Topic 2.1: Vertex Form of a Quadratic Function

Essential Question:

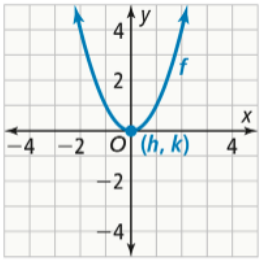
How does the equation of a quadratic function in vertex form highlight key features of the function's graph?

CONCEPT: Representation of Quadratic Functions

Parent Function: $f(x) = x^2$

Standard Form: $f(x) = ax^2 + bx + c, a \neq 0$

Vertex Form: $f(x) = a(x - h)^2 + k, a \neq 0$, where *(h, k)* is the vertex



CONCEPT SUMMARY

Vertex Form of a Quadratic Function

WORDS The graph of a quadratic function is called a parabola.

A quadratic function can be represented by an equation in vertex form $y = a(x - h)^2 + k$. Vertex form shows the different ways in which the graph of the parent function $f(x) = x^2$ can be transformed.

ALGEBRA

$f(x) = x^2$
vertex (0, 0)
axis of symmetry $x = 0$
opens upward
minimum $y = 0$
domain $(-\infty, \infty)$
range $[0, \infty)$

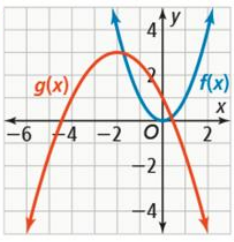
$y = a(x - h)^2 + k$
$a \neq 0$
vertex (h, k)
axis of symmetry $x = h$
domain: $(-\infty, \infty)$

If $a > 0$:
opens upward
minimum $y = k$
range: (k, ∞)

if $a < 0$:
opens downward
minimum $y = k$
range: $(-\infty, k)$

NUMBERS $g(x) = -\frac{1}{2}(x + 2)^2 + 3$
vertex $(-2, 3)$
axis of symmetry $x = -2$
opens downward
maximum $y = 3$
domain $(-\infty, \infty)$
range $(-\infty, 3)$

GRAPH



Notes:

Examples & Questions

Examples 1
Q: How does the variable a affects the graph in relation to the parent function?

Examples 2
Q: how do *a, h, k* affect the domain and range of a quadratic function in vertex form?

Q: In what order should you apply the transformations?

Examples 3
Q: Do you have to use both the vertex and the y-intercept to write the equation of a parabola?
Q: Why is the y-intercept a good point to use in this example?

Examples 4

Q: What can you learn about the values of a, b, and c by looking at the graph?
Q: What does the ball start with a height of 4?

Practice and Problem Solving

Complete MathXL for School: Practice and Problem Solving (online)
Complete MathXL for School: Enrichment (online)

Challenge: #2, 15, 35, 38 – key will be posted in Power School Learning.

Lesson Quiz 2.1