"Old" families | Linear $y=x$ | Absolute Value $y=|x|$ | Exponential $y=b^x$

Name ______________________ Date Key

8.1 Notetaking with Vocabulary

I can identify characteristics (properties) of quadratics: ⇐ Day 1

- opens up/down, axis of symmetry and vertex.

I can graph quadratics using transformations. ⇐ Day 2

Write the meaning of each vocabulary term.

quadratic function – a nonlinear function that can be written in the standard form $y=ax^2+bx+c$ where $a \neq 0$.

function notation : $f(x) = ax^2 + bx + c$

parabola – the U-shaped graph of a quadratic

In this lesson we will graph quadratics where $b=0$ and $c=0$. $(ax^2)=y$

Core Concepts New family - Quadratics

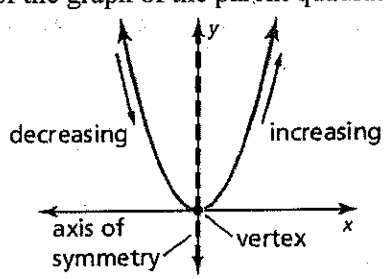
Characteristics of Quadratic Functions

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.

$f(x)=x^2$ Key points

x	y
-2	4
-1	1
0	0
1	1
2	4

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 origin is the lowest point.



The vertical line that divides the parabola into two $\boxed{\text{symmetric}}$ 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 $\boxed{x = 0.}$

AoS = Axis of Symmetry

always give the axis of symmetry as the equation of a vertical line : x = #

Notes:

D: ℝ or $\{-\infty < x < \infty\}$

R: $\{y \geq 0\}$

when $x < 0$, y decreases as x increases.

when $x > 0$, y increases as x increases.

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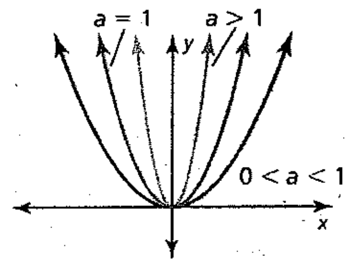
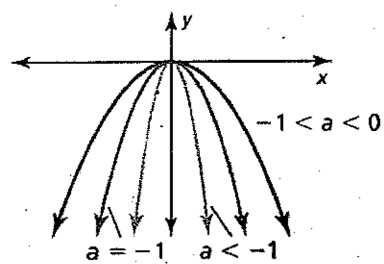
Graphing $f(x) = ax^2$ When $a > 0$ – opens up



- When $0 < a < 1$, the graph of $f(x) = ax^2$ is a vertical shrink of the graph of $f(x) = x^2$.
  compression
- 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 $a < 0$ – opens down



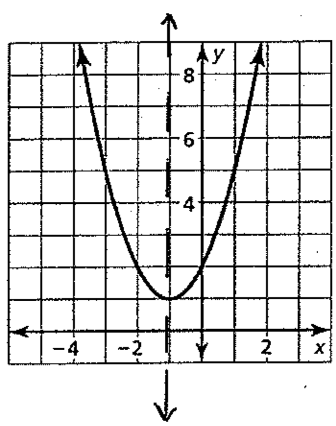
- When $-1 < a < 0$, the graph of $f(x) = ax^2$ is a vertical shrink with a reflection in the x-axis of the graph of $f(x) = x^2$.
  compression
- When $a < -1$, the graph of $f(x) = ax^2$ is a vertical stretch with a reflection in the x-axis of the graph of $f(x) = x^2$.

Practice

In Exercises 1 and 2, identify characteristics of the quadratic function and its graph.

vertex: $(-1, 1)$ opens up
AoS: $x = -1$

1.

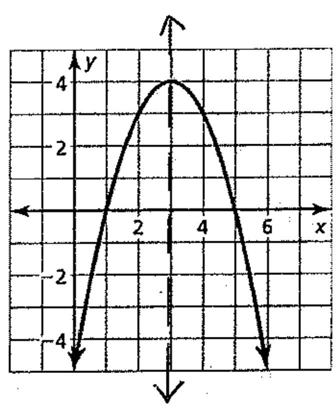


$x = -1$

D: $\mathbb{R}$
R: $\{y \geq 1\}$
when $x < -1$, $y\downarrow$ as $x\uparrow$
when $x > -1$, $y\uparrow$ as $x\uparrow$

vertex: $(3, 4)$ opens down
AoS: $x = 3$

2.



$x = 3$

D: $\mathbb{R}$
R: $\{y \leq 4\}$
when $x < 3$, $y\uparrow$ as $x\uparrow$
when $x > 3$, $y\downarrow$ as $x\uparrow$

use a table of values
to graph parent $f(x) = x^2$

x	f(x)
-2	4
-1	1
0	0
1	1
2	4

$f(-2) = (-2)^2$
$f(-2) = 4$

$y = (-1)^2$
$y = 1$

In Exercises 3–8, graph the function. Compare the graph to the graph of $f(x) = x^2$.

Note that when "a" is negative parabola opens down + is a reflection

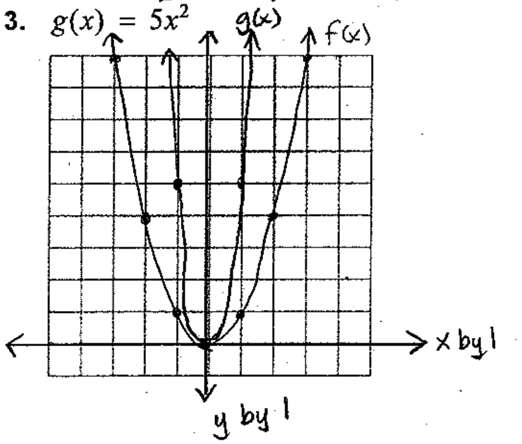
3. $g(x) = 5x^2$

vertical stretch (narrower)

x	g(x)
-1	5
0	0
1	5
2	20

v

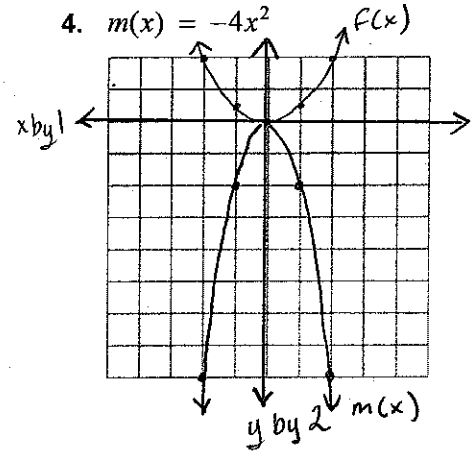
AoS x=0



g(x) is a vertical stretch by a factor of 5 of f(x).

4. $m(x) = -4x^2$

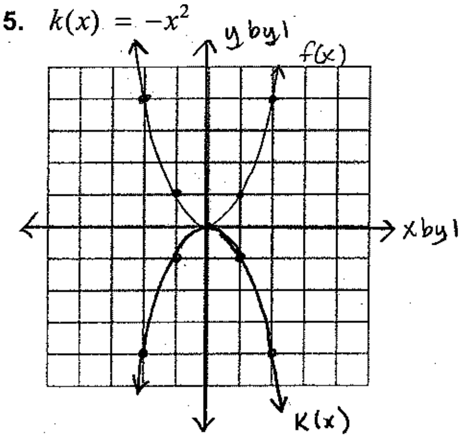
x	m(x)
-1	-4
0	0
1	-4
2	-16



m(x) is a reflection over the x-axis and a vertical stretch by a factor of 4 of f(x).

5. $k(x) = -x^2$

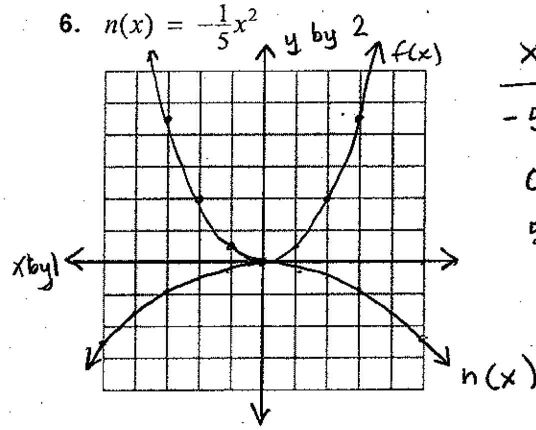
x	K(x)
-2	-4
-1	-1
0	0
1	-1
2	-4



K(x) is a reflection over the x-axis of f(x).

6. $n(x) = -\frac{1}{5}x^2$

x	n(x)
-5	-5
0	0
5	-5



n(x) is a reflection over the x-axis and a vertical compression by a factor of 5 of f(x).

In Exercises 9 and 10, determine whether the statement is *always, sometimes,* or *never* true. Explain your reasoning.

9. The graph of $g(x) = ax^2$ is wider than the graph of $f(x) = x^2$ when $a > 0$.

This is sometimes true. When $0 < a < 1$ then g(x) is wider than f(x). But when $a > 1$, g(x) is narrower than f(x).

10. The graph of $g(x) = ax^2$ is narrower than the graph of $f(x) = x^2$ when $|a| < 1$.

This is never true. When $0 < |a| < 1$ then ax^2 is wider than $f(x) = x^2$ because $|a|$ is causing a compression of the parent.