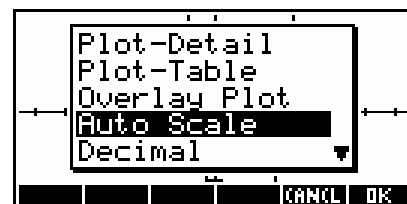


Auto Scale

Auto Scale attempts to fit the best possible vertical scale to the horizontal scale you have chosen. It is not always successful but will often give you a good starting point from which to refine the scale. In the example which follows it is assumed that you have plotted the graph as shown on the previous page.

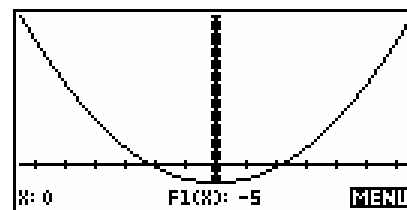
In the PLOT view, press the VIEWS key. Use the arrow keys to scroll down to *Auto Scale* and press ENTER. The calculator will adjust the y axis in an attempt to fit as much of the graph on to the screen as possible.



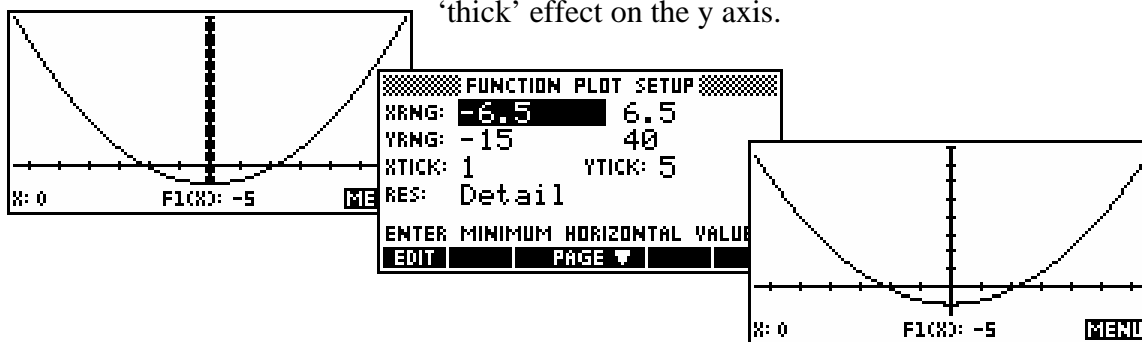
Some points to bear in mind;

- the y axis is scaled only on the first function which has a CHK.
- the y axis is scaled for the current x axis (domain) you have chosen in PLOT SETUP. If you've not chosen the domain wisely then your result may not be good.
- it doesn't choose 'nice' scales for the y axis such as we would choose (going up in 0.2's or 5's or 10's etc.) so you will generally need to tidy up its choice a little.

If you look at the y axis of the graph you've just produced, you'll see that the axis tick marks are so close together that it looks like a solid line. To tidy this up you must change to the PLOT SETUP view. If you look above the PLOT, SYMB and NUM keys you will see the word 'SETUP'. The SETUP view for each of these keys is obtained via the SHIFT key.



The values produced by the Auto Scale are shown below, along with a better set that produces a clearer PLOT view. Note particularly the YTick setting that removes the 'thick' effect on the y axis.



Finding a suitable set of axes

This is probably the most frustrating aspect of graphical calculators for many users and there is unfortunately no simple answer. Part of the answer is to know your function – this is why we still expect you to learn mathematics instead of expecting the calculator to do it all! If you know, for example, that your function is hyperbolic then that immediately gives information about what to expect. If you don't have knowledge then here are a few tips:

- Try plotting the function on the default axes. You may find that enough of the function is showing to give you a rough idea of how to adjust them to display it better. Remember that **ZOOM** can work on either axis or on both. When in doubt, zoom out rather than in.
- The NUM view can be very helpful. Try changing to NUM SETUP and setting the value of NumStep to 5 or even 10. Now scroll through the NUM view and look at what is happening to the F(X) values. Look for two things.
 - Firstly, where is the function most active? For what domain on the x axis is it changing rapidly both up and down? This is likely to be the domain you are most interested in.
 - Secondly, what is the range? What sort of values will you need to display on the y axis? Change to the PLOT SETUP view and set what you think may be appropriate axes. From those you can PLOT and then zoom in or out.
- If the graph is part of a test or an examination then the wording of the question will often give a clue as to what x axis domain you should work with. You can then use Auto Scale.

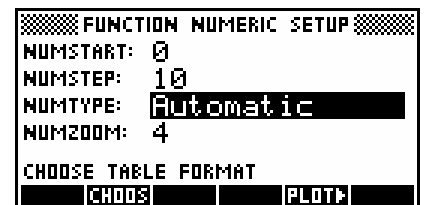
Auto Scale can be used to get a first approximation to a good set of axes. To do this you must choose your x axis domain first. Use your knowledge of what the function might look like, perhaps together with a quick scroll through the NUM view, to get an idea of what section of the x axis is important.

For example, suppose a company's profit is modeled by the equation

$$P(x) = \frac{-100}{x} + 50e^{-0.025x}, \text{ where } x \text{ is the number of items manufactured. Suppose that from}$$

the context of the question it is clear that we are mainly interested in the domain $0 \leq x \leq 100$.

After entering the equation into the SYMB view, change into the NUM SETUP view and set the numeric scale to start at zero and increment in steps of 10 (or 5 if you want more details).



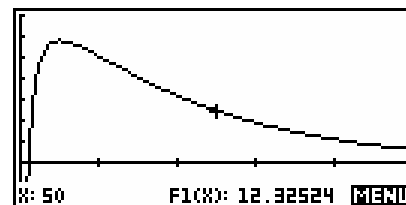
Change into the NUM view and scroll through the window from zero to 100. As you do so, take note of the values that the function takes. From the display it seems that the function peaks around $y=30$ and then declines steadily.

X	F1		
0	UNDEF.		
10	28.94004		
20	35.32653		
30	32.28449		
40	15.89397		
50	12.32524		

Change into the PLOT SETUP view and enter an x axis of 0 to 100 with a 'tick' value of 20, and a y axis of -10 to 35 with a tick value of 5.

FUNCTION PLOT SETUP	
XRNG: 0	100
YRNG: -10	35
XTICK: 20	YTIK: 5
RES: Detail	
ENTER MINIMUM HORIZONTAL VALUE	
EDIT	PAGE ▾

The result of this is a PLOT view as shown right. This would be ideal for answering questions on the domain stated.

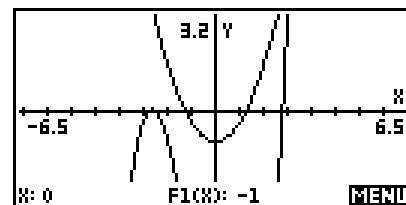


Another possible strategy for graphing which works quite well and, perhaps importantly, always gives 'nice' scales is to use **ZOOM**.

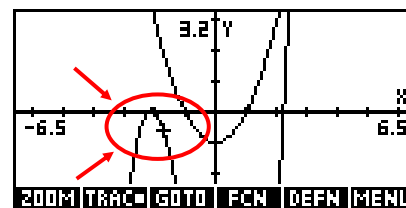
Enter your graphs into the SYMB view. Remember that *Auto Scale* only works on the first ticked graph.

FUNCTION SYMBOLIC VIEW	
<input checked="" type="checkbox"/> F1(X)=	X^2-1
<input checked="" type="checkbox"/> F2(X)=	$X^3+2*X^2-5*X...$
F3(X)=	
F4(X)=	
F5(X)=	
EDIT	<input checked="" type="checkbox"/> CHK % SHOW EVAL

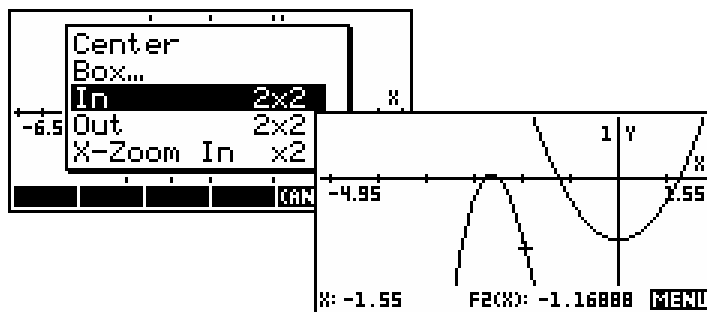
Press VIEWS and choose *Decimal*, or press SHIFT CLEAR in the PLOT SETUP view. This will give you the default axes, probably not showing the graph very well.



Place the cursor so that it is in the center of the area you are most interested in.



Use the **ZOOM** menu to adjust the view. You may choose first to change the zoom factors to something other than 4x4, and to ensure that *Recenter* is **CHK**ed. The PLOT view on the right is the result of setting 2x2 and re-center.



The advantage of doing it this way is that if you zoom in or out by a factor of 2 or 4 or 5, the cursor jumps will stay at (relatively) nice values allowing you to trace more easily. In this case, the cursor now moves in jumps of 0.05, which is ideal for most purposes. If you are not interested in tracing along the graph then this may not be important.

The disadvantage of this method is that you need to have at least some of the graph showing on the screen before you can zoom in or out to show more! Auto Scale can sometimes give you this first step.