Casio 9860 Self-guided Instructions – STAT Mode

Instructions	Screenshots

Entering Data, Finding Statistics and Drawing Graphs:

The 9860 is an excellent environment in which to investigate statistics.

Lists and Files:

Switch your calculator on, press MENU and 2 (or scroll to STAT and press EXE)
You may have data in the lists on the screen, or the lists may be blank.
Discover how many lists there are by **using the right arrow to scroll.** (Fig1)
There are 26 lists, but there are actually six files of 26 lists!
Find out which file you are in by going to **SETUP (SHIFT MENU) and scroll down to the third line called List File.**
The calculator generating these screen shots is in File2 (Fig2)
To change files (say, to File4) **press FILE (F1) then the file number, in this case, 4 then EXE. EXIT**
The calculator generating these screen shots has the data displayed in Fig3 in its File4
IMPORTANT: If you are not using your own calculator with this activity do not over-write or delete any data as it may have been entered for later use ie check with the presenter.

Fig1

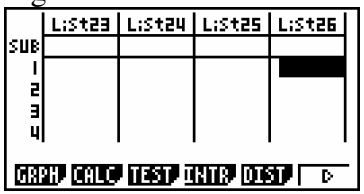
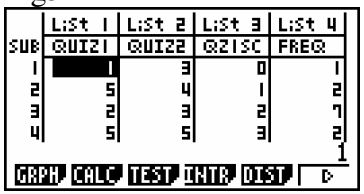


Fig2

Fig3

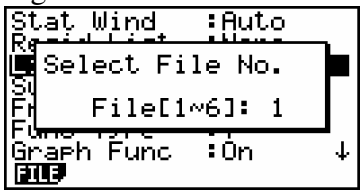


Entering and Deleting Data:

Entering Data:

Go to File1 (**SHIFT MENU scroll to List File FILE (F1) 1**) (Fig4)

Fig4



Press EXE and EXIT (fig5)

Fig5

If you have data in the lists make sure the data is not valuable.

Enter the data 1-6 as in Fig6:
Place the cursor in the top of List 1 type 1 press EXE
Type 2 EXE etc
After entering 4 **use right arrow** to go to List 2.

Three ways of Deleting Data:

Let's delete the 5 at the top of List 2 (Fig6)
Place the cursor over the 5 and press the DEL button (which is to the left of the AC/ON button) (Fig7)

Note that the data below jumps up to take the place of the deleted data.
Now let's delete the 6 but using a different method.
Press ▷ (F6) then DEL (F3) (Fig8)

Now let's delete List1 using DEL-A

Place the cursor anywhere in List 1
Press DEL-A (F4) (Fig9)

Now press F1. You are back to a blank screen

Fig6

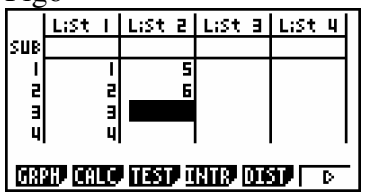


Fig7

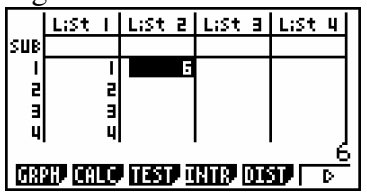


Fig8

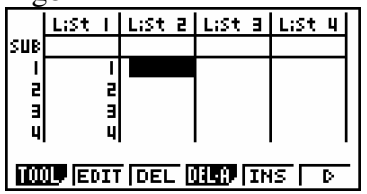


Fig9

Finding Statistics and Drawing Graphs:

It is important when teaching technology to use a conceptual approach rather than a 'button-pressing' approach. We don't, for example, want students to think there is an 18-button sequence to remember when entering data and drawing a graph. Rather, if we can teach the logic behind operating the calculator then there is much less to remember.

An efficient way to present STAT mode is to point out that once data has been entered there is only two things we will ever want to do … 1) Find the statistics, and … 2) Draw a graph. From the initial screen in STAT (Fig10) the 'gateway' to drawing a graph is GRPH (F1) and the 'gateway' to finding the statistics on a set of data is CALC (F2). Pressing either of these options (F1 or F2) will bring up a SET option at F6. (Fig11 is the result of pressing CALC). The SET option needs to be pressed to 'tell' the calculator which lists to look into to find the data.

We will do this next.

Finding statistics from a List of Data:

Press EXIT to return to the default STAT screen (as in Fig10)
Enter the following data into List 1:
5 2 9 6 4 5 10 8 3 5 7 2 9 10 3 7 (Fig12)

To find the statistics we will enter through the CALC 'gateway'.
Press CALC (F2) (Fig13)

then press SET (F6) (Fig14)
NOTE: You will almost definitely have different values than those in Fig14)

Fig10

Fig11

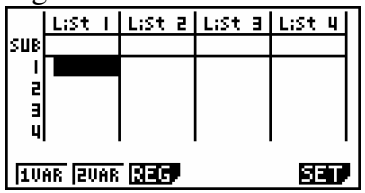


Fig12

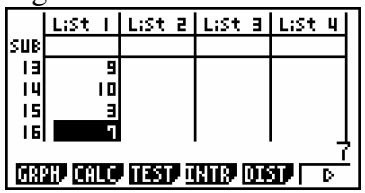


Fig13

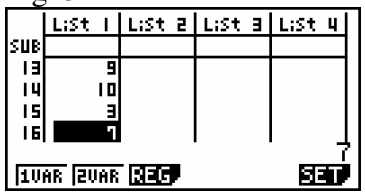


Fig14

1Var and 2Var Settings … NOTE: This is important to understand:

'1Var' stands for 1-Variate Data ie use the 1Var settings when generating statistics on one set of data at a time. '2Var' stands for 2-Variate Data and allows you to generate statistics on two sets of data simultaneously. BUT '2-Var' only gives mean, standard deviation, number of scores and not the 5-Number summary so '2-Var' is rather limited.

When entering 1-Var settings IGNORE 2-Var settings.
When entering 2-Var settings IGNORE 1-Var settings.

For now we will ignore the 2Var settings

The list number which holds the scores needs to be entered into 1Var XList (In our case List 1)
Scroll the cursor into the XList Line and Press LIST (F1) then 1 (Fig15)

Press EXE

Place the cursor over 1Var Freq (Fig16)

Because the data is displayed in a single list (and not as a frequency distribution table) and therefore there is no frequency column, **press F1** (Fig17)

NOTE: A good way of explaining the Freq = 1 scenario is that each number (in the data) is one score.

Press EXIT (Fig18)

Now **press 1VAR (F1)** (Fig19)

Note that in regard to the mode … the mode is 5, there is 1 mode and the frequency of the mode is 3

Fig15

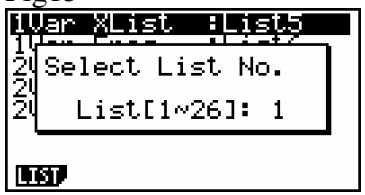


Fig16

Fig17

Fig18

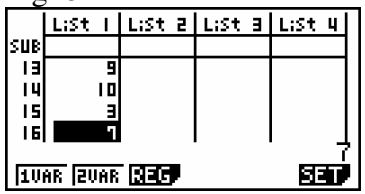
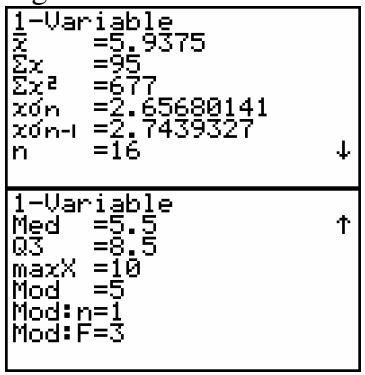


Fig19



Entering titles into the SUB line:

Press EXIT EXIT to get back to the default STAT screen
Scroll the cursor into the **SUB line of List 3**
Lock on the ALPHA button by pressing **SHIFT ALPHA**
Type S C R (Fig20)
Press EXE

Place the cursor into the **SUB of Line 4**
Press SHIFT ALPHA F R E Q then EXE (Fig21)

Finding statistics from a Frequency Distribution Table:

Enter the following Frequency Distribution Table (Fig22)

SCR	FREQ
1	1
2	1
3	2
4	6
5	12
6	17
7	10
8	5
9	3
10	1

Press CALC (F2) then SET (F6)
Again we will ignore the 2VAr settings.
Remember the scores are in List 3 and the frequency is List 4 (if you forget simply press EXIT, then return through SET)
With **cursor over XList press LIST (F2) and 3** (Fig24)

Fig20

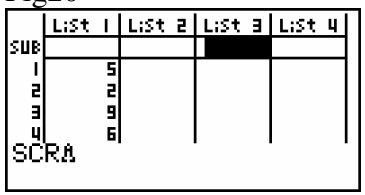


Fig21

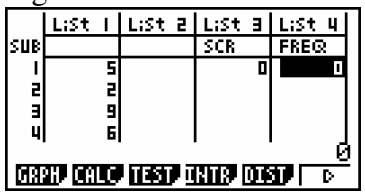


Fig22

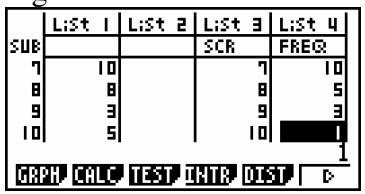
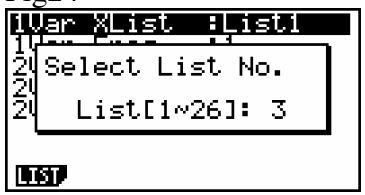


Fig23

Fig24



Press EXE
Arrow down to Freq (Fig25)
Note that the LIST button is now F2

Press LIST then 4 EXE (Fig26)

Press EXIT and then 1VAR (Fig27)
Scroll down to view all statistics.
Take note of the 5 number summary as we will be drawing a Box and Whisker Plot next.

Drawing a Box and Whisker Plot:

Let's draw a Box and Whisker Plot using the same data.
Press EXIT EXIT to get back to Fig22

To draw a graph we will enter through the GRPH 'gateway'
Press **GRPH (F1) then SET (F6)** (Fig28)
NOTE: Your settings will almost definitely be different to those in Fig28

With the cursor at the top of the screen note we have 3 different options at F1 F2 and F3
Press F2 and F3 to see what happens.

What this allows us to do is to produce up to 3 graphs and to display them simultaneously. More of that later. For now we will set up StatGraph1
Press GRPH1 (Fig28)

Scroll down to Graph Type. Press ▷ (F6) then Box (F2) (Fig29)
Scroll to XList

Press LIST (F1) then enter 3 then EXE (Fig30)

Fig25

Fig26

Fig27

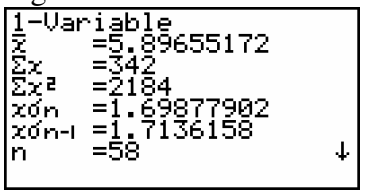


Fig28

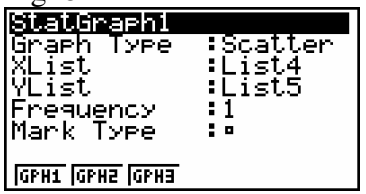


Fig29

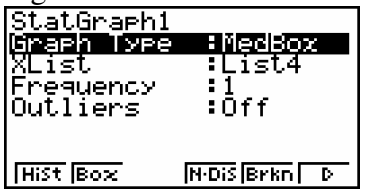
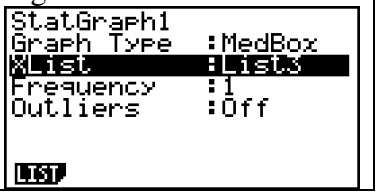


Fig30



Scroll to Frequency
Press LIST (F2) then 4 EXE (Fig31)
Leave the **Outliers off** for now.
Press EXIT (Fig32)

Setting up the calculator for graphs:

Before drawing the graph let's prepare the screen for graphing.
Go to SETUP (SHIFT MENU) and scroll up 5 places
Using F1 and F2 turn **Coord : On and Grid, Axes and Label Off** (Fig33)
NOTE: My preferences are:

- Coord On allows you to trace the values of the graph … always leave this On
- Grid … leave it off
- Axes … turn them On for X-Y graphs and Off for STAT Graphs
- Label … simply places an X and a Y on the screen … I leave them off.

Press EXIT and GRPH1 (Fig34)

Note there is no scale given. This is where the trace is important.

Any graph of any type generated from any mode can be traced.
Press SHIFT F1
Use right and left arrow to see the 5 number summary. (Fig35)

Outliers:

Let's see what happens when we turn the outliers ON
We need to return to the SET screen.
Press EXIT and then SET (F6)

Scroll to Outliers and turn them on by pressing F1 (Fig36)

Fig31

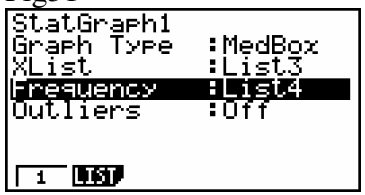


Fig32

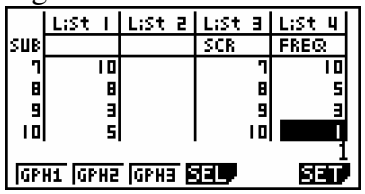


Fig33

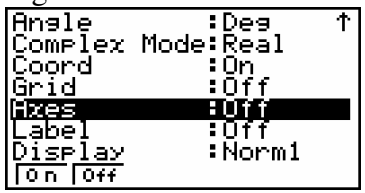


Fig34

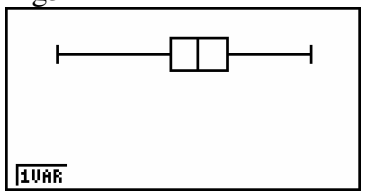


Fig35

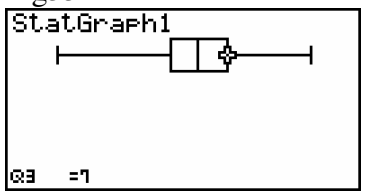
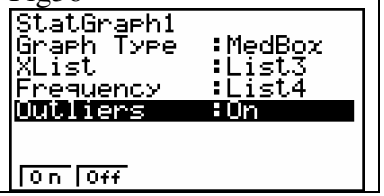


Fig36



Press EXIT and redraw the graph by pressing **GPH1 (F1)** (Fig37)
When traced note that the minimum score of 1 is actually an outlier.
NOTE: The mathematical definition of an outlier is any score that is more than 1.5 times the inter-quartile range above Q3 or below Q1

Drawing a Histogram:

Let's now draw a Histogram of the same data.
Press EXIT EXIT
Press GRPH (F1) and SET (F6) (Fig38)

Let's set up the Histogram on StatGraph2
With the cursor at the top **choose GPH2 (F2)**
Scroll to Graph Type and **press F6 then Hist** (F1)
Then **complete the set up as in Fig39**

Press EXIT then GPH2 (F2) (Fig40)

'Start' means 'what score do you want the Histogram to begin with?' We want the Histogram to start at 1.
'Width' means 'how wide do you want each column to be?' Let's use a column width of 2.

Enter 1 for start and press EXE
Enter 2 for Width and press EXE (Fig41)

Press EXE again and trace the graph with **SHIFT F1** (Fig42)
In Fig42 the first column is the sum of all scores 1 and 2, the second column is the sum of all scores 3 and 4, etc.

Fig37

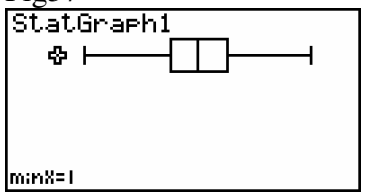


Fig38

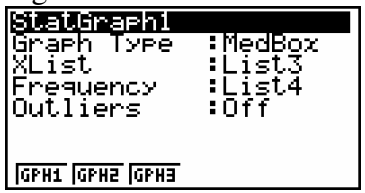


Fig39

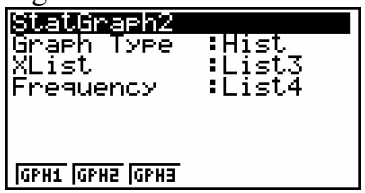


Fig40

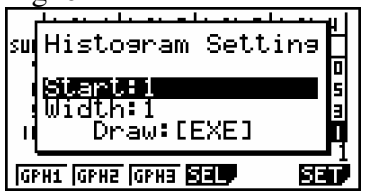
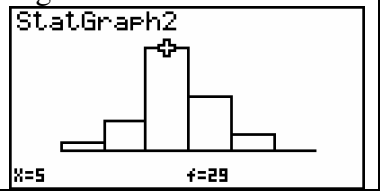


Fig41

Fig42



Changing the column width:

Let's change the column width to 1

Press EXIT and redraw the graph by pressing **GPH2 (F2)**

Enter the set up as per Fig43 (NOTE: you should find the calculator has already suggested this set up which means you can simply execute it. It is rare that the calculator will suggest the set up that you want!)

Press EXE

Press Trace (SHIFT F1) and use right and left arrows to trace the graph (Fig44)

Drawing Multiple Graphs:

There are numerous occasions where it is advantageous to draw 2 or 3 graphs when comparing data or of the same data. A very common practice is to draw 2 or 3 Box and Whisker Plots to compare data.

What we will do now is draw the Box Plot and the Histogram simultaneously. This can help give a better understanding of the function of both graphs.

Remember that currently we have the Box Plot set up for GPH1 and the Histogram set up for GPH2

Press EXIT then SEL (F4)

Turn StatGraph 1 and 2 On as per Fig45 (use F1 for On)

Press DRAW (F6) (Fig46)

There is no need to change the Histogram settings in this case.

Press EXE

Trace the graph (Fig47)

As you can see from Fig47 the median score of 6 makes sense from the Histogram.

Fig43

Fig44

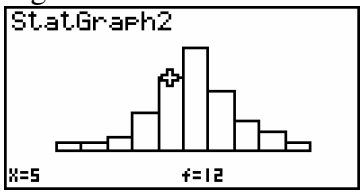


Fig45

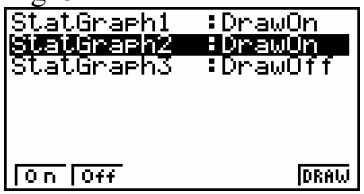


Fig46

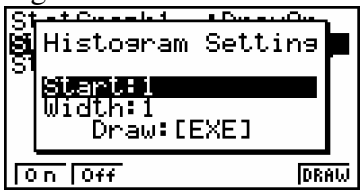
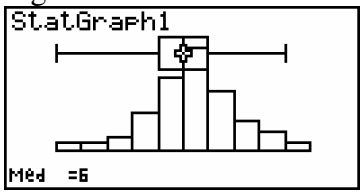


Fig47



Drawing a Frequency Histogram with Polygon:

NOTE: Step-by step instructions are not given for this section.
A polygon can be drawn by choosing the Brkn (F5) Graph Type setting from the SET screen (FigA)
To superimpose the Polygon onto the Histogram, set up 2 graphs (eg StatGraph1 to Histogram and StatGraph2 to Polygon) and display them simultaneously.
Note that the Graphic Calculator will not draw the histogram with a half-a-column gap each side of the end columns. (FigB)

Cumulative Frequency Histograms and Polygons:

There is little point drawing a Cumulative Frequency Histogram with a Graphics Calculator as the main reason for the Cumulative Frequency Histogram and Polygon is to determine the Median and Quartiles, tasks which the Graphic Calculator performs easily.

Drawing a Scatter Plot:

The 9860 is an excellent environment to investigate correlation through Scatter Graphs.
Usually an investigation would involve at least a reasonably significant amount of data.
To save time here we will demonstrate the functions of the calculator using a small amount of data. Its important that you recognize the relevance of these functions to larger sets of data.

Press EXIT and **scroll right until you reach Lists 5 and 6** (Fig48)
We will type SCR1 and SCR2 as the List 5 and 6 headings.
Place the cursor into the **SUB of List5** (Fig48)
Press SHIFT ALPHA S C R APLHA 1 EXE

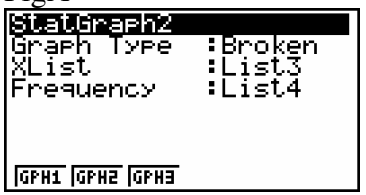
Place the cursor into the **SUB of List6**
Press SHIFT ALPHA S C R APLHA 2 EXE (Fig49)

Let's assume the following are the quiz scores from two comparable quizzes taken by 4 students.

STUDENT	SCORE1	SCORE2
1	4	5
2	10	9
3	8	10
4	6	7

Enter this data as in Fig50

FigA



FigB

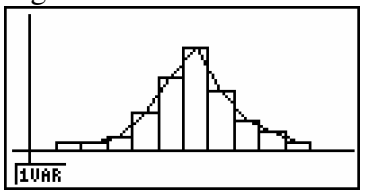


Fig48

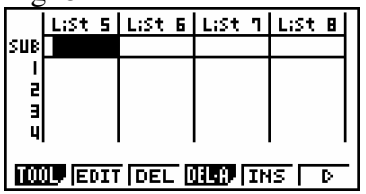


Fig49

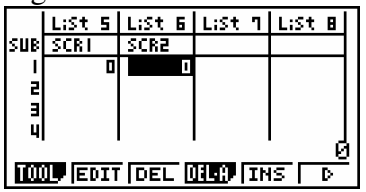
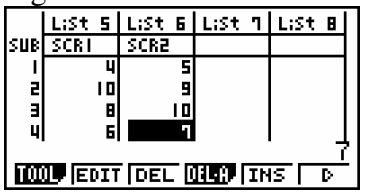


Fig50



Return to the screen with GRPH at F1 as in Fig51. It is important to be aware that the difference between Fig 50 and Fig 51 is one press of the F6 button. This can be frustrating for beginners who are on a 'Fig50' screen and who are looking for the GRPH button. F6 is the answer!!

Press GRPH (F1)
Press SET (F6)

Enter the settings as shown in Fig52

Press EXIT and GPH1 (F1) (Fig53)
There appears to be a strong correlation.

Finding an Algebraic Model - Drawing a Linear Regression Line:

To draw the line of best fit press **CALC (F1) then X (F2)** (Fig54)

We are given the equation of the Linear Regression Line, which in this case is y = 0.75x + 2.5

Importantly the correlating coefficient (r) is 0.87 (2sf), indicating a strong correlation.

Press DRAW (F6) to draw the Linear Regression Line (Fig55)

By tracing the graph **(SHIFT F1)** and using the up-down arrows you can trace both the plotted points and the Linear Regression Line.

Drawing the Median Regression Line:

Press Med (F3) (Fig56)
The equation of the Median Regression Line is given.

Fig51

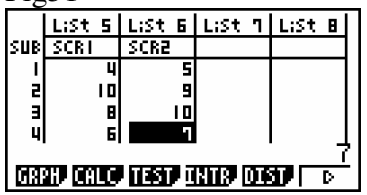


Fig52

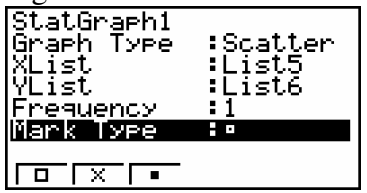


Fig53

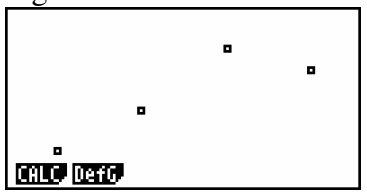


Fig54

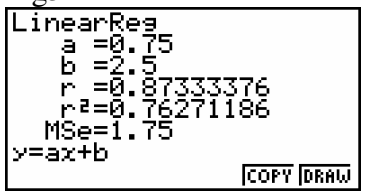


Fig55

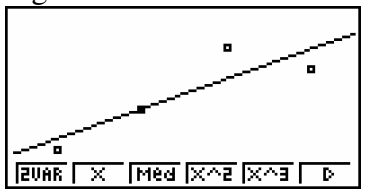
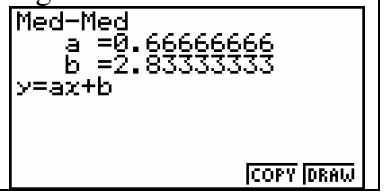
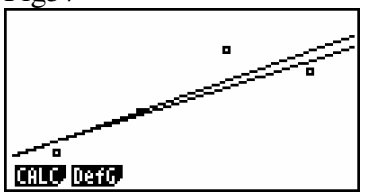


Fig56



Press DRAW (F6) (Fig57)

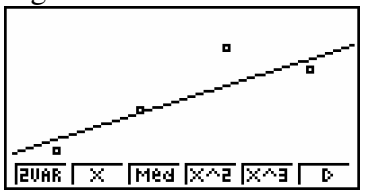
Fig57



If you wanted to see the Median regression Line without the Linear Regression Line then:

EXIT GPH1 (F1) CALC (F1) Med (F3) DRAW (F6) (Fig58)

Fig58

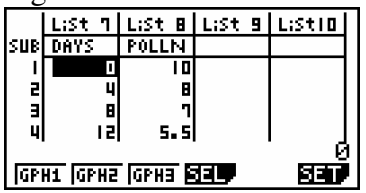


Finding Non-Linear Models for a Scatter Plot:

Consider the data below to be pollution readings in parts per million taken from a water-way every 4 days

DAYS	POLLUTION
0	10
4	8
8	7
12	5.5
16	4.3
20	3.6
24	3.4
28	2.2
32	2
36	1.6
40	1.7

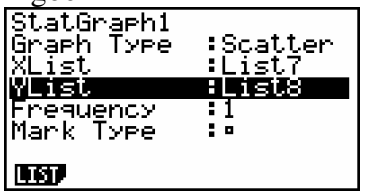
Fig59



Enter the titles and data into Lists 7 and 8 as shown in Fig59

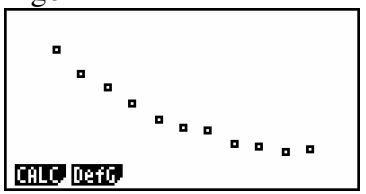
Go to the SET screen and enter the settings shown in Fig60.

Fig60



Press EXIT and GPH1 (Fig61)

Fig61



Press CALC (F1)

Fig62 shows some algebraic model types.

The Linear Regression and Median Regression models are obviously inappropriate.
Similarly the Quadratic (F4) and Cubic (F5) models are inappropriate for this data.
It is interesting, however, to try these. To the uninitiated they appear to fit at first.

For example choose the **cubic (F5) and then press DRAW (F6)** (Fig63)

The graph certainly seems to fit the data.

Press the **right arrow repeatedly** to 'push' the graph 'forward'

We see that the model rises which does not fit the data. (Fig64)

Further 'pushing' to the right produces Fig65

Now we would be into 'negative pollution', an impossible scenario!

To try a different model **press EXIT EXIT**

Then **GPH1 (F1) and CALC (F1)** (back to Fig62)

Press ▷ **(F6)** for further model types.
Press Exp (F3) then DRAW (F6)
Trace the graph to the right as far as it will go. (Fig66)

Note the trace stops at the far right edge of the screen.
In order to predict values beyond the data set we need to 'push' the graph to the right. To do this we need to turn off the trace.
Press SHIFT F1 to turn off the trace. Then arrow right. Now turn the trace back on. (Fig67)

Fig62

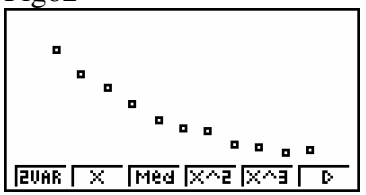


Fig63

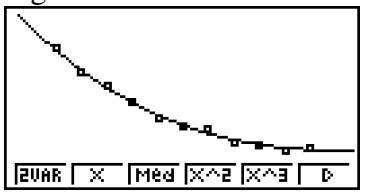


Fig64

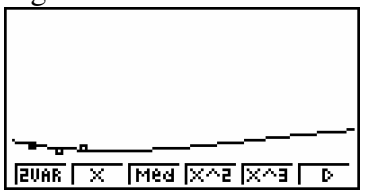


Fig65

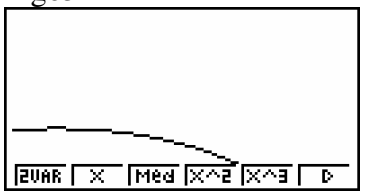


Fig66

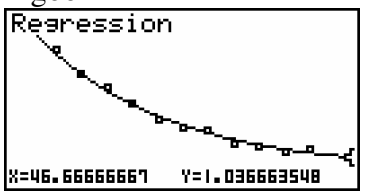
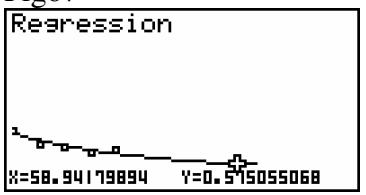


Fig67



Performing an X-Calculation or a Y-Calculation:

What if we needed to find the exact prediction for Y when X = 58? Or the exact prediction for X when Y = 0.5?
By scrolling we rarely are able to see the exact value we might be looking for.
We are unable to perform this operation in STAT mode. However, we are able to in GRAPH mode. Therefore we will transfer this algebraic model into GRAPH, draw the model and then perform X-Calcs and Y-Calcs there.

Press EXIT (Fig68)

Press CALC (F1) then ▷ (F6) then Exp (F3) (Fig69)

Press COPY (F5) (Fig70 -but yours will look different!)
Now we are in the GRAPH Mode set up screen
The screen in Fig70 shows an equation previously entered into GRAPH. This is not a problem. Simply **scroll to an empty line.** In this demonstration I will scroll to Y2 (Fig71). If your screen is blank then keep your cursor in the top line.

Press EXE (Fig72)
The equation has been copied into GRAPH Mode, but we are still in STAT Mode. We need to go to GRAPH.

Press MENU and scroll to GRAPH (Fig73)

Fig68

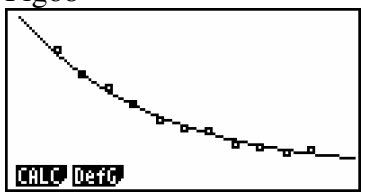


Fig69

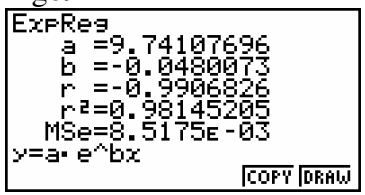


Fig70

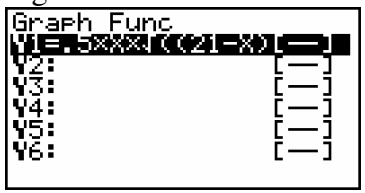


Fig71

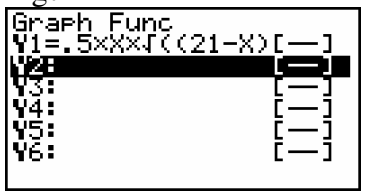


Fig72

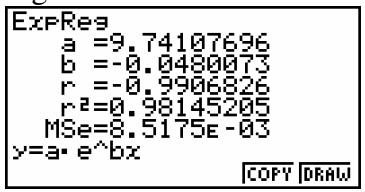
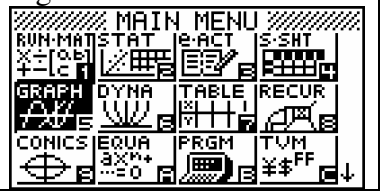


Fig73



Press EXE (Fig74)
Your screen will look different to Fig74 because you may or may not have had an equation(s) entered in GRAPH previously. You should however, have the exponential equation that is at the Y2= line in Fig74 (Note this looks like a number but is actually an equation, most of which is off the screen)
We need to turn ON our exponential equation and turn OFF any other equations.

For my situation I will turn OFF the Y1 Graph by pressing **SEL (F1)** and then scroll down to the Y2 Graph and select it by again pressing **SEL (F1)** (Fig75)

Now we need to set up the axes in V-Window.
Press EXIT and then SHIFT F3
Enter the values given in Fig76.
Don't be concerned with scale and dot for now.

Press EXIT

Now we will turn on the Axes in SETUP

Press SHIFT MENU and arrow up to Axes
Turn the Axes On with F1 (Fig77)

Lets we can draw the graph

Press EXIT (Fig78)

Now EXE and Trace (Fig79)

Fig74

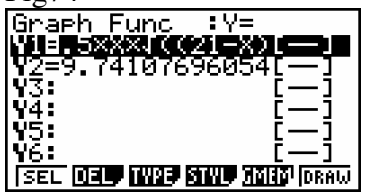


Fig75

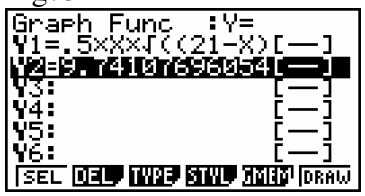


Fig76

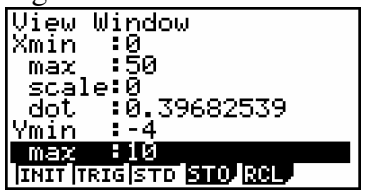


Fig77

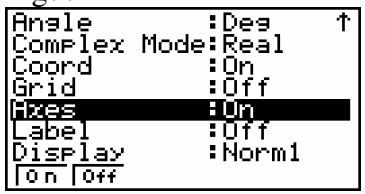


Fig78

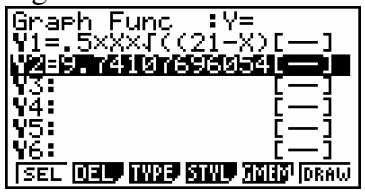
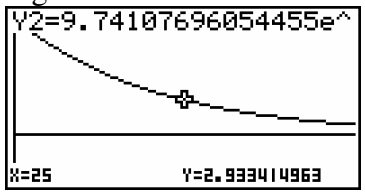
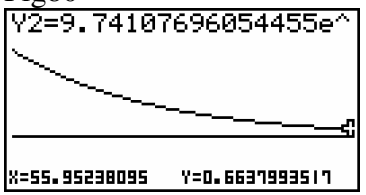


Fig79



Note by pressing the right arrow repeatedly we are able to 'push' the graph to the right with the Trace On (Fig80)

Fig80

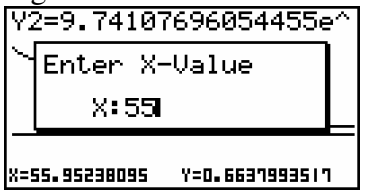


Now for the X-Calc and Y-Calc:

Let's say we want to find the exact value for Y when X is 55. Notice is you trace the graph you will not see X = 55, rather you will see values either side of X = 55.

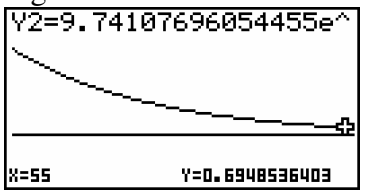
To perform this Y calculation simply **enter 55** (Fig81)

Fig81



Then EXE (Fig82)

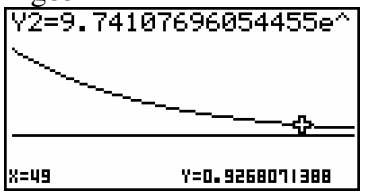
Fig82



Let's perform a Y calculation on X = 49

Enter 49 EXE (Fig83)

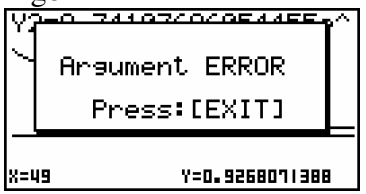
Fig83



NOTE: To perform a Y calculation the respective X value needs to be within the range of the current graph section displayed on the screen. Let's attempt a Y calculation for an X value that is off the screen.

Enter 5 EXE (Fig84)

Fig84

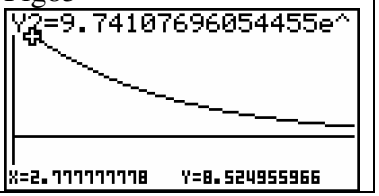


As you can see this generates an error message

All we need to do in this case is to 'push' the graph to the left.

Press **EXIT EXIT and arrow repeatedly to the left** until an X value less than 5 is reached. (Fig85)

Fig85



Now enter 5 EXE (Fig86)

But what if we want to perform an X calculation

This can be done through G-Solv

Press SHIFT F5 (Fig87)

Press ▷ (F6) (Fig88)

Then press X-CAL (F2) and enter 5 (Fig89)

Press EXE (Fig90)

This facility is extremely beneficial when investigating graphical systems.
The TABLE-GRAPH Self-Guided sheets illustrate further graphical applications of the Casio 9860.
Enjoy!!

For further and more advanced information including practice questions refer to the manual 'Mathematics with a Graphics Calculator – Casio fx-9860 AU' by Barry Kissane & Marian Kemp, available at
http://www.casioed.net.au/downloads/books/fx9860/orderBarryBook.pdf

Fig86

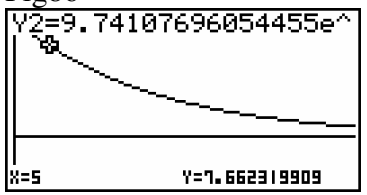


Fig87

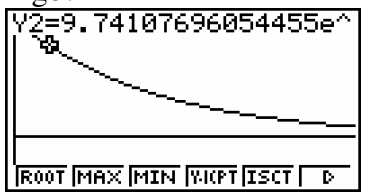


Fig88

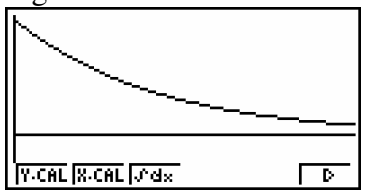


Fig89

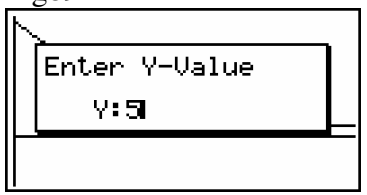
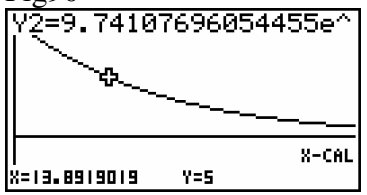


Fig90



NOTES: