

Section 10-2 Parabolas

Students will be able to write the equation of a parabola and graph it.

In Chapter 4 we talked about parabolas, its vertex and axis of symmetry.

We are going to look at other characteristics of parabolas.

Each point of a parabola is equidistant from a point called the *focus* and a line called the *directrix*.

Key Concept Parabola

Definition

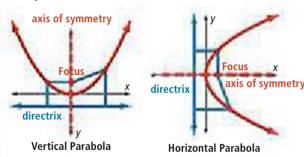
A parabola is the set of all points in a plane that are the same distance from a fixed line and a fixed point not on the line.

The fixed point is called the **focus of a parabola**.

The fixed line is called the **directrix**.

The distance between the vertex and the focus is the **focal length** of the parabola.

Graph

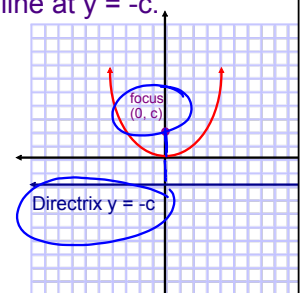


Khan Academy Video

You can find the equation of a vertical parabola with the vertex at the origin by using the geometric definition. The focus is denoted by $(0, c)$, the directrix is the line at $y = -c$.

The standard quadratic form is

$$y = \frac{1}{4c} x^2$$



$\frac{1}{4c}$ determines the focus $(0, c)$ and the directrix $y = -c$.

Audio Clip

What is an equation of a parabola with vertex $(0, 0)$ and focus $(0, -1.5)$?

Video:

Handwritten work for the problem above:

$$\text{Focus } (0, c)$$

$$c = -1.5$$

$$y = \frac{1}{4c} x^2$$

$$y = \frac{1}{4(-1.5)} x^2$$

$$y = -\frac{1}{6} x^2$$

What are the vertex, focus and directrix of the parabola with equation $y = \frac{1}{4} x^2$?

Video

Handwritten work for the problem above:

$$y = \frac{1}{4c} x^2$$

$$y = \frac{1}{4} x^2$$

$$\frac{1}{4c} = \frac{1}{4} \quad c = 1$$

$$V = (0, 0)$$

$$F = (0, 1)$$

$$D = y = -1$$

A horizontal parabola has an equation of ~~$x = ay^2$~~ and has a vertex at (0,0).

$$x = \frac{1}{4c}y^2$$

The coefficient $a = 1/4c$ determines the focus $(c, 0)$ and the **directrix** $x = -c$. (Just the opposite of a vertical parabola for the focus and directrix.)

Audio:

What is the equation of a parabola with the vertex at the origin and the directrix $x = -5/2$?

$$x = \frac{1}{4c}y^2 \quad c = \frac{5}{2}$$

Video

$$x = \frac{1}{4(\frac{5}{2})}y^2$$

$$x = \frac{1}{10}y^2$$

What are the vertex, focus, and directrix of a parabola with equation $x = -4y^2$.

$$x = -4y^2$$

$$x = \frac{1}{4c}y^2$$

Video

$$V: (0,0)$$

$$F: (-\frac{1}{16}, 0)$$

$$D: x = \frac{1}{16}$$

$$4c = -4 = \frac{1}{4c} \cdot 4c$$

$$\frac{-16c}{-16} = \frac{1}{16}$$

Hwk:

pg. 627 - 628

#8 - 22 evens, 34, 37