Activity

8-1 Key Features of a Quadratic Function

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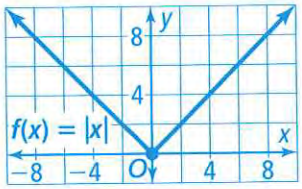
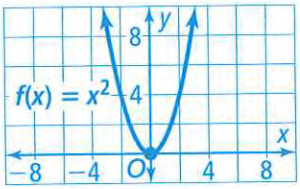
EXPLORE & REASON





A. **Look for Relationships** How is the graph of $f(x) = |x|$ similar to the graph of $f(x) = x^2$? How is it different? MP.7

B. What do you notice about the axis of symmetry in each graph?

HABITS OF MIND

Construct Arguments Why is the graph of $y = x^2$ always positive? MP.3

EXAMPLE 1 **Try It! Identify a Quadratic Parent Function**

1. When are the values of $f(x)$ positive and when are they negative?

EXAMPLE 2 **Try It! Understand the Graph of $f(x) = ax^2$**

2. How does the sign of a affect the domain and range of $f(x) = ax^2$?

EXAMPLE 3 **Try It! Interpret Quadratic Functions from Tables**

3. A function of the form $g(x) = ax^2$ increases over the interval $x < 0$ and decreases over the interval $x > 0$. What is a possible value for a? Explain.

HABITS OF MIND

Reason Suppose you are comparing rates of change for two quadratic functions of the form $f(x) = ax^2$ over the interval $2 < x < 5$. One function has a positive rate of change and the other function has a negative rate of change over this interval. What can you conclude about the value of a in each function? Which function has a maximum value and which has a minimum value? Explain. **MP.2**

EXAMPLE 4 **Try It! Apply Quadratic Functions**

4. By how much will the cost increase if the side length of the dance floor is increased by 2 ft?

EXAMPLE 5 **Try It! Compare the Rate of Change**

5. How do the average rates of change for $f(x) = -0.5x^2$ and $g(x) = -1.5x^2$ over the interval $-5 \leq x \leq -2$ compare?

HABITS OF MIND

Look for Relationships How does knowing whether a function of the form $f(x) = ax^2$ has a maximum or minimum value help you know over what intervals the function increases and decreases? MP.7

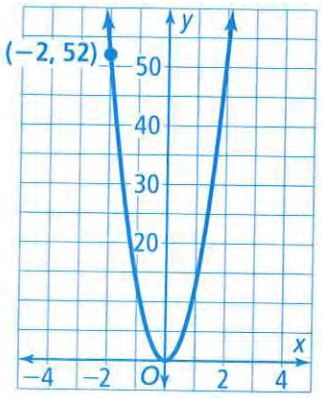
Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** What is the quadratic parent function and how can you recognize the key features of its graph?

2. **Communicate Precisely** How is the graph of $f(x) = ax^2$ similar to the graph of $f(x) = x^2$? How is it different? MP.6

3. **Vocabulary** Make a conjecture about why the term *quadratic parent function* includes the word "parent."

4. **Error Analysis** Abby graphed the function $f(x) = -13x^2$ by plotting the point $(-2, 52)$. Explain the error Abby made in her graph. MP.3



Do You KNOW HOW?

How does the value of a in each function affect its graph when compared to the graph of the quadratic parent function?

5. $g(x) = 4x^2$

6. $h(x) = 0.8x^2$

7. $j(x) = -5x^2$

8. $k(x) = -0.4x^2$

9. Given the function $f(x) = 2.5x^2 + 3$, find the average rate of change over the interval $0 \le x \le 4$. What does the average rate of change tell you about the function?