CASIO

Simply Calculate The Difference!

QUICK START GUIDE
fx-CG500

fx-CG500

Tap any icon to select the application.

Tap Menu at any time to return to the menu screen.

Tap to advance to the next page.

Tap Main at any time to return to the **Main** menu.

In any menu application, press [Keyboard] for the onscreen keyboard.

Press [Clear] to power on. Then press [Clear] to clear commands. Press [Shift] [Clear] to power off.

Press these keys for numbers, basic operations, and the most common variables

Press [EXE] to execute commands.

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Simply Calculate The Difference!

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INDEX

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MAIN MENU

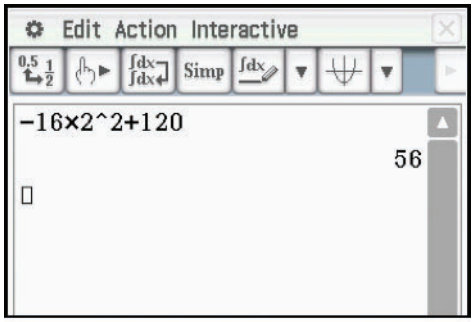
If an object, such as a ball, is dropped from a initial height, *c*, the height, *h*, in feet, as a function of time, *t*, in seconds, can be modeled by $h = -16t^2 + c$.

If the object is tossed upwards with an initial velocity, *v*, then the model becomes $h = -16t^2 + vt + c$. These models ignore air resistance.

1. If a ball is dropped from a height of 120 feet, compute the height after 2 seconds.

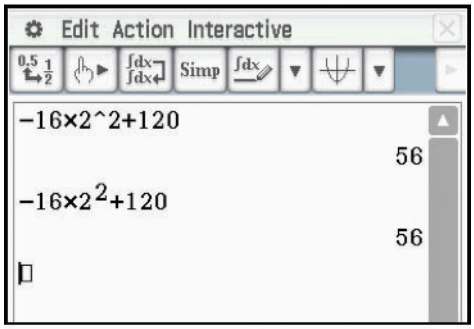
Tap Main $\sqrt{\alpha}$ for the **Main** menu.

Press (−) 1 6 × 2 ^ 2 + 1 2 0 EXE.



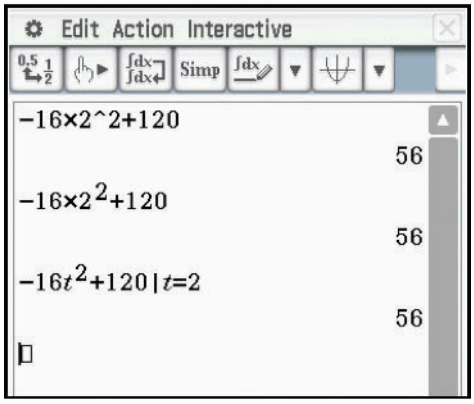
For a more mathematical display, the raised exponent template can be found on the **Math1** Keyboard.

Press (−) 1 6 × 2 Keyboard $\square^{\square}$ 2 ▶ + 1 2 0 EXE.



This expression can also be evaluated using a variable for substitution. A command in the form *expression* | *variable* = *value* means evaluate the expression with the given value(s) substituted for the variable(s).

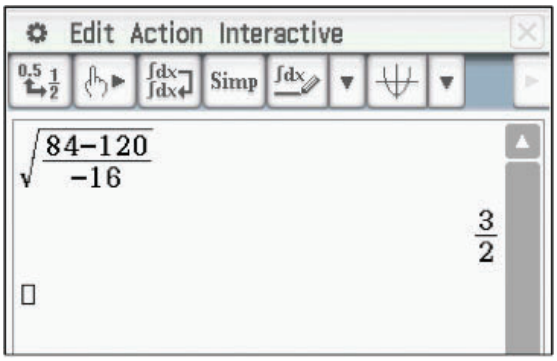
Press (−) 1 6 Keyboard Var *t* Math1 $\square^{\square}$ 2 ▶ + 1 2 0 Math3 | Var *t* = 2 EXE.



2. Compute the time when the height of the ball is 84 feet.

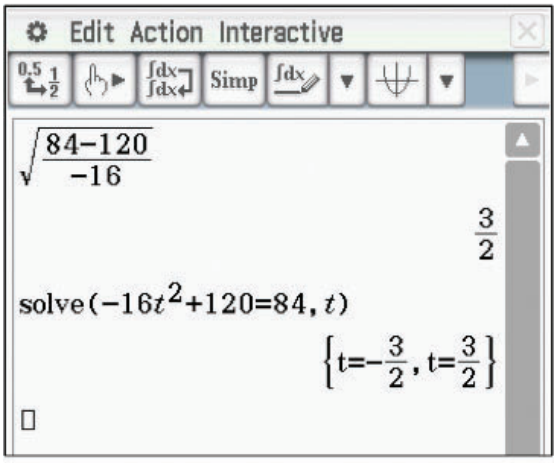
The value can be computed using the square root and fraction templates from **Math1**.

Tap [Keyboard] [√■] [□/□] [8] [4] [−] [1] [2] [0] [▼] [(−)] [1] [6] [EXE].



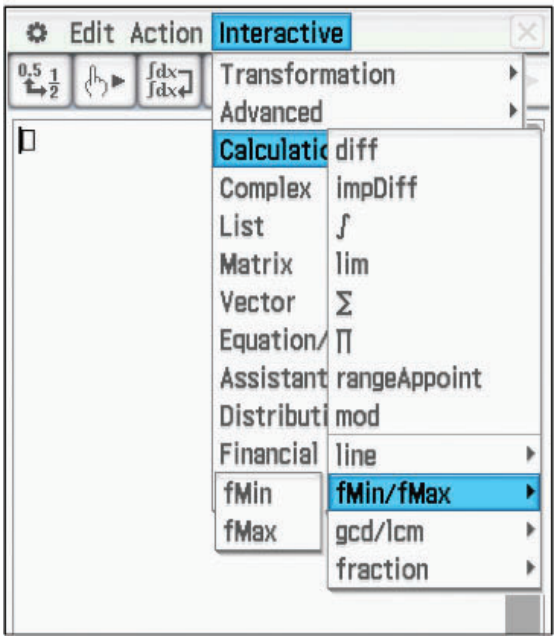
The value can also be computed using a **solve** command from **Math1**. The format is (*equation,variable*) even if there is only one variable in the equation.

Tap [Math1] [solve(] [(−)] [1] [6] [Var] [t] [Math1] [□■] [2] [▶] [+] [1] [2] [0] [=] [8] [4] [,] [Var] [t] [)] [EXE].

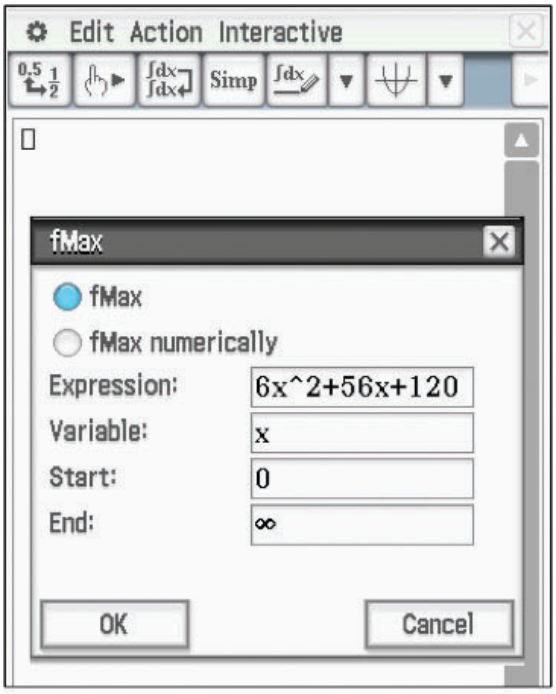


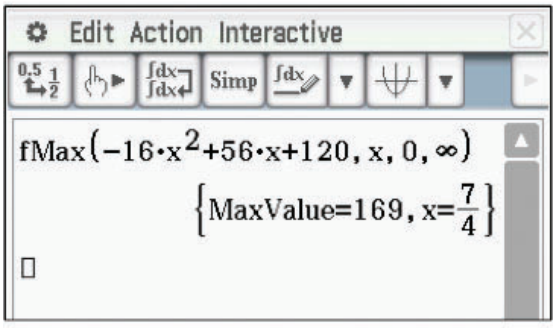
3. A ball is tossed upwards with an initial velocity of 56 feet/second, from an initial height of 120 feet. Compute the time and the height when the ball is at a maximum height.

Commands such as **fMax** are found under the **Interactive** and the **Action** menus. The **Interactive** commands open a dialogue box which gives prompts for the input. The **fMax** command uses *x* as the default variable, but another variable such as *t* can be used.



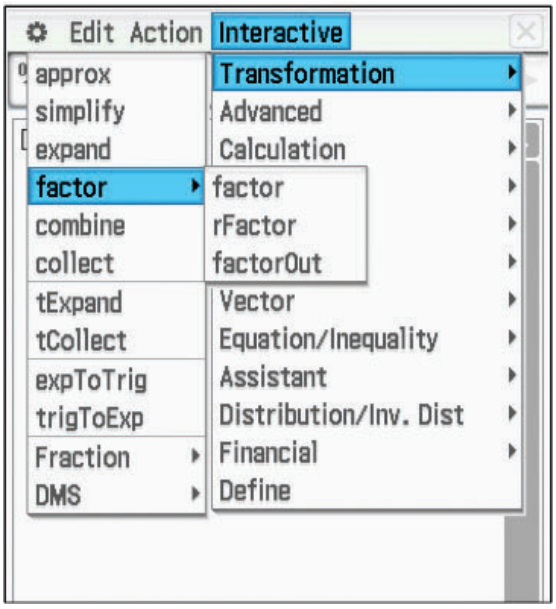
Tap **Interactive, Calculation, fMin/fMax, fMax** and complete the inputs as shown. (Part of the first coefficient, -16, has scrolled off the screen.) Then tap **OK**.



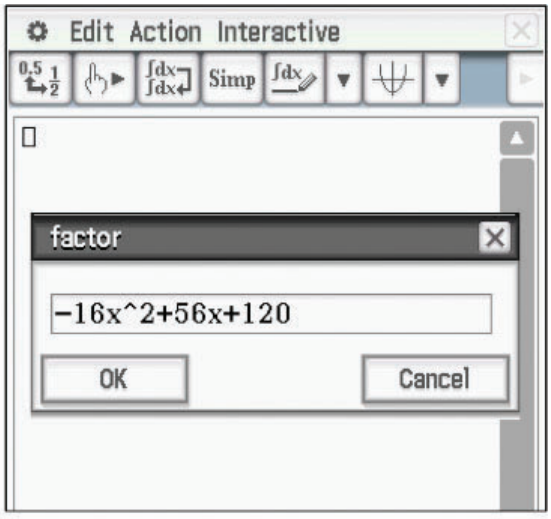


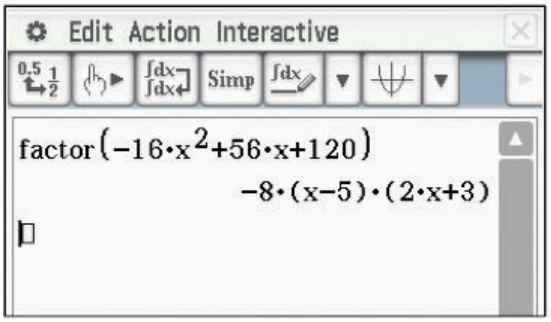
4. Rewrite the expression from Question 3 in factored form.

Tap **Interactive, Transformation, factor, factor.**



Enter the expression in the box. Then tap **OK**.

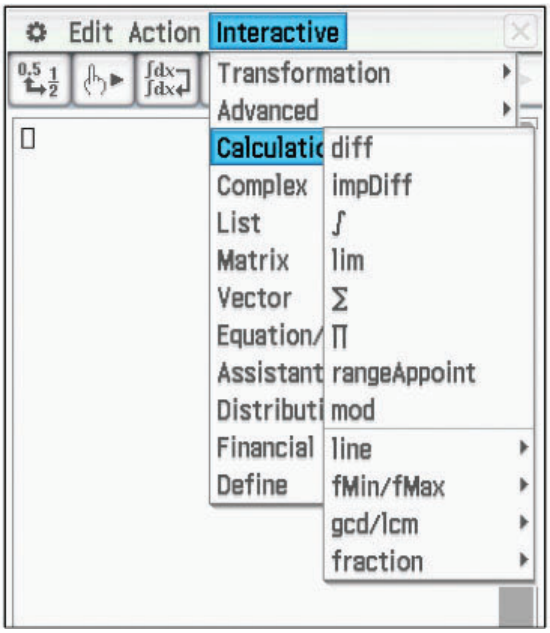




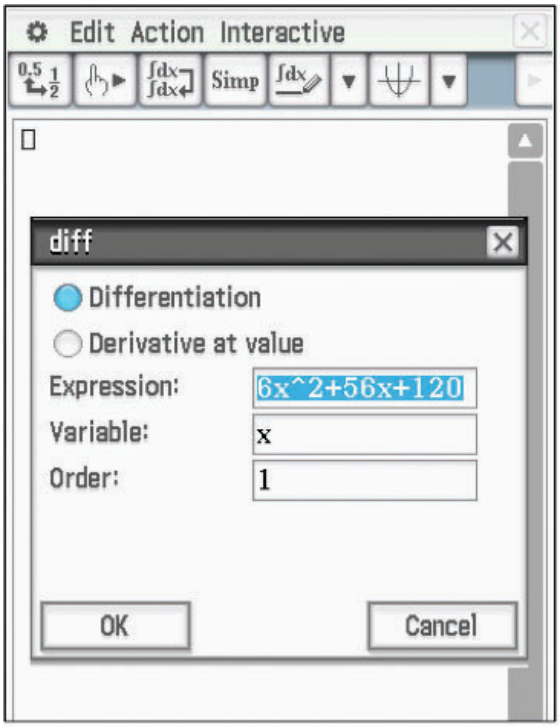
5. This model expresses height, or position, as a function of time. Construct a model for velocity as a function of time.

The velocity would be the derivative of the position function.

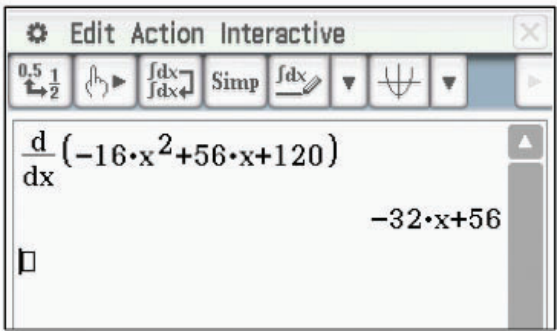
Tap **Interactive, Calculation, diff.**



Enter the expression in the box. (Again, part of the first coefficient, -16, has scrolled off the screen.) Then tap **OK**.

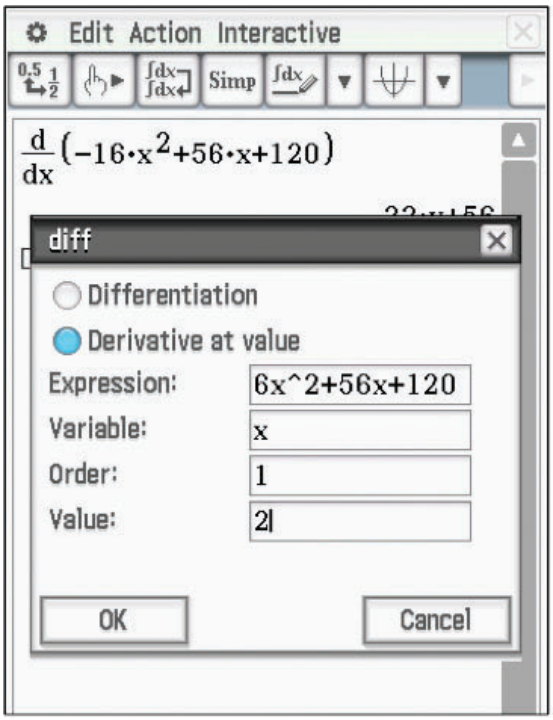


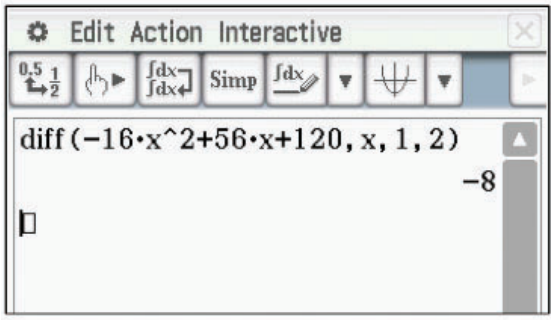
Alternately, the template for a derivative from **Math2** can be used; the result will look the same.



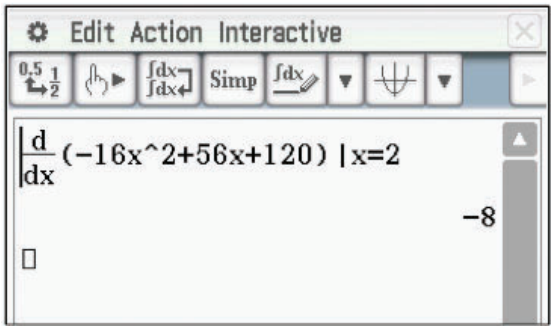
6. Compute the instantaneous velocity at time 2 seconds.

The only difference is to tap the bullet for **Derivative at value**, and to enter the value in the last box.

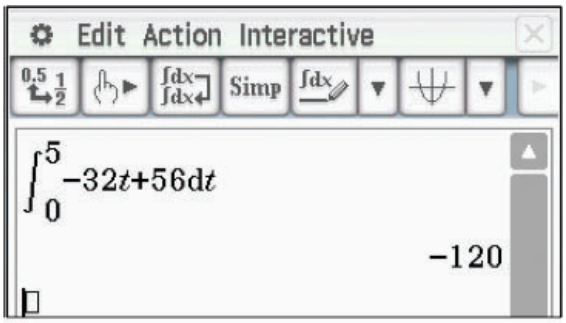




For a more intuitive display, use the derivative template from **Math2** and the “with” (|) command on **Math3**.



7. Compute the total net distance that the ball travels.



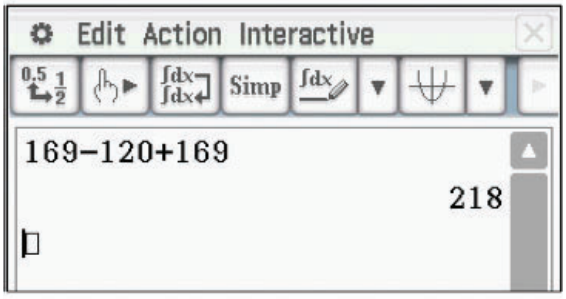
The ball had an initial height of 120 and fell to height of 0, so the net distance should be -120.

For a calculus connection, integrate the velocity function.

Tap [Keyboard] [Math2] [∫].

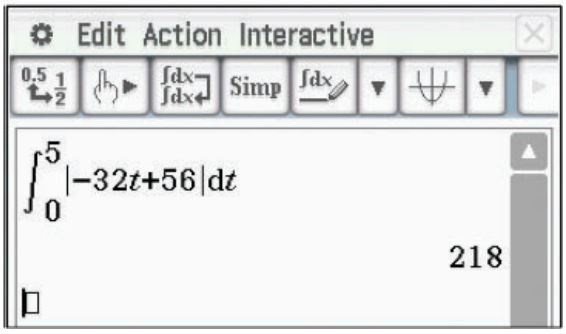
Enter the integrand, the variable, and the limits. The variable t can be found at [Math2], then tap [EXE].

8. Compute the total distance that the ball travels.



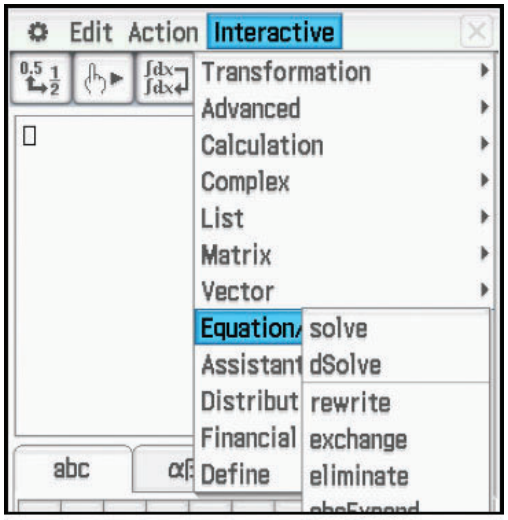
The initial height and the maximum height are known, so the total distance can be easily computed.

For another calculus connection, another integral can be used. The traditional approach is to use two integrals, but it is quicker to use the absolute value template, which can be found in [Math2].

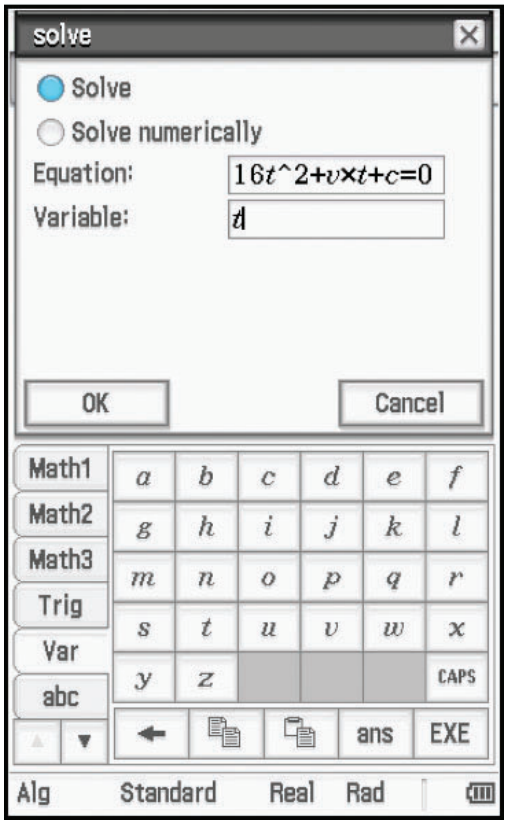


The ClassPad has a symbolic algebra system, sometimes called a computer algebra system, or CAS. An important distinction is a calculator using symbolic algebra can manipulate undeclared variables. The factoring example from Question 4 was an illustration. It is usually a good idea to tap **Edit**, then **Clear All Variables** to ensure that the variables do not have a value stored in memory. The next 2 questions illustrate additional symbolic algebra.

9. If a model for the height of a ball thrown upwards as a function of time is given by $h = -16t^2 + vt + c$, compute an expression for the time when the ball hits the ground.



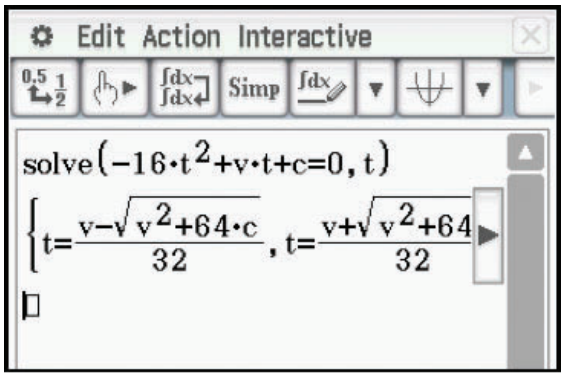
Tap **Interactive, Equation, solve.**



Enter the equation in the box by pressing Keyboard and tap Var to view the variables. The negative sign is to the left of 16 and has scrolled off.

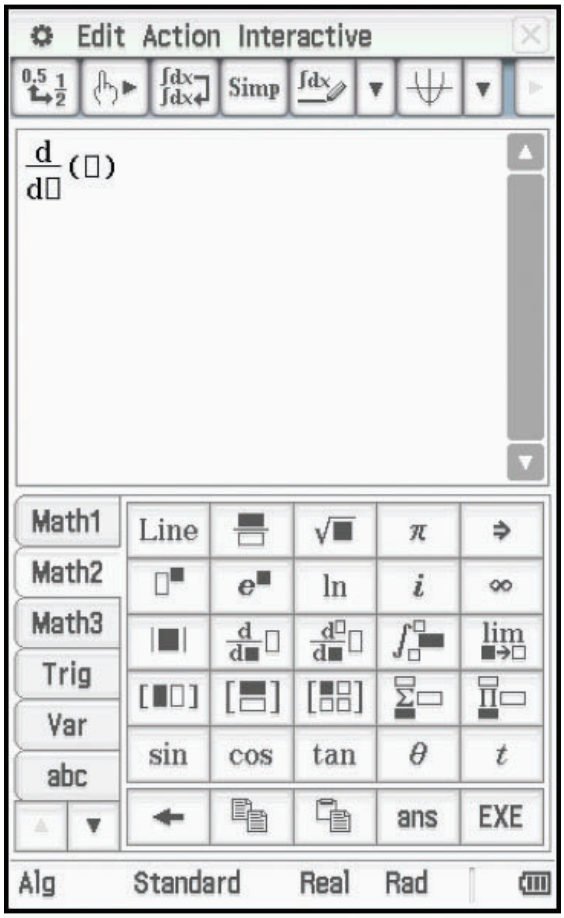
Enter the variable in the second box and tap EXE, or press the EXE key; then tap **OK**.

Both solutions are shown; the first solution would be negative and is not in the domain.

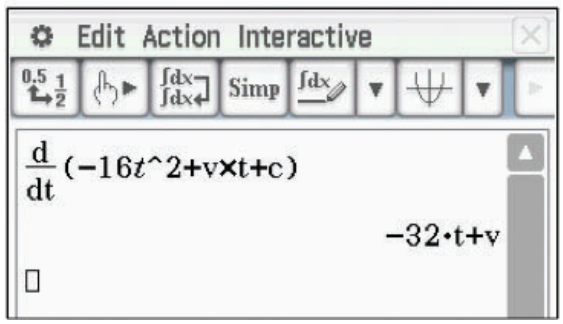


10. If a model for the height of a ball, thrown upwards, as a function of time, is given by $h = -16t^2 + vt + c$, compute an expression for velocity as a function of time.

Press [Keyboard] and tap [Math2] [d/d□].



Enter the expression and the variable and tap [EXE], or press the [EXE] key.



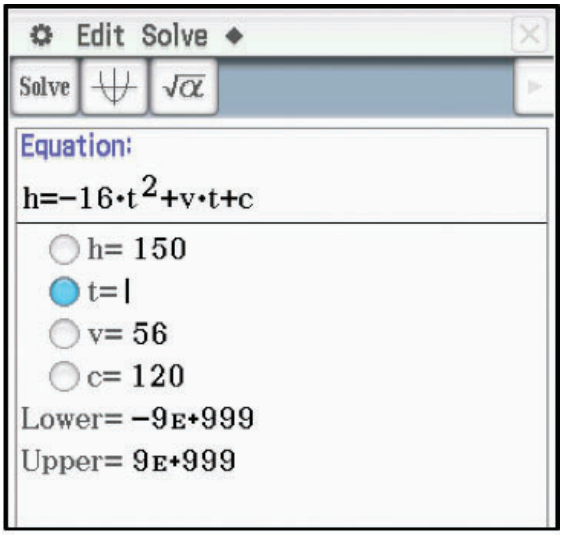
NUMERICAL SOLVE MENU

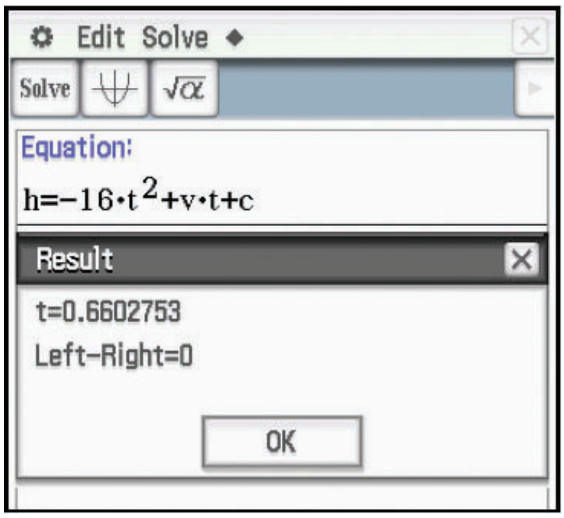
To use the Numerical Solve menu, tap the icon, enter the equation in the box, then enter values for the variables. Tap the bullet for the unknown variable and tap 1.

1. If a ball is tossed upwards with an initial velocity of 56 ft/sec, from an initial height of 120 feet, compute the times when the ball is at height 150 feet.

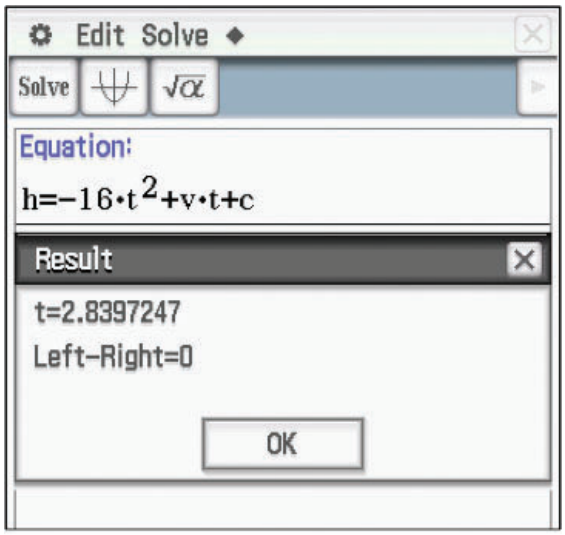
Enter the equation. Note that a times symbol is needed between **v** and **t** to distinguish the product from a single variable named vt.

Enter the values of 150, 56, and 120, select the bullet for **t** and tap Solve.



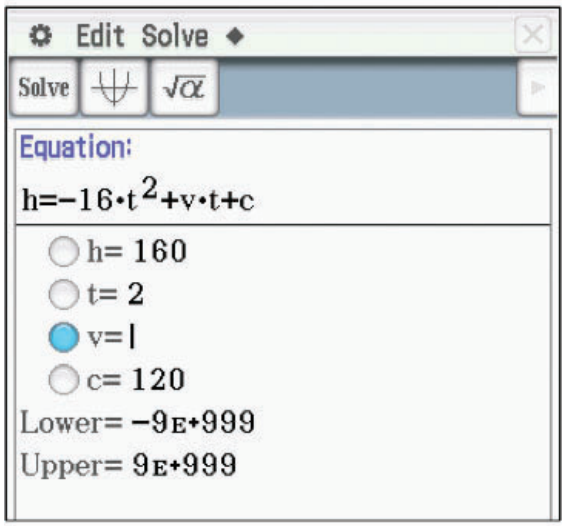


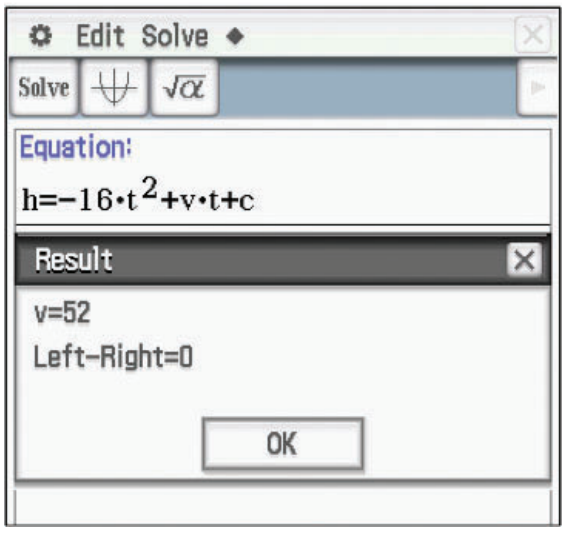
To compute the second value for **t**, enter an initial estimate, say 4, for **t** and tap Solve.



2. If a ball is tossed upwards from an initial height of 120 feet, and has height of 160 feet after 2 seconds, compute the initial velocity.

Enter the values of 160, 2, and 120, select the bullet for **v** and tap Solve.



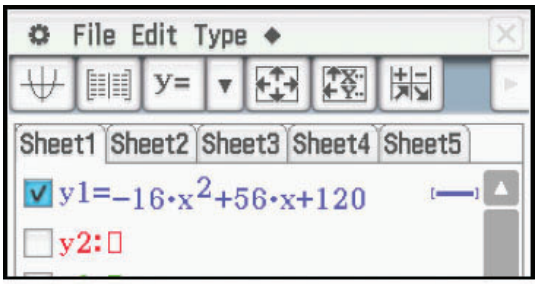


GRAPH & TABLE MENU

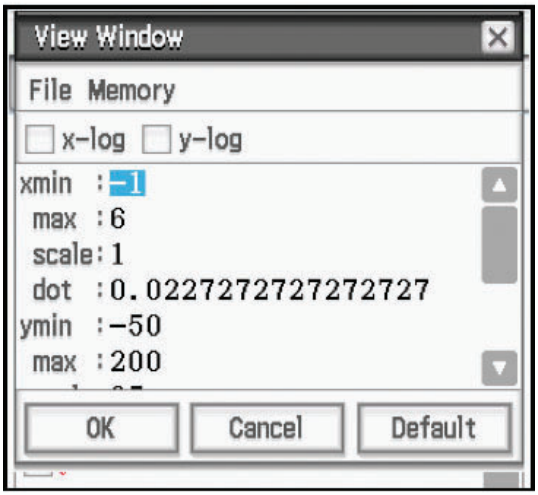
1. If a ball is tossed upwards with an initial velocity of 56 ft/sec from an initial height of 120 feet, graph the height of the ball, as a function of time.

From the Menu, select the Graph & Table icon.

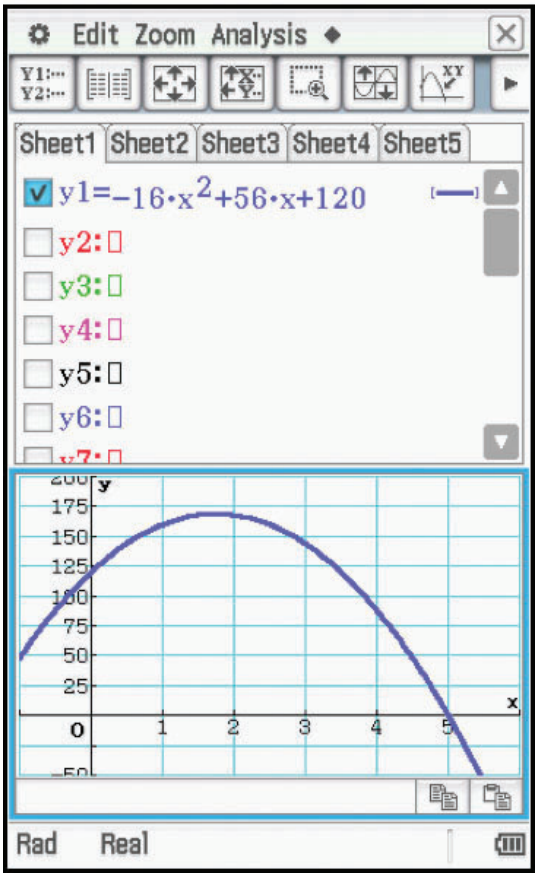
Enter the function as **y1**.



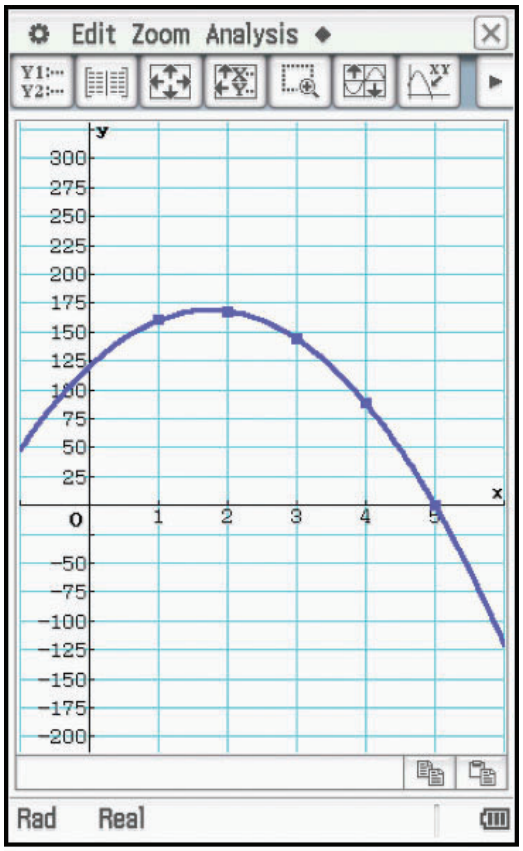
To set a window, tap [⊞], enter the values and tap **OK**.



Tap [⊞] to graph.

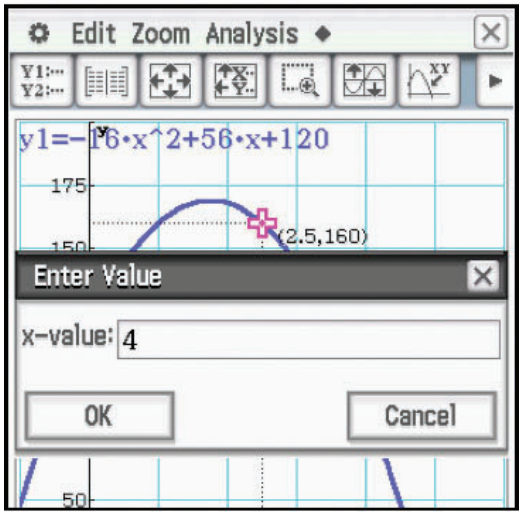


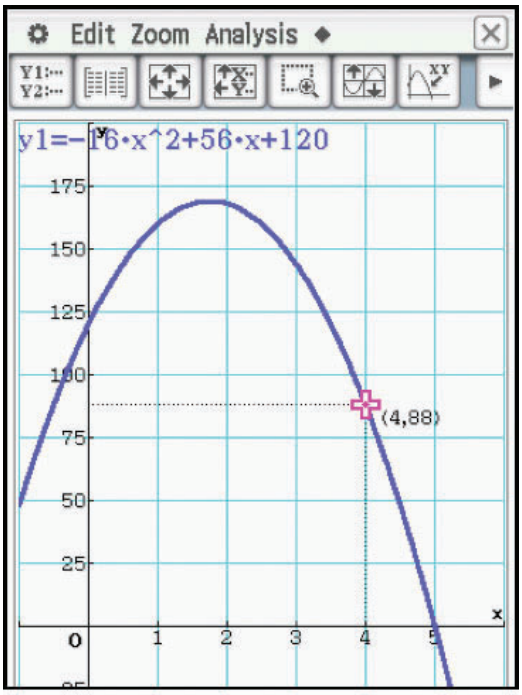
Tap Resize to plot the graph in a full screen. To adjust the window, use ▼ ▲ ◀ ▶ to scroll in any of the four directions, + to zoom in, and − to zoom out.



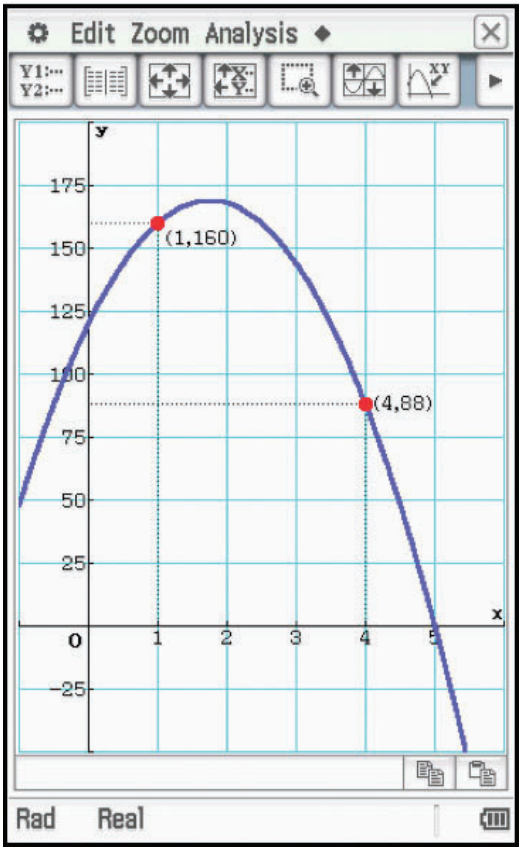
2. Compute the height of the ball at time 4 seconds.

To trace, tap XY. To find a specific value, press any one of the number keys; this will open a dialogue box. Then tap **OK**.



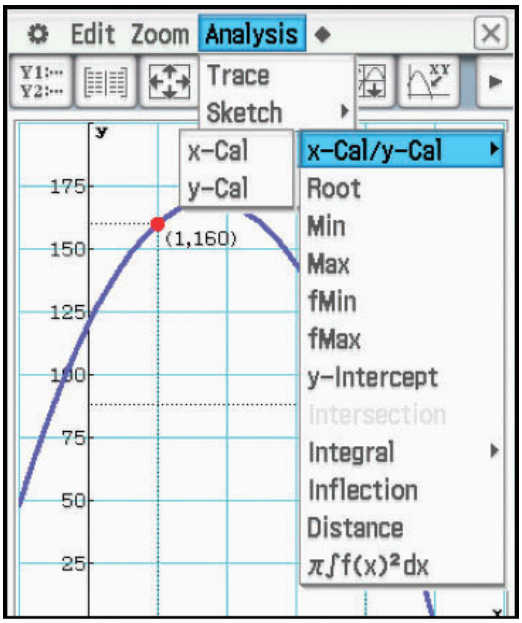


Press [EXE] to mark the point and keep the coordinates on the display.

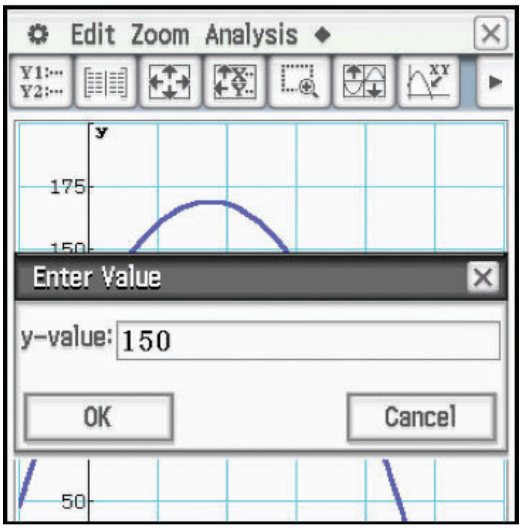


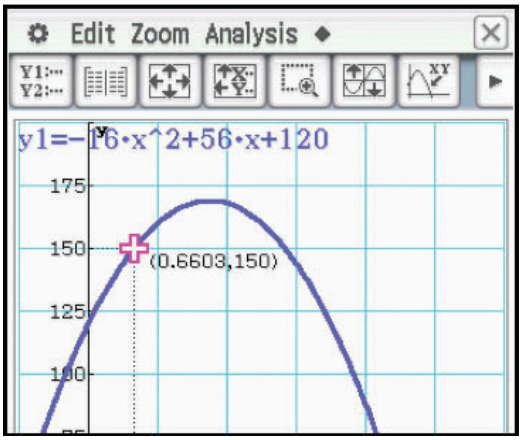
3. Compute the times when the ball is at height 150 feet.

Tap **Analysis, G-Solve, x-Cal/y-Cal, x-Cal**.



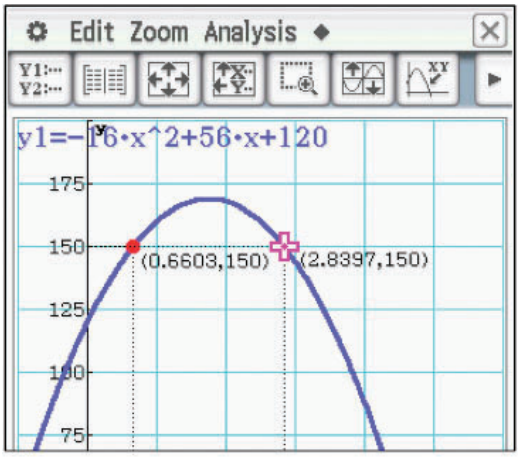
Enter the value for *y* and tap **OK**.





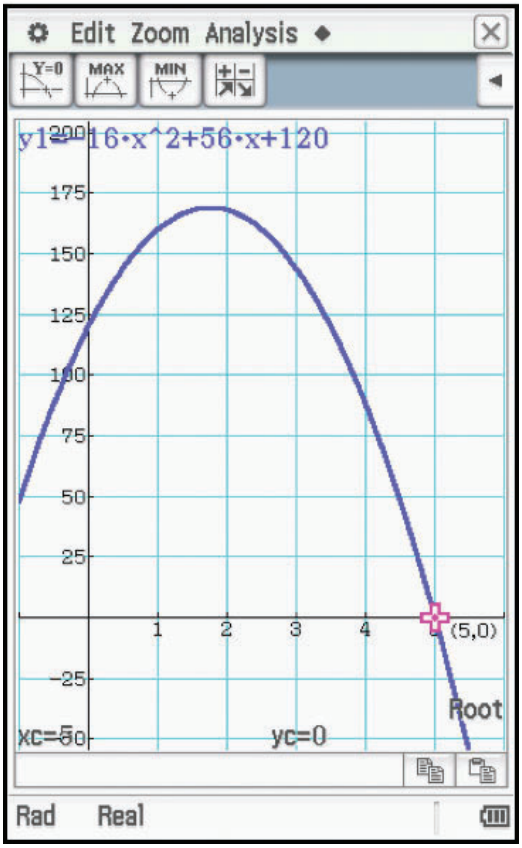
Press [EXE] to mark the point and keep the coordinates on the display.

Press [▶] to move to the second point.



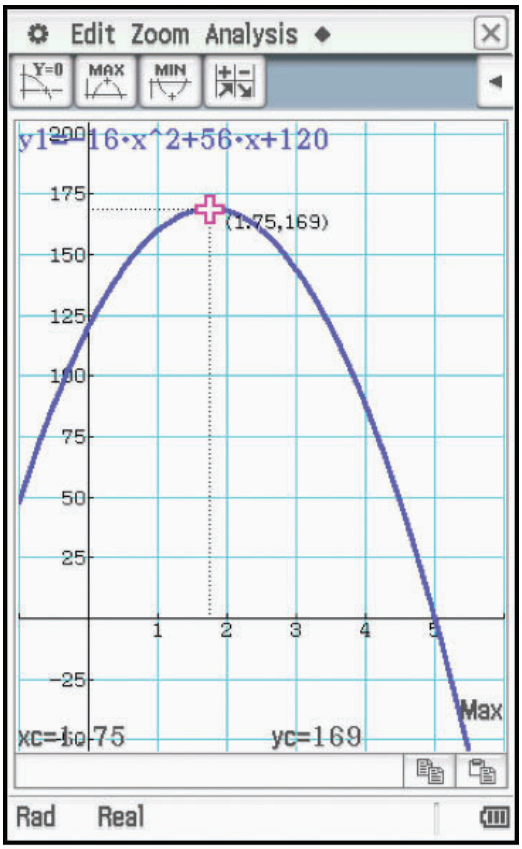
4. Compute the time when the ball hits the ground.

To compute an x-intercept, tap the [▶] icon at the top of the screen, then tap [Y=0].



5. Compute the coordinates of the maximum point.

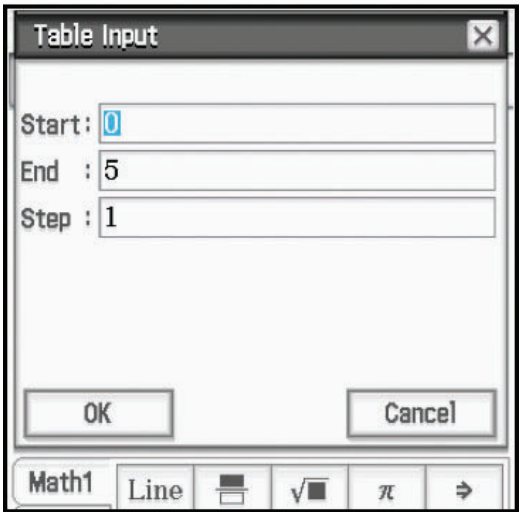
For a maximum point, tap the ▶ icon at the top of the screen, then tap MAX.



6. Construct a table of values for times {0, 1, 2, 3, 4, 5}.

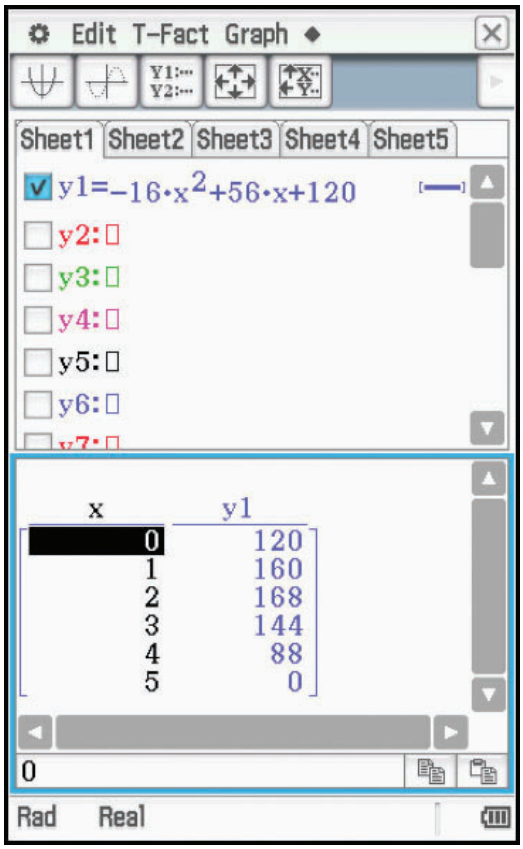
To set the table, tap .

Enter the values and tap **OK**.



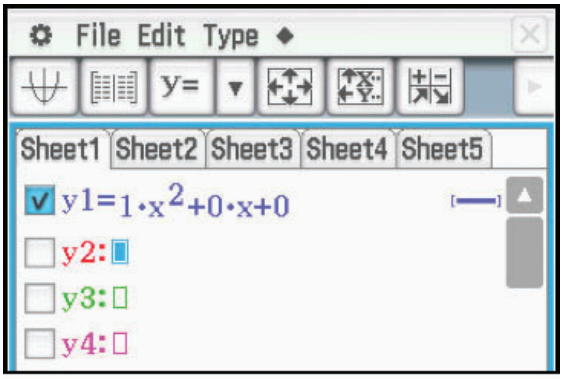
GRAPH & TABLE MENU

To view the table, tap .



These examples have used the coefficient of -16 for the t^2 term. The value of that coefficient could be different, based on conditions such as altitude. It would also be different on the moon or another planet, and of course, if different units for distance and/or time were used. A more general equation for the model would be $h = -\frac{1}{2}gt^2 + vt + c$. This is an application of the general quadratic $y = ax^2 + bx + c$.

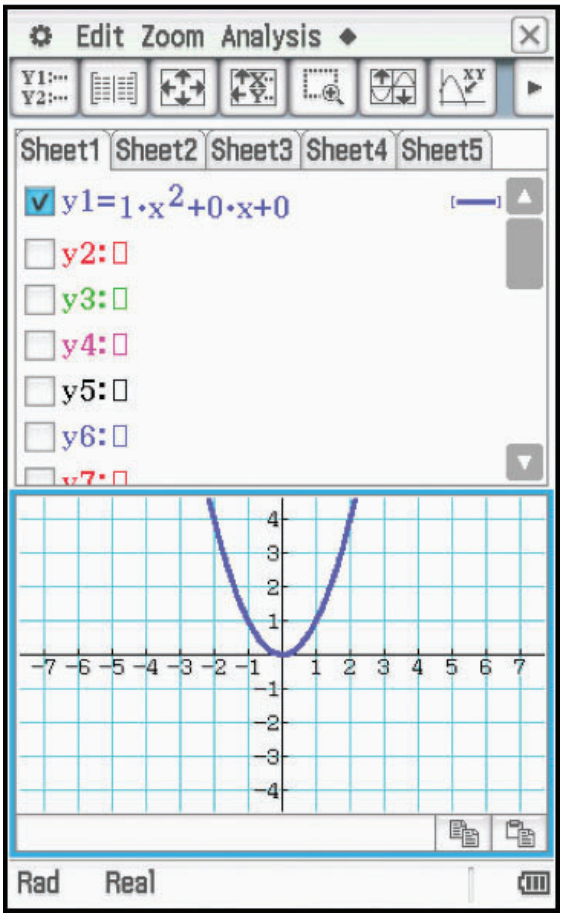
7. Explore the transformations of the graph of the function $y = ax^2 + bx + c$ as the coefficients a, b, c are changed.



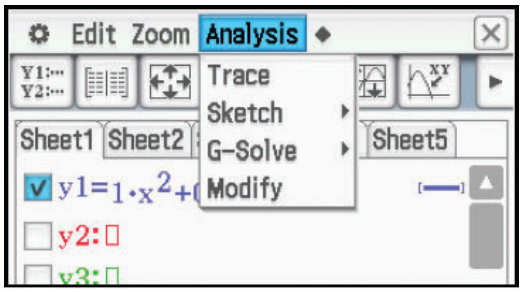
Enter the function $y1 = 1x^2 + 0x + 0$. The three coefficients are needed, as explained later.

Set the window to **Default**.

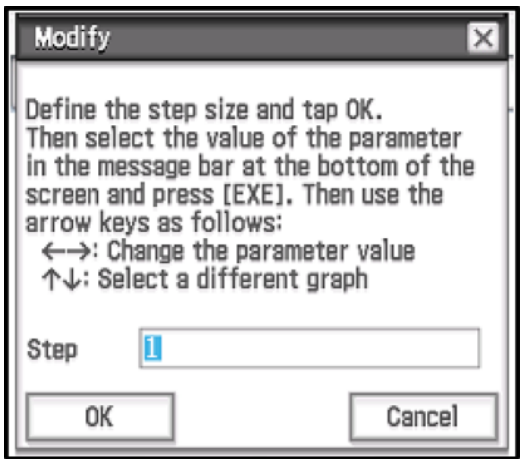
Graph the equation.



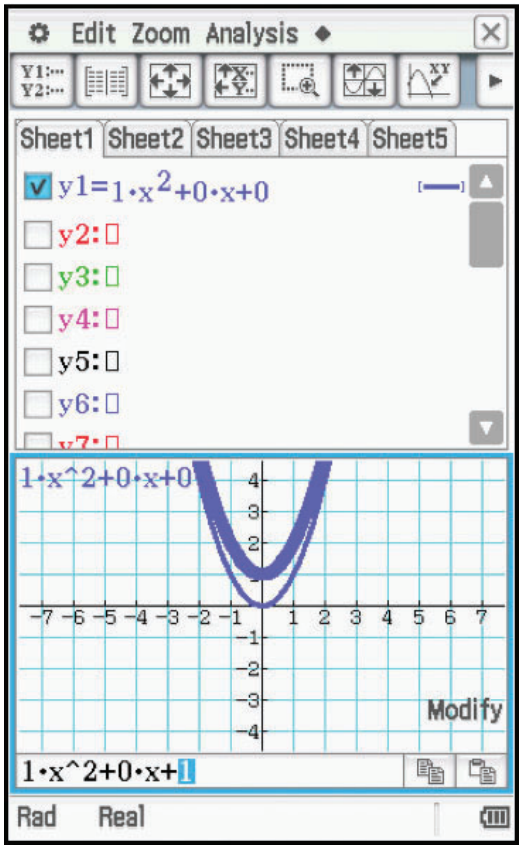
Tap **Analysis, Modify**.



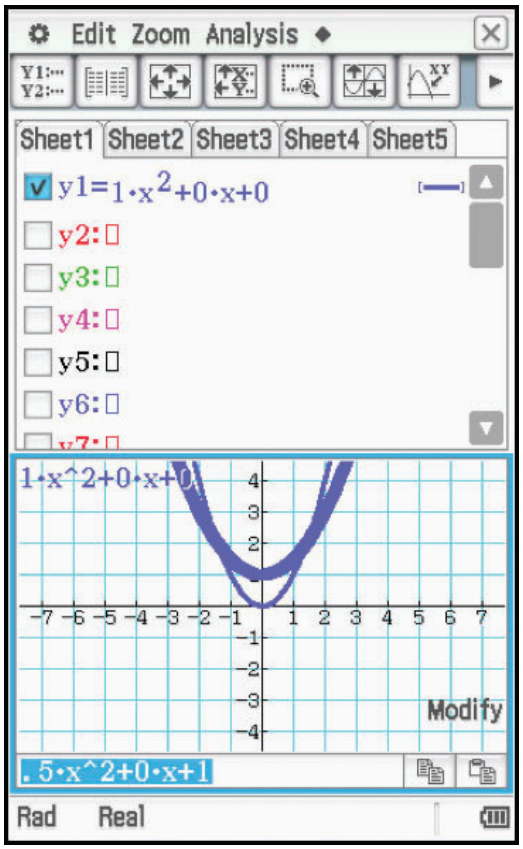
Enter 1 for the **Step** size and tap **OK**.



The word **Modify** appears on the graph screen, the graph is thicker, and the function rule appears in the message bar at the bottom. To explore the transformations, highlight one of the 3 coefficients and press [EXE] to select that coefficient. Now use [▶] and [◀] to increase or decrease the coefficient, respectively, and see the graph transform.



Alternately, to make changes without a step size, tap any one of the 3 coefficients, highlight it, enter a new value and press EXE.



CONIC MENU

The Conic Menu will graph conics in an (H, K) form, such as $x = A(y - K)^2 + H$, a standard form such as $x = Ay^2 + By + C$, or the general form, $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. The general form includes rotated conics. The easiest way to input the equation for the relation is to insert a form, and edit the coefficients.

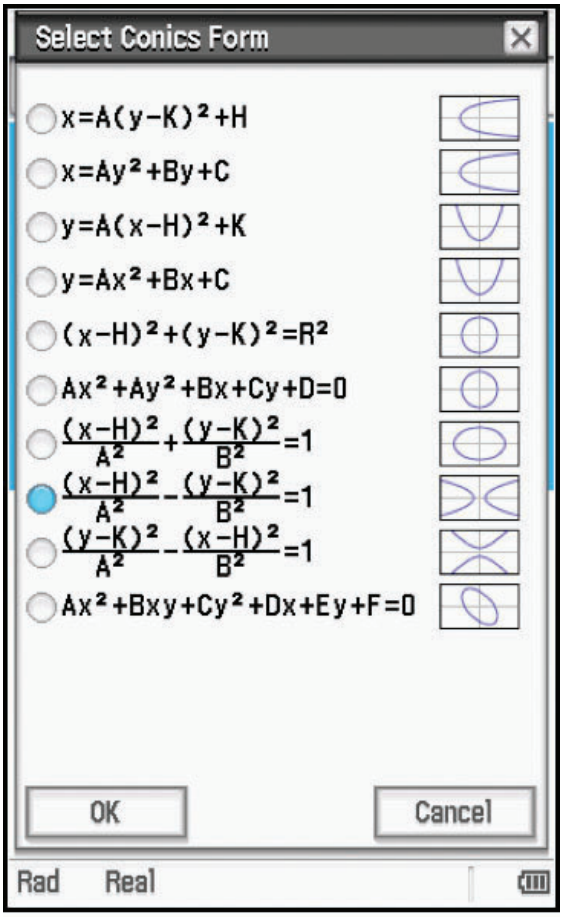
The G-Solve commands will display important features related to conics, such as a center, vertices, foci, and asymptotes.

1. Graph $\frac{(x - 2)^2}{6^2} - \frac{(y + 1)^2}{8^2} = 1$.

Tap Menu, then the Conics icon.

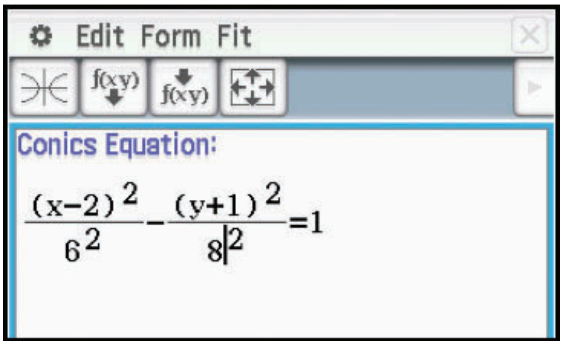
Tap f(xy).

Select the form for this hyperbola, and tap **OK**.

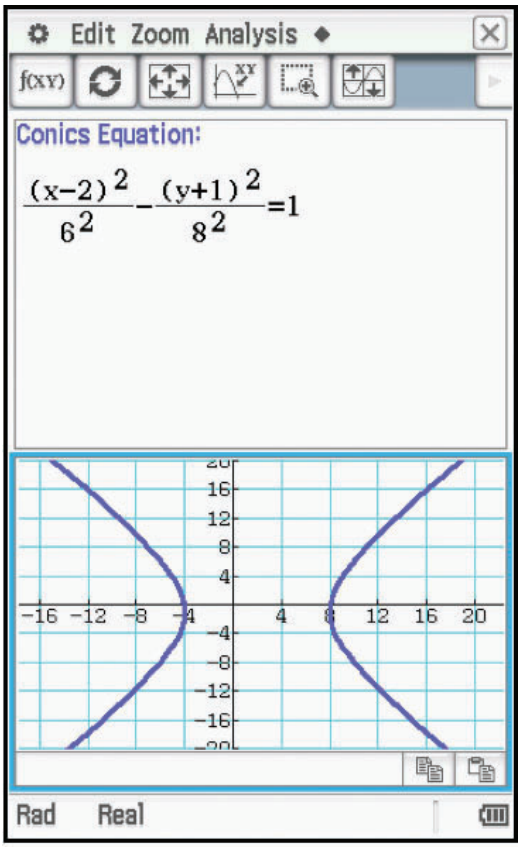


Edit the coefficients **A, B, H**, and **K**. Highlight the letter and press the key for the number. For **K**, also change from subtraction to addition.

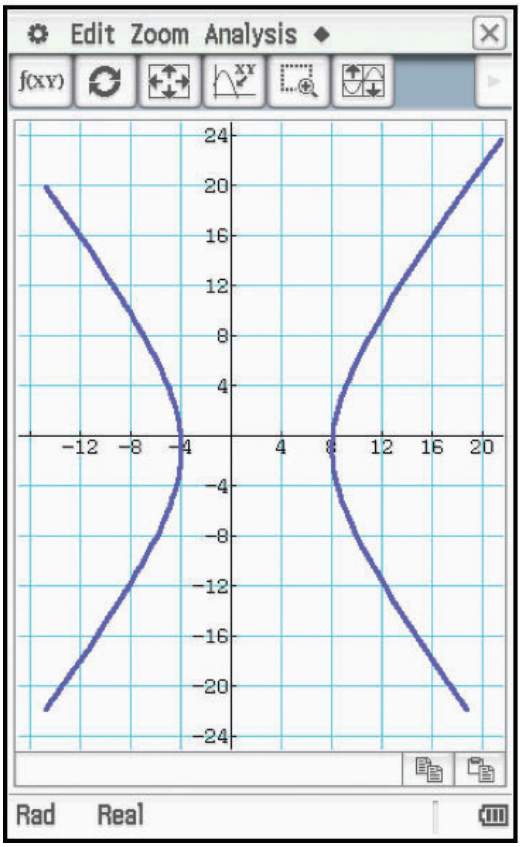
Tap to set the window, or use shortcuts after graphing.



Tap [graph] to graph.



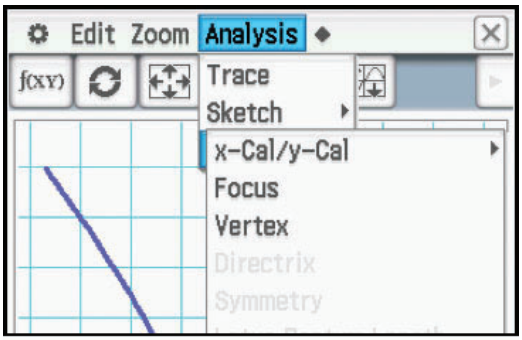
Tap Resize to plot the graph in a full screen.

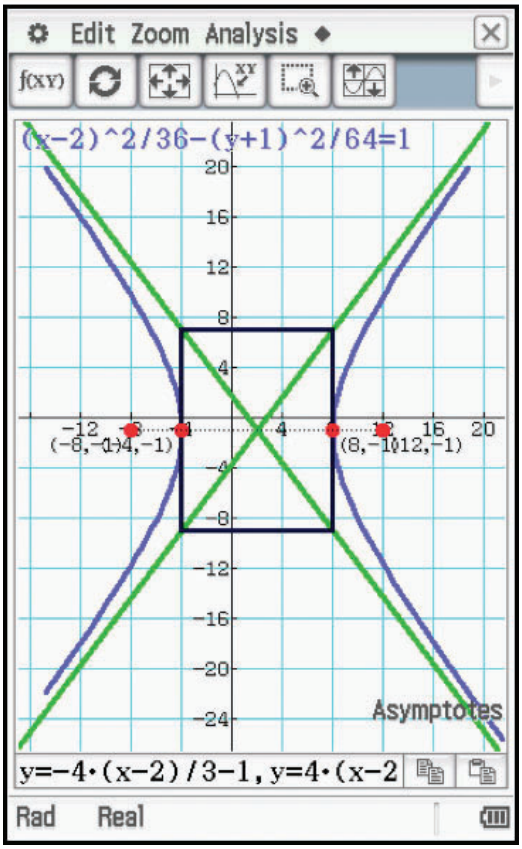


The window can be changed by using ▼ ▲ ◀ ▶ to scroll in any of the four directions, + to zoom in, and − to zoom out.

2. Display the vertices, foci, and asymptotes.

For vertices, tap **Analysis, G-Solve, Vertex.**





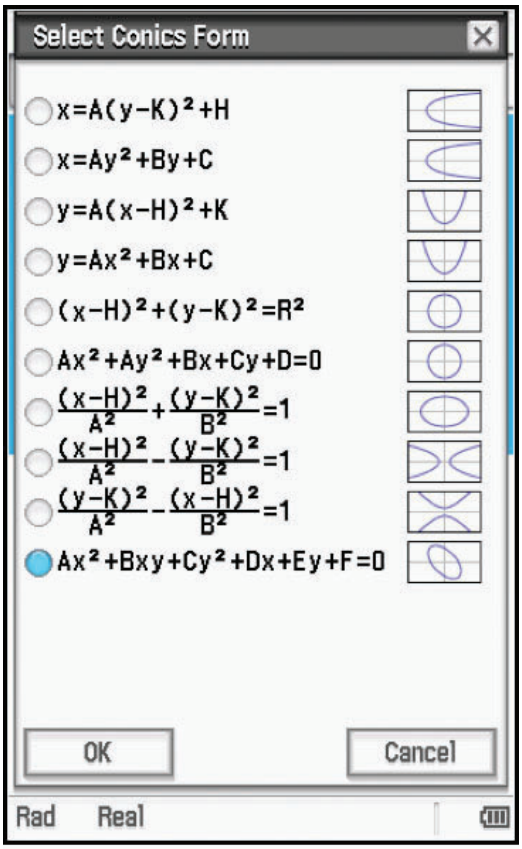
Press [EXE] to mark the point and keep the coordinates on the display. Press [◄] to display the other vertex.

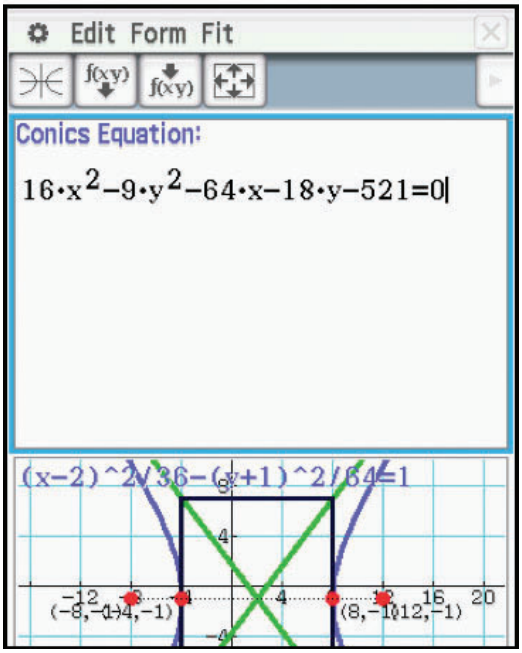
Use **G-Solve** in the same manner for foci and asymptotes.

3. Convert the equation to a standard form.

Tap Resize , then tap the equation window.

Tap f(x,y), then select the bullet for general form, then tap **OK**.

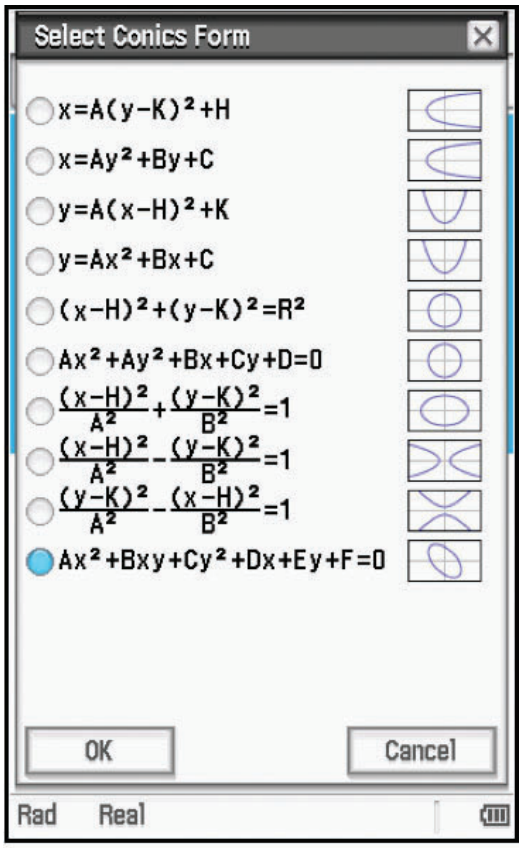




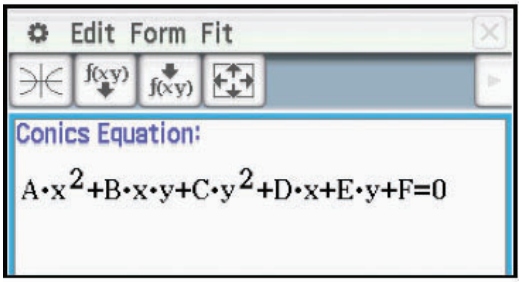
4. Graph the rotated conic
$2x^2 - 3xy + 4y^2 - 5x + 6y - 7 = 0$.

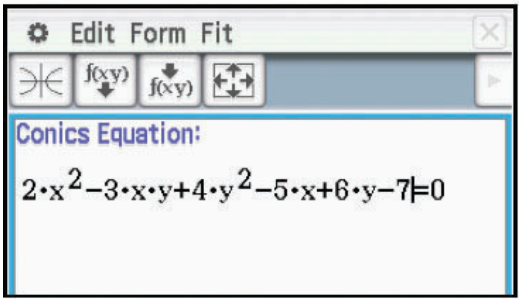
Tap [f(xy)].

Tap the bullet for general form, then tap **OK**.

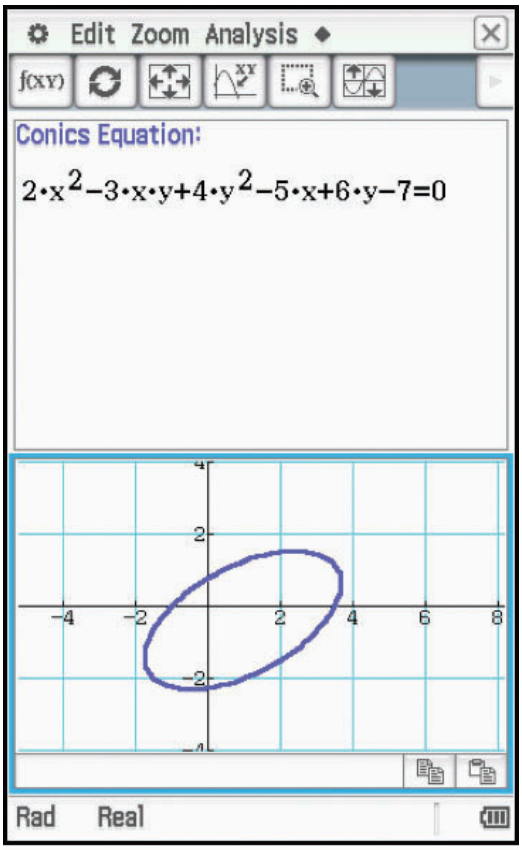


Edit the coefficients and the signs. The addition sign and the number can be highlighted together.

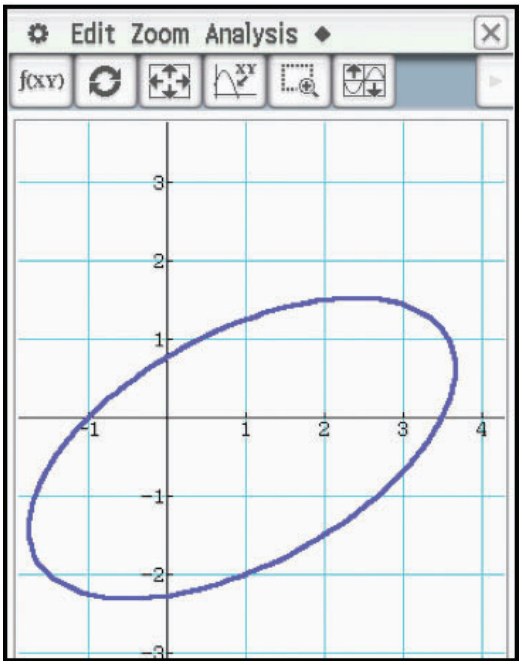




Tap [graph] to graph.

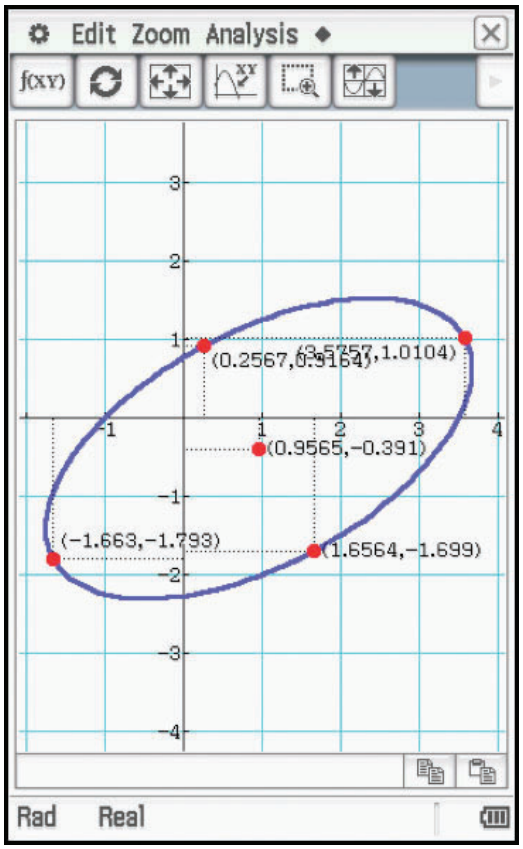


Tap Resize to plot the graph in a full screen.



The window can be changed by using
[▼] [▲] [◀] [▶] to scroll in any of the four directions,
[+] to zoom in, and [−] to zoom out.

G-Solve commands may be used on rotated conics.

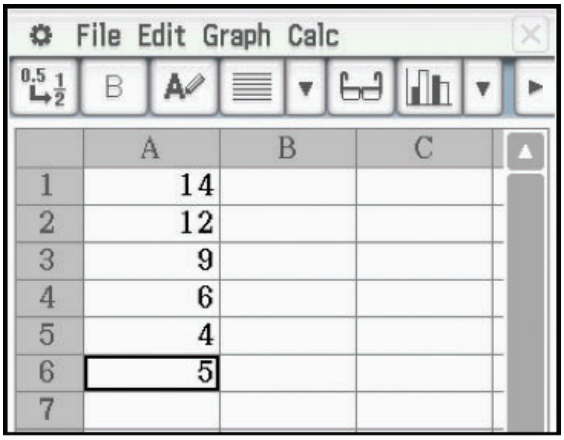


STATISTICS MENU

Suppose one of the questions asked on a survey was “What type of pet do you have?”, and the results from 50 people are shown in this table.

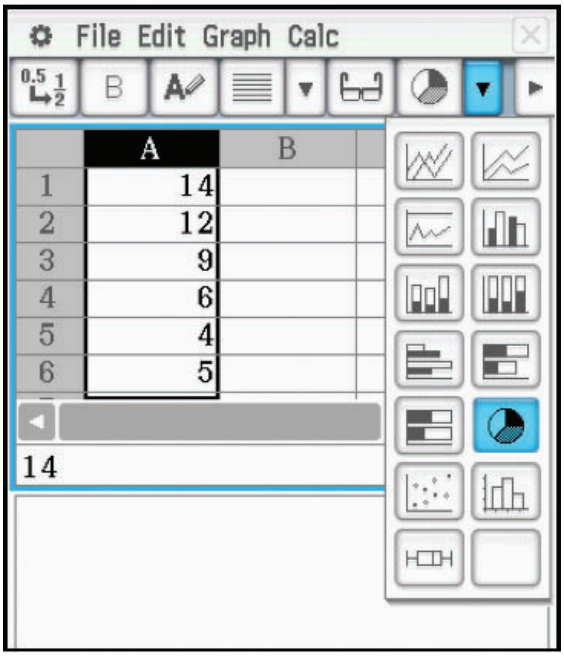
Pet Category	Dog	Cat	Fish	Bird	Other	None
Frequency	14	12	9	6	4	5

1. Construct a pie chart of these data.

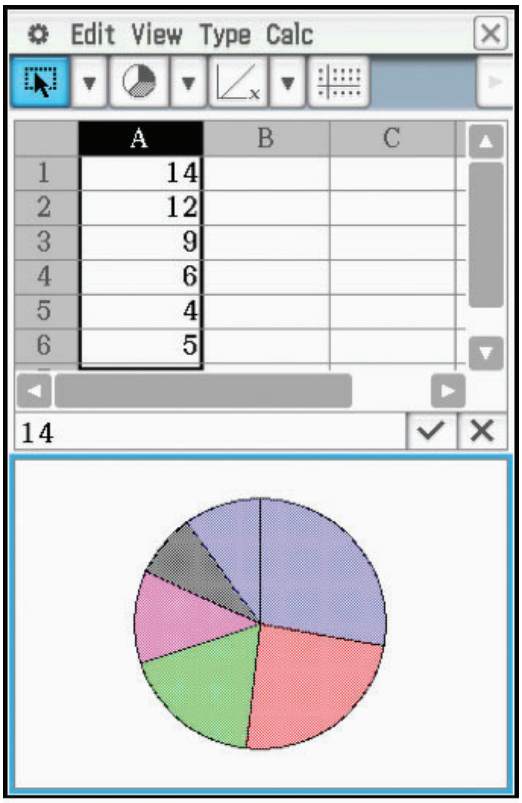


It is easiest to work with categorical data from a spreadsheet. Tap Menu, then the Spreadsheet icon.

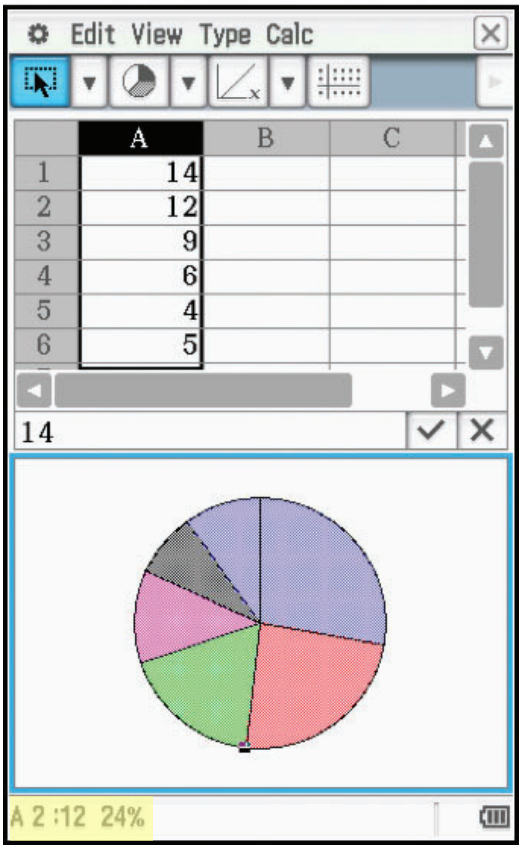
Enter the frequencies in the first column. Press EXE to move to the next cell.



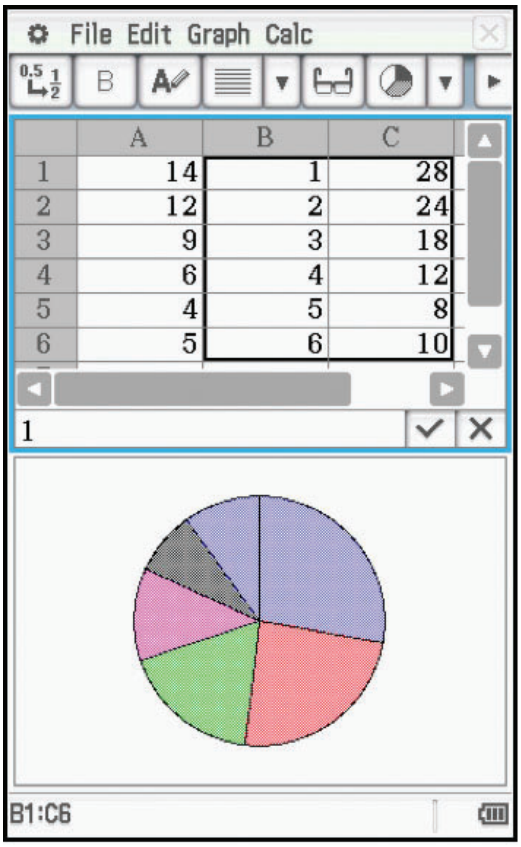
To construct the chart, tap **Column A** so it is selected. If the graph icon is , tap it. Otherwise tap the ▼ near the top-right to open the graph menu and then tap from the drop down list.



Tap any section of the chart to display the frequency.



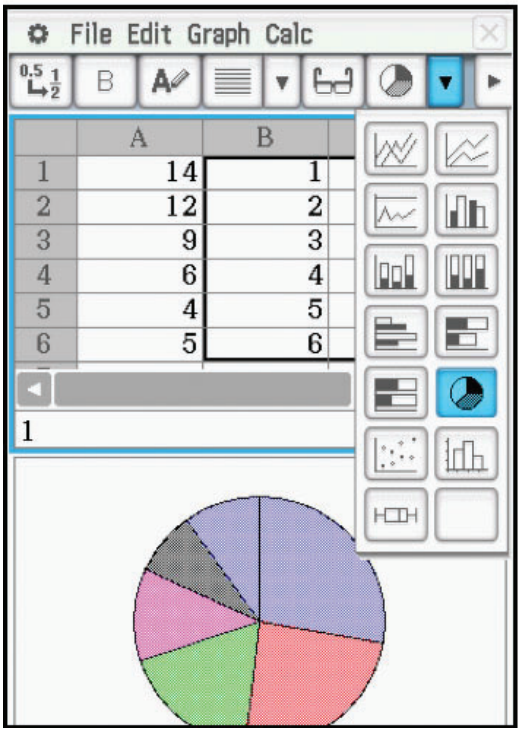
Tap the chart and drag to **Cell B1** to display the relative frequencies, shown as percents. (tap-and-drag is similar to click-and-drag with a mouse.)



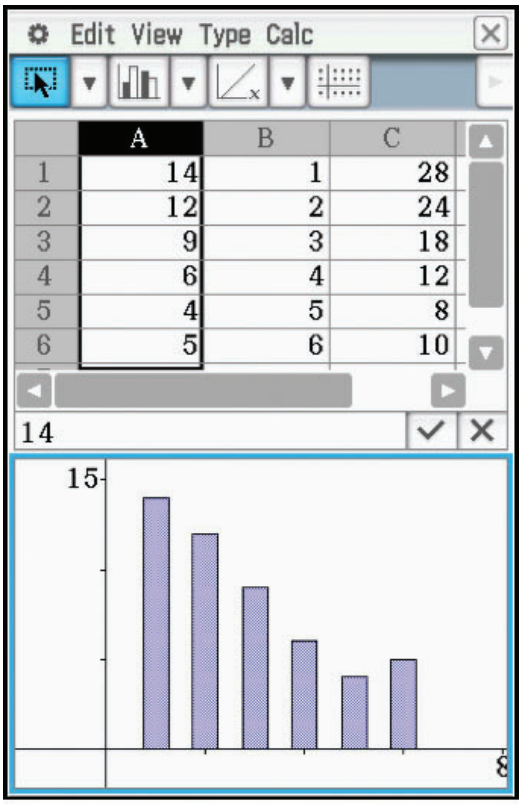
2. Construct a bar chart for these data.

Select **Column A** again. Tap the ▼ near the upper-right corner to access the graph drop down menu.

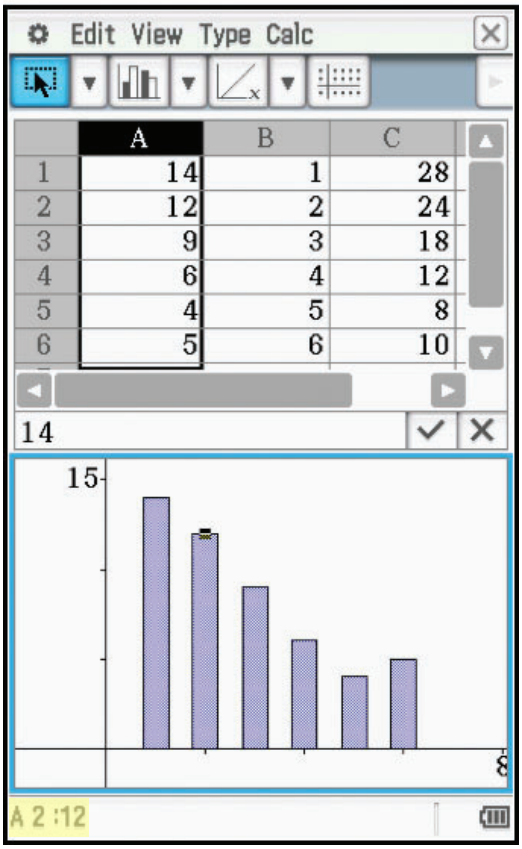
Then tap  to construct a bar chart.



The bar graph is displayed.



Tap any bar to display the frequency.



STATISTICS MENU

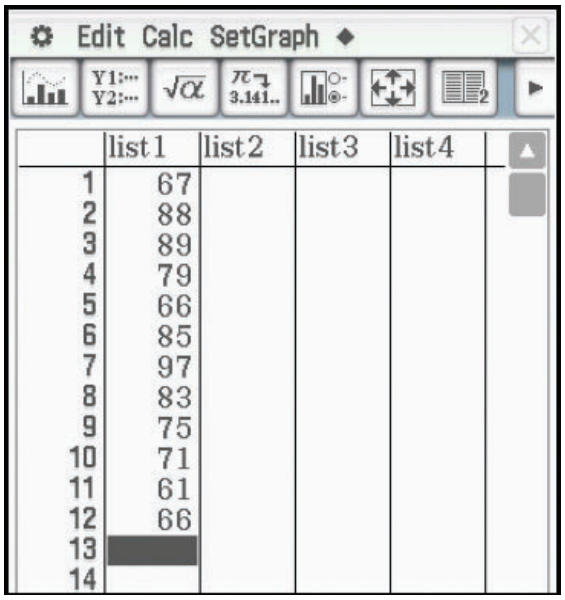
Plots and statistics for quantitative data can be created in either the spreadsheet or statistics menu. The statistics menu will be used for this example.

The number of games won (out of 162) by a certain baseball team for the years 2002 – 2013 are shown in the table.

67	88	89	79	66	85
97	83	75	71	61	66

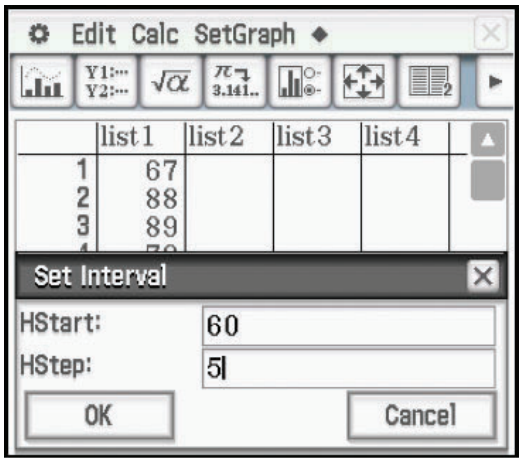
1. Construct a histogram for these data.

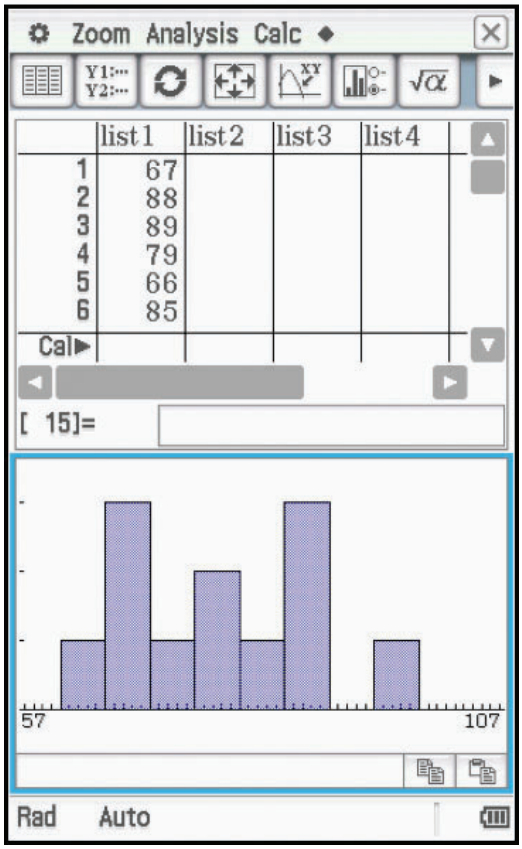
Tap Menu, then the Statistics icon. Enter the frequencies in **list1**. Press EXE to move to the next value.



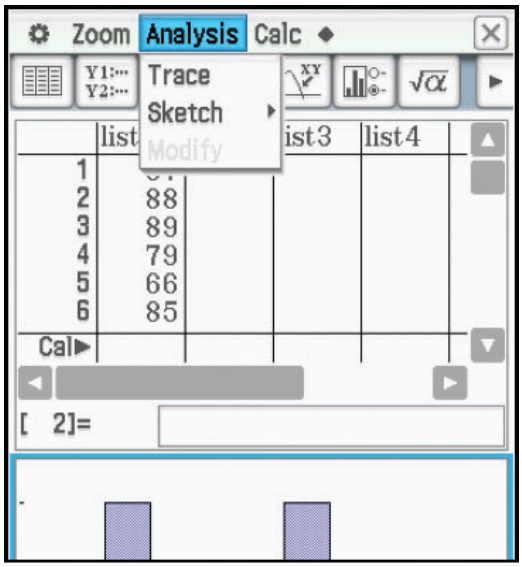
Tap to setup the plot. Set **Draw** to **On**, set **Type** to **Histogram**, set **XList** to **list1**, and **Freq** to **1**, as shown. Tap **Set** when complete.

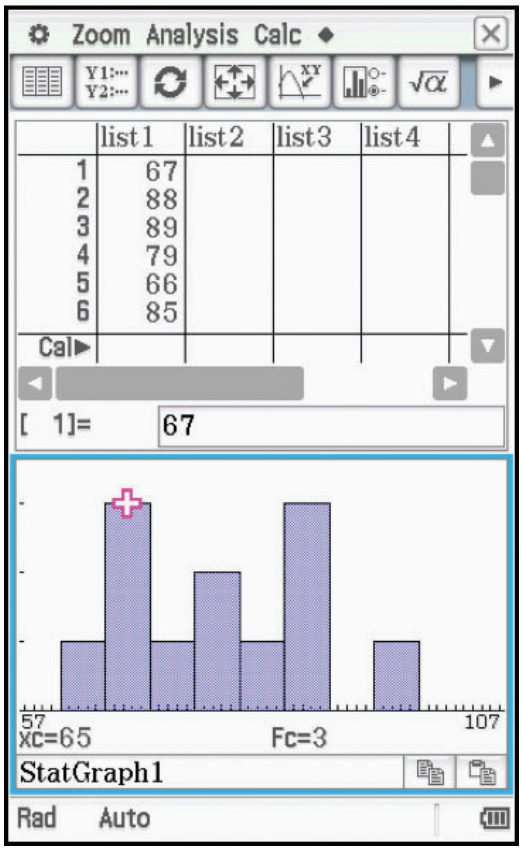
Tap . Enter values for the starting value (**HStart**) and the step (**Hstep**), the width of each bin; then tap **OK**.





Tap **Analysis, Trace** to display the frequencies, using the directional pad to move through the data values.

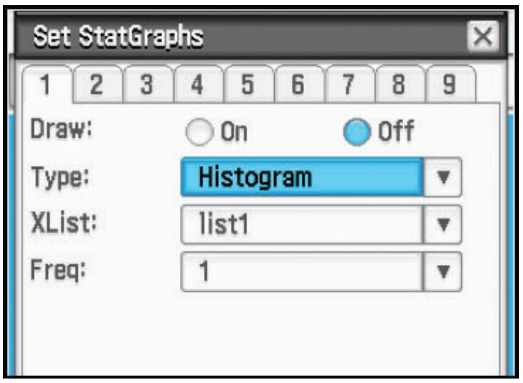




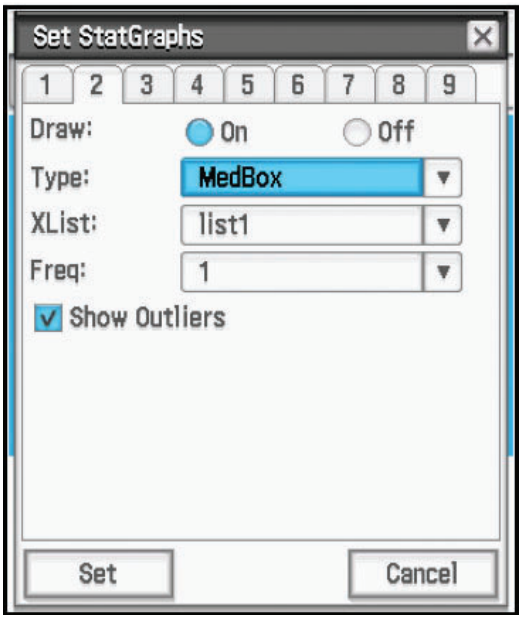
2. Construct a box and whisker plot for these data.

Tap the list editor window.

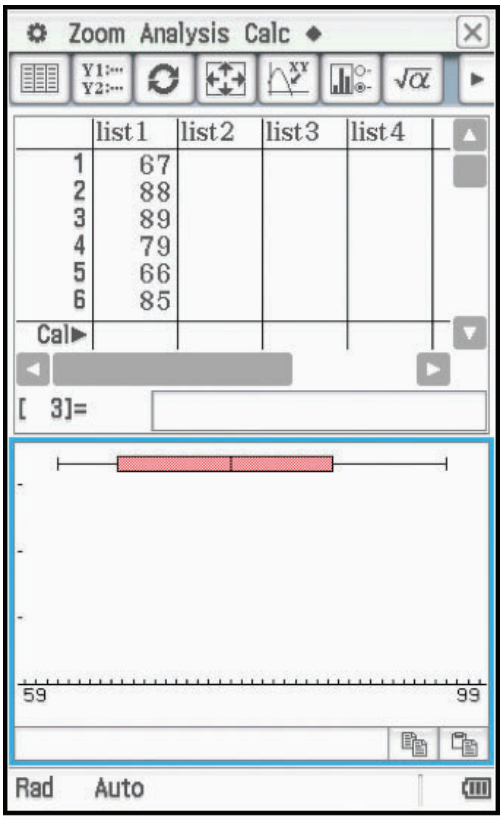
Tap  to setup the plot. Tap **Off** for **StatGraph1**, then tap the 2 tab to select **StatGraph2**.



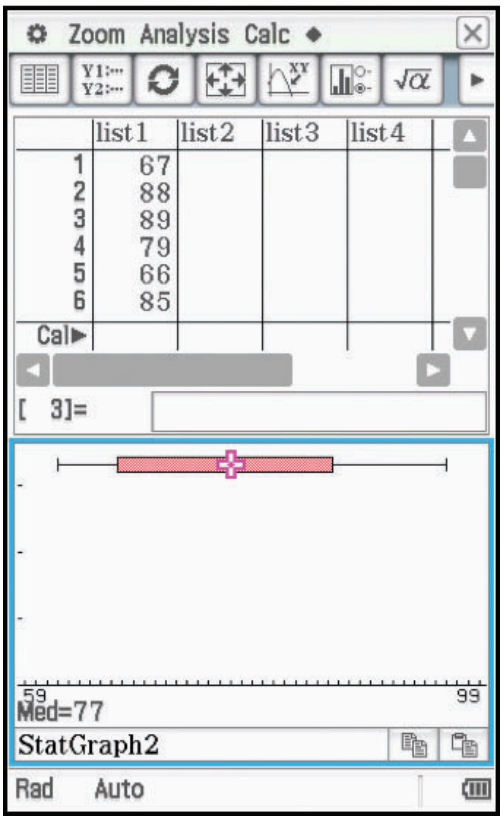
Select **On, Medbox, list1**, and **1** as shown. Tap the box to **Show Outliers** and tap **Set**.



Tap  to view the box and whisker plot.



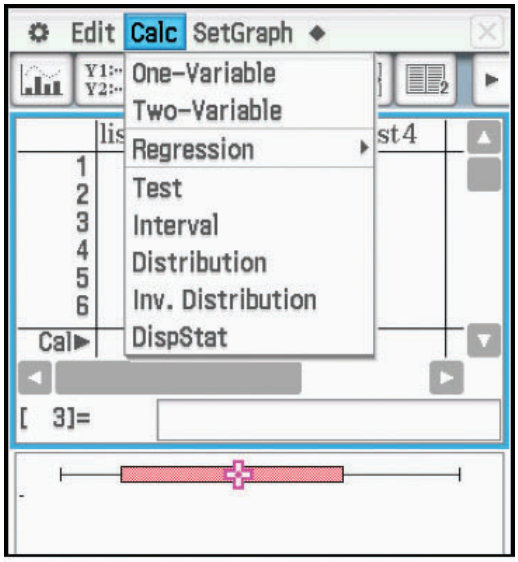
Tap **Analysis, Trace** and use the directional pad to view the five number summary.



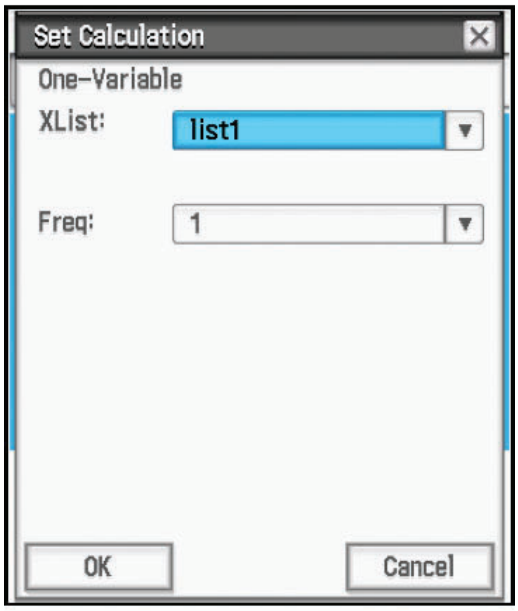
3. Compute summary statistics for these data.

When the list editor window is selected (note the bold border) the **Calc** command is the second command. When the plot window is selected, the Calc command is the third command.

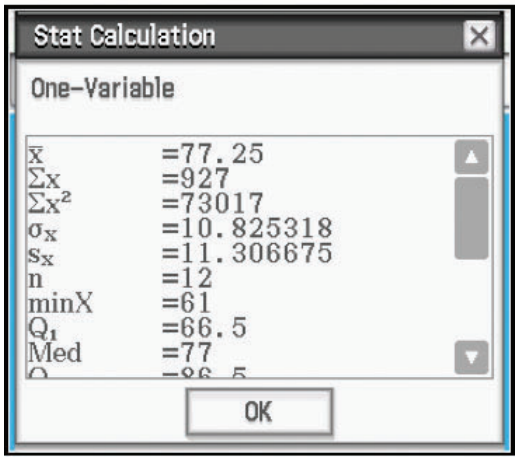
In either case, tap **Calc, One-Variable**.



Select **list1** for **XList, 1** for **Freq,** and tap **OK**.



One variable statistics are displayed; use the scroll bar to see additional information.



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