

Algebra 1 9.1

$x^2$

Analyze characteristics of graphs of quadratic functions  
Graph quadratic functions

quadratic  
standard form  
→ parabola  
axis of symmetry  
vertex  
maximum  
minimum  
table of values

$$y = x^2 + 2x + 3$$

$x$	$x^2 + 2x + 3$	$y$

$$-5^2$$

$$(-5)^2 = 25$$

What happens when we square negative numbers?  
Is there a difference between  $-x^2$  and  $(-x)^2$ ?

$$-1 \cdot 5 \cdot 5 = -25$$

$$-x^2 \quad (-x)^2$$

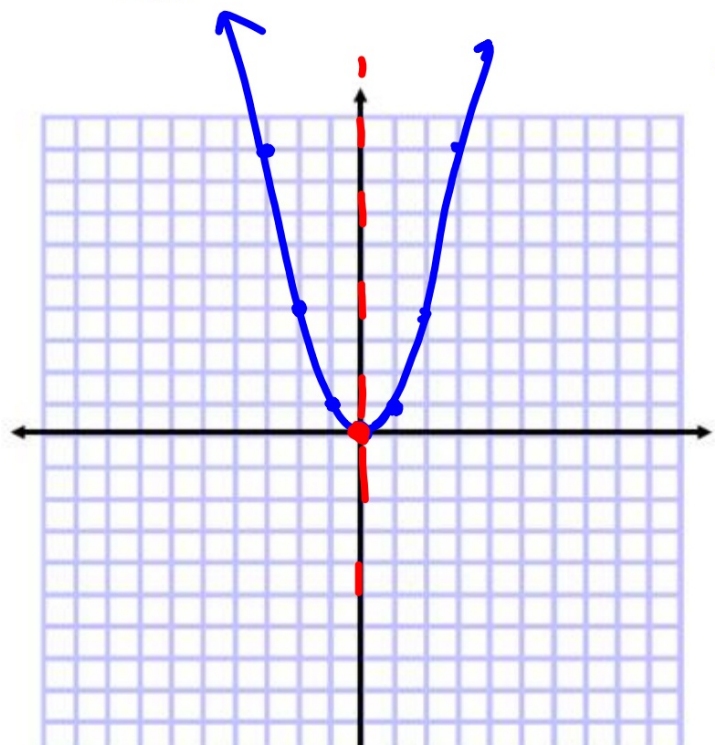
Use a table of values to graph:  
(remember order of operations...)

Giant graphs  
parabola

$$y = x^2$$

x	x <sup>2</sup>	y
-3	-3 · 3	9
-2	-2 · 2	4
-1	-1 · 1	1
0	0 · 0	0
1	1 · 1	1
2	2 · 2	4

$$-s^2 \quad -s \cdot -s$$
$$-25$$



$$y = 1x^2 + 2x + 1$$

Vertex?

Axis of symmetry?

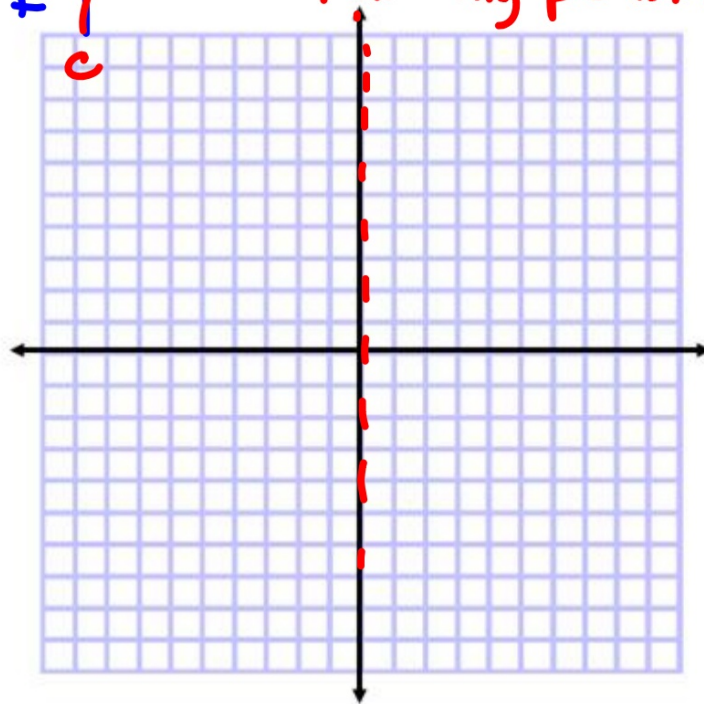
domain?

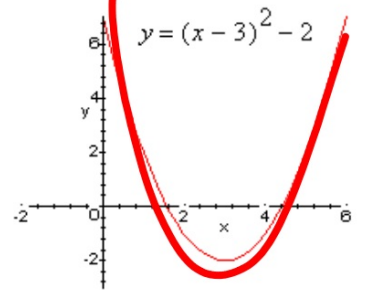
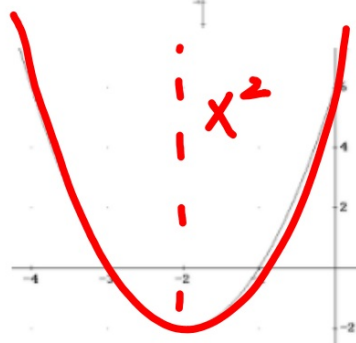
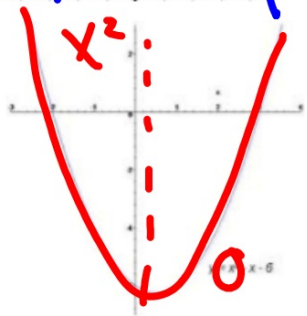
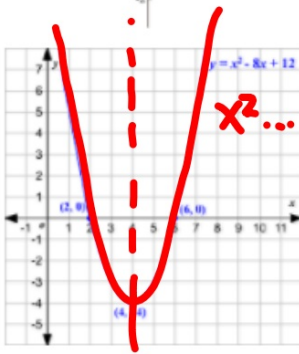
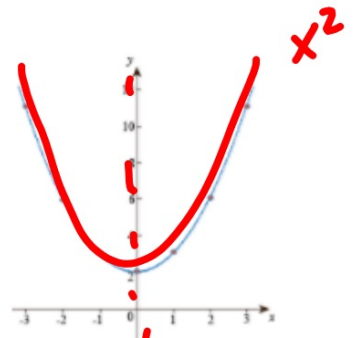
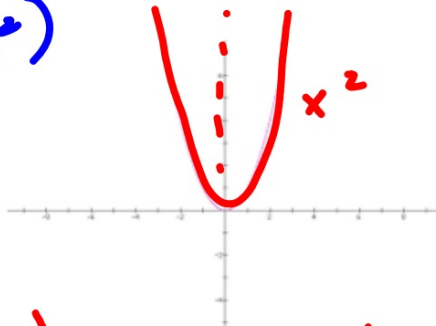
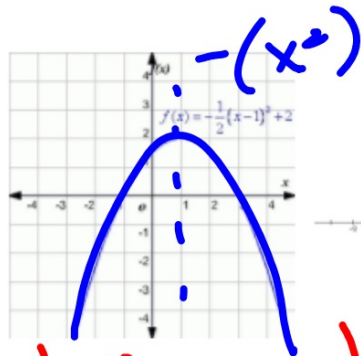
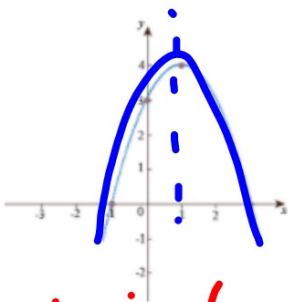
range?

$$x = \frac{-b}{2a}$$

$$x = \frac{0}{2 \cdot 1} = 0$$

turning point = vertex  
(x, y)





## KeyConcept Quadratic Functions

Parent Function:

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

Standard Form:

$$f(x) = ax^2 + bx + c$$

Type of Graph:

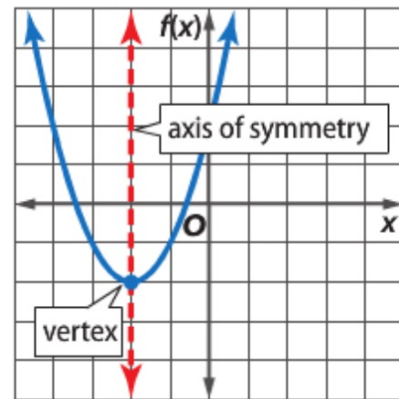
parabola

Axis of Symmetry:

$$x = -\frac{b}{2a}$$

y-intercept:

$c$



$$y = x^2 + 3$$

Use a table of values to graph  $y = x^2$ .

Vertex?

-1 -1

→ Axis of symmetry?

x x

(parent graph)

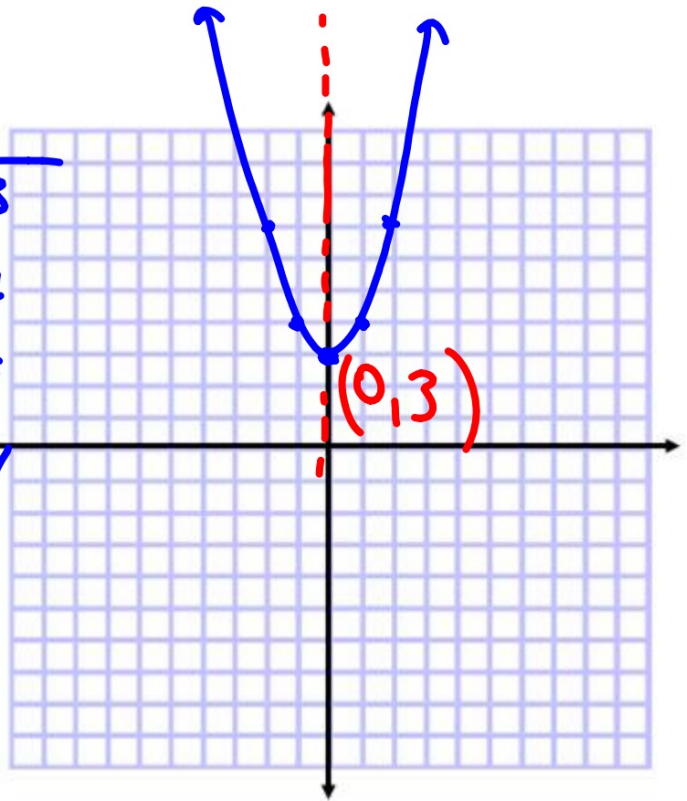
domain?

range?

$$x = \frac{-b}{2a} = \frac{0}{2} = 0$$

	$x^2 + 3$	
0	$0 + 3$	3
1	$1 + 3$	4
2	$4 + 3$	7
-1	$1 + 3$	4
-2	$4 + 3$	7

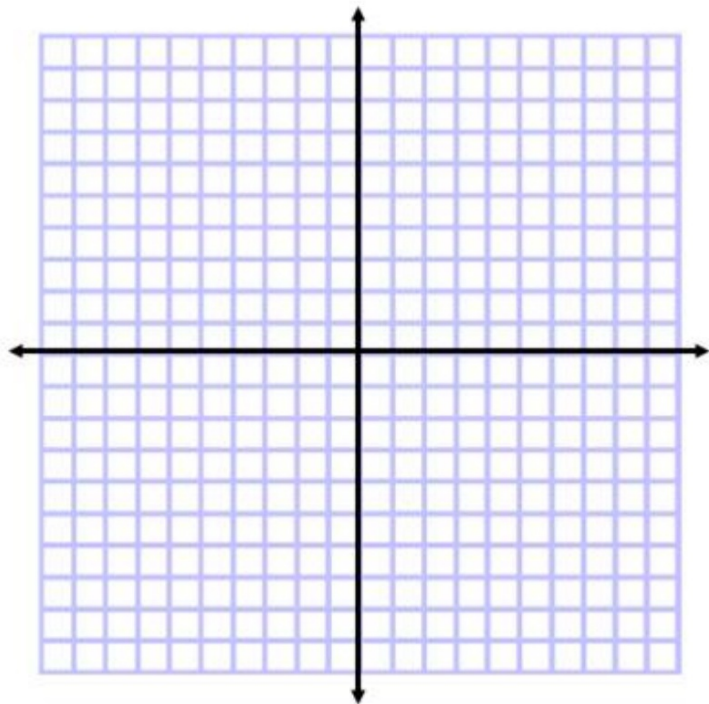
Giant graphs



## Guided Practice

1. Use a table of values to graph  $y = x^2 + 3$ . State the domain and range.

Self-Check Practice

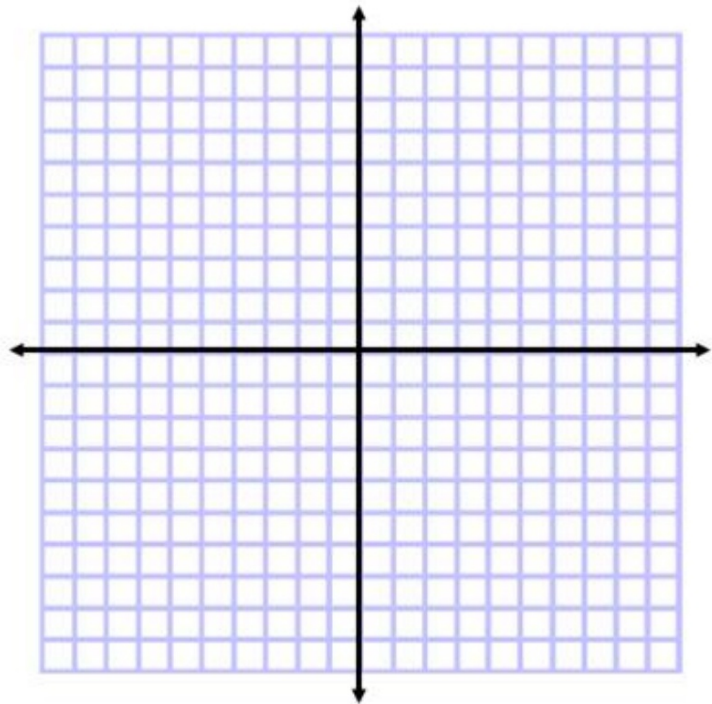
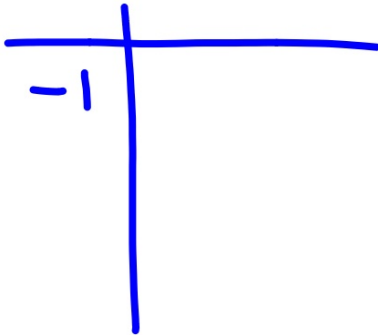


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### Example 1 Graph a Parabola

Use a table of values to graph  $y = 3x^2 + 6x - 4$ . State the ~~domain and range~~

$$x = \frac{-b}{2a} = \frac{-6}{2 \cdot 3} = \frac{-6}{6} = -1$$

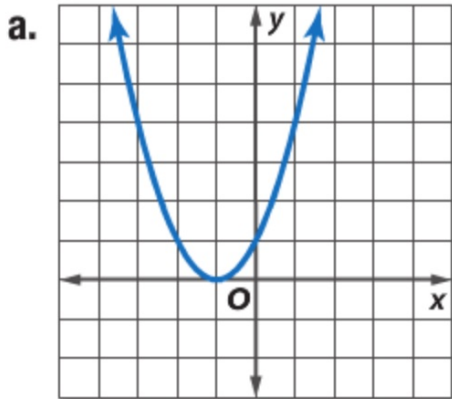


x-coord:  $-b/2a$

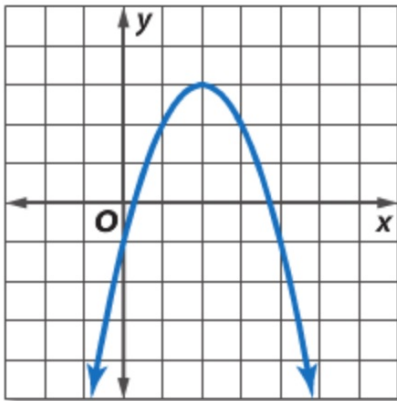


### Example 2 Identify Characteristics from Graphs

Find the vertex, the equation of the axis of symmetry, and the  $y$ -intercept of each graph.



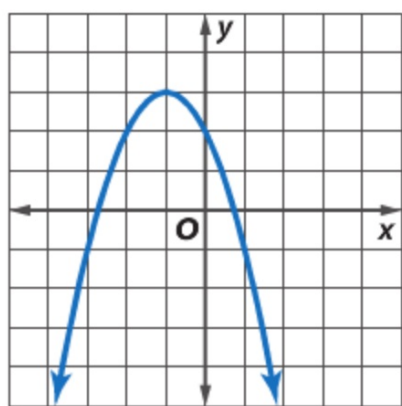
b.



vertex  
axis of symmetry  
y-intercept

▶ **Guided**Practice

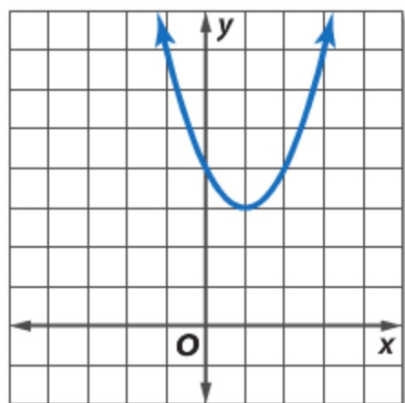
2A.



vertex  
axis of symmetry  
y-intercept  
domain  
range

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2B.



$-b/2a$

**Example 3** Identify Characteristics from Functions



Find the vertex, the equation of the axis of symmetry, and the  $y$ -intercept of each function.

a.  $y = 2x^2 + 4x - 3$

$-b/2a$

**b.**  $y = -x^2 + 6x + 4$

### Guided Practice

**3A.**  $y = -3x^2 + 6x - 5$

**3B.**  $y = 2x^2 + 2x + 2$

## Vertex

### KeyConcept Maximum and Minimum Values

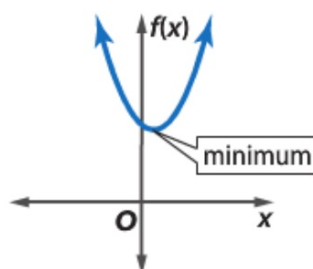
#### Words

The graph of  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$ :

- opens upward and has a minimum value when  $a > 0$ , and
- opens downward and has a maximum value when  $a < 0$ .
- The range of a quadratic function is all real numbers greater than or equal to the minimum, or all real numbers less than or equal to the maximum.

#### Examples

$a$  is positive.



$a$  is negative.

