

# A User's Perspective of the HP 39gII

Namir Shammas

## Introduction

The HP 39gII graphing calculator is the latest member of the HP graphing calculators, which HP had first launched in 1990. The new arrival is aimed at the high school students in China, and as such can be operated in either English or Chinese. As the model's name suggests, this algebraic machine replaces the algebraic HP 39GS calculator. The lack of RPL support, present in most HP graphing calculators, should not let the reader conclude that the new HP 39gII is a lightweight graphing calculator. Quite the contrary! The new arrival is a heavy hitter.

## Calculator Layout

Figure 1 shows the full layout of the HP 39gII calculator in text mode. The machine has a display that supports 256 by 126 pixels. Below the LCD you find the following set of controls:

1. **Six function buttons**, labeled F1 through F6 to support various *soft* menus.
2. The **cursor keys** are located to the right and below the menu keys. These keys are molded into a single plastic component. The cursor keys allow you to navigate up and down a list, left or right in a list or a line editor, or all four directions of a table, depending on the current App.
3. The **six HP Apps keys** are located to the left of the cursor keys. The blue-shifted button labeled Home supports setting of the Modes App.
4. The **common math buttons**. These buttons occupy the three rows of buttons below the cursor keys.
5. The rest of the keys include the numeric keys, the two shift keys, the ON key, the ENTER key (used to execute an operation), and the comma key. The red shift key allows you to enter a character. The blue shift key serves to access shifted commands and menus.

In addition to these keys, the HP 39gII has a USB port located on the right side. You can use that port to connect the calculator to a PC.

Regarding the power requirements of the HP 39gII, its battery compartment has space for four AAA cells. Interestingly, these four batteries are connected in parallel. This means that the calculator really needs only one cell to operate! The

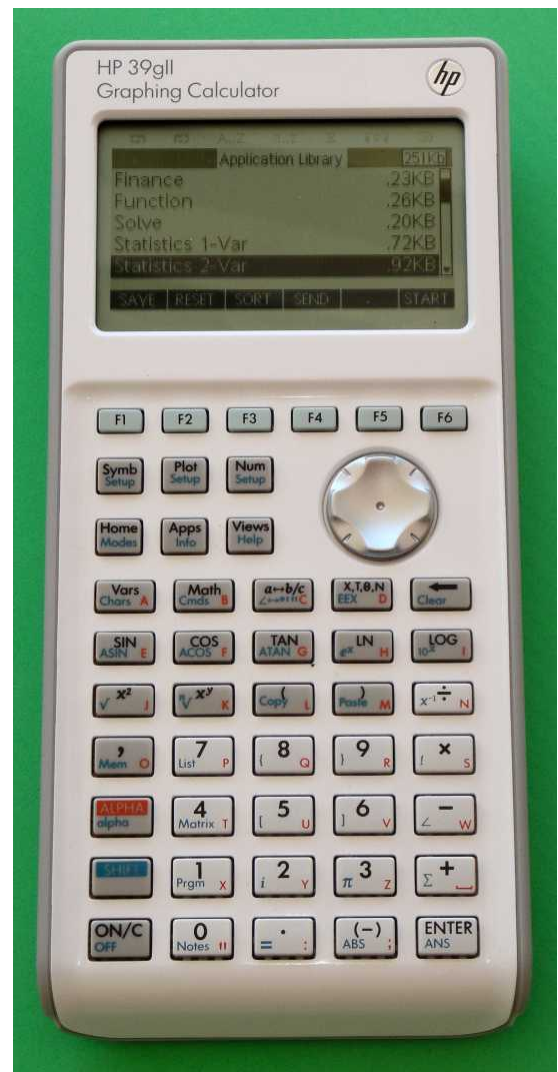


Fig.1 - The HP 39gII.

additional three cells ensure that the calculator will run for a good while. Moreover, since the machine is aimed at students, they can lend a battery to another student who needs it to keep her or his calculator going, especially during a test!

When you press the Home key, you shift to basic calculations mode. Figure 2 shows this mode. The display comprises of the following set of lines:

1. The top line is an annunciator line. It shows information like the level of battery power.
2. The Title line. This line displays information like the current angle mode, and up/down scroll indicators.
3. The History lines make up five lines. They display recent operations and their results. You can scroll these lines up and down.
4. The Edit line is the placeholder for entering and editing an expression or a command.
5. The Menu key labels appear as the bottom most line. This line displays the current *soft* menu.

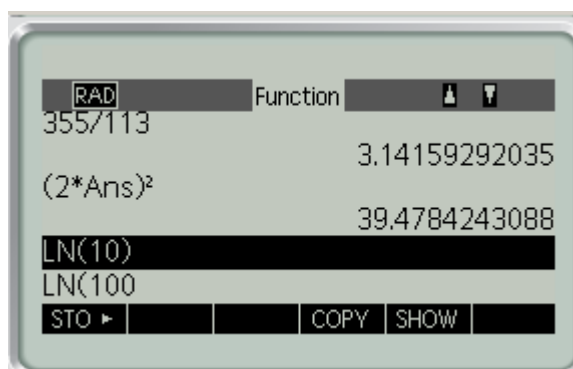


Fig. 2 - The Calculation mode.

Working with the History lines is easy. You can scroll up and press the COPY soft menu to copy that item into the Edit line. You can then edit the command or expression and execute the modification. This feature can save you a lot of typing, especially if you repeat the above operation many times.

### The Vars Menu

The HP 39gII calculator supports several types of variables and offers a number of predefined variables for each data type. You can access the data types and their associated predefined variables by pressing the Vars button. The calculator presents you with menu of data types:

1. Complex. The calculator supports ten predefined complex variables named Z0 through Z9.
2. List. The calculator offers ten predefined list variables named L0 through L9.
3. Matrix. The calculator provides ten predefined matrix variables named M0 through M9.
4. Modes (variables related to the Modes settings)
5. Real. The calculator supports the predefined real variables A to Z, and  $\theta$ .

You can also access the list of predefined list variables and matrix variables using shift keys. Figure 3 shows a sample screen that accesses a predefined matrix variable. The figure shows that the matrix variable M1 is selected. Notice that under the list of data types, the calculator has a line that displays the

size of the currently selected matrix. In Figure 3, the matrix variable M1 has five rows and four columns. In a similar manner, the calculator displays the size of the selected list variable.

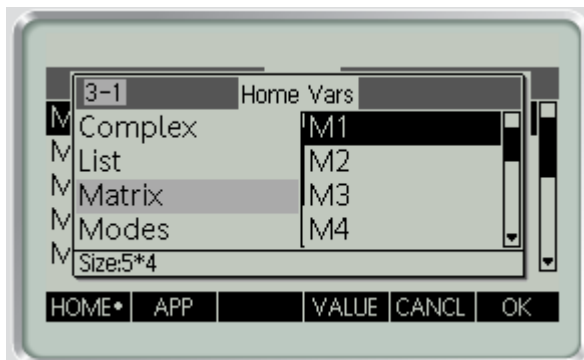


Fig. 3 - The Matrix variables.

Figure 4 shows the Real variables. The figure shows that variable A is currently selected. The line below the list of data types shows the current value of variable A, which is 2.30258509299. In a similar manner, the calculator displays the values in the selected complex and modes variables.

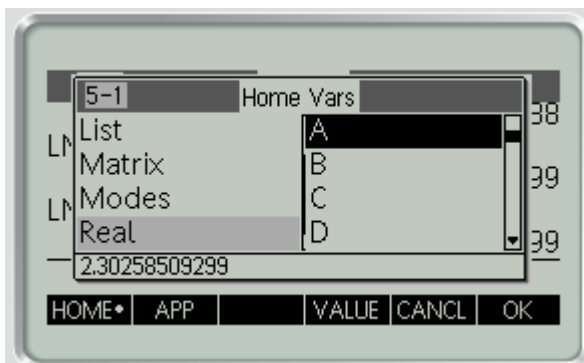


Fig. 4 - The Real variables

### The Math Menu

The Math menu is, in my opinion, the computational powerhouse of the HP 39gII. This menu displays a list of the following sets of mathematical functions:

- |                              |  |
|------------------------------|--|
| 1. Calculus functions        | 8. Loop functions                          |
| 2. Complex functions         | 9. Matrix functions                        |
| 3. Constants                 | 10. Polynomial functions                   |
| 4. Statistical distributions | 11. Probability functions                  |
| 5. Hyperbolic functions      | 12. Real functions                         |
| 6. Integer functions         | 13. Relational tests and Boolean operators |
| 7. List functions            | 14. Trigonometric functions                |

When you select a specific function, the display shows you the general syntax for calling that function. This information includes the names of the parameters. This a very useful on-the-fly tip.

The designers of the HP 39gII offer a very adequate set of functions for each of the above categories of functions. These functions make the HP 39gII a serious contender in the calculator market. I was pleased

to see that the set of matrix functions included a rich collection of function that went well beyond the minimum list of matrix functions (i.e. determinant, inverse, and transpose). The list of function includes ones for eigenvalues, eigenvectors, identity matrix, LU decomposition, QR factorization, SVD factorization, and least-square regression (my number one favorite command for this machine), to say a few.

Figure 5 displays the Math Functions menu showing the list of matrix commands. The figure shows the selection of the LSQ matrix function, which performs least-square regression.

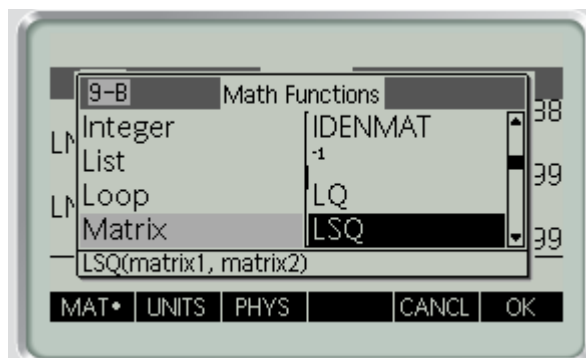


Fig. 5 - The Math Functions menu showing the list of matrix commands.

## The Apps Menu

The Apps menu offers the calculator user several form-based Apps that perform a wide variety of tasks. These Apps absolve you from creating them using custom programs. Each App displays its own input form and soft menus. The HP 39gII offers the following Apps:

1. The **Function App**. This App allows you to enter up to ten functions that you can use to plot.
2. The **Solve App**. This App allows you to enter up to ten functions that you solve for their roots. The heart of this App is the HP Solve software that is present in many HP calculators.
3. The **Statistics 1 Var App**. This App allows you to enter data in a matrix and then select the column for which you obtain many descriptive statistics.
4. The **Statistics 2 Var App**. This App allows you to enter data in a matrix and then select the columns for which you obtain many statistics for the correlation between any two columns.
5. The **Inference App**. This App allows you to tests the means of two populations using normal and Student-t tests. Each set of tests can check if the two means are less, equal, or greater than each other.
6. The **Parametric App**. This App allows you to define pairs of parametric X and Y variables that depend of a third variable T. The calculator uses the information to make parametric plots.
7. The **Polar App**. This App allows you to define polar variables and uses the information to make polar plots.
8. The **Sequence App**. This App allows you to define sequence variables and uses the information to make plots.
9. The **Finance App**. This App performs basic TVM (time value of money) calculations and also displays an amortization table.

10. The **Linear Solver App**. This App allows you to solve systems of two or three variables, by easily entering the values for the matrix coefficients and the constants vector.
11. The **Triangle Solver App**. This App allows you to solve for the sides or angles of a triangle.
12. The **Linear Explorer App**. This split graph/text view App allows you to explore the slope and intercept of a straight line. You can use the navigation keys and the soft menus to change the slope and intercept. The App alters the graph of the straight line according to the current settings.
13. The **Quadratic Explorer App**. This split graph/text view App allows you to explore the plot of a quadratic equation. You can use the navigation keys and the soft menus to change the parameters for the quadratic equations and instantly change the shape of the quadratic curve.

### The Graphics Features

The HP 39gII supports graphing function in a manner we are accustomed to. The Function App allows you to specify one or more functions to plot. The Function Plot Setup command (invoked by pressing the blue shift and Plot buttons) allows you to specify the range of the plot as well as other plotting parameters. Figure 6 shows a sample Function Plot Setup form.

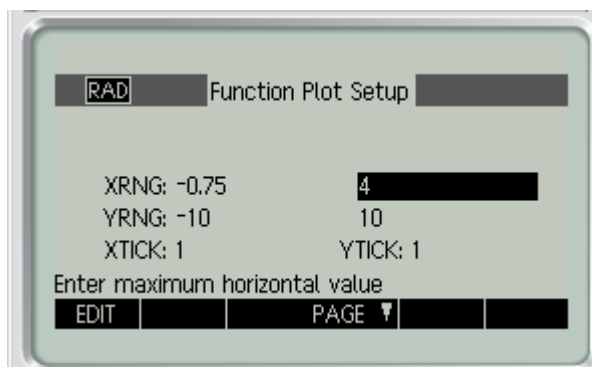


Fig. 6 - A sample Function Plot Setup form.

You can use this setup repeatedly to fine-tune the plotted functions. To view the graphs of the functions, you press the Plot button. Figure 7 shows a sample function. The calculator offers additional soft menus, once you invoke the MENU option. You can then zoom in on the graph, trace the values on the curve, and jump to the curve at a value of X of your choice.

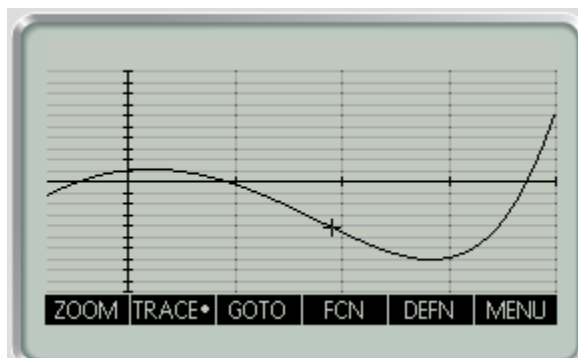


Fig. 7 - A sample function plot.

## Programming the HP 39gII

Programming the HP 39gII is another impressive aspect of the calculator. The approach to programming the HP 39gII is to create functions with optional, though frequently needed, parameters. These parameters are type-less and can be complex, list, matrix, and real typed-values. A function can call other existing functions. It can also declare local and exported variables that can be complex, list, matrix, and real typed-values.

When you press the Prgm command (invoked by pressing the blue shift and 1 buttons), the calculator displays the Program Catalog form, as shown in Figure 8. This form lists the names of the programs along with their sizes.

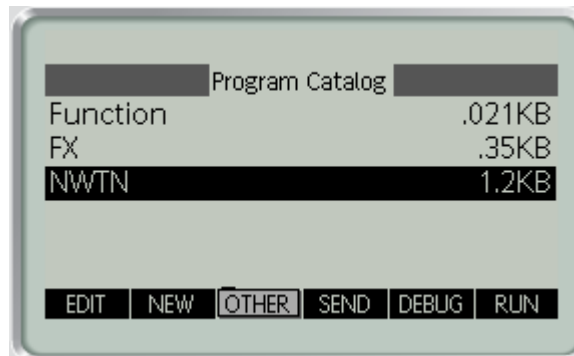


Fig. 8 - The Program Catalog form.

The Program Catalog form allows you to create a new program, edit, debug, run, delete, clear, and transmit the currently selected program. When you select to create a new program, the calculator first prompts you to enter the program's name. It then displays the program form, after inserting a minimum skeleton code. Your task is to insert any parameters used by the program, declare any local variables, declare any exported variables, and enter the program statements. You need to declare variables whose names exceed one letter. The program requires that each statement ends with a semicolon.

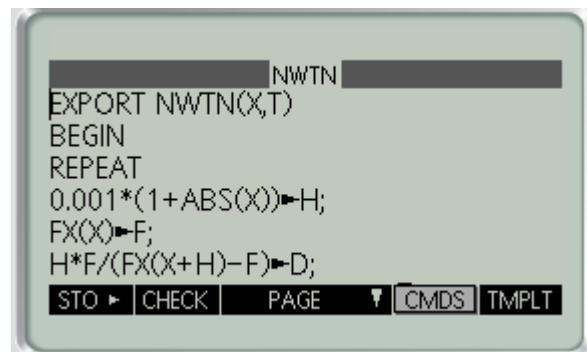


Fig. 9 - A Sample program.

The HP 39gII supports common decision-making and looping constructs. The TMPLT soft menu allows you to insert various kinds of constructs:

1. Decision-making constructs. These constructs include IF-THEN, IF-ELSE-THEN, CASE, and IFERR (to handle runtime errors).
2. Looping constructs. These constructs include FOR, FOR STEP, REPEAT-UNTIL, and WHILE.
3. Input constructs. These constructs include CHOOSE and INPUT.

Using the EXPORT command, you can export variables from programs so that you can access their values after their host programs terminate. You can use the Vars menu to view these exported variables.

You can run a program from the Program Catalog form or from the edit line after you press the Home button. If you choose the former, the calculator dynamically creates a form that lists the program's parameters and waits for you to enter a value for each parameter. The default value for each parameter is zero. Once you are done with the input, you press the OK soft menu. This action executes the program using the current arguments you entered, and default values you chose to accept, for the different parameters. The calculator then displays the result in a small popup window. To store the value returned by a program you need to invoke it from the editor of the basic calculation mode, and assign the result to a variable.

Since Figure 9 shows part of the listing of program NWTN (which uses program FX), here are the listings for both programs. First, here is program FX:

```
EXPORT FX(X)
BEGIN
e^X-3*X^2;
END;
```

Here is the listing for program NWTN, which implements Newton's method to calculate the root of the function in program FX:

```
EXPORT NWTN(X,T)      H*F/(FX(X+H)-F) →D;
BEGIN                 X-D→X;
REPEAT                UNTIL ABS(D)<T;
0.001*(1+ABS(X))→H;  X;
FX(X)→F;              END
```

The subject of programming the HP 39gII is worthy of one or more separate articles. So for now, I will limit my coverage to the above discussion.

## Conclusion

The HP 39gII is a powerful machine that uses a rich set of soft menus and forms to interact with the user. The machine packs a respectable set of math and graphing functions, along with a versatile BASIC-like programming language.

## About the Author



Namir Shammam is a native of Baghdad, Iraq. He resides in Richmond, Virginia, USA. Namir graduated with a degree in Chemical Engineering. He received a master degree in Chemical engineering from the University of Michigan, Ann Arbor. He worked for a few years in the field of water treatment before focusing for 17 years on writing programming books and articles. Later he worked in corporate technical documentation. He is a big fan of HP calculators and collects many vintage models. His hobbies also include traveling, music, movies (especially French movies), chemistry, cosmology, Jungian psychology, mythology, statistics, and math. As a former PPC and CHHU member, Namir enjoys attending the HHC conferences. *Email me at: nshammam@aol.com*