hp calculators
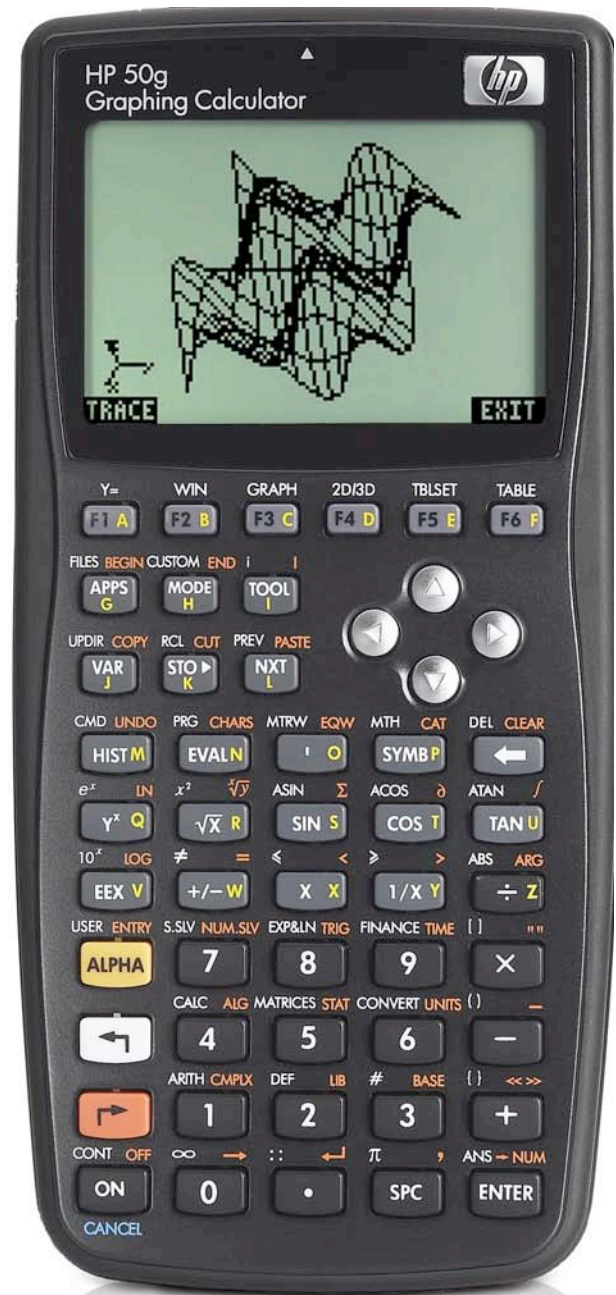
HP 50g Using the Numeric Solver to solve a formula

The Numeric Solver

Practice solving formulas for unknowns

The Numeric Solver

The HP 50g has a numeric solver that can find the solutions to many different types of problems. It is invoked by pressing the ORANGE shift key followed by the [7] key, or [→] *NUM.SLV* .

When pressed, the CHOOSE box below is displayed:

Figure 1

The first choice allows for the solution of an equation containing a number of unknowns. The second choice solves differential equation problems. The third choice solves for zeroes of a polynomial and is of interest here. The fourth choice can solve linear systems of equations for unknown values. The fifth choice invokes the finance solver. The sixth choice begins the multiple equation solver. To select the equation solver, press [1] [ENTER] . The 50g displays the following screen:

Figure 2

There is one input area on this form. This is where equation to be solved is entered. To enter an equation, press ▓▓▓▓▓.

Figure 3

The cursor will be flashing between the two quote marks at the bottom left corner of the screen. The 50g is waiting for the entry of an equation. Type in the following:

Figure 4

and press ▓▓▓ shown above the [F6] key at the right side of the display. The equation entered will be stored in the variable EQ in the current directory and will be displayed in the Eq: line of the screen, as shown below. If the variable EQ already contained an equation when the solver was entered, it would have been displayed in the Eq: line in the display above.
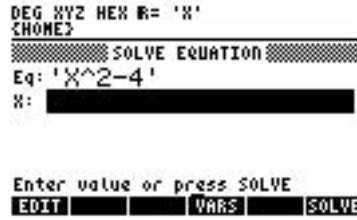
Figure 5

If you prefer, the EquationWriter can be used to type up an equation which is then placed on the stack. If you place the 'EQ' name in the first level of the stack with the equation from the EquationWriter in the second level of the stack and press $\boxed{STO\blacktriangleright}$, the equation will be stored in the EQ variable. It may be easier to do this before starting the solver for many equations.

The remainder of the screen below the Eq: line is where the 50g solver will place variables found in the equation. Each variable will be given an input space on this screen where you can either input a known value for the variable or attempt to solve for the value of that variable if it is unknown. In the example shown, the only variable is X and there is one entry line for it as shown below.
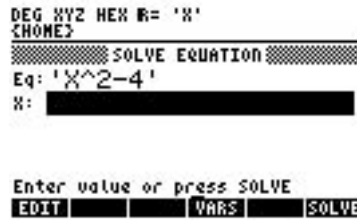

Figure 6

To solve for the value of X that makes the entered equation equal to zero, press the █SOLVE█ menu label above the $\boxed{F6}$ key at the right side of the display. The 50g will solve for X and return its value as shown below.
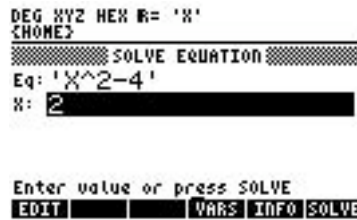

Figure 7

Note that the solver returned only one of the real solutions to the equation, +2. The solver only finds one answer. To seek for other answers, a starting guess can be given for the variable to influence the search for an answer. It may also be easier to graph the function and look for roots in that manner. Consider what the solver returns if the cursor is placed over the X: input area and –3 is entered followed by pressing the █SOLVE█ menu label above the $\boxed{F6}$ key at the right side of the display:

Figure 8

The solver found the other real solution to the equation. If you do not have any idea for a possible solution, the solver will make a guess and attempt to find an answer. However, to find other answers, a user-supplied guess may be needed.

Practice solving formulas for unknowns

Example 1: The equation for the motion of a free-falling object is shown below, where V0 is the initial velocity, T is the time, and G is the acceleration due to gravity.

$$DIST = V0 \cdot T + 0.5 \cdot G \cdot T^2$$

Figure 9

If an object begins at rest, determine how far the object falls in 5 seconds? How long does it take an object to fall 500 meters?

Solution: To answer these questions, use the EquationWriter to enter the function and solve for the unknowns using the numeric solver as shown. Since the answer is to be in meters, use a value of 9.8 m/s² for G.
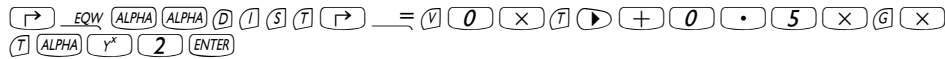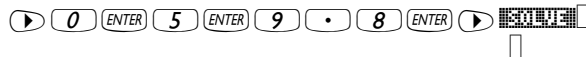
[→] _EQW [ALPHA] [ALPHA] [D] [I] [S] [T] [→] __= [V] [0] [×] [T] [▶] [+] [0] [.] [5] [×] [G] [×]
[T] [ALPHA] [Yˣ] [2] [ENTER]

$$DIST = V0 \cdot T + 0.5000 \cdot G \cdot T^2$$

Figure 10

['] [ALPHA] [ALPHA] [E] [Q] [ENTER] [STO▶] [→] NUM.SLV [ENTER]

```
SOLVE EQUATION
Eq: 'DIST=V0*T+.5*G*T^...
DIST:          V0:
T:             G:

Enter function to solve
EDIT CHOOS      VARS      EXPR=
```
Figure 11

[▶] [0] [ENTER] [5] [ENTER] [9] [.] [8] [ENTER] [▶] SOLVE

```
SOLVE EQUATION
Eq: 'DIST=V0*T+.5*G*T^...
DIST: 122.5    V0: 0
T: 5           G: 9.8

Enter value or press SOLVE
EDIT           VARS INFO SOLVE
```
Figure 12

[5] [0] [0] [ENTER] [▶] SOLVE

Figure 13

Answer: The object would fall 122.5 meters in 5 seconds. It would take the object a little over 10.1 seconds to fall 500 meters.

Example 2: Given the length of two sides of a triangle and the angle between the two known sides, the length of the third side of the triangle can be determined using the formula shown below:
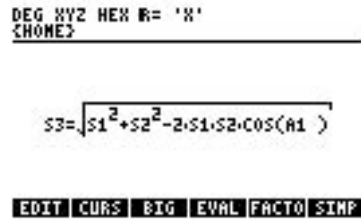

Figure 14

Given a triangle with Side 1 equal to 170 feet, Side 2 equal to 220 feet, and the included Angle A1 equal to 30 degrees, what is the length of the third side of the triangle?

Solution: To answer these questions, use the EquationWriter to enter the function and solve for the unknowns using the numeric solver as shown. Make sure the 50g is in degrees mode before starting the solver.
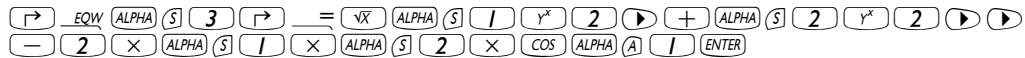

Figure 15

Figure 16

Figure 17

$$\blacktriangleright \blacktriangleright \boxed{1}\ \boxed{7}\ \boxed{0}\ \boxed{\text{ENTER}}\ \boxed{2}\ \boxed{2}\ \boxed{0}\ \boxed{\text{ENTER}}\ \boxed{3}\ \boxed{0}\ \boxed{\text{ENTER}}\ \blacktriangleright \boxed{\text{SOLVE}}$$
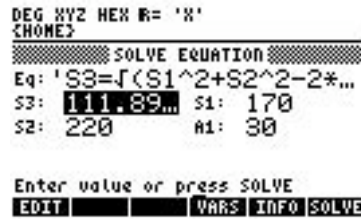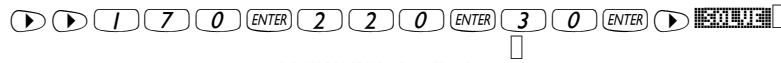

Figure 18

Answer: The third side of the triangle is 111.89 feet in length.