Name _____ Date _____ Class _____

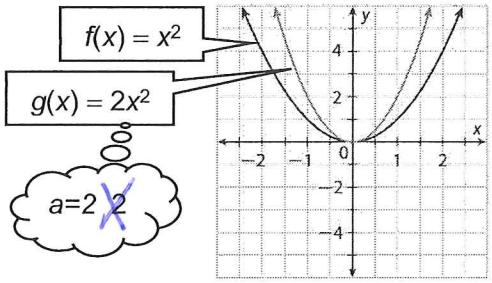
LESSON 19-1

Understanding Quadratic Functions

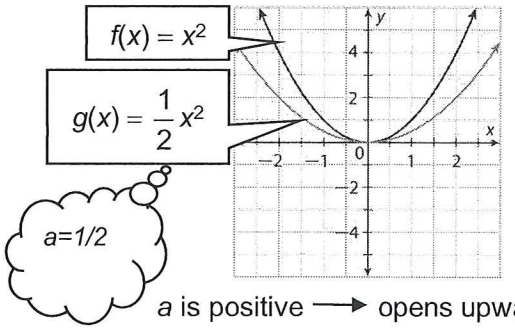
Compare the graph of $g(x) = ax^2$ to the graph of $f(x) = x^2$.
Remember f(x) is the Parent Graph with Vertex (0,0)

Problem 1

Let *a* be a positive number.



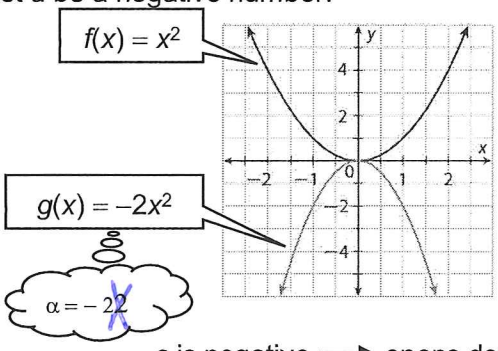
a is positive ⟶ opens upward
a is greater than 1 ⟶ narrower
vertical stretch (skinnier)



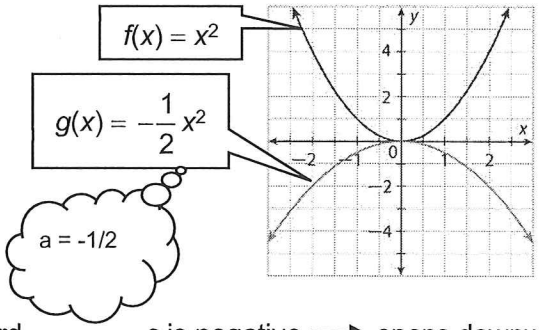
a is positive ⟶ opens upward
a is between 0 and 1 ⟶ wider
vertical shrink (opens wider)

Problem 2

Let *a* be a negative number.



a is negative ⟶ opens downward
a is less than –1 ⟶ narrower
vertical stretch (skinnier)



a is negative ⟶ opens downward
a is between –1 and 0 ⟶ wider
vertical shrink (opens wider)

1. Why do both graphs in Problem 2 open downward?

_____

2. Why is the first graph in Problem 2 narrower than the graph of $f(x) = x^2$?

_____

3. What will the graph of $g(x) = -x^2$ look like? Explain.

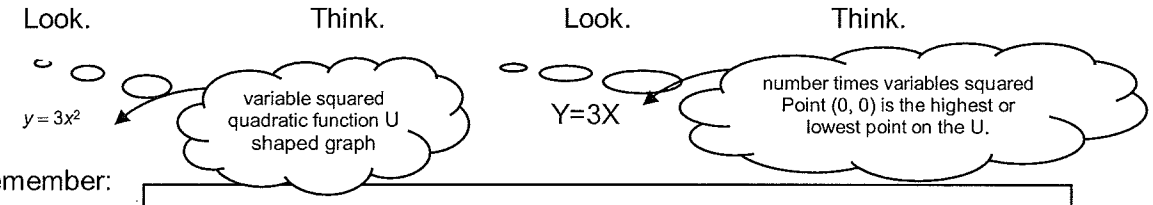
_____

LESSON 19-1

Understanding Quadratic Functions

Reteach

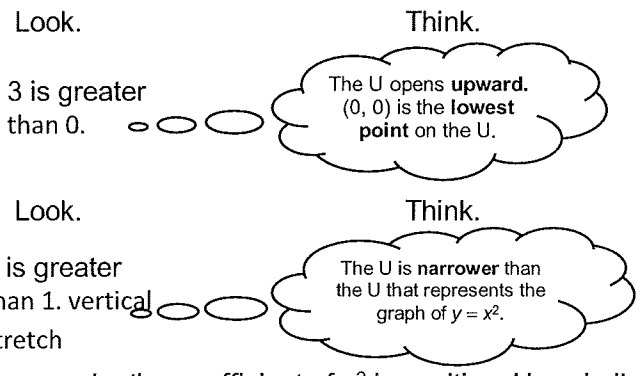
To analyze a function of the form $y = ax^2$, where a is not 0, you can take notes about the equation.

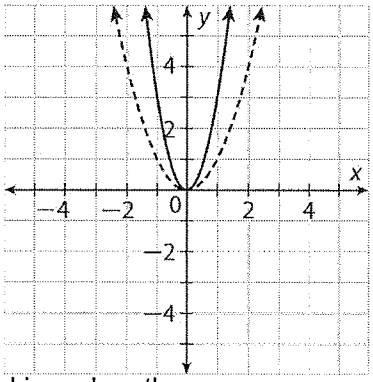


Remember:

> The line $x = 0$ divides the U into left and right parts that are identical. The U is symmetric with $x = 0$ as the line of symmetry.

Now look at the number 3, the coefficient of x^2.





In this example, the coefficient of x^2 is positive. Use similar thinking when the coefficient is negative. The U will flip over the x-axis of the one shown here.

Answer each question about $y = -3x^2$.

1. Does the graph open up or down? _____

2. Is (0, 0) the highest (maximum) or lowest (minimum) point on the graph? _____

Answer each question about $y = 0.1x^2$.

3. Is the graph wider or more narrow than the graph of $y = x^2$? _____

4. What is an equation of the axis of symmetry of the graph? _____

Answer each question about $y = -0.1x^2$.

5. Does the graph open up or down? _____

6. What are the coordinates of the highest (maximum) or lowest (minimum) point on the graph? _____

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LESSON 19-1

Understanding Quadratic Functions

Practice and Problem Solving: A/B

For Exercises 1–4, tell whether the graph of the function

a. opens upward or downward

b. has a maximum or minimum

c. is a reflection across the *x*-axis of the parent function

d. is a stretch or a compression (shrink)?

1. $y = 4x^2$

_____

_____

2. $y = -5x^2$

_____

_____

3. $y = -3.2x^2$

_____

_____

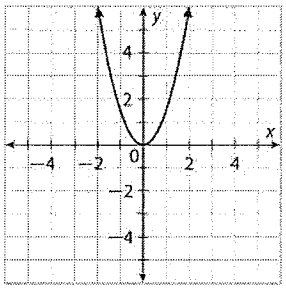
4. $y = 0.4x^2$

_____

_____

Determine the characteristics of each quadratic function.

5. $y = 1.5x^2$



Vertex: _____

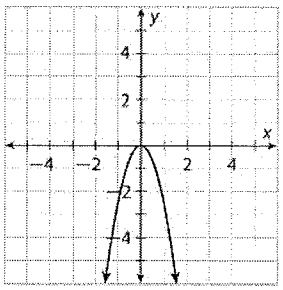
Minimum (if any): _____

Maximum (if any): _____

Parent function reflected across *x*-axis? _____

Stretch or shrink? _____

6. $y = -2.5x^2$



Vertex: _____

Minimum (if any): _____

Maximum (if any): _____

Parent function reflected across *x*-axis? _____

Stretch or shrink? _____

Solve.

7. A quadratic function has the form $y = ax^2$ for some nonzero value of a and (4, 48) is on the graph. What is the value of a? _____

Answer Keys for the following worksheets

UNDERSTANDING QUADRATIC FUNCTIONS

1) When the value of a is negative, the graph of $f(x) = x^2$ is reflected across the x-axis and opens downward.
2) The value of a is -2. When the value of a is less than -1, the graph of $f(x) = x^2$ is stretched vertically.
3) The graph of $g(x)$ is a parabola that opens downward and has the same width as the graph of $f(x) = x^2$. Possible explanation: The expression $-x^2$ is equivalent to $-1x^2$, and so the value of a is -1. Since the value of a is negative, the graph is the reflection of $f(x) = x^2$ when it is reflected across the x-axis. That is the reason the graph of $g(x)$ opens downward. For every x, the value of $g(x)$ is the opposite of the value of $f(x)$. That is the reason the graph of $g(x)$ has the same width as the graph of $f(x)$.

RETEACH

1) down
2) highest
3) wider
4) $x = 0$
5) down
6) (0, 0)

PRACTICE AND PROBLEM SOLVING: A/B

1) a. upward
   b. minimum 0 c. no
   d. stretch
2) a. downward b. maximum 0 c. yes
   d. stretch
3) a. downward b. maximum 0 c. yes
   d. stretch
4) a. upward
   b. minimum
   c. no
   d. compression
5) (0, 0), 0, none, no, stretch
6) (0, 0), none, 0, yes, stretch
7) 3