

10.2 Parabolas

Learning Targets for today

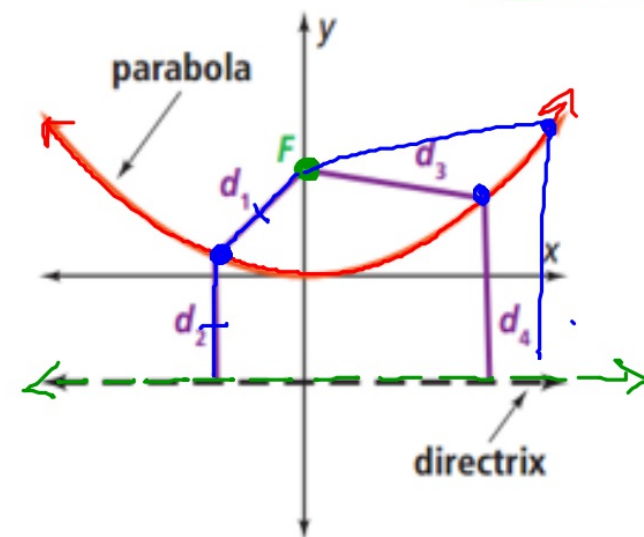
- ① To be able to graph parabolas with equation $y = ax^2$.
- ① To be able to graph parabolas with equation $x = ay^2$.
- ① To be able to work with the vertex, focus and directrix of a parabola.
- ① To be able to transform a parabola.
- ① To be able to use parabola equations to solve problems.

Vocabulary

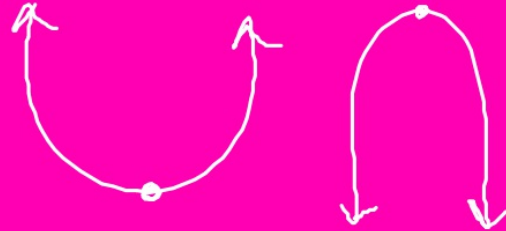
Parabolas – the set of all points in a plane that are the same distance from a fixed line and a fixed point NOT on the line.

Focus of a Parabola – the fixed point!

Directrix – the fixed line!



$$y = ax^2 + bx + c$$

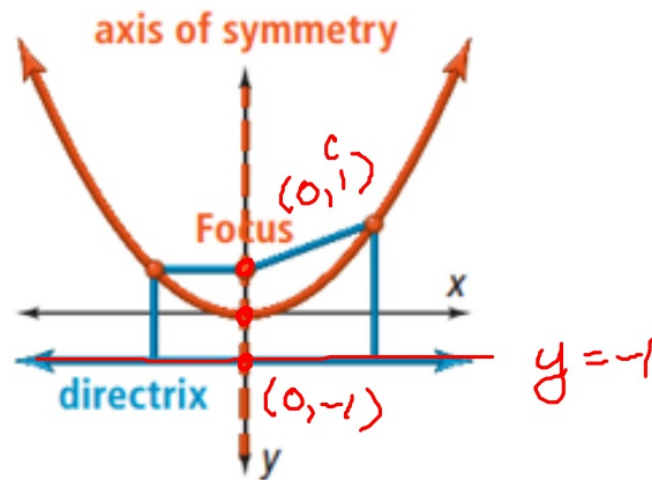


Vertical Parabola - $y = ax^2$ (with vertex $(0,0)$)

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

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

~~$$a = \frac{1}{4c}$$~~

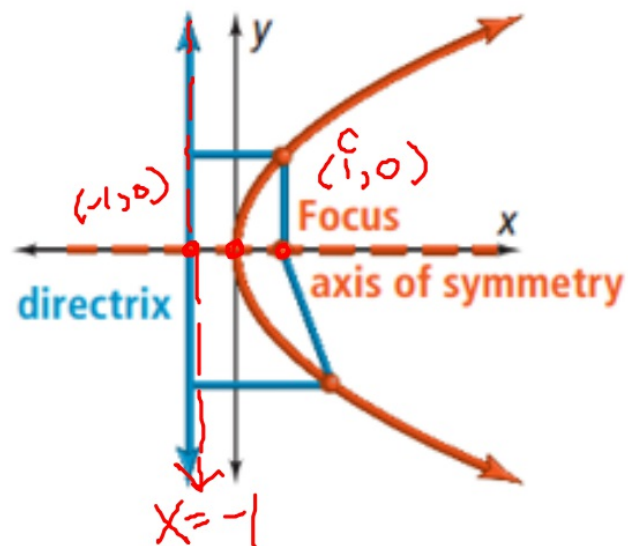


$$y = ax^2 + bx + c$$

Horizontal Parabola – $x = ay^2$ (with vertex $(0,0)$)

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

↑
use to find
"c" / focus
↓
Directrix



Parabolas with equations $y = ax^2$

Example for you...

1. What is the equation of the parabola with the vertex (0,0) and focus (0,-1.5)? $c = -1.5$

find $a \rightarrow a = \frac{1}{4c} = \frac{1}{4(-1.5)} = -\frac{1}{6} \checkmark$

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

2. What is the focus and directrix of the parabola with the equation $y = 2x^2$. $a = 2$

find $c \rightarrow a = \frac{1}{4c}$

~~$\frac{2}{1} = \frac{1}{4c}$~~

$\frac{8c}{8} = \frac{1}{8}$

$c = \frac{1}{8}$

Directrix: $y = -\frac{1}{8}$

focus $(0, \frac{1}{8})$

Your turn to try...

$y = ax^2$

1. What is the equation of the parabola with the vertex (0,0) and focus (0,3)?

find $a \rightarrow a = \frac{1}{4c} = \frac{1}{4(3)} = \frac{1}{12} \checkmark$

$$y = \frac{1}{12}x^2$$

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

find " c " $\rightarrow a = \frac{1}{4c}$

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

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

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

Directrix $y = \frac{1}{16}$

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

Parabolas with equations $x = ay^2$

Example for you...

1. What is the equation of the parabola with the vertex (0,0) and directrix $x = -4$?
 focus (4,0) $c=4$

find $a \rightarrow a = \frac{1}{4(c)} = \frac{1}{4(4)} = \frac{1}{16}$

$$X = \frac{1}{16}y^2$$

2. What is the focus and directrix of the parabola with the equation $x = 6y^2$. $a=6$

find $c \rightarrow a = \frac{1}{4c}$

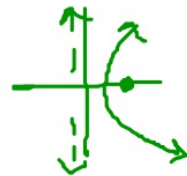
$\frac{6}{1} = \frac{1}{4c}$

$\frac{24c}{24} = \frac{1}{24}$

$c = \frac{1}{24}$

Directrix: $X = -\frac{1}{24}$

focus $(\frac{1}{24}, 0)$



Your turn to try...

1. What is the equation of the parabola with the vertex (0,0) and directrix $x = \frac{5}{2}$?
 focus $c = -2.5$

find $a \rightarrow a = \frac{1}{4(-2.5)} = -\frac{1}{10}$

$$X = -\frac{1}{10}y^2$$

2. What is the focus and directrix of the parabola with the equation $x = -2y^2$. $a=-2$

find $c \rightarrow a = \frac{1}{4c}$

$\frac{-2}{1} = \frac{1}{4c}$

$\frac{-8c}{-8} = \frac{1}{-8}$

$c = -\frac{1}{8}$

Directrix: $X = \frac{1}{8}$

focus $(-\frac{1}{8}, 0)$