Essential Question: How does the value of $c$ affect the graph of $f(x) = ax^2 + c$?

Exploration 1: Graphing $y = ax^2 + c$

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner. Sketch the graphs of the functions in the same coordinate plane. What do you notice?

a. $f(x) = x^2$ and $g(x) = x^2 + 2$

b. $f(x) = 2x^2$ and $g(x) = 2x^2 - 2$
8.2  Graphing \( f(x) = ax^2 + c \) (continued)

2  EXPLORATION: Finding \( x \)-Intercepts of Graphs

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner. Graph each function. Find the \( x \)-intercepts of the graph. Explain how you found the \( x \)-intercepts.

a. \( y = x^2 - 7 \)

b. \( y = -x^2 + 1 \)

Communicate Your Answer

3. How does the value of \( c \) affect the graph of \( f(x) = ax^2 + c \)?

4. Use a graphing calculator to verify your answers to Question 3.

5. The figure shows the graph of a quadratic function of the form \( y = ax^2 + c \). Describe possible values of \( a \) and \( c \). Explain your reasoning.
8.2 Notetaking with Vocabulary
For use after Lesson 8.2

In your own words, write the meaning of each vocabulary term.

zero of a function

Core Concepts

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

- When $c > 0$, the graph of $f(x) = ax^2 + c$ is a vertical translation $c$ units up of the graph of $f(x) = ax^2$.

- When $c < 0$, the graph of $f(x) = ax^2 + c$ is a vertical translation $|c|$ units down of the graph of $f(x) = ax^2$.

The vertex of the graph of $f(x) = ax^2 + c$ is $(0, c)$, and the axis of symmetry is $x = 0$.

Notes:
Extra Practice

In Exercises 1–4, graph the function. Compare the graph to the graph of \( f(x) = x^2 \).

1. \( g(x) = x^2 + 5 \)

2. \( m(x) = x^2 - 3 \)

3. \( n(x) = -3x^2 - 2 \)

4. \( q(x) = \frac{1}{2}x^2 - 4 \)
8.2 Notetaking with Vocabulary (continued)

In Exercises 5–8, find the zeros of the function.

5. \( y = -x^2 + 1 \)
6. \( y = -4x^2 + 16 \)

7. \( n(x) = -x^2 + 64 \)
8. \( p(x) = -9x^2 + 1 \)

In Exercises 9 and 10, sketch a parabola with the given characteristics.

9. The parabola opens down, and the vertex is (0, 5).
10. The lowest point on the parabola is (0, 4).

11. The function \( f(t) = -16t^2 + s_0 \) represents the approximate height (in feet) of a falling object \( t \) seconds after it is dropped from an initial height \( s_0 \) (in feet). A tennis ball falls from a height of 400 feet.

a. After how many seconds does the tennis ball hit the ground?

b. Suppose the initial height is decreased by 384 feet. After how many seconds does the ball hit the ground?