The Vertex Form of a Quadratic Relation

Previously, we looked at quadratic relations in the form y = a(x - s)(x - t).

This form was known as **factored form**, and was used to help us find the zeros of the parabola and the direction of the opening.

* **s, t** are the zeros, if a > 0, opens up or if a < 0, opens down

We are now going to look at equations in the **vertex form** and determine what information we can gather from them.

**y = a(x - h)2 + k**

When looking at equations in this form, the vertex of the corresponding parabola is (h, k)

If the vertex of a parabola (h, k) is known, you can write the quadratic relation in vertex form by substituting h and k into y = a(x-h)2 + k. To find the value of a, sub in another known point into the x and y, then solve for a.

When looking at the vertex form, if a > 0, the parabola opens upward. If a < 0, the parabola opens downward.

When compared to where the vertex is, you can figure out how many zeros the parabola has.

**Example 1 - Analyzing y = a(x - h)2 + k**

Find the vertex, axis of symmetry, the direction of opening, and the number of zeros for the graph of the quadratic relation.

a) y = -1 (x - 5)2 - 3

2

b) y = 2(x + 3)2 - 7

Need to rewrite the equation into vertex form

**Example 2 - Word Problem**

A ball is hit into the air. Its height H (in metres) after t seconds is

H = -5(t - 4)2 + 120

a) In which direction does the parabola open? How do we know?

b) What are the coordinates of the vertex? What does it represent, a max

or a min?

c) From what height was the ball hit?

d) Find one other point on the curve.

**Example 3 - Finding the equations from a graph**

A parabola passes through the point (-5, 6) and has a vertex (-3, -10). Find its equation in vertex form and standard form.

Since we know the vertex, we can use the vertex form:

y = a(x - h)2 + k h = x =

k = y =

Sub into the formula and solve for a

The equation of the parabola in vertex form is:

Expand to express the equation in standard form

Homework

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