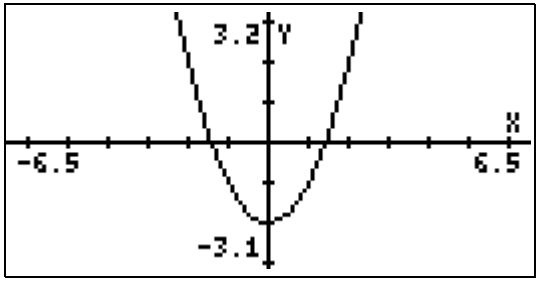
Chapter 10

Advanced plotting options

Labelling and relocating the axes

To label the coordinate axes with the variable names

The names of the independent and dependent variables, and the coordinates (in user-units) of the largest and smallest *displayed* values for each variable, can be added to the plot after it has been drawn. The figure below shows labels added to the plot of $y = x^2 - 2$ (assuming that you have used the default settings).



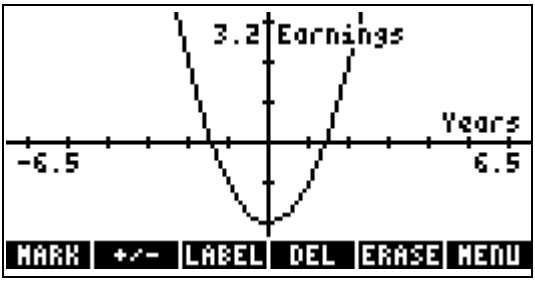
To label the axes:

1. Press EDIT.
2. Press (NXT) to display the second page of the function-key menu.
3. Press LABEL.

   You may need to hide the menu to see the lowest label on the vertical axis. You hide the menu by pressing ⊕ or ⊖, and redisplay it by pressing ⊕ or ⊖.

To label the axes with user-defined labels

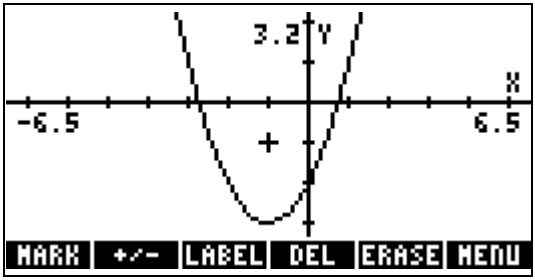
1. Select the AXES command from the command catalog (CAT).
2. Enter a list containing the horizontal and vertical axis labels as strings: { "*h-label*" "*v-label*" }.
   For example: AXES({"Years", "Earnings"}).
3. Press ENTER to store the labels.
4. Press ↰ GRAPH to display the plot again.
5. Press EDIT.
6. Press NXT to display the second page of the function-key menu.
7. Press LABEL.



To have the axes intersect at a point other than (0,0)

1. Select the AXES command from the command catalog (CAT).
2. Enter a complex number representing the new point of intersection.
   For example: AXES((1,1)).
3. Press ENTER to store the new point of intersection.
4. Press either ↰ Y=, ↰ WIN, or ↰ 2D/3D.
5. Press ERASE.
6. Press DRAW.

The following diagram is of the same plot as in the previous illustration, but the axes now meet where x =1 and y =1.



Plotting programs

You can plot a program if it takes nothing from the stack, uses the independent variable in the program, and returns exactly one untagged number to the stack.

Examples

- **Real result.** Equivalent to the expressions $f(x)$ (function plots) and $r(\theta)$ (polar plots). For example, the program:

  `« IF 'X<0' THEN '3*X^3-45X^2+350' ELSE 1000 END »`

  plots $f(x) = 3x^3–45x^2+350$ if $x<0$ and $f(x) = 1000$ if $x\geq 0$.

  Store the program in *EQ*, select autoscaling, and draw the plot.

- **Complex result.** Equivalent to $(x(t), y(t))$ (parametric plots). For example, the program:

  `« 't^2-2' →NUM 't^3-2t+1' →NUM R→C »`

  plots the parametric equations $x = t^2–2$ and $x = t^3–2t+1$.

  Store the program in *EQ*, make t the independent variable, select autoscaling, and draw the plot.

Plotting range vs. display range

The *plotting range* is the range of the independent variable (or variables) over which the current equation is evaluated. If you don't specify the plotting range, the HP 49G uses the x-axis display range (specified by XRNG or by H-VIEW) as the plotting range. However, you can specify a plotting range that is different from the x-axis display range:

- For polar and parametric plots, the independent variable isn't related to the x-axis variable; therefore you specify the plotting range to control the range of the independent variable.
- For truth and conic plots, you can shorten plotting time by specifying plotting ranges that are smaller than the x- and y-axis display ranges. These plot types require you to specify the *dependent* variable. You can specify a plotting range different from the y-axis display range.

You can make *PICT* larger than its default size (131 by 64 pixels) and either keep the same x and y scale factors (which extends the display range), or keep the same display range (which extends the scale and appears to stretch the plot.

To check the current size of PICT

1. Press ◁ (RCL) to select the Recall command.
2. Type PICT.
3. Press (ENTER).

   The message "Graphic *width* × *height*" is returned, indicating the current dimensions of PICT.

In RPN mode: follow steps 2 and 1.

To change the size of PICT

To keep the same scaling:

1. Press ◁ (PRG) PICT PDM to select the PICT DIMENSION command.
2. Enter a complex number to indicate the coordinates, in user units, of one corner of PICT.
3. Press ▷ (,).

4. Enter a complex number to indicate the coordinates, in user units, of the corner of PICT diagonally opposite the corner specified at step 2 above.

   For example, PDM((–6,–6), (6,9)).

5. Press ENTER.

Press ↰ GRAPH to see the results of the re dimensioning of PICT.

In RPN mode: follow steps 2, 4, and 1.

To keep the same display ranges:

1. Press ↰ PRG PICT PDM to select the PICT DIMENSION command.
2. Enter a binary integer to indicate the horizontal size of PICT in pixels.
3. Press ↱ ,.
4. Enter a binary integer to indicate the vertical size of PICT in pixels.

   For example, PDM(#105h, #3Fh).

5. Press ENTER.

Press ↰ GRAPH to see the results of the redimensioning of PICT.

In RPN mode: follow steps 2, 4, and 1.

The result of the PDIM command depends on the type of coordinates—user-units or pixels—although both forms change the size of *PICT*.

To use computed values for plotting or display ranges

1. On the Plot Window input form, highlight the range field whose value you wish to compute.
2. Press NXT CALC.
3. Perform the desired calculation.
4. If it is not already a real number, convert the result to a real number by pressing ↱ →NUM.
5. Press OK to return to the Plot Window input form. The result of the calculation will be in the field you highlighted at step 1.

Saving and Restoring Plots

A plot consists of several components:

- The plot picture (that is, a graphic object).
- The current equation or equations (stored in the reserved variable *EQ*).
- The current plot parameters (stored in the reserved variable *PPAR* and, in the case of three-dimensional plot types, *VPAR*).
- Flag settings that determine plotting and display options.

You have the option to save any or all of these plot components in a variable so that you can retrieve them later. Here are two useful approaches:

- Save just the plot picture in a variable. This is a simple procedure (see below) but each plot picture uses about one kilobyte of memory.
- Save the current *EQ*, *PPAR*, *VPAR* (if necessary), and flag settings in a list. See "To save a reconstructable version of the current plot" on page 10-7. The plot can be reconstructed by restoring each of these values contained. (See "To reconstruct a plot from its stored version" on page 10-8.)

To save the current plot picture in a variable

1. While viewing the plot, press (STO▶).
   A copy of the plot is placed in history.
2. Press (CANCEL) until you return to history.
3. Press (STO▶).
4. Enter a name for the plot.
5. Press (ENTER).

In RPN mode: follow steps 1, 2, 4, and 3.

To view a plot picture stored in a variable

1. Press (VAR).
2. Press the function key corresponding to the variable containing the plot picture.

   You may have to press (NXT) a number of times to display the variable you want. You may also have to change directories if the variable is not in the current directory.
3. Press (▼) to display the plot.

To save a reconstructable version of the current plot

1. After drawing the plot, press (CANCEL) to return to your default screen.
2. Press (←) (⋮).
3. Press (VAR).
4. Press EQ.
5. Press (→) (,).
6. Press PPAR.
7. Press (→) (,).
8. If your plot was three-dimensional, press VPAR and (→) (,).
9. Press (CAT) RCLF.
10. Press (▶) until the cursor is outside the list.
11. Press (STO▶).
12. Enter a name for the list.
13. Press (ENTER).

To reconstruct a plot from its stored version

This procedure is best done in RPN mode.

1. Press (VAR).
2. Press the function key associated with the variable that contains the stored version of the plot's components.
3. Press ◁ (PRG) TYPE OBJ→ to disassemble the list and put the components onto the stack.
4. Press ◀ to delete the object on level 1. This is the number of items in the original list and is not needed in the procedure. The new level-1 object is the flag settings current at the time you stored the plot components variable.
5. Press (CAT) STOF to reset the flag settings. Note that your current flag settings will be lost.
6. If the plot is a three-dimensional plot, press ▷ ', type VPAR and press (STO▶) to reset *VPAR* to its earlier values.
7. press ▷ ', type PPAR and press (STO▶) to reset *PPAR* to its earlier values.
8. press ▷ ', type EQ and press (STO▶) to reset *EQ* to its earlier value.
9. Press ◁ (Y=) ERASE and DRAW to redraw the plot.