hp calculators

HP 48GII Working with matrices

The MatrixWriter form

The Matrix.. part of the MTH (MATH) CHOOSE box

Practice solving problems involving matrices

The MatrixWriter form

The HP 48GII contains a wonderful form built-in to facilitate the entry of matrices. This form is called the MatrixWriter, and it is the RED shifted function of the ' key. To start the MatrixWriter, press ← MTRW . The screen below is displayed to allow for the entry of data into a matrix.

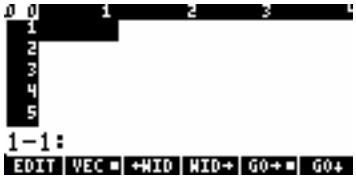

Figure 1

In many ways, this screen works like any spreadsheet. Enter numbers and they will go in the highlighted cell. The menu labels at the lower left corner of the screen, GO→ and GO↓, determine the direction the cursor moves after a data point has been entered, either right to the next column or down to the next row. In this example, the selection is to move right after each data point has been entered. This is indicated by the square present next to the GO→ menu label. To change the way the cursor will move, press the menu label for the direction desired and the square in the menu label will change accordingly. If a column is too small to show the data entered, the NXD→ and ←NXD menu keys may be used to expand or shrink the area displayed for each column.

Enter the first data value by keying in the numbers and pressing the ENTER key. The cursor will move to the right into the second column where the second data value should be keyed with the ENTER key pressed to accept this value. At this point, the cursor will be in column 3. If the matrix being entered has more than two columns of data, continue entering the data until done. Use the ▼ and ◀ keys to move back to the first column and enter the second row of data (if any). Continue entering rows of data into the matrix until done. If at any time you notice a mistake in the data, use the arrow keys to go back to the incorrect data value, key in the correction, press the ENTER key to accept the change, and then use the arrow keys to go back to where you were. After entering a matrix, the screen would look something like this:

Figure 2

To accept the data as input, press the ENTER key and the matrix will be placed on the first level of the stack.

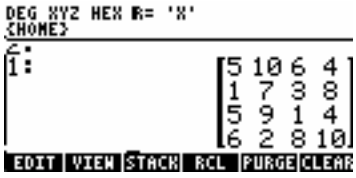

Figure 3

The Matrix.. part of the MTH (MATH) CHOOSE box

The Math menu is accessed from the BLUE shifted function of the SYMB key by pressing ← MTH . When pressed, a CHOOSE box is displayed with a number of choices allowing problems to be solved with different math functions on the HP 48GII calculator.

Figure 4

The first choice allows for calculations dealing with vectors. The second choice provides access to many functions for working with matrices. The third choice allows for the manipulation of lists and for using lists to apply mathematical functions to a list of numbers, all at the same time. The fourth function provides access to the hyperbolic trigonometric functions. The fifth selection provides a list of many functions that can be applied to real numbers. The sixth choice displays functions dealing with numbers in different bases. Choices seven through eleven are not displayed in the screen above, but deal with probability, fast fourier transformations, complex numbers, constants and a choice dealing with several special functions. We are interested in the second choice for working with matrices. To access that second-level CHOOSE box, either press 2 ENTER or ▼ ENTER to display the list of matrix functions.

Figure 5

There are a large number of functions available to use on matrices. The practice problems will illustrate only a few of these.

Practice solving problems involving matrices

Example 1: What is the determinant of the matrix shown below? Assume RPN mode.

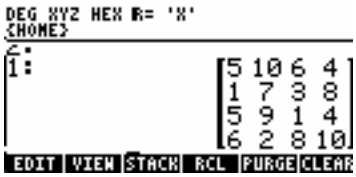

Figure 6

Solution: To find the determinant, use the MatrixWriter to enter the matrix as shown.

↰ MTRW 5 ENTER 1 0 ENTER 6 ENTER 4 ENTER ▼ ◀ ◀ ◀
1 ENTER 7 ENTER 3 ENTER 8 ENTER
5 ENTER 9 ENTER 1 ENTER 4 ENTER
6 ENTER 2 ENTER 8 ENTER 1 0 ENTER ENTER

The matrix should now be on the first level of the stack as shown above. The determinant function is found in the MTH (MATH) CHOOSE box, in the MATRIX.. second-level CHOOSE box, in the NORMALIZE third-level CHOOSE box as function number 8. If this function is used frequently, there are several ways to access it much more quickly. A USER key assignment can be made (which is discussed in another of these training aids). The function can be placed in a CUSTOM menu. The function can also be spelled out using the ALPHA ALPHA D E T letter keys and pressing ENTER. The 48GII is very flexible. The solution shown below will use the CHOOSE box approach.

↰ MTH 2 ENTER 2 ENTER 8

Figure 7

ENTER

Figure 8

Answer: The determinant of the matrix is –2,432.

Example 2: Transpose the matrix shown below and find the inverse of the transposed matrix. Assume Algebraic mode.

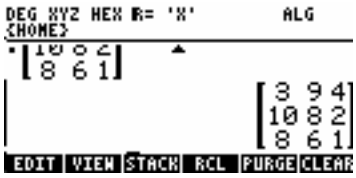

Figure 9

Solution: To transpose the matrix and find the inverse, use the MatrixWriter to enter the matrix as shown.

[↰] MTRW 3 ENTER 9 ENTER 4 ENTER [▼] [◀] [◀]
1 0 ENTER 8 ENTER 2 ENTER
8 ENTER 6 ENTER 1 ENTER ENTER

The matrix should now be on the first level of the stack as shown above. To transpose the matrix, use the TRAN command, which is the 10th command of the NORMALIZE CHOOSE box (which makes it two below the DET command used in the previous example).

[↰] MTH 2 ENTER 2 ENTER 1 0

Figure 10

ENTER

Since we are in algebraic mode for this example, the TRAN() command is copied to the command line and is looking for a matrix to transpose as an argument to the function.

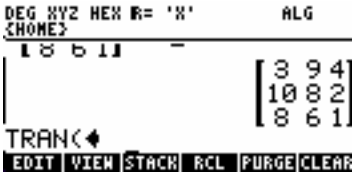

Figure 11

Since the matrix is in the first level of the command stack, we can use [↰] ANS to fill in the argument needed.

Figure 12

When [ENTER] is pressed, the transposed matrix is in the first level of the command stack.

Figure 13

Finding the inverse of a matrix can be done by pressing the [1/x] key. In algebraic mode, this will place the INV() function (which is how the reciprocal function is displayed as a text command) on the command line looking for a matrix to serve as the argument for the function. Sine the transposed matrix is on the first level of the command stack, to find the inverse of this transposed matrix, press:

[1/x] [←] ANS [ENTER]

The inverse is displayed as shown below (assuming EXACT mode):

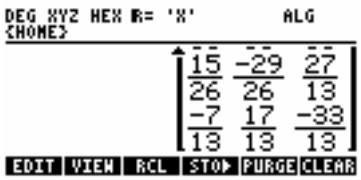

Figure 14

Since this matrix may scroll off the top of the screen, we can use the VIEW function (which is above the [F2] key) from the [TOOL] menu to take a closer look at the solution. The arrow keys allow the view to be moved around on the screen. If desired, press TEXT to see the matrix in a different format.

[TOOL] [F2]

Answer: The inverse of the transposed matrix is shown below.

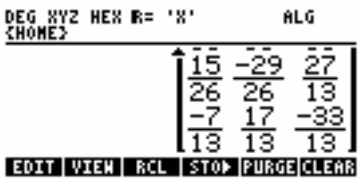

Figure 15

or as shown in the TEXT viewpoint:

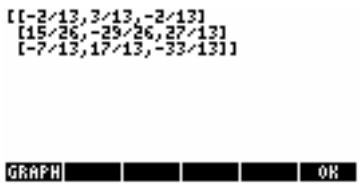

Figure 16

Example 3: What are the characteristic roots (or eigenvalues) of the matrix shown below? Assume RPN mode.

Figure 17

Solution: To find the characteristic roots, use the MatrixWriter to enter the matrix as shown.

↰ MTRW 6 +/- ENTER 3 ENTER ▼ ◀ 3 ENTER 6 +/- ENTER ENTER

The matrix should now be on the first level of the stack as shown above. The eigenvalues function is found in the MTH (MATH) CHOOSE box, in the MATRIX.. second-level CHOOSE box as function number 8.

↰ MTH 2 ENTER 8

Figure 18

ENTER

Figure 19

Answer: The characteristic roots or eigenvalues are –3 and –9.