8.1 Graph Quadratic Functions of the Form: $f(x) = ax^2$

Essential Question:

What are some of the characteristics of the graph of a quadratic functino of the form $f(x) = ax^2$?

What You Will Learn:

- Identify characteristics of quadratic functions
- Graph and use quadratic functions of the form $f(x) = ax^2$

Core Vocabulary:

quadratic function

parabola

vertex

axis of symmetry

PREVIOUS:

domain

range

vertical shrink

vertical stretch

reflection

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Identifying Characteristics of Quadratic Functions

A quadratic function is a nonlinear function that can be written in the standard form $y = ax^2 + bx + c$, where $a \neq 0$. The U-shaped graph of a quadratic function is called a parabola. In this lesson, you will graph quadratic functions where b and c equal 0.

CORE CONCEPT:

$f(x) = x$

The *parent function* is $f(x) = x^2$. The graphs of all other quadratic functions are *transformations* of the graph of the parent quadratic function.

REMEMBER
The notation $f(x)$ is another name for y.

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 vertical line that divides the parabola into two 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 $x = 0$.

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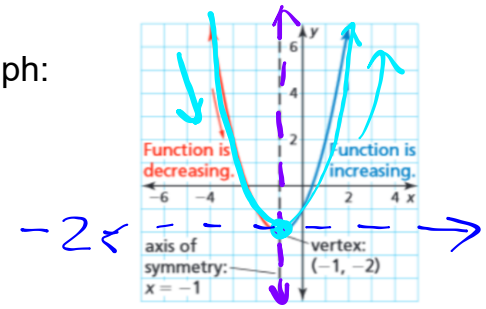
Example 1:

Identify example of characteristics of this graph:



vertex (Min) (-1,-2)

axis of symmetry x = -1

behavior increasing/decreasing

x < -1, y increases as x decreases

x > -1 y increases as x increases

Compare to dec/inc on graph

domain : ℝ

range : $y \geq -2$

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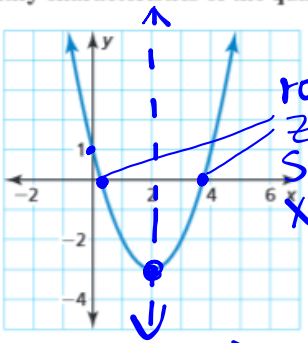
Practice:

Identify characteristics of the quadratic function and its graph.

1.



roots
zeros
solutions
x-intercepts

Vertex: (2,-3)

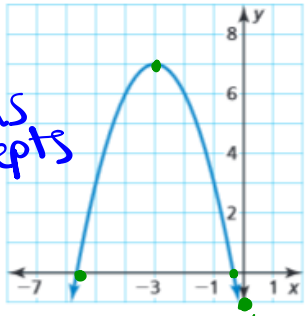
AofS: x=2

zeros: x=.5, 3.5

y-int: (0,1)

D: ℝ R: $y \geq -3$

2.



Vertex: (-3,7)

AofS: x=-3

zeros: x=-0.5, -5.5

y-int: (0,-1)

D: ℝ R: $y \leq 7$

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8.1 Graph Quadratic f(x)ax2 with work

REMEMBER

The graph of $y = a \cdot f(x)$ is a vertical stretch or shrink by a factor of a of the graph of $y = f(x)$.

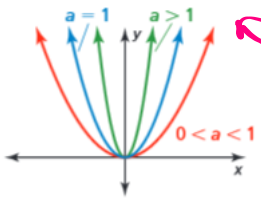
The graph of $y = -f(x)$ is a reflection in the x-axis of the graph of $y = f(x)$.

Graphing and Using $f(x) = ax^2$

Core Concept

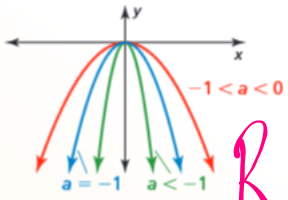
Graphing $f(x) = ax^2$ When $a > 0$

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

- 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 $f(x) = x^2$.
- 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 $f(x) = x^2$.



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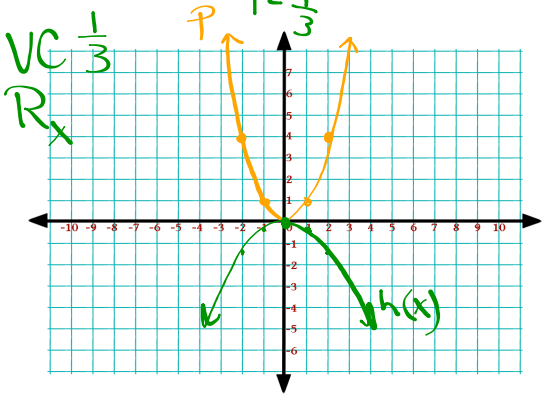
Graph $h(x) = -\frac{1}{3}x^2$. Compare the graph to the graph of $f(x) = x^2$.

1. Graph f(x) = x^2 2. Graph h(x) = -1/3 x^2

x	f(x)	h(x)
-2	4	-4/3
-1	1	-1/3
0	0	0
1	1	-1/3
2	4	-4/3



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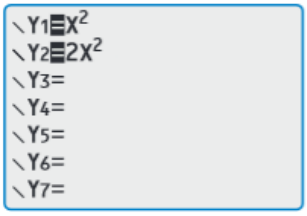
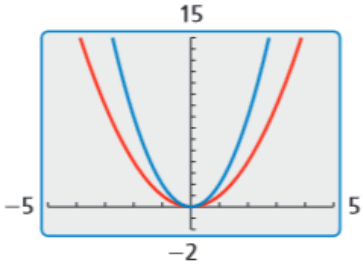
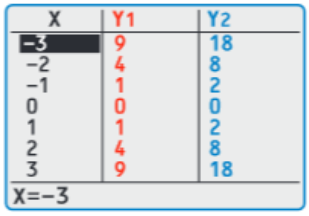
3 ways to show the same functions:



Symbolic
(equation)



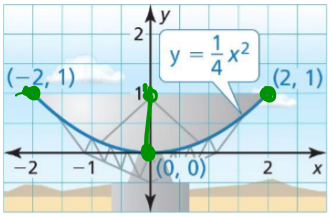
Graphical



X	Y1	Y2
−3	9	18
−2	4	8
−1	1	2
0	0	0
1	1	2
2	4	8
3	9	18

X=−3

Numerical



The diagram at the left shows the cross section of a satellite dish, where x and y are measured in meters. Find the width and depth of the dish.

w = 4u
d = 1u

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8.1 Graph quadratic functions of the form: $f(x) = ax^2$

Assign:

p 423

A: 4, 8, 12 - 22, 26, 28, 34

B: 1 - 4, 5, 8, 9, 12 - 16, 20 - 23, 26, 28

C: 1 - 6, 14, 17 - 19, 32

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