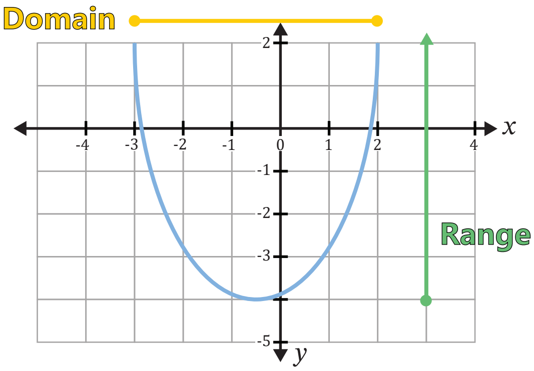
DOMAIN AND RANGE OF QUADRATICS

Domain: The set of all possible inputs of a function
Range: The set of all possible outputs of a function



The structure of a function determines its domain and range. The domain of a quadratic function is the set of all x-values for which the function is defined, and the range of a quadratic function is the set of all the y-values.

There are three main forms of quadratic equations: standard form, vertex form, and factored form. The goal is always to determine which way the function opens and find the y-coordinate of the vertex.

Standard Form

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

y-coordinate of the vertex:

$f\left(\frac{-b}{2a}\right)$

Let's find the range of the function $f(x) = -3x^2 + 12x + 17$.

$$\left(\frac{-12}{2(-3)}\right) = \frac{-12}{-6} = 2$$

$$f(2) = -3(2)^2 + 12(2) + 17$$
$$= -12 + 24 + 17 = 29$$

Since a is negative, the graph opens down, so the range is all real numbers less than or equal to 29.

Vertex Form

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

y-coordinate of the vertex:

k, from the vertex (h,k)

Let's find the range of the function $f(x) = -3(x + 2)^2 + 5$.

The coordinates for the vertex are $(-2,5)$.

Since a is positive, the graph opens up, so the range is all real numbers greater than or equal to 5.

Factored Form

$f(x) = a(x - b)(x - c)$

- x-coordinate of the vertex: the average of the x-intercepts b and c
- y-coordinate of the vertex: f(the average of the x-intercepts)

Let's find the range of the function $f(x) = \frac{2}{5}(x - 1)(x + 9)$.

The average of the x-intercepts is $\frac{1+(-9)}{2} = \frac{-8}{2} = -4$.

$$f(-4) = \frac{2}{5}(-4 - 1)(-4 + 9) = \frac{2}{5}(-5)(5) = -10$$

Since a is positive, the graph opens up, so the range is all real numbers greater than or equal to -10.

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