HP 50g Examples

The examples collected in this brief article are meant as an introduction to the HP 50g graphing calculator. Although the HP 50g can switch between Reverse Polish Notation (RPN) input and algebraic logic, the examples here all utilize RPN. Key names are written with all upper-case letters and menu items are written in italics. The term "menu key" refers to one of the 6 blank keys at the top of the keyboard; which give you access to the functions printed along the bottom of the display.

Getting Started

Press the MODES key and press the CHOOS menu key to select RPN as the *Operating Mode*. Uncheck the *Beep* option so your calculator will not beep each time there is an error (Figure 1).

Figure 1

Press the FLAGS menu key and check flag 117 (Figure 2).

Figure 2

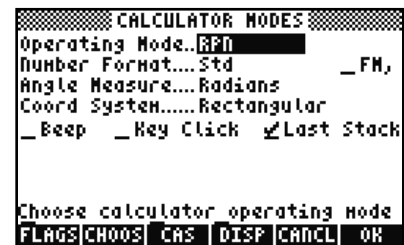Figure 4 shows the default appearance of the display, with 7 levels of the stack visible (Fig. 3).

Figure 3

There are two CAS settings that control how operations are processed and how the results appear: *Exact* vs. *Approximate* and *Real* vs. *Complex* modes. The header in Figure 3 shows the HP 50g is in *Real* and *Approximate* modes. In short, operations on complex numbers will not be supported and all results will be numerical approximations.

In RPN mode, operations take their required number of inputs from the stack, in order. To calculate $\dfrac{1+\sqrt{5}}{2}$, enter 1, then enter 5 and press the $\sqrt{\ }$ key to see Figure 4. Now press the + key. Finally, enter 2 and press the ÷ key to see the result (Fig. 5). Switch to Exact mode by holding down the Right-Shift key and pressing the Enter key. Repeat the steps above to see Figs. 6-7.

Figure 4

Figure 5

Figure 6

Figure 7

Programs

Programming on the HP 50g relies on the stack as well. Suppose we wish to write a program to average the two numbers in levels 1 and 2 of the stack. Figure 8 shows two numbers in levels 1 and 2 of the stack. To average them, we would press the + key, then enter 2 and press the ÷ key (Fig. 9). To write a program that does the same thing, press Right-Shift of the + key to invoke a program type (<< >>) and enter the same keystrokes. Press the ' key and enter a name for your program (we will use AVER). Figure 10 shows the name in level 1 and the program in level 2. Press the STO key to save your program. Enter two numbers, press the VAR key to find your program and press its menu key to run the program (Figures 11-12).
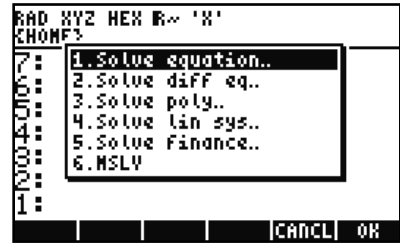

Figure 8

Figure 9
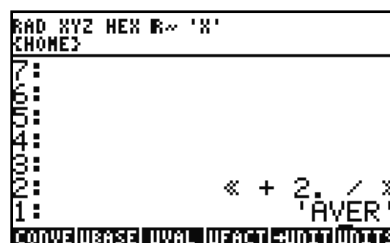
Figure 10

Figure 11

Figure 12

Units

As you saw in the previous section, the HP 50g relies on object typing. Programs use the <<>> delimiters, and both variable names and symbolic algebraics use the ' ' delimeters. You can attach units to numbers using the underscore character (Right-Shift -) as well. All units are in lower case, requiring the Alpha-Left-Shift combination. Figure 13 shows 8 meters in level 2 and 3 yards in level 1. Press the + key to see the sum, as in Figure 14. The units of the sum are the same as those in level 1. Press Right=Shift HIST (Undo) and swap levels 1 and 2 and repeat to see Figure 15. You can convert units as well. Figure 16 shows 1 Newton in level 1 (1, Right-Shift-6, NXT, N). Press NXT, UNITS, TOOLS, UBASE to see Figure 17.

Figure 13

Figure 14

Figure 15

Figure 16
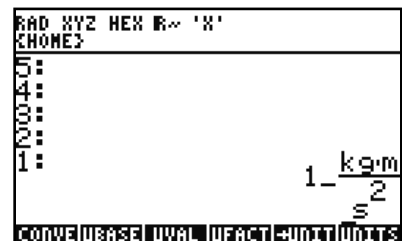
Figure 17

Solving Equations

The HP 50g has an array of equation solvers. In this example, we use the simple equation solver and the Pythagorean Theorem. Press Right-Shift-7 and select the Equation Solver (Fig. 18). Enter the equation shown in Figure 19. Enter 5 for A and 12 for B, then solve for C, as in Figure 20.
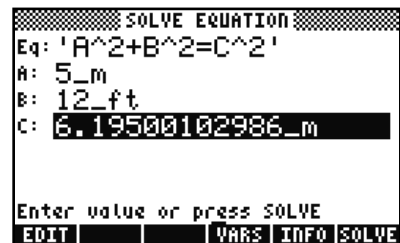
Figure 18

Figure 19

Figure 20

In Figure 21, the values of A and C are now in meters and the value of B is in yards. Highlight C and press the SOLVE menu key to see Figure 22. Units must be selected for each variable value before solving!
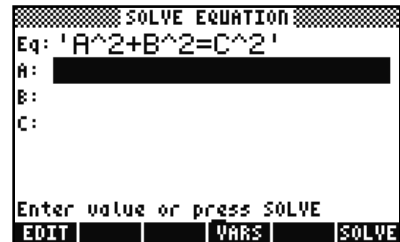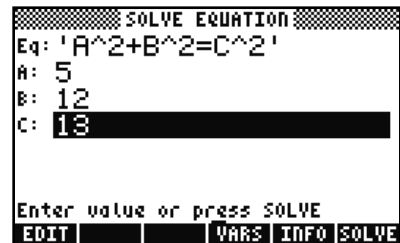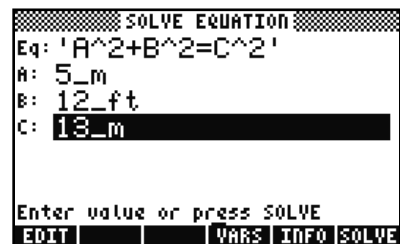
Figure 21

Figure 22

Solve a Linear System of Equations

Solve the linear system

$$2x_1 + 3x_2 - 5x_3 = 13$$

$$x_1 - 3x_2 + 8x_3 = -13$$

$$2x_1 - 2x_2 + 4x_3 = -6$$

Figure 23

Solution (3 ways)

For maximum flexibility, create the matrices A and b first (Fig. 23) and name them (Fig. 24).

Figure 24

Enter the Numerical Solver and select option *4: Solve Linear System.* Choose the matrices A and b (Fig. 25), then highlight X and press the SOLVE menu key (Fig. 26).

Figure 25

Figure 26

Or, from the stack, enter $A^{-1}b$, either in two steps or all at once.
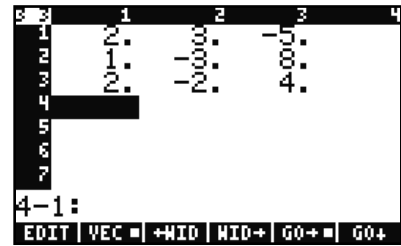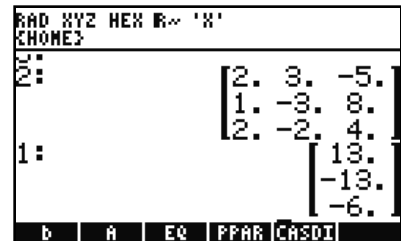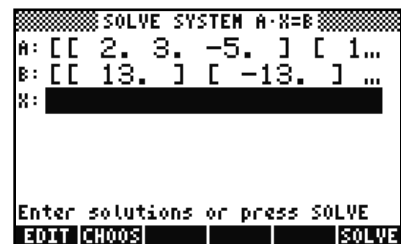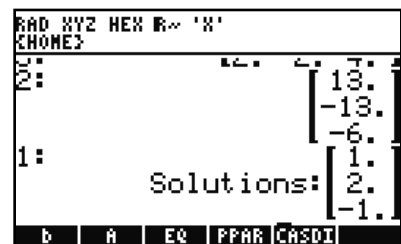
Vector Example

Determine if $\vec{F} = x^2 y \vec{i} + xyz \vec{j} - xy^2 \vec{k}$ is a conservative vector field. Then show that $div(curl(\vec{F})) = 0$.

Figure 27

Solution

Compute $curl(\vec{F})$ to see it is not the zero vector (Figures 27-28).

Figure 28

Now compute $div(curl(\vec{F}))$.   Figure 29 shows the setup and Figure 30 the result. By inspection, $-1 \cdot 2y - y + -(-1 \cdot 2y) + y = 0$, but the expression can be easily evaluated by pressing the EVAL key (Fig. 31).
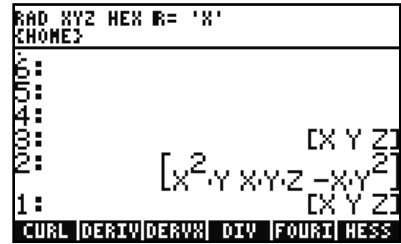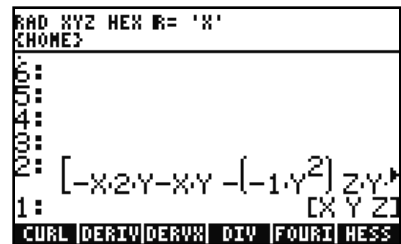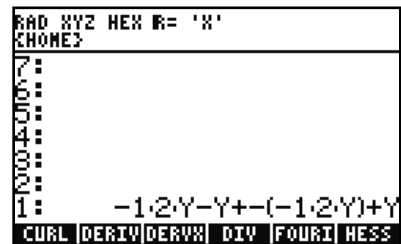

Figure 29

Figure 30

Figure 31

Solve a Differential Equation

Find the general solution to the differential equation $\frac{\partial}{\partial x} y + 5y = 0$ such that y(0)=1.

Figure 32

Solution

First, use DESOLVE to find the general solution. DESOLVE takes two inputs: the differential equation and the function name (Fig. 32). The result in Figure 33 includes cC0, a constant.

Figure 33

Substitute X=0 and Y(0)=1 and solve for cC0 (Figures 34-35).

Figure 34

We must change 1=cC0 to cC0=1 and substitute; otherwise, the numerator of 1 will be replaced with cC0 rather than replacing cC0 with 1 (Figure 36)!

Figure 35

Figure 36