

- Get in groups of 3
- Answer the six questions using the notes on a piece of notebook paper (everyone needs their own copy)

20 minutes to complete

1 Characteristics of Quadratic Functions Quadratic functions are nonlinear and can be written in the form $f(x) = ax^2 + bx + c$, where $a \neq 0$. This form is called the **standard form** of a quadratic function.

The shape of the graph of a quadratic function is called a **parabola**. Parabolas are symmetric about a central line called the **axis of symmetry**. The axis of symmetry intersects a parabola at only one point, called the **vertex**.

Key Concept Quadratic Functions

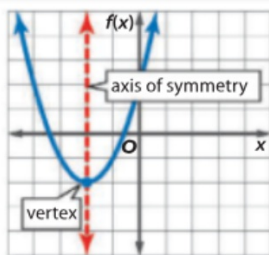
Parent Function: $f(x) = x^2$

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

Type of Graph: parabola

Axis of Symmetry: $x = -\frac{b}{2a}$

y-intercept: c



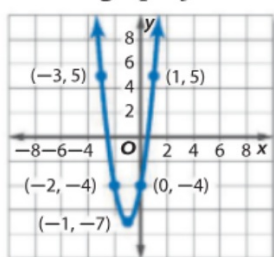
When $a > 0$, the graph of $y = ax^2 + bx + c$ opens upward. The lowest point on the graph is the **minimum**. When $a < 0$, the graph opens downward. The highest point is the **maximum**. The maximum or minimum is the vertex.



Example 1 Graph a Parabola

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

x	y
-3	5
-2	-4
-1	-7
0	-4
1	5



Graph the ordered pairs, and connect them to create a smooth curve. The parabola extends to infinity. The domain is all real numbers. The range is $\{y \mid y \geq -7\}$, because -7 is the minimum.

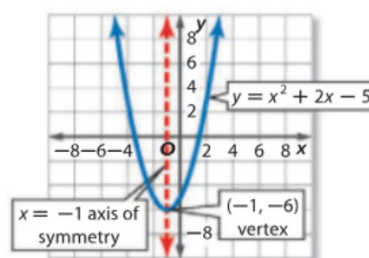
Check Your Understanding

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



Recall that figures with symmetry are those in which each half of the figure matches exactly.

A parabola is symmetric about the axis of symmetry. Every point on the parabola to the left of the axis of symmetry has a corresponding point on the other half. The function is increasing on one side of the axis of symmetry and decreasing on the other side.

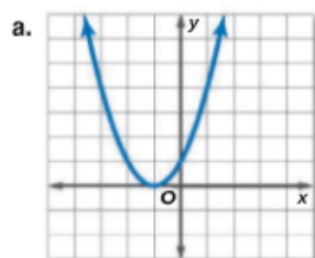


When identifying characteristics from a graph, it is often easiest to locate the vertex first. It is either the maximum or minimum point of the graph.



Example 2 Identify Characteristics from Graphs

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



Step 1 Find the vertex.

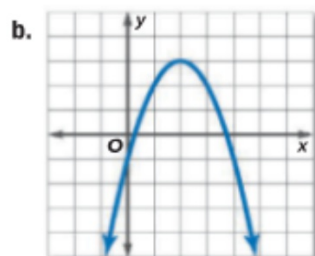
Because the parabola opens upward, the vertex is located at the minimum point of the parabola. It is located at $(-1, 0)$.

Step 2 Find the axis of symmetry.

The axis of symmetry is the line that goes through the vertex and divides the parabola into congruent halves. It is located at $x = -1$.

Step 3 Find the y -intercept.

The y -intercept is the point where the graph intersects the y -axis. It is located at $(0, 1)$, so the y -intercept is 1.



Step 1 Find the vertex.

The parabola opens downward, so the vertex is located at its maximum point, $(2, 3)$.

Step 2 Find the axis of symmetry.

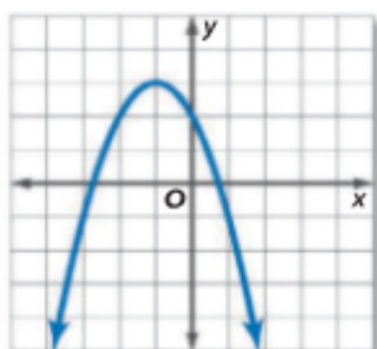
The axis of symmetry is located at $x = 2$.

Step 3 Find the y -intercept.

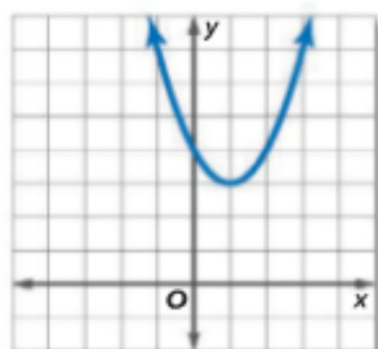
The y -intercept is where the parabola crosses the y -axis. It is located at $(0, -1)$, so the y -intercept is -1 .

GuidedPractice

2A.

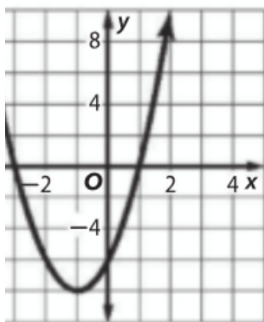


2B.



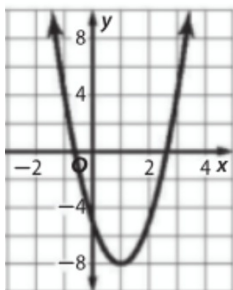
practice 1-8 on page 549

-3	-2	-1	0	1	2
0	-6	-8	-6	0	10



$D = \{\text{all real numbers}\};$
 $R = \{y \mid y \geq -8\}$

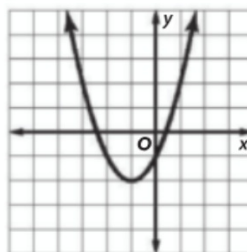
-2	-1	0	1	2	3
19	4	-5	-8	-5	4



$D = \{\text{all real numbers}\};$
 $R = \{y \mid y \geq -8\}$

2.

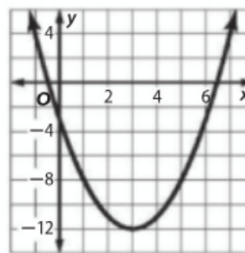
x	-3	-2	-1	0	1	2
y	2	-1	-2	-1	2	7



$D = \{\text{all real numbers}\};$
 $R = \{y \mid y \geq -2\}$

3.

x	y
-1	4
0	-3
1	-8
2	-11
3	-12
4	-11
5	-8
6	-3
7	4



$D = \{\text{all real numbers}\};$
 $R = \{y \mid y \geq -12\}$

cept

5. vertex $(-1, 5)$, axis of symmetry $x = -1$, y-intercept 3
6. vertex $(-2, -3)$, axis of symmetry $x = -2$, y-intercept 1
7. vertex $(-2, -12)$, axis of symmetry $x = -2$, y-intercept -4
8. vertex $(0, 5)$, axis of symmetry $x = 0$, y-intercept 5

