

Vocabulary

- Parent Function
 - The most basic function of a family of functions, or the original function before a transformation is applied
- Transformation
 - A change in the position, size, or shape of a figure. A transformation *maps* the *preimage* to the *image*.

Transformation Notes

- If a number is inside the parentheses:
 - It affects “x”
 - It tells you how many units to shift left or right and does the opposite of what you expect
- If a number is in front of $f(x)$:
 - It affects the “y”
 - It is your stretch or shrink factor
- If a number is behind $f(x)$:
 - It affects the “y”
 - It tells you how many units to shift up or down

Transformation Notes

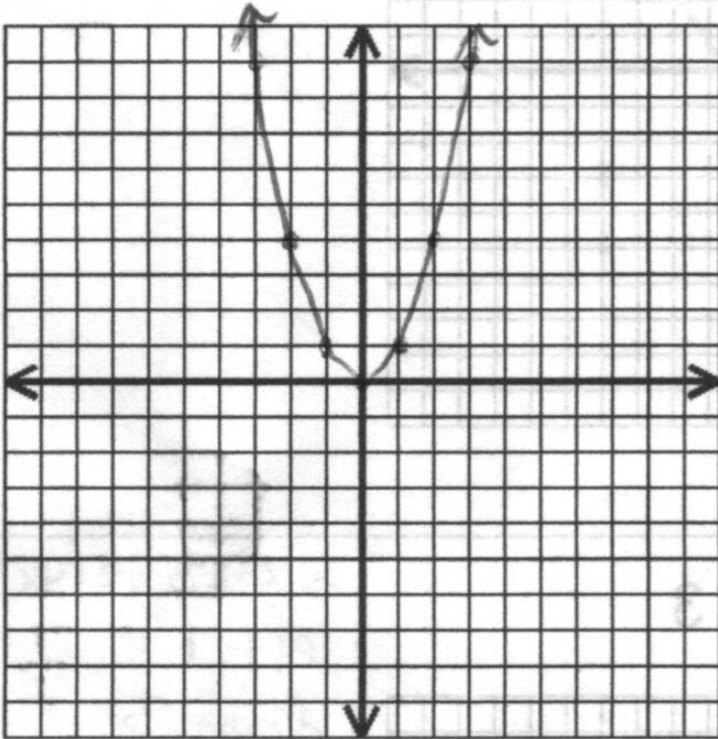
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- If $f(x)$ is negative:
 - It affects the “y”
 - It reflects across the x-axis

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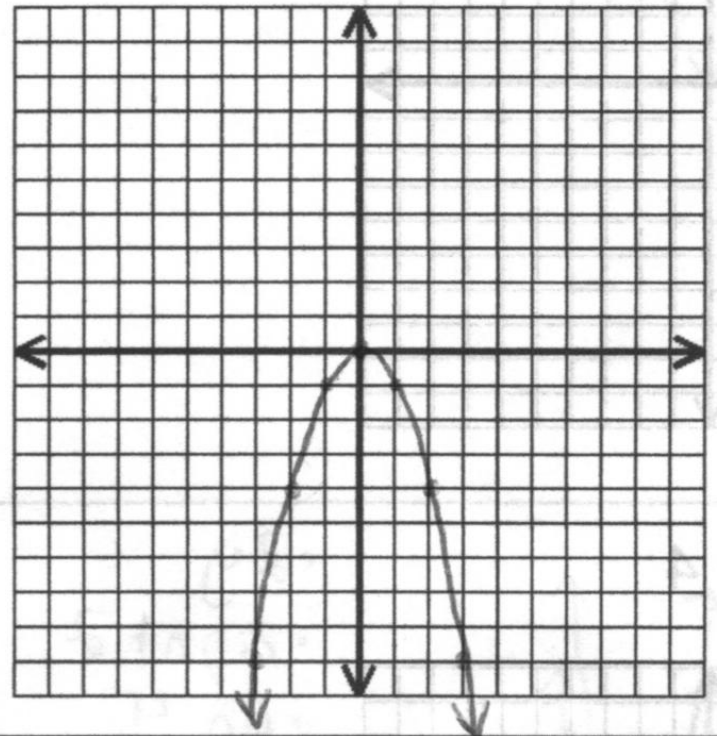
Parent Function

Graph: $f(x) = x^2$



x-axis reflection

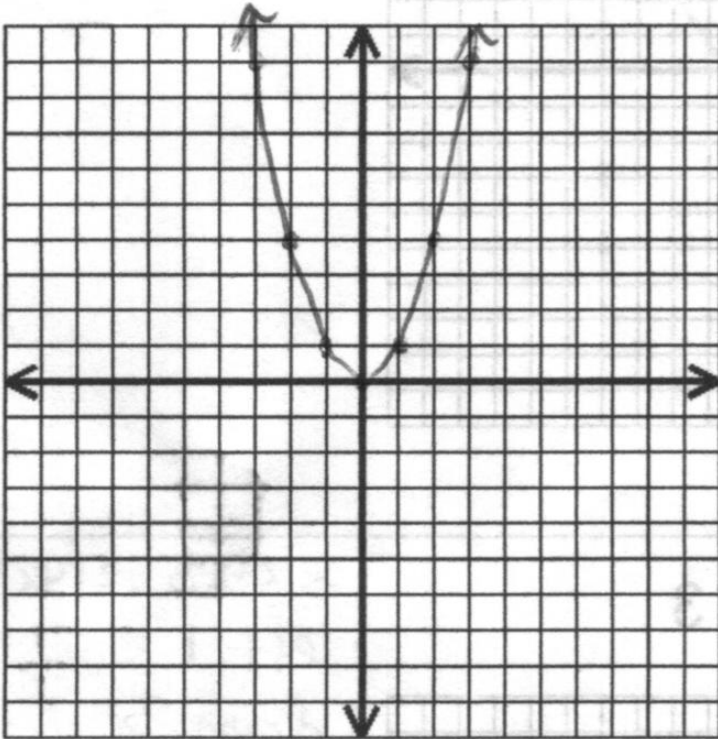
1. $-f(x)$



Graph and compare the following to this parent function. Describe what happens to the graph.

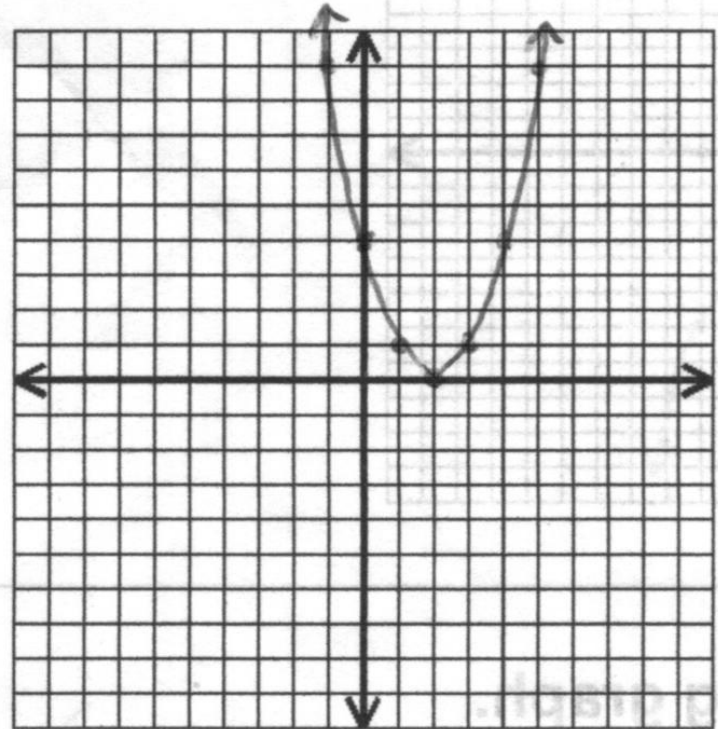
Parent Function

Graph: $f(x) = x^2$



Right 2

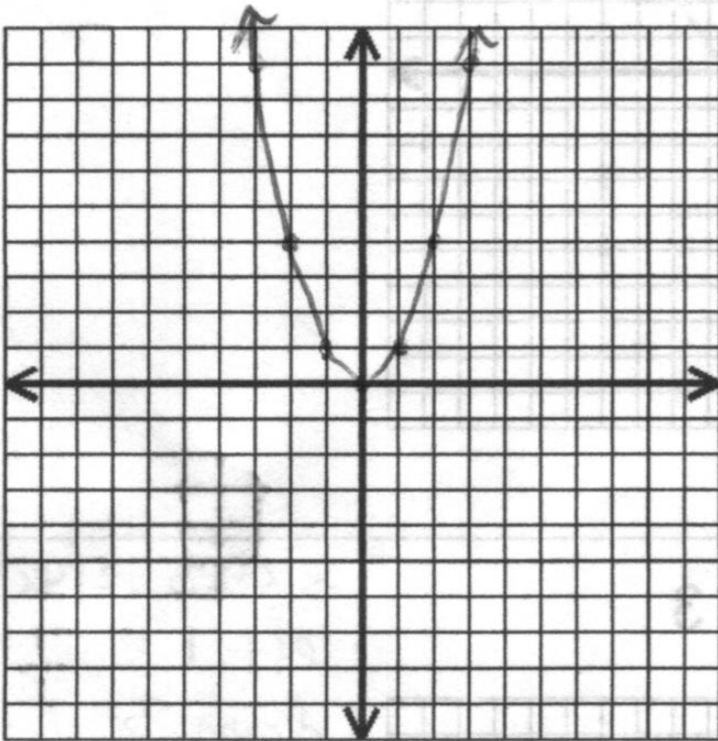
2. $f(x - 2)$



Graph and compare the following to this parent function. Describe what happens to the graph.

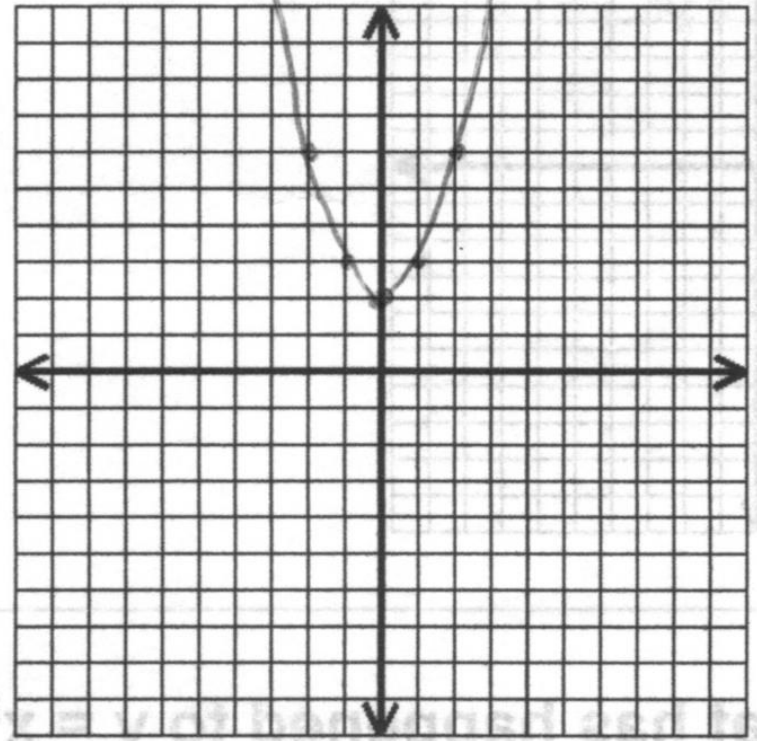
Parent Function

Graph: $f(x) = x^2$



Up 2

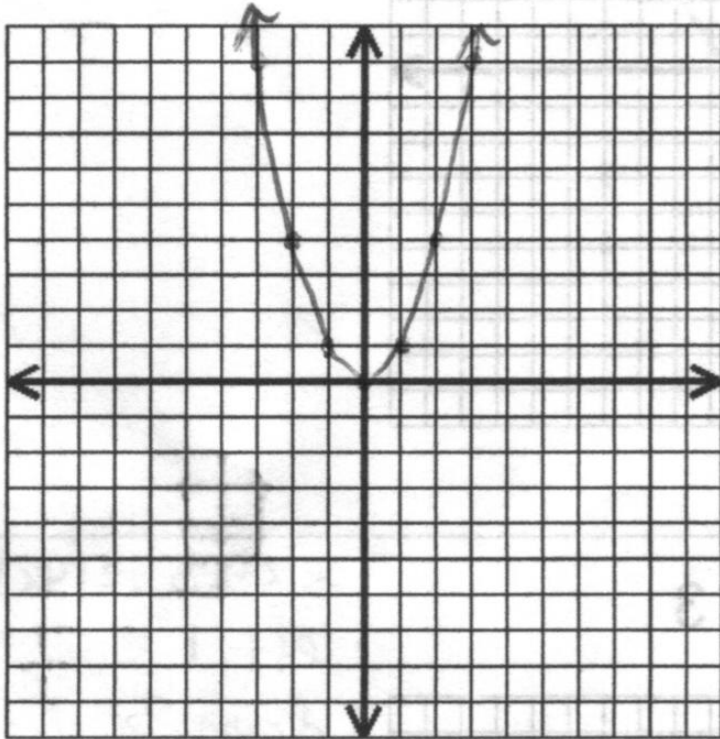
3. $f(x) + 2$



Graph and compare the following to this parent function. Describe what happens to the graph.

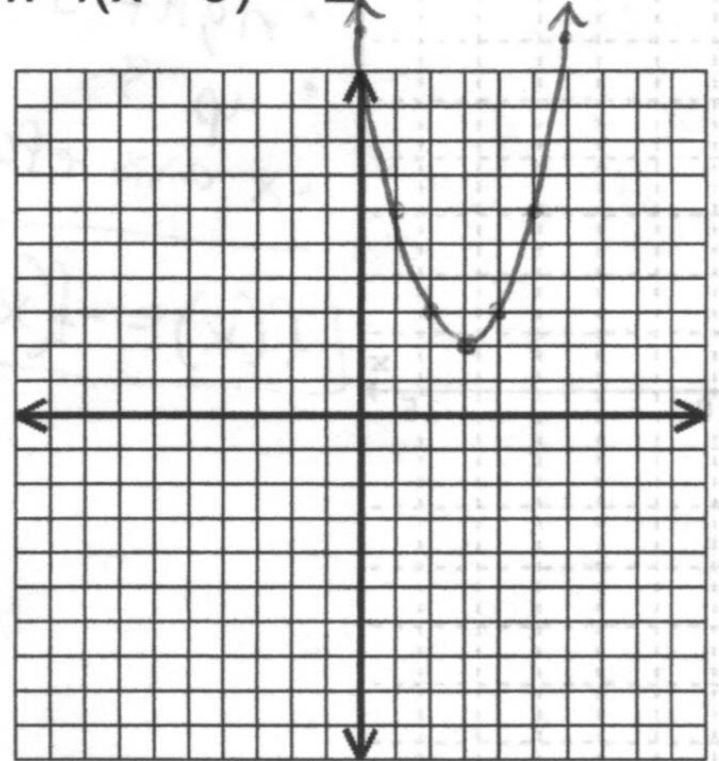
Parent Function

Graph: $f(x) = x^2$



Right 3; up 2

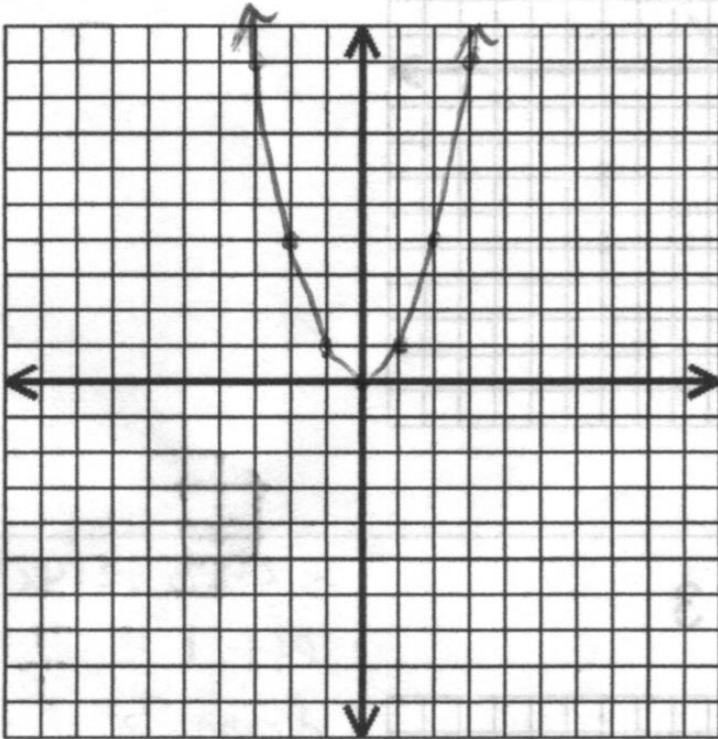
4. $f(x - 3) + 2$



Graph and compare the following to this parent function. Describe what happens to the graph.

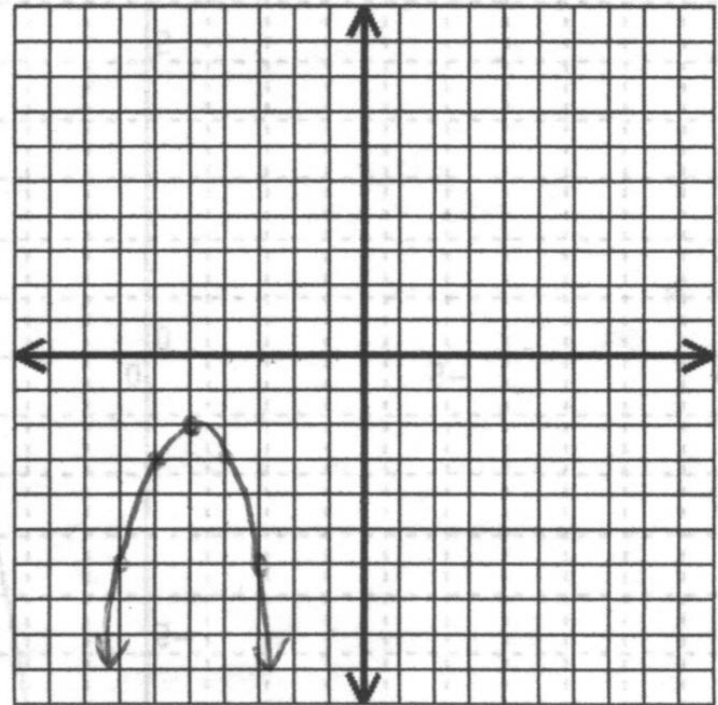
Parent Function

Graph: $f(x) = x^2$



x-axis reflection; left 5; down 2

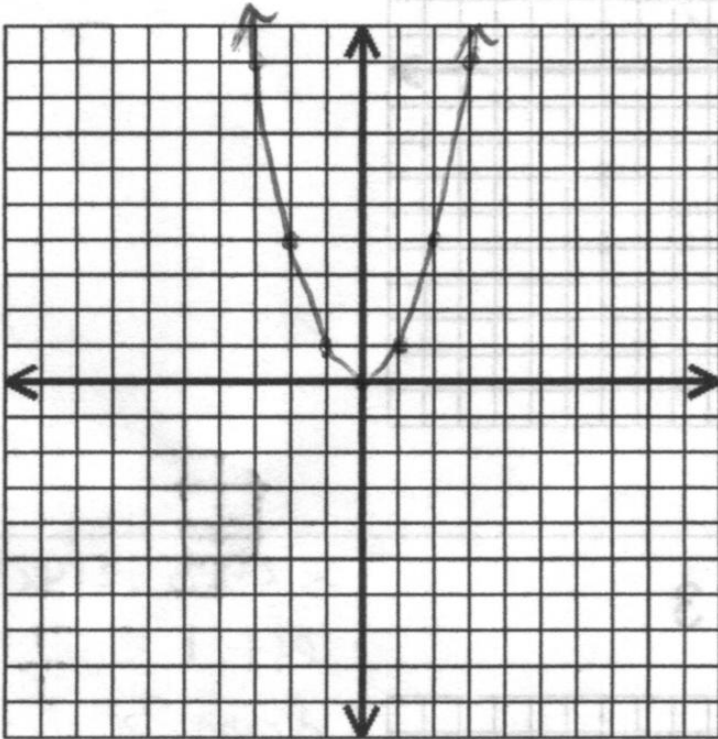
5. $-f(x + 5) - 2$



Graph and compare the following to this parent function. Describe what happens to the graph.

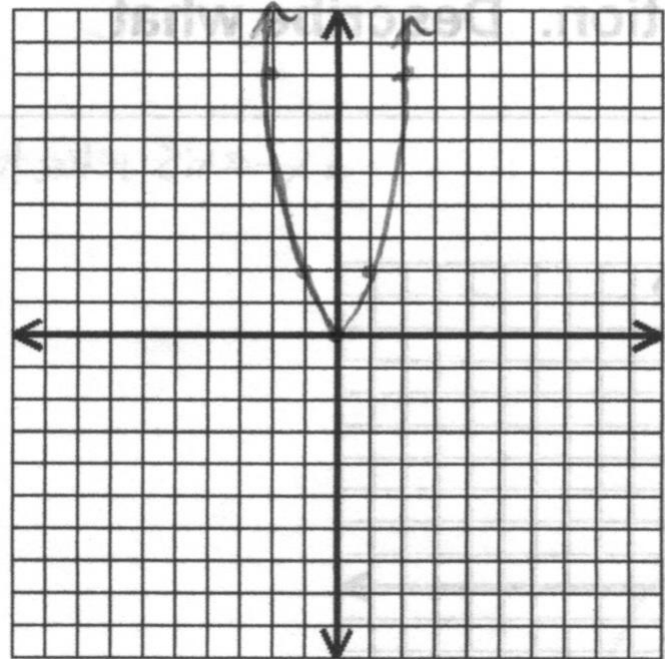
Parent Function

Graph: $f(x) = x^2$



Vertical stretch factor of 2

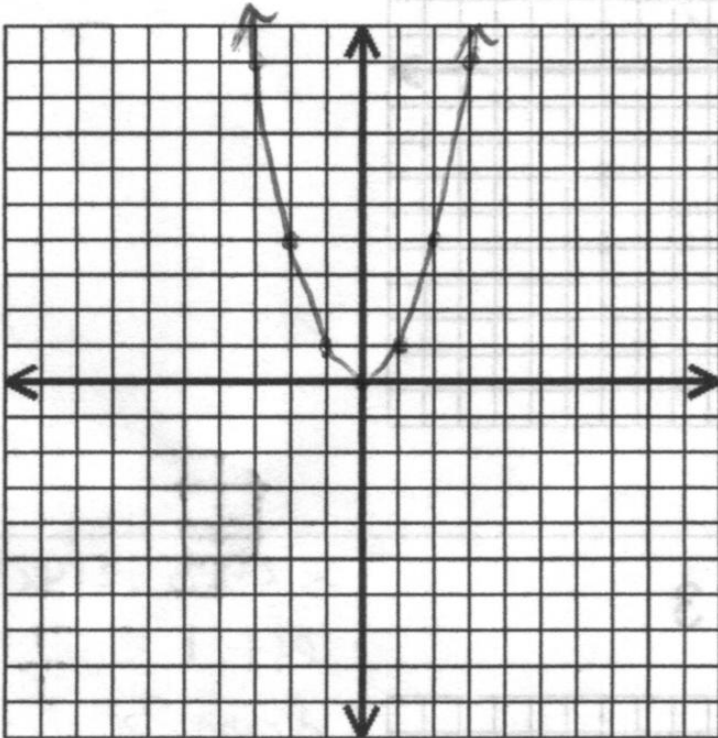
6. $2f(x)$



Graph and compare the following to this parent function. Describe what happens to the graph.

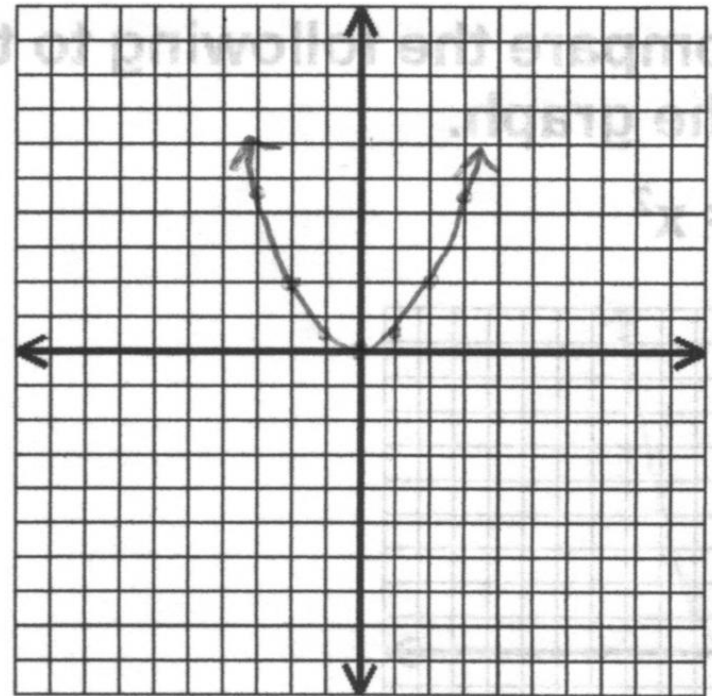
Parent Function

Graph: $f(x) = x^2$



Vertical shrink factor of $\frac{1}{2}$

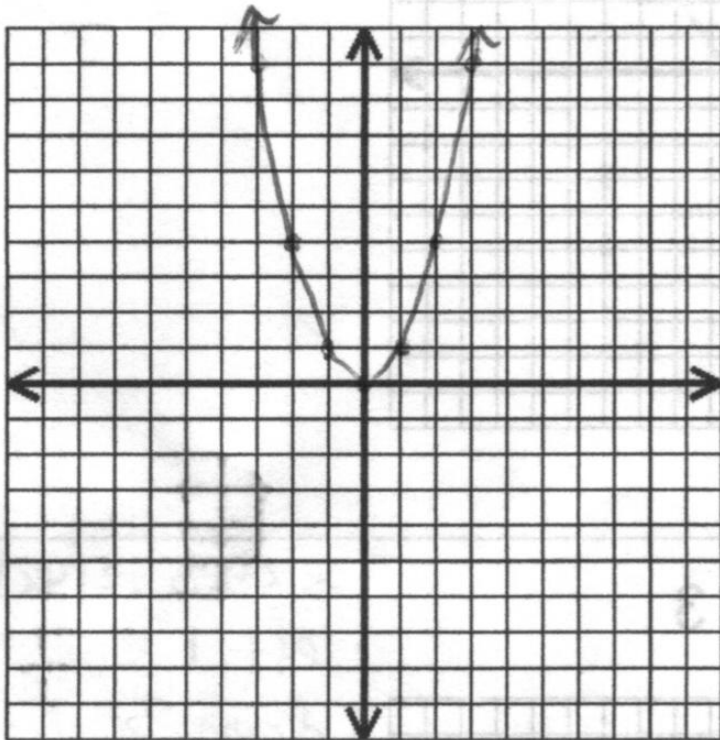
7. $\frac{1}{2}f(x)$



Graph and compare the following to this parent function. Describe what happens to the graph.

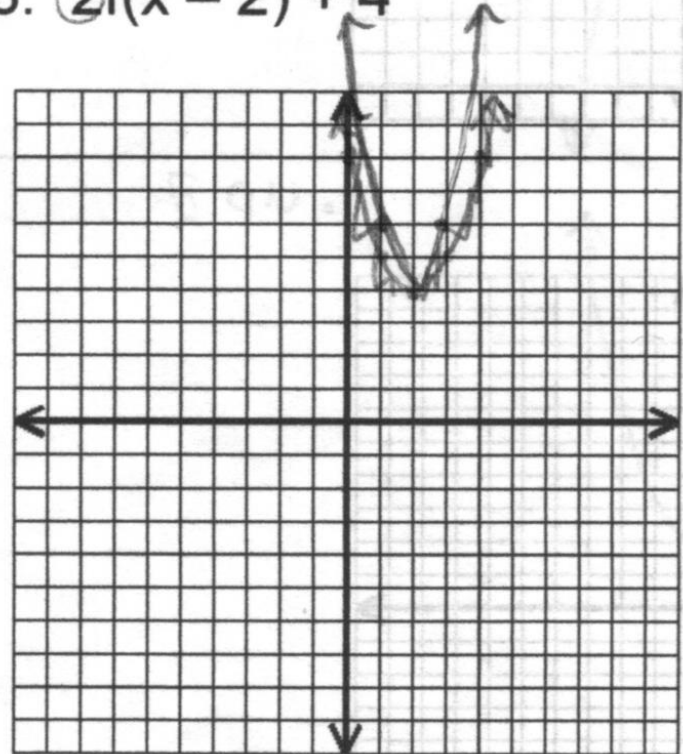
Parent Function

Graph: $f(x) = x^2$



Vertical stretch factor of 2;
right 2; up 4

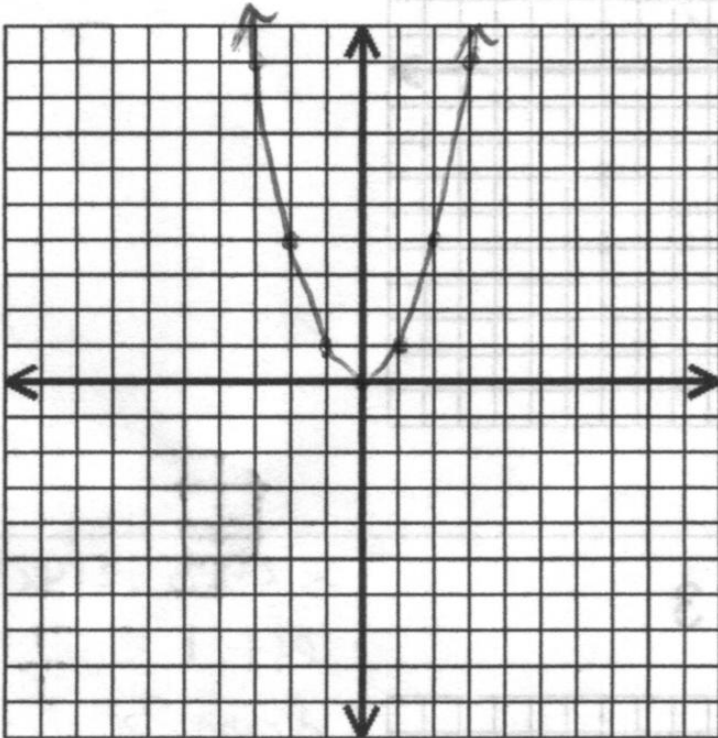
8. $2f(x - 2) + 4$



Graph and compare the following to this parent function. Describe what happens to the graph.

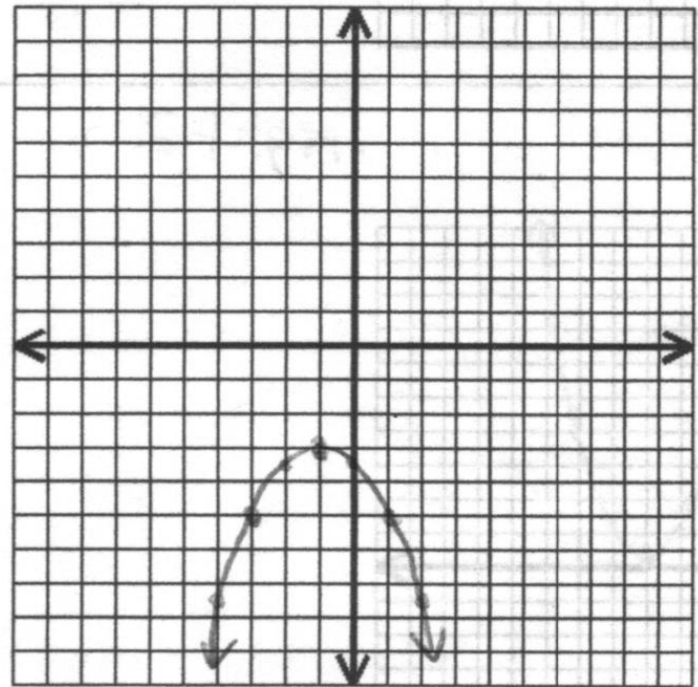
Parent Function

Graph: $f(x) = x^2$



x-axis reflection; left 1; down 3;
vertical shrink factor of $\frac{1}{2}$;

9. $-\frac{1}{2}f(x + 1) - 3$



Graph and compare the following to this parent function. Describe what happens to the graph.

Transformations of Graphs

Linear: $y = mx + b \rightarrow y = x$

--The m determines steepness.

--The b determines the shift.

-- + shifts up and - shifts down.

Quadratic: $y = a(x-h)^2 + k \rightarrow y = x^2$

--The vertex is (h,k).

--The a determines Vertical Stretch or Vertical Shrink.

--If $a > 1$, it will be a Vertical Stretch. If $0 < a < 1$, it will be a Vertical Shrink.

--The h shifts the graph left and right.

--The k shifts the graph up and down.

--If the a is positive it opens up. If it is -, it opens down.

--If a is negative, it is called a Reflection across the x-axis.

--This graph is Symmetric or it reflects itself.

Absolute Value: $y = a|x-h| + k \rightarrow y = |x|$

--The vertex is (h,k).

--a acts like the slope.

--h shifts the graph left and right.

--k shifts the graph up and down.

--This graph is Symmetric or it reflects itself.

Radical: $y = a\sqrt{x-h} + k \rightarrow y = \sqrt{x}$

--The vertex is (h,k).

--The a determines Vertical Stretch or Vertical Shrink.

--If $a > 1$, it will be a Vertical Stretch. If $0 < a < 1$, it will be a Vertical Shrink.

--The h shifts the graph left and right.

--The k shifts the graph up and down.

--If the a is positive it opens up. If it is -, it opens down.

--If a is negative, it is called a Reflection across the x-axis.

--This graph is Symmetric or it reflects itself.

Determine the transformations from the parent function.

1) $y = \sqrt{x} + 4$ (0,4)

- Shifted up 4 units.

2) $y = 3\sqrt{x-2}$ (2,0)

- Vertical Stretch with a factor of 3.

- Shifts right 2 units.

3) $y = -2(x+1)^2$ (-1,0)

- Vertical Stretch with a factor of 2.

- Reflection across x-axis.

- Shifted left 1 unit.

4) $y = (x+3)^2 + 2$ (-3,2)

- Shifted left 3 units and up 2 units.

5) $y = |x+3| - 1$ (-3,-1)

- Shifted left 3 units, down 1 unit

6) $y = -2|x-3|$ (3,0)

- Vertical Stretch with a factor of 2.

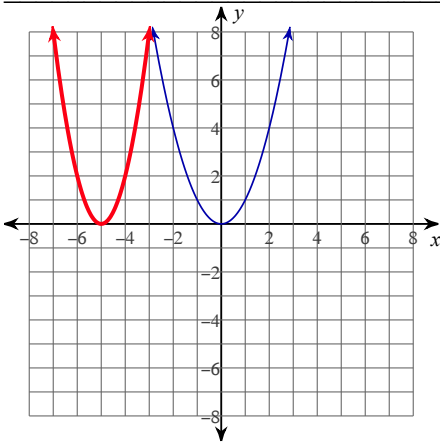
- Reflection across the x-axis.

- Shifted right 3 units.

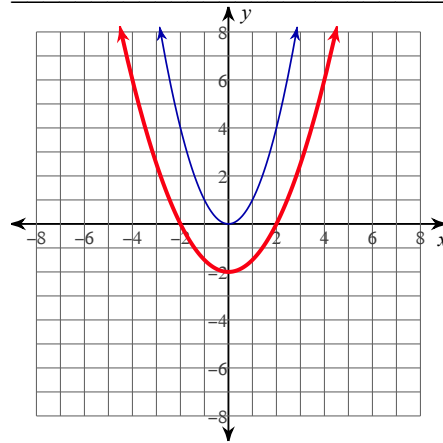
Transformations of Quadratic Graphs: All types

Fill in the blanks with the transformation or transformations of each parent function $y = x^2$ (The parent graph is the graph with the thin line in blue, the transformed graph is the thick line in red).

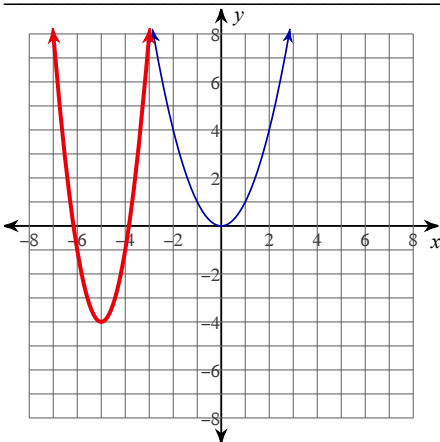
1) _____



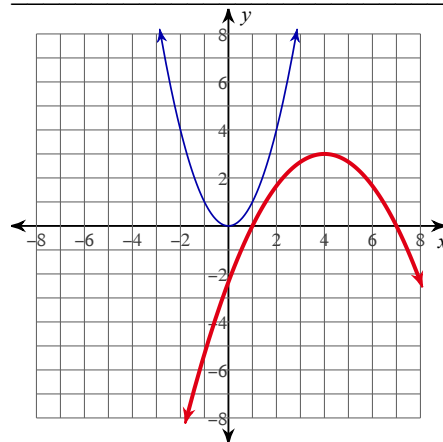
2) _____



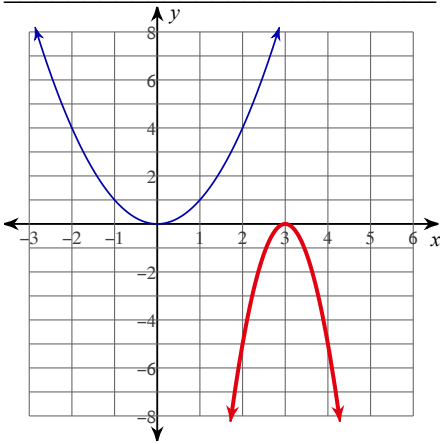
3) _____



4) _____



5) _____



Use the given function to list the transformations to the quadratic parent.

6) $y = -\frac{1}{4}(x + 1)^2$

7) $y = -6(x - 2)^2 + 8$

8) $y = -(x + 5)^2 - 3$

9) $y = \frac{3}{4}(x + 9)^2 - 1$

10) $y = \frac{2}{5}x^2 + 7$

Answers to Transformations of Quadratic Graphs: All types (ID: 1)

- 1) Vertical Stretch by a factor of 2
Horizontal Translation left 5 units
- 2) Vertical Compression by a factor of $\frac{1}{2}$
Vertical Translation down 2 units
- 3) Vertical Stretch by a factor of 3
Horizontal Translation left 5 units
Vertical Translation down 4 units
- 4) Reflection over the x-axis
Vertical Compression by a factor of $\frac{1}{3}$
Horizontal Translation right 4 units
Vertical Translation up 3 units
- 5) Reflection over the x-axis
Vertical Stretch by a factor of 5
Horizontal Translation right 3 units
- 6) reflection over the x-axis
Vertical compression by a factor of $\frac{1}{4}$
Horizontal Translation left 1
- 7) reflection over the x-axis
Vertical stretch by a factor of 6
Horizontal Translation right 2
Vertical Translation up 8
- 8) reflection over the x-axis
Horizontal Translation left 5
Vertical Translation down 3
- 9) Vertical compression by a factor of $\frac{3}{4}$
Horizontal translation left 9
Vertical translation down 1
- 10) Vertical compression by a factor of $\frac{2}{5}$
Vertical translation up 7