Graph the equation.

1. $y = -x - 1$
2. $y = \frac{3}{2}x + 2$
3. $y = -x - 2$
4. $y = 3x + 3$
5. $y = x$
6. $y = \frac{3}{4}x - 3$

Things to look for
: Slope
· Positive
· Negative

Warm Up

· Review graphing linear equations

· $y = mx + b$
↑ Slope, ↑ y-Intercept

· Always start with the y-Intercept

Use the Distributive Property to find the product.

1. $(x - 2)(x - 2)$
2. $(z + 6)(z - 2)$
3. $(g + 8)(g + 1)$
4. $(y - 7)(y - 3)$
5. $4m(m - 10)$
6. $(x - 4)(x - 1)$

Cumulative Warm Up

· Foil practice

· Can use double distributive
or
. Tic tac toe

Essential Question

What are some of the characteristics of the graph of a quadratic function of the form $f(x) = ax^2$?

· Shape
· positive
· negative

Essential Question

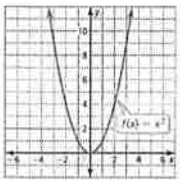
What you will learn:

· Identify the characteristics of quadratic functions

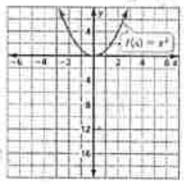
· Graph and use quadratic functions in the form $f(x) = ax^2$

Work with a partner. Graph each quadratic function. Compare each graph to the graph of $f(x) = x^2$.

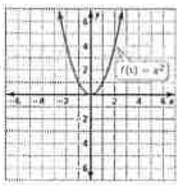
a. $g(x) = 3x^2$



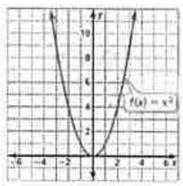
b. $g(x) = -5x^2$



c. $g(x) = -0.2x^2$



d. $g(x) = \frac{1}{10}x^2$



Exploration 1

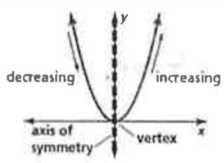
• Practice with a graphing Calculator

Core Concept

Characteristics of Quadratic Functions

The *parent quadratic function* is $f(x) = x^2$. The graphs of all other quadratic functions are *transformations* of the graph of the parent quadratic function.

The lowest point on a parabola that opens up or the highest point on a parabola that opens down is the **vertex**. The vertex of the graph of $f(x) = x^2$ is (0, 0).



The vertical line that divides the parabola into two symmetric parts is the **axis of symmetry**. The axis of symmetry passes through the vertex. For the graph of $f(x) = x^2$, the axis of symmetry is the y-axis, or $x = 0$.

Core Concept

quadratic Function: $y = ax^2 + bx + c$
$a \neq 0$

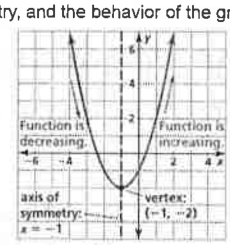
parabola: the shape of the graph of a quadratic

axis of symmetry: $x = \frac{-b}{2a}$

vertex: the highest or lowest point on the parabola

Consider the graph of the quadratic function.

Using the graph, you can identify characteristics such as the vertex, axis of symmetry, and the behavior of the graph, as shown.



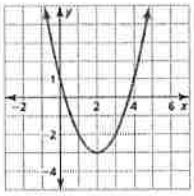
You can also determine the following:

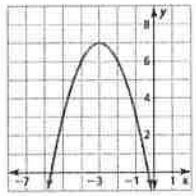
- The domain is all real numbers.
- The range is all real numbers greater than or equal to −2.
- When $x < -1$, y increases as x decreases.
- When $x > -1$, y increases as x increases.

Example 1

• point out label of parabola

Identify characteristics of the quadratic function and its graph.

1. 

2. 

Monitoring Progress 1-2

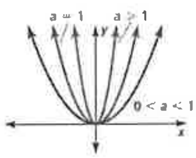
· label each piece of parabola

· axis of symmetry
· vertex
· maximum / minimum
· increase / decrease
· domain
· range

Core Concept

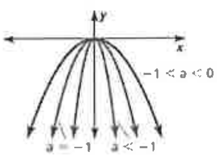
Graphing $f(x) = ax^2$ When $a > 0$

- When $0 < a < 1$, the graph of $f(x) = ax^2$ is a vertical shrink of the graph of $f(x) = x^2$.
- When $a > 1$, the graph of $f(x) = ax^2$ is a vertical stretch of the graph of $f(x) = x^2$.



Graphing $f(x) = ax^2$ When $a < 0$

- When $-1 < a < 0$, the graph of $f(x) = ax^2$ is a vertical shrink with a reflection in the x-axis of the graph of $f(x) = x^2$.
- When $a < -1$, the graph of $f(x) = ax^2$ is a vertical stretch with a reflection in the x-axis of the graph of $f(x) = x^2$.



Core Concept

· translations of the graph

· shrink vs stretch

Graph $g(x) = 2x^2$. Compare the graph to the graph of $f(x) = x^2$.

Example 2

· Graph the two and compare what is happening

Graph $h(x) = -\frac{1}{3}x^2$. Compare the graph to the graph of $f(x) = x^2$.

Example 3

· Graph and compare

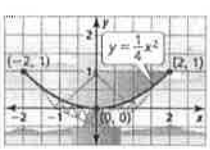
Graph the function. Compare the graph to the graph of $f(x) = x^2$.

3. $g(x) = 5x^2$ **4.** $h(x) = \frac{1}{3}x^2$ **5.** $n(x) = \frac{3}{2}x^2$

6. $p(x) = -3x^2$ **7.** $q(x) = -0.1x^2$ **8.** $g(x) = -\frac{1}{4}x^2$

Monitoring Progress 3-8

· Graph and compare



The diagram at the left shows the cross section of a satellite dish, where x and y are measured in meters. Find the width and depth of the dish.

Example 4

lowest point (0,0)

highest point (-2,1) (2,1)

Range $0 \le y \le 1$

4 meters wide

1 meter deep

9. The cross section of a spotlight can be modeled by the graph of $y = 0.5x^2$, where x and y are measured in inches and $-2 \le x \le 2$. Find the width and depth of the spotlight.

Monitoring Progress 9

Student practice

• **Exit Ticket:** Describe the differences between the graphs of $y = -3x^2$ and $y = \frac{1}{3}x^2$.

Closure