

Graphing Ellipses

The standard equation for an ellipse whose center is at the point (h, k) with major and minor axes of length a and b is $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$.

There is a problem entering this equation in the calculator graphing list for two reasons:

- it is not a function, and only functions can be entered in the Y = list locations.
- the functions entered in the Y = list locations must be in terms of x , not y .

To draw a graph of an ellipse, consider the “top” and “bottom” halves of the ellipse as two different parts of the graph because each individual is a function. Solve the equation of the ellipse for y and enter the two parts in two locations of the Y = list.

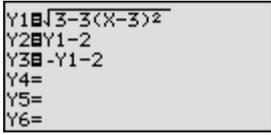
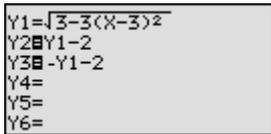
Example

Graph an ellipse in rectangular mode. Solve the equation for y to put it in the standard form.

Graph the ellipse $3(x-3)^2 + (y+2)^2 = 3$

Before Starting There may be differences in the results of calculations and graph plotting depending on the setting. Return all settings to the default value and delete all data.

Set the zoom to the decimal window: ZOOM A (ENTER ALPHA ▼) 7

Step & Key Operation	Display	Notes
<p>1 Solve the equation for y, completing the square.</p> <p>Enter</p> $Y1 = \sqrt{3 - 3(x-3)^2}$ $Y2 = Y1 - 2$ $Y3 = -Y1 - 2$ <p>Y= 2nd F $\sqrt{\quad}$ 3 - 3 (</p> <p>X/θ/T/M - 3) X² ENTER</p> <p>2nd F VARS A ENTER 1 -</p> <p>2 ENTER (-) 2nd F VARS ENTER</p> <p>1 - 2</p>		$3(x-3)^2 + (y+2)^2 = 3$ $(y+2)^2 = 3 - 3(x-3)^2$ $y+2 = \pm\sqrt{3 - 3(x-3)^2}$ $y = \pm\sqrt{3 - 3(x-3)^2} - 2$
<p>2 Turn off Y1 so that it will not graph.</p> <p>▲ ▲ ◀ ENTER</p>		

Step & Key Operation

Display

Notes

3 View the graph.

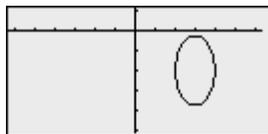
GRAPH



4 Adjust the screen so that the whole graph is shown. Shift 2 units downwards.

WINDOW ▼ (3 times) — 2 ENTER

— 2 ENTER GRAPH



$$-3.1 < Y < 3.1$$

$$\downarrow$$

$$-5.1 < Y < 1.1$$



Graphing an ellipse can be performed easily on the calculator display.