lulumath

Finding Equations of Quadratic Relations in Vertex Form

Video Notes

Video Link

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Background Information:

- Graphing Quadratic Relations in Vertex Form

$$y = a(x-h)^2 + k \qquad \text{vertex: } (h, k)$$

Find the equation of the quadratic relation below in vertex form.
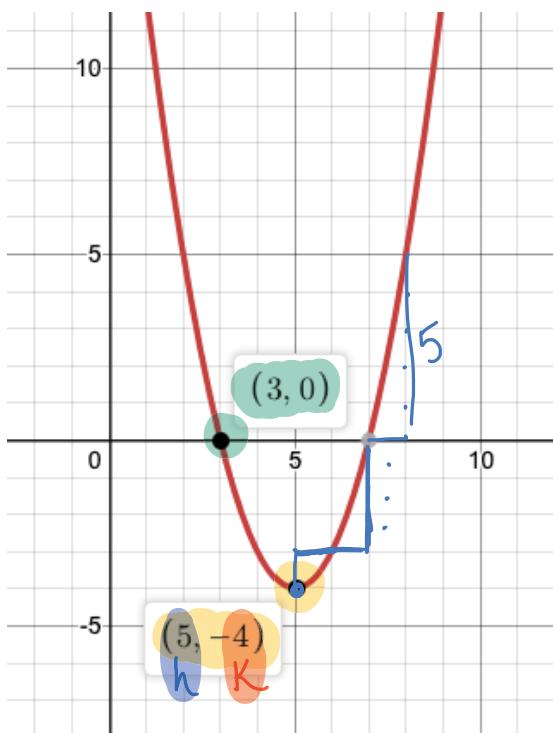
- Identify the vertex and use that information in vertex form.

$$y = a(x-h)^2 + k \qquad \text{vertex: } (5, -4)$$

$$y = a(x-5)^2 - 4$$

- Using another coordinate, solve for a.

$$y = a(x-5)^2 - 4$$

$$(3, 0)$$

$$0 = a(3-5)^2 - 4$$
$$0 = a(-2)^2 - 4$$
$$0 = 4a - 4$$
$$+4 \qquad\qquad +4$$
$$\overline{\qquad\qquad}$$
$$4 = 4a$$
$$1 = a$$

Step Patterns:

$$1a, 3a, 5a, \dots$$
$$\downarrow \quad \downarrow \quad \downarrow$$
$$1, 3, 5$$

$$1a = 1$$
$$a = 1$$

$$3a = 3$$
$$a = 1$$

$$5a = 5$$
$$a = 1$$

Graph points: $(3, 0)$, $(5, -4)$

$$y = a(x-h)^2 + k$$
$$y = 1(x-5)^2 - 4$$
$$y = (x-5)^2 - 4$$

Find the equation of the quadratic relation below in vertex form.

(0, 12)

(6, 0)
h K

$$y = a(x-h)^2 + K$$

$$y = a(x-h)^2 + K$$

$$y = \frac{1}{3}(x-6)^2$$

Step Pattern:
$$1a + 3a + 5a = 3$$
$$9a = 3$$
$$a = \frac{3}{9} = \frac{1}{3}$$
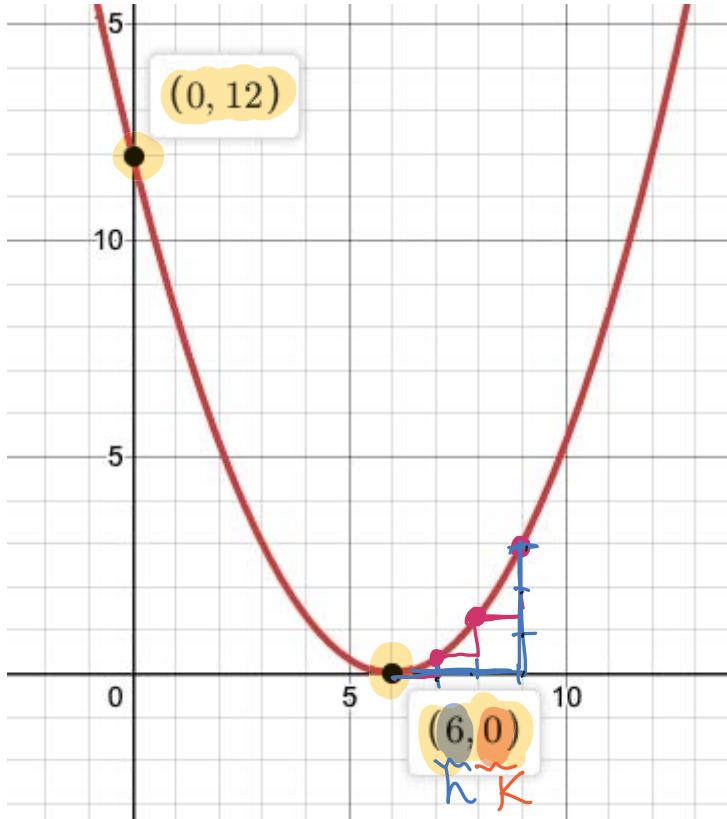
$$y = a(x-h)^2 + K \qquad \text{vertex:}$$
$$(h, K)$$
$$\downarrow$$
$$(6, 0)$$

$$y = a(x-6)^2 + 0$$

$$y = a(x-6)^2 \rightarrow \text{Plug in}$$
$$(0, 12)$$
$$x \quad y$$

$$12 = a(0-6)^2$$
$$12 = a(-6)^2$$
$$12 = 36a$$
$$\frac{12}{36} = a$$
$$\frac{12 \div 12}{36 \div 12} = \frac{1}{3}$$

$$a = \frac{1}{3}$$

Find the equation of the quadratic relation below in vertex form.

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

$(-3, 7)$ h   k

$y = a(x + 3)^2 + 7$

$5 = a(-2 + 3)^2 + 7$

$(-2, 5)$ x   y
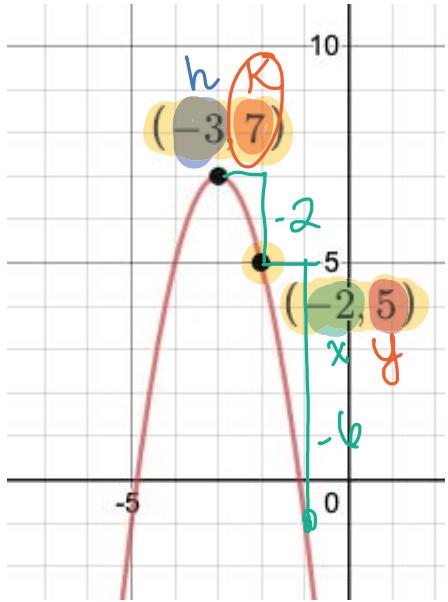
$5 = a(1)^2 + 7$

$5 = a + 7$

$-7 \qquad -7$

$-2 = a$

$a = -2$

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

$$y = -2(x + 3)^2 + 7$$

Step Pattern

$1a, 3a, 5a, \ldots$

   ↓   ↓

$-2 \quad -6$

$1a = -2$

$a = -2$

$3a = -6$

$a = -2$

Find the equation of the quadratic relation below in vertex form.

$(0, 6)$ ← vertex

h   k

$(4, -2)$ x   y
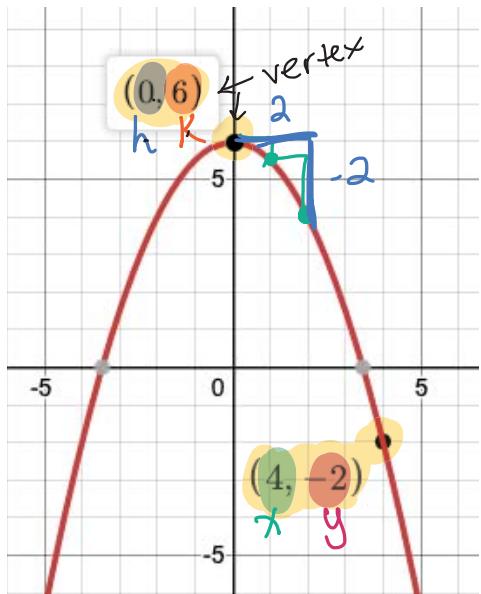
$y = a(x - h)^2 + k$

$y = a(x - 0)^2 + 6$

$y = ax^2 + 6$

$-2 = a(4)^2 + 6$

$-2 = 16a + 6$

$-6 \qquad -6$

$-8 = 16a$

$-\frac{1}{2} = a$

$a = -\frac{1}{2}$

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

Step Pattern:

$\boxed{1a, 3a}\ 5a, \ldots$

$1a + 3a = -2$

$4a = -2$

$a = -\frac{2}{4} = -\frac{1}{2}$