

Graphing Parabolas

The graphs of quadratic equations ($y = ax^2 + bx + c$) are called parabolas. Sometimes the quadratic equation takes on the form of $x = ay^2 + by + c$.

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

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

There are, however, two methods you can use to draw the graph of a parabola.

Method 1: Consider the "top" and "bottom" halves of the parabola as two different parts of the graph because each individually is a function. Solve the equation of the parabola for y and enter the two parts (that individually are functions) in two locations of the Y= list.

Method 2: Choose the parametric graphing mode of the calculator and enter the parametric equations of the parabola. It is not necessary to algebraically solve the equation for y . Parametric representations are equation pairs $x = F(t)$, $y = F(t)$ that have x and y each expressed in terms of a third parameter, t .

Example

Graph a parabola using two methods.

1. Graph the parabola $x = y^2 - 2$ in rectangular mode.
2. Graph the parabola $x = y^2 - 2$ in parametric mode.

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

1-1 Solve the equation for y .

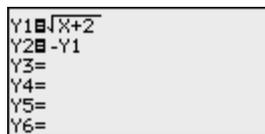
$$x = y^2 - 2$$

$$x + 2 = y^2$$

$$y = \pm\sqrt{x + 2}$$

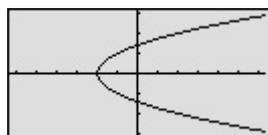
1-2 Enter $y = \sqrt{x+2}$ for Y1 and enter $y = -Y1$ for Y2.

Y= 2nd F $\sqrt{\square}$ X/θ/T/M + 2
 ENTER (-) 2nd F VARS A ENTER 1



1-3 View the graph.

GRAPH



The graph of the equation $y = \sqrt{x+2}$ is the "top half" of the parabola and the graph of the equation $y = -\sqrt{x+2}$ gives the "bottom half."

Step & Key Operation

Display

Notes

2-1 Change to parametric mode.

2nd F **SET UP** **E**

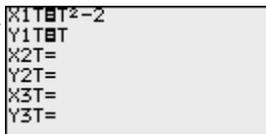
2



2-2 Rewrite $x = y^2 - 2$ in parametric form. Enter $X1T = T^2 - 2$ and $Y1T = T$.

Y= **X/θ/T/π** **X²** **-** **2** **ENTER**

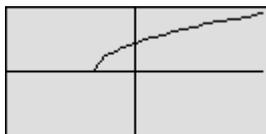
X/θ/T/π



Let $y = T$ and substitute in $x = y^2 - 2$, to obtain $x = T^2 - 2$.

2-3 View the graph. Consider why only half of the parabola is drawn. (To understand this, use Trace feature.)

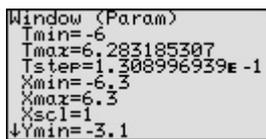
GRAPH (**TRACE** **▶**)



The graph starts at $T = 0$ and increases. Since the window setting is $T \geq 0$, the region $T < 0$ is not drawn in the graph.

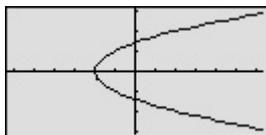
2-4 Set Tmin to -6.

WINDOW **(-)** **6** **ENTER**



2-5 View the complete parabola.

GRAPH



The calculator provides two methods for graphing parabolas, both of which are easy to perform.