

INTRODUCTION In general, the graph of any **quadratic equation** of the form $y = ax^2 + bx + c$, where $a, b,$ and c are real numbers and $a \neq 0$ is a **parabola**. That is, any equation that has a square term (remember that $a \neq 0$) and **maybe** an x term and/or a constant is a **parabola**.

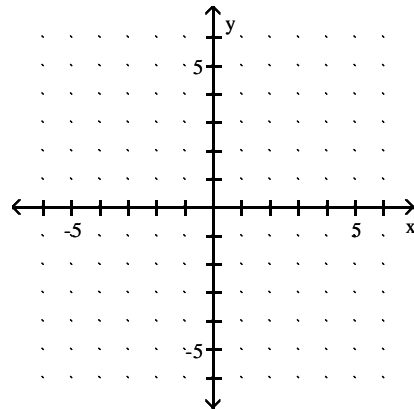
At this time, we want to develop a very easy and systematic way of graphing parabolas **without the use of a graphing calculator**. Two of the most important aspects of a parabola are: 1. the vertex
2. the axis of symmetry

Now let's look the "basic" parabola. This is the most simple parabola and is the starting point of **the transformations** we will discuss below.

TYPE I $f(x) = x^2$ **THE BASIC QUADRATIC**

$y = x^2$ or $f(x) = x^2$

x	y
2	
1	
0	
-1	
-2	

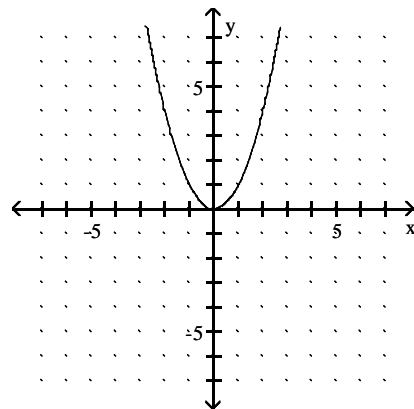


- What is the basic graph? _____
- Opens? _____
- What is the vertex? _____
- What is the axis of symmetry? _____

TYPE II $f(x) = -x^2$ **CHANGING THE SIGN OF x^2**

$f(x) = -x^2$

x	y
2	
1	
0	
-1	
-2	

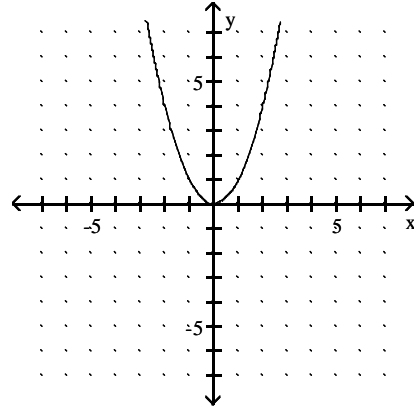


- Opens? _____
- What is the vertex? _____
- What is the axis of symmetry? _____

TYPE III $f(x) = x^2 + k$ **ADDING (OR SUBTRACTING) A CONSTANT TO x^2**

$f(x) = x^2 + 3$

x	y
2	
1	
0	
-1	
-2	



What happened to the parabola when 3 was added to the basic graph? _____
 Opens? _____
 What is the vertex? _____
 What is the axis of symmetry? _____

EXAMPLE

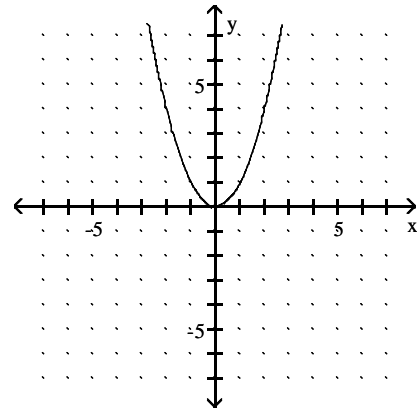
$f(x) = x^2 - 1$

What do you think will happen to the parabola? _____
 What will be the "new" vertex? _____
 What will be the "new" axis of symmetry? _____

TYPE IV $f(x) = (x - h)^2$ **ADDING (OR SUBTRACTING) TO x prior to squaring**

$f(x) = (x - 2)^2$

x	y
0	
1	
2	
3	
4	



What happened to the basic graph? _____
 Opens? _____
 What is the vertex? _____
 What is the axis of symmetry? _____

EXAMPLE

$f(x) = (x + 4)^2$

What do you think will happen to the parabola? _____
 What will be the "new" vertex? _____
 What will be the "new" axis of symmetry? _____

EXAMPLE $f(x) = -(x + 5)^2 - 4$

What do you think will happen to the parabola ?

1. _____ 2. _____ 3. _____

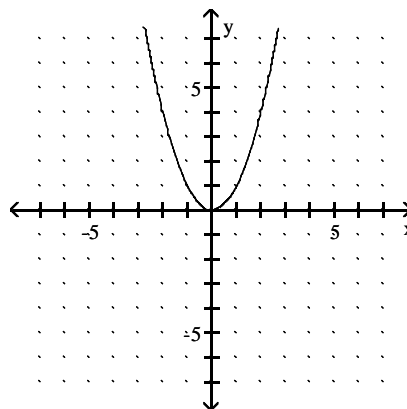
What will be the "new" vertex?

What will be the "new" axis of symmetry?

TYPE V $f(x) = ax^2$ A COEFFICIENT OF x^2

$f(x) = \frac{1}{2}x^2$

x	y
2	
1	
0	
-1	
-2	



What happened to the basic graph? _____

What is the vertex? _____

What is the axis of symmetry? _____

EXAMPLE $f(x) = -2(x - 1)^2 + 5$

What do you think will happen to the parabola ?

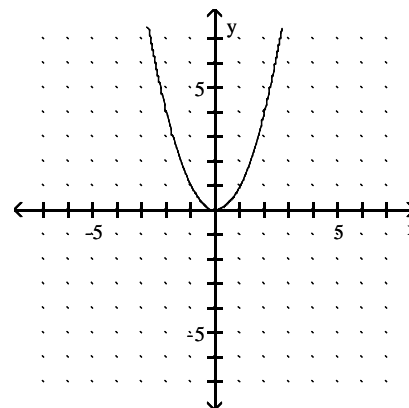
1. _____ 2. _____
 3. _____ 4. _____

x	y

What will be the "new" vertex?

What will be the "new" axis of symmetry?

Graph.



Identify the vertex and A of S of the given parabola, tell whether the graph opens up or down and whether the graph is wider, narrower, or the same shape as the graph of $f(x) = x^2$.

$f(x) = (x + 3)^2 - 1$

$f(x) = \frac{1}{3}x^2 + 8$

$f(x) = -3x^2$