: augment(	Appends two matrices.
8: Matr▶list(	Stores a matrix to a list.
9: List▶matr(	Stores a list to a matrix.
0: cumSum(	Returns the cumulative sums of a matrix.
A: ref(	Returns the row-echelon form of a matrix.
B: rref(	Returns the reduced row-echelon form.
C: rowSwap(	Swaps two rows of a matrix.
D: row+(	Adds two rows; stores in the second row.
E: *row(	Multiplies the row by a number.
F: *row+(	Multiplies the row, adds to the second row.
G: [	Defines the beginning of a matrix and row.
H:]	Defines the end of a matrix and row.

det(1: Determinant

Returns the determinant (a real number) of *matrixname*. The matrix must be square.

det(*matrixname***)**

```
Matrix Home   APPS=Menu
[A]
                 [[1  2]
                  [3  4]]
det([A])
                        -2
```

T 2: Transpose

Returns a matrix in which each element (row, column) is swapped with the corresponding element (column, row) of *matrixname*.

matrixname **T**

```
Matrix Home   APPS=Menu
[A]
            [[1  2  3]
             [3  2  1]]
```

dim(3: Matrix Dimensions

dim(lets you perform three separate operations.

- To find the dimensions of a matrix:

  Use **dim(** to return a list containing the dimensions
  (**{***rows columns***}**) of *matrix*.

  dim(*matrix***)**

Note If **dim(***matrix***)→L1**, then **L1(1)** returns the number of rows and
L1(2) returns the number of columns.

```
Matrix Home   Apps=Menu
dim([[2,7,1][-8,
3,1]])
              {2 3}
```
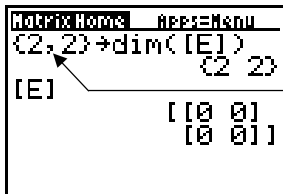
```
Matrix Home   Apps=Menu
dim([[2,7,1][-8,
3,1]])→L1
              {2 3}
L1(1)
                 2
```

You can press
[2nd] [STAT] and then
select L1.

- To create a new matrix:

  Use **dim(** with [STO▶] to create a new *matrixname* of dimensions *rows* × *columns* with 0 as each element.

  {*rows,columns***}**→**dim(***matrixname***)**

  { and } are available from the Text Editor or the **CATALOG**.

♦ To change the dimensions of a matrix:

  Use **dim(** with [STO▶] to redimension an existing *matrixname* to dimensions *rows* × *columns*. The elements in the old *matrixname* that are within the new dimensions are not changed. Additional created elements are zeros. Matrix elements that are outside the new dimensions are deleted.

  {*rows,columns***}**→**dim(***matrixname***)**

Fill(4: Fill Matrix Elements

Stores *value* to every element in *matrixname*.

Fill(*value,matrixname***)**

```
Matrix Home   APPS=Menu
Fill(5,[E])
                  Done
[E]
            [[5 5]
             [5 5]]
```

identity(5: Identity Matrix

Returns the identity matrix of *dimension* rows × *dimension* columns.

identity(*dimension***)**

```
Matrix Home   APPS=Menu
identity(4)
         [[1 0 0 0]
          [0 1 0 0]
          [0 0 1 0]
          [0 0 0 1]]
```

randM(6: Random Matrix

Returns a *rows* **×** *columns* random matrix of integers ≥ ⁻9 and ≤ 9. The seed value stored to the **rand** function controls the values (Chapter 2 in the TI-73 Guidebook at education.ti.com/guides).

randM(*rows,columns***)**

```
Matrix Home    APPS=Menu
0→rand
                     0
randM(2,2)
         [[0  -7]
          [8  8 ]]
```

augment(7: Append Matrices

Appends *matrixnameA* to *matrixnameB* as new columns. *matrixnameA* and *matrixnameB* both must have the same number of rows.

augment(*matrixnameA,matrixnameB***)**

```
Matrix Home    APPS=Menu
[A]
          [[1  2]
           [3  4]]
[B]
          [[5  6]
           [7  8]]
```

```
Matrix Home    APPS=Menu
augment([A],[B])

          [[1  2  5  6]
           [3  4  7  8]]
```

Matr▸list(8: Store Matrix to List

Matr▸list(has two variations.

- To fill each *listname* with elements from each column in *matrixname*:

Use the syntax:

Matr▸list(*matrixname*,*listnameA*, … ,*listname n***)**

You can press [2nd] [STAT] and then select L1, L2, and L3.

If you specify more *listnames* than the *matrixname* has columns, the additional *listnames* are ignored. Likewise, if you specify fewer *listnames*, the additional columns in the *matrixname* are ignored.

- To fill a *listname* with elements from a specified *column#* in *matrixname*:

  Use the syntax:

  Matr▸list(*matrixname*,*column#*,*listname***)**

3rd column in matrix [A].

List▸matr(9: Store List to Matrix

Fills *matrixname* column by column with the elements from each *list*. If dimensions of all *lists* are not equal, **List▸matr(** fills each extra *matrixname* row with 0.

List▸matr(*listA*, … ,*listN*,*matrixname***)**

2nd column is filled with a 0.

cumSum(0: Cumulative Sums

Returns cumulative sums of the elements in *matrixname*, starting with the first element. Each element is the cumulative sum of the column from top to bottom.

cumSum(*matrixname***)**

```
Matrix Home   Apps=Menu
[D]
            [[1 2]
             [3 4]
             [5 6]]
```

```
Matrix Home   Apps=Menu
cumSum([D])
            [[1  2 ]
             [4  6 ]
             [9  12]]
```
— 2, 2+4, 2+4+6
— 1, 1+3, 1+3+5

Note About Row Operations

MATRIX MTH menu items **A** through **F**, as described in the remaining part of this section, are row operations. You can use a row operation in an expression. Row operations do not change the matrix in memory. You can enter all row numbers and values as expressions. You can select the matrix from the MATRIX NAME menu.

ref(, rref(A: and B: Row-echelon and Reduced Row-echelon Forms

ref(returns the row-echelon form of a real *matrixname*. The number of columns must be greater than or equal to the number of rows.

ref(*matrixname***)**

rref(returns the reduced row-echelon form of a real *matrixname*. The number of columns must be greater than or equal to the number of rows.

rref(*matrixname***)**

```
Matrix Home   Apps=Menu
[B]
             [[4 5 6]
              [7 8 9]]
```

```
Matrix Home   Apps=Menu
ref([B])
[[1 1.142857143...
 [0 1           ...
rref([B])
          [[1 0 -1]
           [0 1 2 ]]
```

... indicates that the result extends beyond the screen. To scroll the result right or left, press ► or ◄ at any time *before* you perform the next calculation.

rowSwap(C: Row Swap

Swaps *rowA* and *rowB* of *matrixname*, and returns the new matrix.

rowSwap(*matrixname***,***rowA***,***rowB***)**

```
Matrix Home  APPS=Menu
[F]
        [[2 3 6 9]
         [5 8 4 7]
         [2 5 1 0]
         [6 3 8 5]]
```

```
Matrix Home  APPS=Menu
rowSwap([F],2,4)
        [[2 3 6 9]
         [6 3 8 5]
         [2 5 1 0]
         [5 8 4 7]]
```

From the original matrix, rows 2 and 4 are swapped.

row+(D: Row Addition

Adds *rowA* and *rowB* of *matrixname*, stores the sum in *rowB*, and returns the new matrix.

row+(*matrixname***,***rowA***,***rowB***)**

```
Matrix Home  APPS=Menu
[D]
        [[2 5 7]
         [8 9 4]]
```

```
Matrix Home  APPS=Menu
row+([D],1,2)
        [[2  5  7 ]
         [10 14 11]]
```

From the original matrix, rows 1 and 2 are added to create this new row 2.

*row(E: Row Multiplication

Multiplies a specified *row* of *matrixname* by *value*, stores the result in *row*, and returns the new matrix.

∗**row(***value***,***matrixname***,***row***)**

```
Matrix Home   APPS=Menu
[D]
        [[2 5 7]
         [8 9 4]]
*row(2,[D],1)
        [[4 10 14]
         [8 9  4 ]]
```

From the original matrix, row 1 is multiplied by 2 to create this new row 1.

*row+(F: Row Multiplication and Addition

Multiplies *rowA* of *matrixname* by *value*, adds it to *rowB*, stores the results in *rowB*, and returns the new matrix.

∗**row+(***value***,***matrixname***,***rowA***,***rowB***)**

```
Matrix Home   APPS=Menu
[E]
        [[1 2 3]
         [4 5 6]]
```

```
Matrix Home   APPS=Menu
*row+(3,[E],1,2)
        [[1 2  3 ]
         [7 11 15]]
```

From the original matrix, row 1 is multiplied by 3 to produce [3 6 9], which is then added to row 2.

[,] G: and H: Direct Matrix Entry

Let you enter a matrix directly from the Matrix Home screen. For example:

For →, press STO▶.

[[1, 2, 3] [3, 2, 1]] → **[B]**

You can also press Y= and WINDOW to type **[** and **]** directly from the keyboard.

Deleting a Matrix

From the Matrix Home Screen

Use the **DelVar** instruction available from the **CATALOG**.

```
Matrix Home  Apps=Menu
DelVar [A]
                  Done
```
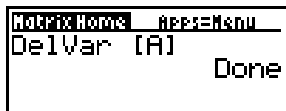
From the MEMORY Menu

1. Quit the Matrices application ([2nd] [QUIT]).

2. Press [2nd] [MEM].

3. Select **4:Delete**.

4. Select **9:AppVars**. (Because matrices are not standard variables on a TI-73, they are stored as application variables.)

5. Use ⏷ and ⏶ to move the ▶ pointer to the applicable matrix name.

Note | On this calculator screen, matrix names are shown as **MATA** and **MATB** instead of **[A]** and **[B]**.

6. Press [ENTER] to delete the matrix.

7. Continue deleting matrices as necessary.

Uninstalling the Application from Your TI-73

To uninstall the application and delete it from the calculator's memory:

1. Quit the Matrices application ([2nd] [QUIT]).

2. Press [2nd] [MEM].

3. Select **4:Delete**.

4. Select **8:Apps**.

5. Select **Matrices** and press [ENTER].

6. Select **2:Yes** to confirm that you want to delete the application.

If you retained the application file on your computer, you can reinstall it later.

Error Recovery Instructions

Low Battery Condition

Do not attempt a Flash download if the low-battery message appears on the calculator. Low battery indication is shown on the initial screen. If you receive this error during an installation, change the batteries before trying again.

Check Amount of Flash Application Free Space

On the TI-73, select [2nd] [MEM] **3:Check APPs…**. The number to the right of **Spaces Free:** indicates the number of spaces available for applications. The Matrices application requires one space. There are a maximum of four spaces.

Communication Error

This error indicates the Flash installer is unable to communicate with the TI-73. The problem is usually associated with the TI-GRAPH LINK™ cable and its connection to the TI-73 and/or to the computer. Make sure the cable is firmly pushed in to the calculator and the computer.

If this does not correct the problem, try a different TI-GRAPH LINK cable and reboot your computer. If you continue to get this error, please contact [TI-Cares™](#) Customer Support for assistance.

Memory is Full

This download error appears when the TI-73 contains one to four applications that occupy the available 64K of space. To make room for another application, you must delete one from the TI-73. Before deleting an application, you can back it up to your computer so that you can reload it later as necessary.

Syntax Error

QUIT ignores the last transaction and displays the last results.

GOTO displays the screen with the error highlighted. Make any necessary correction and press ENTER.

Singular Mat

A singular matrix (determinant=0) is not valid as an argument for $^{-1}$.

Invalid Dim

You specified a matrix dimension as something other than an integer between 1 and 99.

You attempted to invert a non-square matrix.

You attempted to access an invalid row or column value referencing an existing matrix (e.g. [A] (1,2) when [A]=1×1).

Memory

You specified a matrix with more than 100 elements.

Dim Mismatch

You attempted to perform an operation that references more than one matrix, but the dimensions do not match.

Miscellaneous Error Received

Write down the error code displayed in the dialog box and contact TI-CARES.

Checksum Error

Exit the installation and try it again. If this problem persists, contact TI-CARES.

Miscellaneous

If you obtain new or upgraded software for your TI-73, you may need to provide your current software version and/or the serial number of your unit. It is also good to know your version number in case you have difficulties with your TI-73 and need to contact technical support. Knowing the software version may make it easier to diagnose the problem.

Knowing the available number of application spaces in advance helps you better manage your application downloads.

Verify Maintenance Upgrade Version

On the TI-73, enter [2nd] [MEM] **1:About**. The version number has the format x.yy or x.yyyy.

Verify Flash Application Version

On the TI-73, select [APPS]. Select the appropriate application and press [ENTER]. The version number of the application appears on the initial screen.

Verify Serial Number

On the TI-73, enter [2nd] [MEM] **1:About**. The serial number appears on the line beneath the product ID number.

Texas Instruments (TI) Support and Service Information

For general information

E-mail: ti-cares@ti.com

Phone: 1-800-TI-CARES (1-800-842-2737)
For US, Canada, Mexico, Puerto Rico, and
Virgin Islands only

Home page: education.ti.com

For technical questions

Phone: 1-972-917-8324

For product (hardware) service

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