

Calculator Instructions

Texas Instruments TI-*n*spire

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GETTING STARTED

Pressing  takes you to the **home screen**, where you can choose which application you wish to use.

The TI-nspire organises any work done into **pages**. Every time you start a new application, a new page is created. You can navigate back and forth between the pages you have worked on by pressing

  or  .

Press   **1: Add Calculator** to open the Calculator application. This is where most of the basic calculations are performed.

SECONDARY FUNCTION KEY

The secondary function of each key is displayed in grey above the primary function. It is accessed by pressing the  key followed by the key corresponding to the desired secondary function.

A

BASIC FUNCTIONS

GROUPING SYMBOLS (BRACKETS)

The TI-nspire has bracket keys that look like  and .

Brackets are regularly used in mathematics to indicate an expression which needs to be evaluated before other operations are carried out.

For example, to evaluate $2 \times (4 + 1)$ we type 2   4  1  .

We also use brackets to make sure the calculator understands the expression we are typing in.

For example, to evaluate $\frac{2}{4+1}$ we type 2   4  1  .

If we typed 2  4  1  the calculator would think we meant $\frac{2}{4} + 1$.

In general, it is a good idea to place brackets around any complicated expressions which need to be evaluated separately.

POWER KEYS

The TI-nspire has a power key that looks like . We type the base first, press the power key, then enter the index or exponent.

For example, to evaluate 25^3 we type 25  3 .

Numbers can be squared on the TI-nspire using the special key .

For example, to evaluate 25^2 we type 25  .

ROOTS

To enter roots on the TI-*nspire* we need to use the secondary function **ctrl** .

We enter square roots by pressing **ctrl** **x²** .

For example, to evaluate $\sqrt{36}$ we press **ctrl** **x²** 36 **enter** .

You can press the right arrow key **▸** to move the cursor out of the square root sign. For example, to evaluate $\sqrt{18} + 5$ we type **ctrl** **x²** 18 **▸** **+** 5 **enter** .

Higher roots are entered by pressing **ctrl** **^** , which creates the  template.

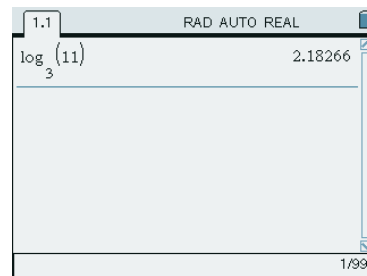
Enter the root number in the first entry, and the number you wish to find the root of in the second entry. Use the arrow keys to navigate around the template.

LOGARITHMS

We can perform operations involving logarithms using the **log** function, which is accessed by pressing **ctrl** **10^x** .

Put the base number in the first entry, and the number you wish to find the logarithm of in the second entry.

For example, to find $\log_3 11$ press **ctrl** **10^x** 3 **▸** 11 **enter** .



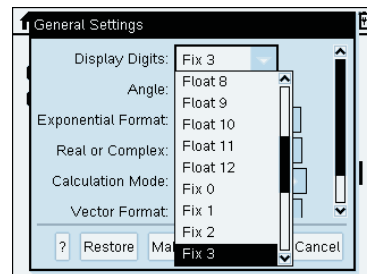
ROUNDING OFF

You can instruct the TI-*nspire* to round off values to a fixed number of decimal places.

For example, to round to 3 decimal places, from the home screen select **5 : Settings > 2 : Settings > 1 : General**. When the **Display Digits** drop-box is highlighted, press **▸** , then use the **▼** key to select *Fix 3*, and press **enter** .

For most operations, the default setting of *Float 6* is recommended.

You can return to the application you were working on by pressing **4 : Current** from the home screen.



DECIMAL EXPANSION OF FRACTIONS

If you press 5 **÷** 8 **enter** , the calculator will simply return the fraction $\frac{5}{8}$. To find the decimal expansion of $\frac{5}{8}$, press 5 **÷** 8 **ctrl** **enter** .

INVERSE TRIGONOMETRIC FUNCTIONS

The inverse trigonometric functions $\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$ are the secondary functions of **[sin]**, **[cos]**, and **[tan]** respectively. They are accessed by using the secondary function key **[ctrl]**.

For example, if $\cos x = \frac{3}{5}$, then $x = \cos^{-1}\left(\frac{3}{5}\right)$.

To calculate this, press **[ctrl]** **[cos]** 3 **[÷]** 5 **)** **[enter]**.

SCIENTIFIC NOTATION

Very large and very small numbers can be expressed in scientific notation, which is in the form $a \times 10^k$ where $1 \leq a < 10$ and k is an integer.

To evaluate 2300^3 , press 2300 **[^]** 3 **[enter]**. To express this in scientific notation, press **[ctrl]** **[enter]**. The answer displayed is 1.2167E10, which means 1.2167×10^{10} .

To express $\left(\frac{3}{20\,000}\right)^4$ in scientific notation, press **(** 3 **[÷]** 20 000 **)** **[^]** 4 **[ctrl]** **[enter]**. The answer is 5.0625×10^{-16} .

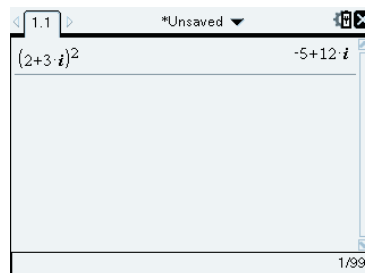
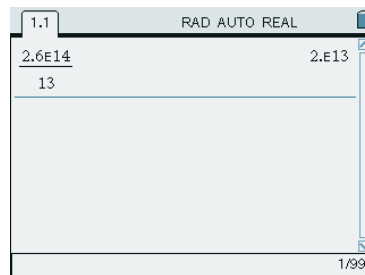
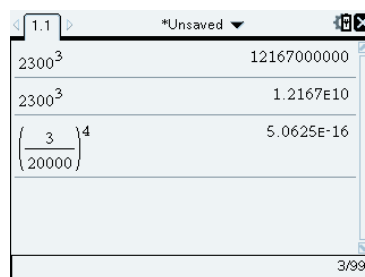
You can enter values in scientific notation using the **[EE]** key.

For example, to evaluate $\frac{2.6 \times 10^{14}}{13}$, press 2.6 **[EE]** 14 **[÷]** 13 **[enter]**. The answer is 2×10^{13} .

COMPLEX NUMBERS

We can enter the imaginary number i using the **[i]** key.

For example, to find $(2 + 3i)^2$, press **(** 2 **+** 3 **[i]** **)** **[x^2]** **[enter]**.



B

MEMORY

Utilising the memory features of your calculator allows you to recall calculations you have performed previously. This not only saves time, but also enables you to maintain accuracy in your calculations.

SPECIFIC STORAGE TO MEMORY

Values can be stored into the variable letters A, B, ..., Z. Storing a value in memory is useful if you need that value multiple times.

Suppose we wish to store the number 15.4829 for use in a number of calculations. To store this number in variable A, type in the number then press **ctrl** **var** (sto►) **A** **enter**.

We can now add 10 to this value by pressing **A** **+** 10 **enter** or cube this value by pressing **A** **^** 3 **enter**.

The image shows a TI-Nspire calculator screen with the following content:

1.1 RAD AUTO REAL	
15.4829 → a	15.4829
a + 10	25.4829
a ³	3711.56
3/99	

ANS VARIABLE

The variable **Ans** holds the most recent evaluated expression, and can be used in calculations by pressing **ctrl** **(-)**.

For example, suppose you evaluate 3×4 , and then wish to subtract this from 17. This can be done by pressing 17 **-** **ctrl** **(-)** **enter**.

If you start an expression with an operator such as **+**, **-**, etc, the previous answer **Ans** is automatically inserted ahead of the operator. For example, the previous answer can be doubled simply by pressing **×** 2 **enter**.

RECALLING PREVIOUS EXPRESSIONS

Pressing the **▲** key allows you to recall and edit previously evaluated expressions.

To recall a previous expression, press the **▲** key until the desired expression is highlighted, and press **enter**. The expression then appears in the current entry line, where it can be edited.

C

LISTS

Lists are used for a number of purposes on the calculator. They enable us to store sets of data, which we can then analyse and compare.

In order to perform many of the operations involving data lists on the TI-*nspire*, you need to **name** your lists as you define them.

CREATING A LIST

Pressing **ctrl** **1** **4 : Lists & Spreadsheet** takes you to the **list editor** screen.

To enter the data $\{2, 5, 1, 6, 0, 8\}$ into **List A**, start by moving the cursor to the first entry of **List A**. Press **2** **enter** **5** **enter** and so on until all the data is entered.

Move the cursor to the heading of **List A** and use the green alphabet keys to enter a name for the list, for example *data*.

	A	B	C	D
1.1	RAD AUTO REAL			
	data			
1	2			
2	5			
3	1			
4	6			
5	0			
A	data			

DELETING LIST DATA

To delete a list of data from the list editor screen, move the cursor to the heading of that list, and press **▲** to highlight the whole column. Press **←** to delete the list.

REFERENCING LISTS

Once you have named a list, you can use that name to reference the list in other operations.

Suppose you want to add 2 to each element of the *data* list we created in the above example, and display the results in **List B**.

Move the cursor to the second row of **List B**, and press **=** *data*

+ **2** **enter** .

	A	B	C	D
1.1	RAD AUTO REAL			
	data			
1	2	=data+2		
2	5	7		
3	1	3		
4	6	8		
5	0	2		
6	8	10		
B1		=4		

D

SOLVING SIMULTANEOUS EQUATIONS

To solve
$$\begin{cases} x + 2y + z = 2 \\ 3x - 4y - 2z = 11 \\ -x - 2y + 3z = -10 \end{cases}$$
 press **menu** from the

Calculator application and select **3 : Algebra > 2 : Solve System of Linear Equations**. Set up the screen as shown, then press **enter** .

1.1 *Unsaved

Solve a System of Linear Equations

Number of equations: 3

Variables: x,y,z

Enter variable names separated by commas

OK Cancel

0/99

Enter the equations as shown, then press **enter** .

So, the solutions are $x = 3$, $y = \frac{1}{2}$, and $z = -2$.

1.1 *Unsaved

linSolve $\begin{cases} x+2y+z=2 \\ 3x-4y-2z=11 \\ -x-2y+3z=-10 \end{cases} \{x,y,z\}$

$\left\{ 3, \frac{1}{2}, -2 \right\}$

1/99

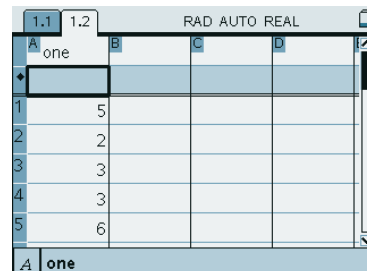
E

STATISTICS

Your graphics calculator is a useful tool for analysing data and creating statistical graphs.

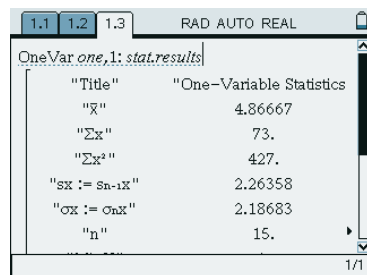
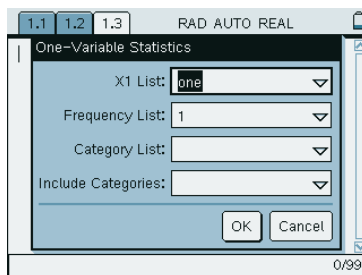
We will first produce descriptive statistics and graphs for the data set: 5 2 3 3 6 4 5 3 7 5 7 1 8 9 5.

Enter the data into **List A** and name this list *one*.



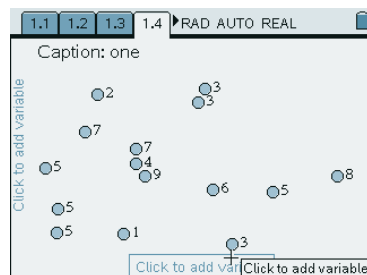
To obtain the descriptive statistics, press **ctrl** **1** : **Add Calculator** to open the Calculator application, press **menu**, then select **6 : Statistics > 1 : Stat Calculations ... > 1 : One-Variable Statistics**.

Press **enter** to choose 1 list. Select *one* from the **X1 List** drop-box, and press **enter**.



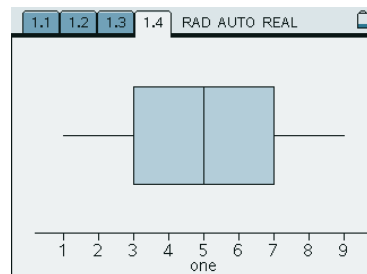
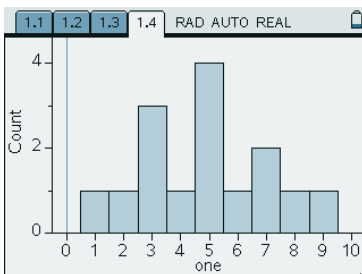
We will now draw some statistical graphs for the data. Press

ctrl **5** : **Data & Statistics** to open the Data and Statistics application. You will see the data points randomly scattered on the screen. Move the cursor to the bottom of the screen until the "Click to add variable" box appears. Press **enter**, then select *one*. The points will order themselves into a dotplot along the horizontal axis.



To obtain a vertical bar chart of the data, press **menu**, then select **1 : Plot Type > 3 : Histogram**.

To obtain a boxplot of the data, press **menu**, then select **1 : Plot Type > 2 : Box Plot**.



We will now add a second set of data, and compare it to the first.

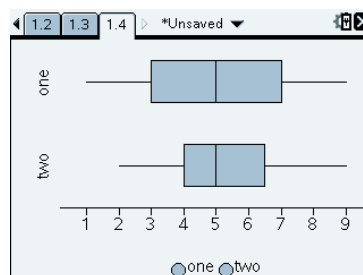
Use the **ctrl** **◀** command to return to the page containing the list of data.

Enter the set 9 6 2 3 5 5 7 5 6 7 6 3 4 4 5 8 4 into **List B**, and name the list *two*.

Use the **ctrl** **▶** command to navigate back to the page containing the boxplot of *one*.

To view boxplots of both data sets, press **menu**, then select **2 : Plot Properties > 5 : Add X Variable**. Select *two* from the box.

	1.1	1.2	1.3	1.4	RAD	AUTO	REAL
A	one						
B	two						
13		8	4				
14		9	4				
15		5	5				
16			8				
17			4				
B17		4					



STATISTICS FROM GROUPED DATA

To obtain descriptive statistics for the data in the table alongside, enter the data values into **List A**, and label the list *data*. Enter the frequency values into **List B**, and label the list *freq*.

<i>Data</i>	<i>Frequency</i>
2	3
3	4
4	8
5	5

The 'One-Variable Statistics' dialog box is shown. The 'X1 List' is set to 'data' and the 'Frequency List' is set to 'freq'. The 'Category List' and 'Include Categories' fields are empty. 'OK' and 'Cancel' buttons are at the bottom right.

Press **ctrl** **I** **1** to open the Calculator application. Press **menu**, then select **6 : Statistics > 1 : Stat Calculations > 1 : One-Variable Statistics**. Press **enter** to choose 1 list. Select *data* from the **X1 List** drop-box and *freq* from the **Frequency List** drop-box, then press **enter**.

OneVar data,freq: stat.results	
"Title"	"One-Variable Statist
" $\bar{x}$ "	3.75
" Σx "	75.
" Σx^2 "	301.
" $s_x := s_{n-1}x$ "	1.01954582252
" $\sigma_x := \sigma_{n}x$ "	0.993730345718
"n"	20.

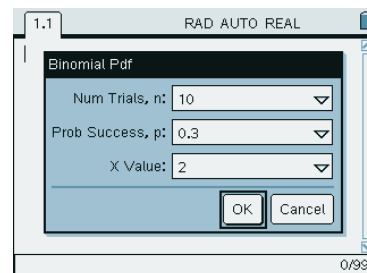
F

PROBABILITY

BINOMIAL PROBABILITIES

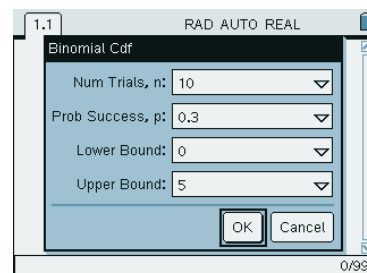
To find $P(X = 2)$ for $X \sim B(10, 0.3)$, press **ctrl** **1** to open the Calculator application. Press **menu** then select **5 : Probability > 5 : Distributions > D : Binomial Pdf ...**

Press 10 **tab** 0.3 **tab** 2 **tab** **enter**. The result is 0.233.



To find $P(X \leq 5)$ for $X \sim B(10, 0.3)$, press **menu** from the Calculator application and select **5 : Probability > 5 : Distributions > E : Binomial Cdf ...**

Press 10 **tab** 0.3 **tab** 0 **tab** 5 **tab** **enter**. The result is 0.953.

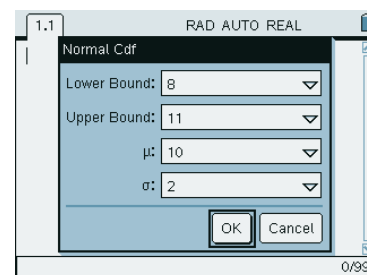


NORMAL PROBABILITIES

Suppose X is normally distributed with mean 10 and standard deviation 2.

To find $P(8 \leq X \leq 11)$, press **menu** from the Calculator application and select **5 : Probability > 5 : Distributions > 2 : Normal Cdf ...**

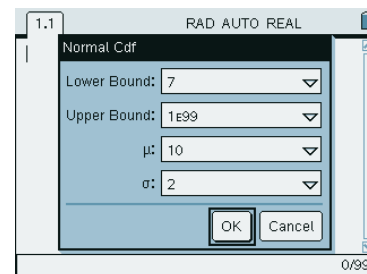
Press 8 **tab** 11 **tab** 10 **tab** 2 **tab** **enter**. The result is 0.533.



To find $P(X \geq 7)$, press **menu** from the Calculator application and select

5 : Probability > 5 : Distributions > 2 : Normal Cdf ...

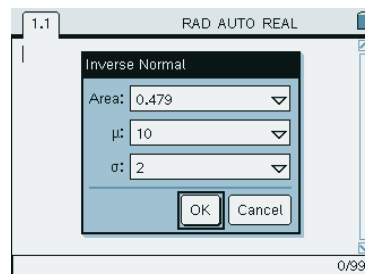
Set up the screen as shown, and select **OK**. The result is 0.933.



To find a such that $P(X \leq a) = 0.479$, press **menu** from the Calculator application and select

5 : Probability > 5 : Distributions > 3 : Inverse Normal ...

Press 0.479 **tab** 10 **tab** 2 **tab** **enter**. The solution is $a \approx 9.89$.

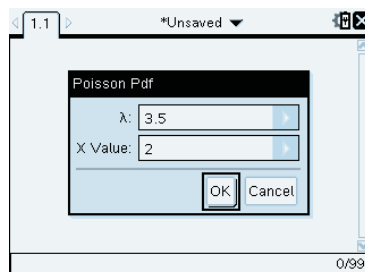


POISSON PROBABILITIES

Suppose X has a Poisson distribution with mean 3.5.

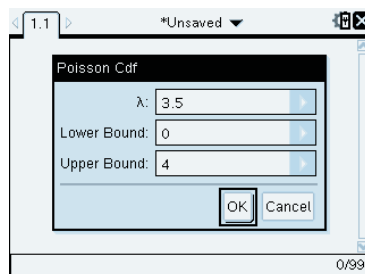
To find $P(X = 2)$, press **menu** from the Calculator application and select **5 : Probability > 5 : Distributions > H : Poisson Pdf ...**

Set up the screen as shown, and select **OK**. The result is 0.185.



To find $P(X \leq 4)$, press **menu** from the Calculator application and select **5 : Probability > 5 : Distributions > I : Poisson Cdf ...**

Set up the screen as shown, and select **OK**. The result is 0.725.



G

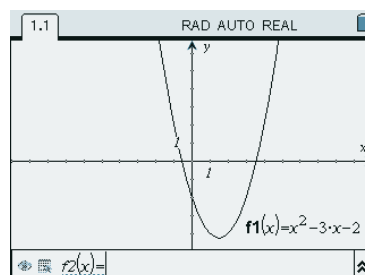
WORKING WITH FUNCTIONS

GRAPHING FUNCTIONS

Pressing **ctrl** **2 : Graphs** opens the Graphing application, where you can graph functions.

To graph the function $y = x^2 - 3x - 2$, press **(X)** **(x²)** **(-)** 3 **(X)** **(-)** 2 **enter**.

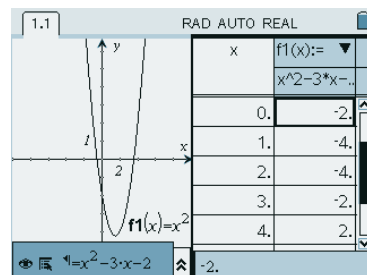
You can delete the functions you have graphed by pressing **menu**, then selecting **1 : Actions > 5 : Delete all**.



To view a table of values for the function, press **ctrl** **T**.

The page splits into two, with the graph on one side and the table of values on the other side.

You can delete the table by pressing **ctrl** **⏏**, then selecting **5 : Page Layout > 5 : Delete Application**.



ADJUSTING THE VIEWING WINDOW

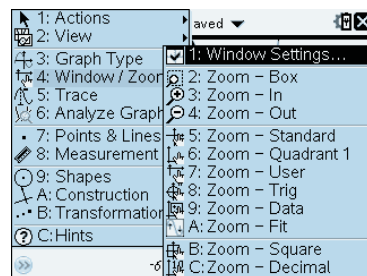
When graphing functions it is important that you are able to view all the important features of the graph. As a general rule it is best to start with a large viewing window to make sure all the features of the graph are visible. You can then make the window smaller if necessary.

To adjust the viewing window, press **menu** then select **4 : Window/Zoom**. The most useful options are:

1 : Window Settings : With this option you can set the minimum and maximum values for the x and y axes manually.

5 : Zoom-Standard : This option returns the viewing window to the default setting of $-10 \leq x \leq 10$, $-\frac{20}{3} \leq y \leq \frac{20}{3}$.

A : Zoom-Fit : This option scales the y -axis to fit the minimum and maximum values of the displayed graph within the current x -axis range.



Pressing **ctrl** **G** removes the function entry line, allowing you to use the full screen to view the graph.

Press **ctrl** **G** again to bring the function entry line back.

FINDING POINTS OF INTERSECTION

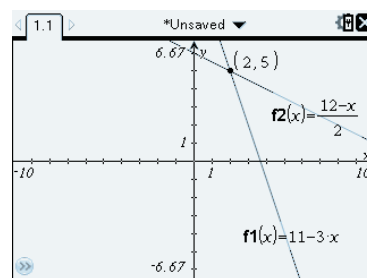
To find the intersection point of $y = 11 - 3x$ and $y = \frac{12 - x}{2}$,

store $y = 11 - 3x$ into $f_1(x)$ and $y = \frac{12 - x}{2}$ into $f_2(x)$.

Press **menu**, then select **6 : Analyze Graph > 4 : Intersection**.

Move the cursor to the left of the intersection point and press **enter**, then move the cursor to the other side and press **enter**.

The intersection point (2, 5) is displayed.

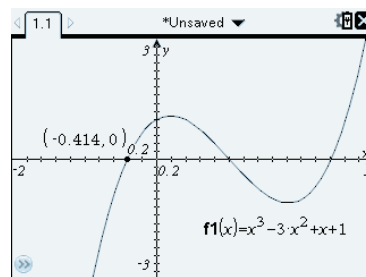


FINDING x -INTERCEPTS

To find the x -intercepts of $f(x) = x^3 - 3x^2 + x + 1$, store $x^3 - 3x^2 + x + 1$ into $f_1(x)$.

To find the x -intercepts, press **menu**, then select **6 : Analyze Graph > 1 : Zero**. Place the lower and upper bounds either side of the first x -intercept.

The first x -intercept $x \approx -0.414$ is given. Repeat this process to find the remaining x -intercepts $x = 1$ and $x \approx 2.414$.

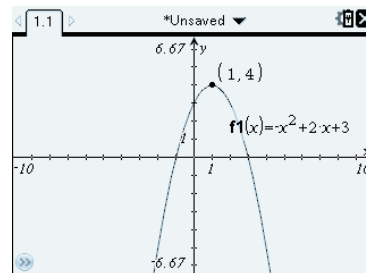


TURNING POINTS

To find the turning point or vertex of $y = -x^2 + 2x + 3$, store $-x^2 + 2x + 3$ into $f_1(x)$.

From the graph, the vertex is clearly a maximum, so press **menu**, then select **6 : Analyze Graph > 3 : Maximum**.

Place the lower and upper bounds either side of the vertex. The vertex is at $(1, 4)$.

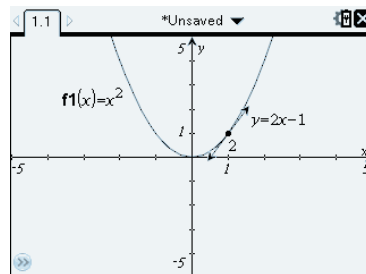
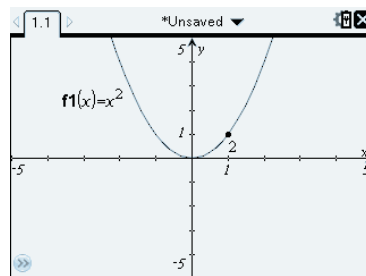


THE TANGENT TO A FUNCTION

To find the gradient of the tangent to $y = x^2$ when $x = 1$, we first draw the graph of $y = x^2$. Press **menu**, then select **6 : Analyze Graph > 5 : dy/dx**. Press **() 1 enter**. The tangent has a gradient of 2 at this point.

Press **menu**, then select **7 : Points & Lines > 7 : Tangent**. Move the cursor towards the point $(1, 1)$ until the phrase *point on* appears, then press **enter** to draw the tangent.

To find the equation of the tangent, press **esc** to exit the tangent command, and move the cursor over the tangent until the word *line* appears. Press **ctrl menu** and select **7 : Coordinates and Equations**. The tangent has equation $y = 2x - 1$.



DEFINITE INTEGRALS

To calculate $\int_1^3 x^2 dx$, we first draw a graph of $y = x^2$. Press **menu**, then select **6: Analyze Graph > 6: Integral**. Press **(** 1 **enter** to specify the lower bound, then **(** 3 **enter** to specify the upper bound.

So, $\int_1^3 x^2 dx = 8\frac{2}{3}$.

Alternatively, you can press **menu** from the Calculator application, select **4: Calculus > 2: Numerical Integral**, then set up the screen as shown.

