

## TI Technology Guide for Internet phone subscribers soar

### TI-83 Plus and TI-84 Plus Families

Creating Lists of Data, Displaying a Graph, Using the Regression Capabilities of the Calculator, Predicting the value of the derivative, Creating the graph of the derivative, and Finding the maximum of the derivative graph.

#### Creating Lists of Data

To enter the data from the Snapshot in the activity, press **[STAT]** and select 1:Edit to access the List Editor window. Be sure to clear any existing data in the lists by highlighting the list name and pressing **[CLEAR]** **[ENTER]**. If you see a list other than L1 through L6, press **[STAT]** and select 5:SetUpEditor **[ENTER]** and then follow the above instructions.







L1	L2	L3	1
-----	-----	-----	
L1(1)=			

Move the cursor to the first data position in L1. Enter data from the Snapshot "Internet phone subscribers soar" that represent the year since 2004. Use 4 to represent 2004. Move the cursor to the first data position in L2 and enter the corresponding Internet phone subscribers (measured in thousands).

L1	L2	L3	1
4	980	-----	
5	2809		
6	6997		
7	12940		
8	17527		
-----	-----		
L1(6)=			

#### Displaying a Graph

Access the STAT PLOTS menu screen by pressing **[2nd]** **[Y=]**. Select (press **[ENTER]** or the number 1) 1:Plot1 to get the screen shown. Notice that Plot1 and On are highlighted. To turn on or off any plot, place the cursor over the name, press **[ENTER]**, then select either On or Off, and press **[ENTER]** again. This process acts like a toggle switch to turn the plots on and off the graphing display. Plot1 should have the same settings as shown at the right.

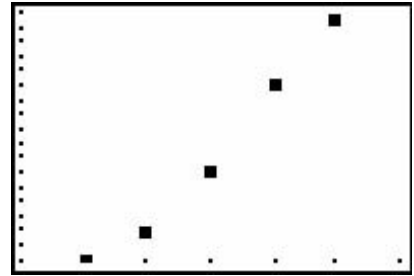
Plot1	Plot2	Plot3
On	Off	Off
Type: 		
Xlist: L1		
Ylist: L2		
Mark: 		

#### Setting a Window

To insure that all the data points are visible, press **[WINDOW]** and enter values for the x-axis and y-axis that contain the range of values from both sets of data shown in the graphic (see suggested values at the right).

WINDOW
Xmin=3
Xmax=9
Xscl=1
Ymin=900
Ymax=18000
Yscl=1000
Xres=1

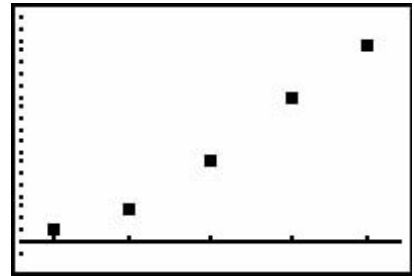
Press  $\boxed{Y=}$  and clear any equations listed. Press  $\boxed{\text{GRAPH}}$  to view the scatter plot. Years since 2004 (L1) are on the horizontal axis, and Internet phone subscribers (L2) will be on the vertical axis. Press  $\boxed{\text{TRACE}}$  and use the  $\boxed{\leftarrow}$  or  $\boxed{\rightarrow}$  keys to read the values of the data points.



Another way to set the window for a scatter plot is to press  $\boxed{\text{ZOOM}}$   $\boxed{9}$ . This will select 9:ZoomStat which will automatically set the viewing window and display all the data points of the scatter plot.

```

WINDOW
Xmin=3.6
Xmax=8.4
Xscl=1
Ymin=-1832.99
Ymax=20339.99
Yscl=1000
Xres=1
  
```



### Using the Regression Capabilities of the Calculator

To use the regression capabilities, press  $\boxed{\text{STAT}}$  to access the CALC menu. Select B:Logistic and enter  $\boxed{2\text{nd}}$   $\boxed{[L1]}$   $\boxed{,}$   $\boxed{2\text{nd}}$   $\boxed{[L2]}$   $\boxed{,}$   $\boxed{\text{VARS}}$   $\boxed{\rightarrow}$   $\boxed{1}$  press  $\boxed{\text{ENTER}}$   $\boxed{\text{ENTER}}$ .

```

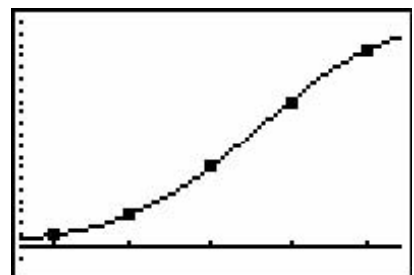
Logistic L1,L2,Y
1
  
```

Press  $\boxed{\text{ENTER}}$  to have the calculator find the logistic function that best models the data set.

```

Logistic
y=c/(1+ae^(-bx))
a=2265.36787
b=1.173963636
c=20841.38131
  
```

Press  $\boxed{\text{GRAPH}}$ . The regression line and the scatter plot are displayed simultaneously.



Press  $\boxed{Y=}$  to view the logistic function. Notice that Plot 1 is highlighted, which indicates that the data points for L1 and L2 are showing on the graph. The = beside Y1 is also highlighted, which indicates that the function determined by the regression capabilities will also show on the graph. Pressing  $\boxed{ENTER}$  when the cursor is in either of these highlighted areas acts as a toggle to turn on or off the display of that component on the graph.

```

2003 Plot2 Plot3
\Y1=20841.381310
432/(1+2265.3678
703994e^(-1.1739
636364994X))
\Y2=
\Y3=
\Y4=

```

### Predicting the value of the derivative

On the home screen enter the following  $nDeriv(Y1,X,5)$ .  $nDeriv$  is found by pressing  $\boxed{MATH}$  and selecting 8:nDeriv(. This calculation will find numerical approximations for the derivative of the function in Y1 for a given value for X.

```

nDeriv(Y1,X,5)

```

### Predicting using the Regression Model

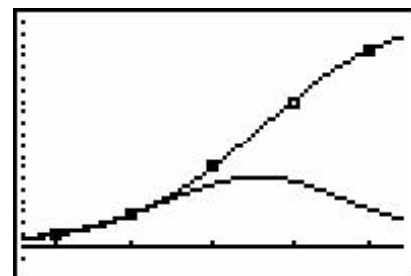
Input the expression  $nDeriv(Y1,X,X)$  in the Y= editor as Y2.

```

2003 Plot2 Plot3
\Y1=20841.381310
432/(1+2265.3678
703994e^(-1.1739
636364994X))
\Y2=nDeriv(Y1,X,
X)
\Y3=

```

Press  $\boxed{GRAPH}$  to see the scatter plot, logistic function, and the approximation of the derivative of the logistic function. Press  $\boxed{TRACE}$  to see the coordinates. Press  $\boxed{\uparrow}$  or  $\boxed{\downarrow}$  to toggle between graphs. Looking in the upper left-hand corner of the screen will show you whether you are looking at data points for Plot1 or points from one of the equations, Y1 or Y2.



### Predicting the value of the derivative

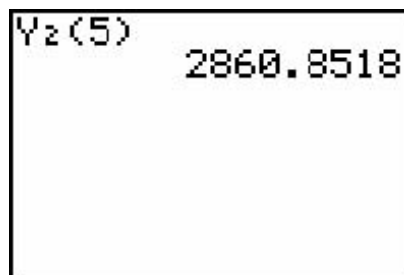
A second way to determine the expected number of internet phone subscribers for a given year is to evaluate the Y= function. Press  $\boxed{VARS}$   $\boxed{\rightarrow}$   $\boxed{ENTER}$  select Y2 and press  $\boxed{ENTER}$  to get to the screen at the right.

```

Y2

```

Following the Y2 enter  $\boxed{1} \boxed{5} \boxed{0}$  and press  $\boxed{\text{ENTER}}$ .  
This represents the expected internet phone subscribers for 2005.



Finding the maximum of the derivative graph

Press  $\boxed{2\text{nd}} \boxed{\text{TRACE}}$ , select 4:maximum, and press  $\boxed{\text{ENTER}}$ .  
Use  $\boxed{\downarrow}$  or  $\boxed{\uparrow}$  to move the cursor to Y2. Use  $\boxed{\leftarrow}$  to move the cursor to the left of the maximum point of Y2 and press  $\boxed{\text{ENTER}}$ . Use the  $\boxed{\rightarrow}$  to move the cursor to the right of the maximum point of Y2 and press  $\boxed{\text{ENTER}}$ . Press  $\boxed{\text{ENTER}}$  again since there is one maximum point. The values at the bottom of the screen represent the ordered pair for the maximum of Y2.

