Key

Standard Form of a Quadratic

Standard Form of a Quadratic: $y = ax^2 + bx + c$

Example 1:

a) Given $y = 3x^2 - 12x + 4$, what is the y-value when $x = 0$?

$y = 3(0)^2 - 12(0) + 4 \rightarrow y = 0 - 0 + 4 \rightarrow y = 4$

b) That means that the point (0, 4) is on the graph of the parabola. In fact, it is the y-intercept (x = 0).

The standard form of a quadratic gives us two pieces of information:

1. the y-intercept, which is (0, c)
2. the x-coordinate of the vertex, which is found with the formula: $x = \frac{-b}{2a}$

Examples: For each quadratic, find the (a) y-intercept, (b) axis of symmetry, and (c) vertex.

2. $y = 3x^2 - 12x + 4$

a) c = 4 so y-int = (0, 4)

b) $x = \frac{-b}{2a}$ vertex = (2,)

$x = \frac{12}{2(3)} = \frac{12}{6} = 2$ $x = 2$ axis of symm

c) $y = 3(2)^2 - 12(2) + 4$

$y = 12 - 24 + 4$

$y = -12 + 4$

$y = -8$

V (2, −8)

3. $y = -3x^2 + 6x + 1$

a) c = 1 so y-int = (0, 1)

b) $x = \frac{-6}{2(-3)} = \frac{-6}{-6} = 1$ vertex = (1,)

axis of symm → x = 1

c) $y = -3(1)^2 + 6(1) + 1$

$y = -3 + 6 + 1 = 4$

vertex = (1, 4)

Maximum and Minimum Value of a Quadratic Function

1. The maximum value of a quadratic is the highest ***y-value*** of the parabola. It always occurs at the vertex of a parabola that opens down.
2. The minimum value of a quadratic is the lowest ***y-value*** of the parabola. It always occurs at the vertex of a parabola that opens up.

Examples: For each quadratic, find the maximum or minimum value.

4. $y = 3x^2 - 12x + 4$

opens up = Min

vertex $x = \frac{12}{2(3)} = \frac{12}{6} = 2$

$(2, -8)$ → Min value $= -8$

$y = 3(2)^2 - 12(2) + 4$

$y = 12 - 24 + 4 = -8$

5. $y = -3x^2 + 6x + 1$

opens down = Max

vertex: $x = \frac{-6}{2(-3)} = \frac{-6}{-6} = 1$

$(1, 4)$ → Max value $= 4$

$y = -3(1) + 6(1) + 1$

$y = -3 + 6 + 1 = 4$

Examples: Write the function in standard form.

6. $y = 2(x-1)^2 + 3$

$y = 2(x-1)(x-1) + 3$

$y = 2(x^2 - x - x + 1) + 3$

$y = 2(x^2 - 2x + 1) + 3$

$y = 2x^2 - 4x + 2 + 3$

$y = 2x^2 - 4x + 5$

7. $y = -3(x+2)^2 - 5$

$y = -3(x+2)(x+2) - 5$

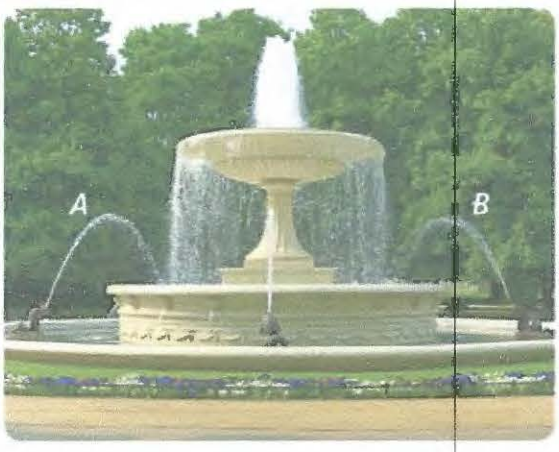
$y = -3(x^2 + 2x + 2x + 4) - 5$

$y = -3(x^2 + 4x + 4) - 5$

$y = -3x^2 - 12x - 12 - 5$

$y = -3x^2 - 12 - 17$

The trajectory of the water from Fountain A is represented by a function in standard form while the trajectory of the water from Fountain B is represented by a table of values. Compare the vertex of each function. Which trajectory reaches a greater height in feet?



Fountain A:

$f(x) = -x^2 + 2x + 8$

Find vertex:

$x = \frac{-2}{2(-1)} = \frac{-2}{-2} = 1$

$(1, 9)$ — Max $= 9$

$y = -(1)^2 + 2(1) + 8$

$y = -1 + 2 + 8$

$y = 9$

Fountain B:

x	y
−6	5
−5	8
−4	10
−3	8
−2	5

Max

Fountain B reaches a greater height