

## Using Lists

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You can do list operations in HOME (and in programs). A list consists of comma-separated real or complex numbers, expressions, or matrices, all enclosed in braces. A list may, for example, contain a sequence of real numbers such as  $\{1, 2, 3\}$ . (If the Decimal Mark in MODES is set to Comma, then the separators are periods.) Lists represent a convenient way to group related objects.

### List variables

There are ten list variables available, named L0 through L9. You can use them in calculations or expressions in HOME or in a program. Retrieve the list names from the VARS menu, or just type their names from the keyboard.

## Creating and storing Lists

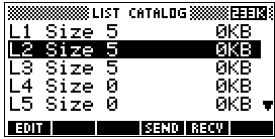
List variables are identical in behaviour to the columns C1..C0 in the Statistics applet. You can store a statistics column to a list (or vice versa) and use any of the list functions on the statistics columns, or the statistics functions, on the list variables.

You can create, edit, delete, send, and receive named lists in the List catalog ( $\text{[SHIFT] LIST}$ ). You can also create and store lists—named or unnamed—in HOME.

### To create a list in List Catalog

1. Open the List catalog.

$\text{[SHIFT] LIST}$ .



LIST CATALOG		
L1	Size 5	0KB
L2	Size 5	0KB
L3	Size 5	0KB
L4	Size 0	0KB
L5	Size 0	0KB
EDIT    SEND    RECV		

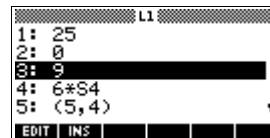
2. Highlight the list name you want to use (L1, etc.) and press **EDIT** to display the List editor.

**EDIT**



3. Enter the values you want in the list and press **ENTER** after each one.

Values can be real or complex numbers (or an expression). If you enter a calculation, it is evaluated and the result is inserted in the list.



4. When done, press **SHIFT** **LIST** to see the List catalog, or press **HOME** to return to HOME .

### List Catalog keys

Key	Meaning
<b>EDIT</b>	Opens the highlighted list for editing.
<b>SEND</b>	Transmits the highlighted list to another HP 39G/40G or a PC. See “Sending and receiving aplets” on page 16-242 for further information.
<b>RCV</b>	Receives a list from another HP 39G/40G or a PC. See “Sending and receiving aplets” on page 16-242 for further information.
<b>DEL</b>	Clears the highlighted list.
<b>SHIFT</b> <b>CLEAR</b>	Clears all lists.
<b>SHIFT</b> <b>▼</b> or <b>▲</b>	Moves to the end or the beginning of the catalog.

### List edit keys

Key	Meaning
<b>EDIT</b>	Copies the highlighted list item into the edit line.

Key	Meaning (Continued)
<b>INS</b>	Inserts a new value before the highlighted item.
<b>DEL</b>	Deletes the highlighted item from the list.
<b>SHIFT CLEAR</b>	Clears all elements from the list.
<b>SHIFT ▼</b> or <b>▲</b>	Moves to the end or the beginning of the list.

### To display a list

- In the List catalog, highlight the list name and press **EDIT**.
- In HOME, enter the name of the list and press **ENTER**.

### To display one element

In HOME, enter *listname(element#)*. For example, if L2 is {3,4,5,6}, then L2 ( 2 ) **ENTER** returns 4.

### To delete a list

In the List catalog, highlight the list name and press **DEL**. You are prompted if you want to delete the contents of the highlighted list variable. Press **ENTER** to delete the contents.

### To delete all lists

In the List catalog ( **SHIFT** LIST ), press **SHIFT CLEAR**.

### To transmit lists

You can send and receive lists between calculators or PCs just as you can transmit applets, programs, matrices, and notes.

After aligning the calculators' infrared ports, open the List catalogs on both calculators. Highlight the list to send, then press **SEND** on the sending calculator and **RCV** on the receiving calculator. *Note: The HP 40G is supplied with a PC adapter and unit to unit cable.*

### To create a list in HOME

1. Enter the list in the edit line. Start and end the list with braces (the shifted **8** and **9** keys) and separate each element with a comma.
2. Press **ENTER** to evaluate and display the list.

Immediately after typing in the list, you can store it in a variable by pressing **STO► listname** **ENTER**. The list variable names are L0 through L9.

This example stores the list {25,147,8} in L1. (You can omit the final brace when entering a list.)



### To store one element

In HOME, enter *value* **STO** *listname(element)*. For example, to change the second element of L1 to 148, type 148 **STO** L1 ( 2 ) **ENTER**.

## List functions

Following are details of list functions. You can use them in HOME, as well as in programs.

You can type in the name of the function, *or* you can copy the name of the function from the List category of the MATH menu. Press **MATH** **(L)** (the alpha L character key). This displays the List category. Highlight a function on the right-hand side and press **OK**.



### Function syntax

- Functions have *arguments* that are enclosed in parentheses and separated by commas. Example : `CONCAT ( L1 , L2 )` . An argument can be either a list variable name (such as L1) *or* the actual list data inside braces. For example, `REVERSE ( { 1 , 2 , 3 } )` .
- If Decimal Mark in MODES is set to Comma, use periods to separate arguments. For example, `CONCAT ( L1 . L2 )` .

## Functions

### Common operators

Operators like +, −, ×, and / can take lists as arguments. If there are two arguments and both are lists, then the lists must have the same length, since the calculation pairs up the elements. If there are two arguments and one is a real number,

then the calculation pairs the number with each element of the list.

#### Example

$\sqrt{\{4, 9, 16\}}$  returns  $\{2, 3, 4\}$ .

Besides the common operators that can take numbers, matrices, or lists as arguments, there are commands that can only operate on lists.

### CONCAT

Concatenates two lists into a new list.

`CONCAT ( list1 , list2 )`

#### Example

`CONCAT ( { 1 , 2 , 3 } , { 4 } )` returns  $\{1, 2, 3, 4\}$ .

### $\Delta$ LIST

Creates a new list composed of the differences between the sequential elements in *list1*. The new list has one fewer elements than *list1*. The first differences for  $\{x_1 x_2 \dots x_n\}$  are  $\{x_2 - x_1 \dots x_n - x_{n-1}\}$ .

`$\Delta$ LIST ( list1 )`

### MAKELIST

Calculates a sequence of elements for a new list. Evaluates expression with *variable* from *begin* to *end* values, taken at *increment* steps. See “To generate a series” on page 13-188

`MAKELIST ( expression , variable , begin , end , increment )`

### $\Pi$ LIST

Calculates the product of all elements in list.

`$\Pi$ LIST ( list )`

#### Example

`$\Pi$ LIST ( { 2 , 3 , 4 } )` returns 24.

### POS

Returns the position (a number) of an element within a list. The *element* can be a value, a variable, or an expression. If there is more than one instance of the element, the position of the first occurrence is returned. A value of 0 is returned if there is no occurrence of the specified element.

`POS ( list , element )`

### REVERSE

Creates a list by reversing the order of the elements in a list.

`REVERSE ( list )`

**SIZE** Calculates the number of elements in a list.

$SIZE(list)$

Also works with matrices.

**ΣLIST** Calculates the sum of all elements in list.

$\Sigma LIST(list)$

**Example**

$\Sigma LIST(\{2, 3, 4\})$  returns 9.

**SORT** Sorts elements in ascending order.

$SORT(list)$

**Example** You can use a list name or the explicit list in an expression using any of the real-number functions.

The following example demonstrates how to create a list from the command line, and use it in a calculation.

HOME

SHIFT

{

1

,

2

,

3

}

SHIFT

}

STO

▶

ALPHA

L

2

ENTER

5

\*

ALPHA

L

2

ENTER

▶

FUNCTION

▶

1,2,3

▶

L2

▶

1,2,3

5\*L2

▶

5,10,15

▶

STO

▶

▶

▶

▶

**To generate a series** The MAKELIST operation generates a series by automatically producing a list from the repeated evaluation of an expression.

**Example** In HOME, generate a list of squares from 23 to 27.

Use the MAKELIST command from the MATH menu. The syntax for MAKELIST is:  
( expression, variable, begin, end, increment ).

MATH

L

▶

Select

MAKELIST

OK

ALPHA

A

x²

,

ALPHA

A

,

23

,

27

,

1

,

1

ENTER

▶

HOME

▶

MAKELIST

▶

A²,A,23,27,1

▶

529,576,625,676,729

▶

STO

▶

▶

▶

▶

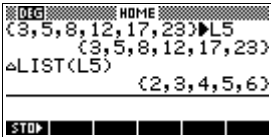
## To find first differences

### Example

In HOME or in a program, the  $\Delta$ LIST operation finds the first differences.

In the List catalog or in HOME, store {3,5,8,12,17,23} in L5. In HOME, find the first differences for this list.

[HOME] [SHIFT] { 3,5,8,12,17,23 } [SHIFT] } **STO►** [ALPHA] L 5  
 [ENTER]  
 [MATH] L ►  
 Select  $\Delta$ LIST OK  
 [ALPHA] L 5 [ENTER]

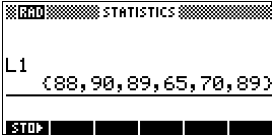


## Finding statistical values for List elements

To find values such as the mean, median, maximum, and minimum values of the elements in a list, use the Statistics applet.

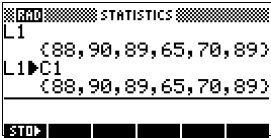
### Example

In this example, use the Statistics applet to find the mean, median, maximum and minimum values of the elements in the list, L1.



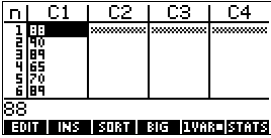
1. In HOME, store L1 into C1. You will then be able to see the list data in the Numeric view of the Statistics applet.

[ALPHA] L1  
**STO►** [ALPHA] C1 [ENTER]



2. Start the Statistics applet, set 1VAR mode (press 2VAR..., if necessary, to display 1VAR...).

[APLET] Select  
 Statistics  
 START



- In the Symbolic view, define H1 (for example) as C1 (sample) and 1 (frequency). Make sure that H1 is checkmarked.

**[SYMB]**

STATISTICS SYMBOLIC VIEW		
✓H1:	C1	1
H2:		1
H3:		1
H4:		1
ENTER SAMPLE		
EDIT	✓CHK	C
		SHOW EVAL

- Go to the Numeric view and access STATS.

**[NUM] STATS**

1-VAR	H1		
NΣ	6		
TOTΣ	441		
MEANΣ	81.83333		
VARΣ	105.1389		
SVARΣ	126.1667		
PSDEV	10.25373		
6			
OK			

From the statistics:

- $N\Sigma$  is the number of elements in L1.
- $TOT\Sigma$  is the sum of all elements in L1.
- $MEAN\Sigma$  is the mean value of all elements in L1.
- $MIN\Sigma$  is the smallest element in L1.
- **MEDIAN** (press **[▼]** to scroll down) is the median value of all elements in L1.
- **MAXΣ** (press **[▼]** to scroll down) is the largest element in L1.