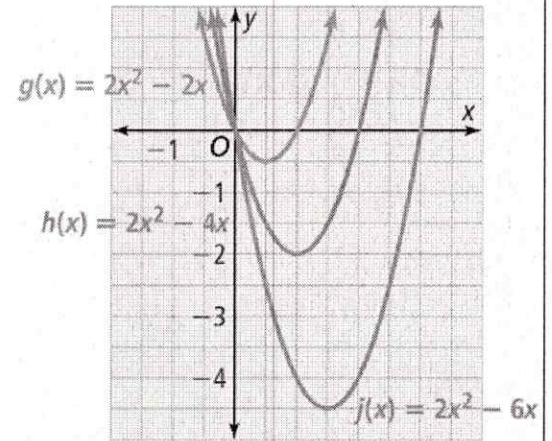


Topic 8.3 – Quadratic Functions in Standard Form

Explore & Reason

Three functions of the form $f(x) = ax^2 + bx$ are graphed for $a=2$ and different values of b .



A. What do the graphs have in common? In what ways do they differ?

B. What do you notice about the x-intercepts of each graph? What do you notice about the y-intercepts of each graph?

C. Look at the ratio $\frac{b}{a}$ for each function and compare it to its graph. What do you notice?

Warm-up

EXAMPLE 1 - Relate c to the Graph of $f(x) = ax^2 + bx + c$

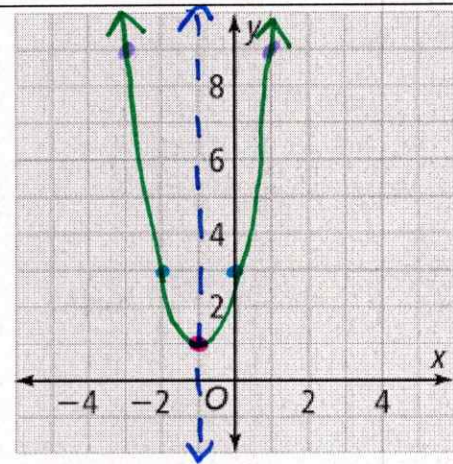
What information does c provide about the graph of $f(x) = ax^2 + bx + c$?

$f(x) = 2x^2 + 6x + 3$	$f(x) = x^2 + x - 2$	$f(x) = 2x^2 + 3x + 6$

It tells us the y-intercept

EXAMPLE 2 - Graph a Quadratic Function in Standard Form

Graph $f(x) = 2x^2 + 4x + 3$. State the axis of symmetry, vertex, and y-intercept of the function?



Step 1. Find axis of Symmetry

$$x = \frac{-b}{2a} = \frac{-4}{2(2)} = -1$$

Step 2. Find Vertex $(-1, 1)$ and plot it

$$2(-1)^2 + 4(-1) + 3 = 1$$

Step 3. Plot y-intercept $(0, 3)$ and its reflection

Step 4. Plot another point and its reflection

Step 5. Graph parabola

Axis of Symmetry: $x = -1$

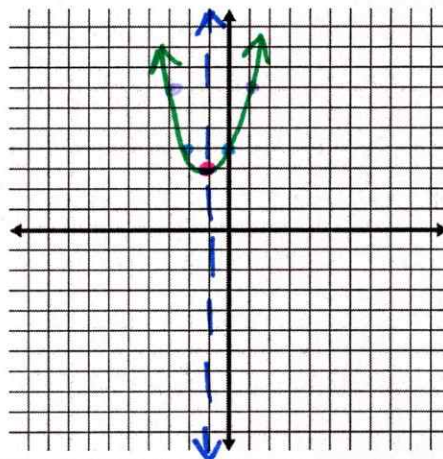
Vertex: $(-1, 1)$

y-intercept: $(0, 3)$

Try it. Graph $f(x) = x^2 + 2x + 4$ ← y-int $(0, 4)$

$$x = -\frac{2}{2(1)} = -1 \quad \text{AOS: } x = -1$$

$$(-1)^2 + 2(-1) + 4 = 3 \quad \text{Vertex: } (-1, 3)$$



EXAMPLE 3 - Compare Properties of Quadratic Functions

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

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

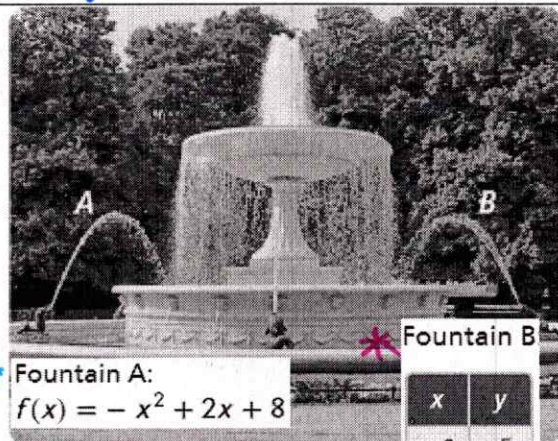
$$-(-1)^2 + 2(-1) + 8$$

$(1, 9)$

Fountain B

$(-4, 10)$

Fountain B reaches higher



* Fountain A:
 $f(x) = -x^2 + 2x + 8$

* Fountain B

x	y
-6	5
-5	8
-4	10
-3	8
-2	5

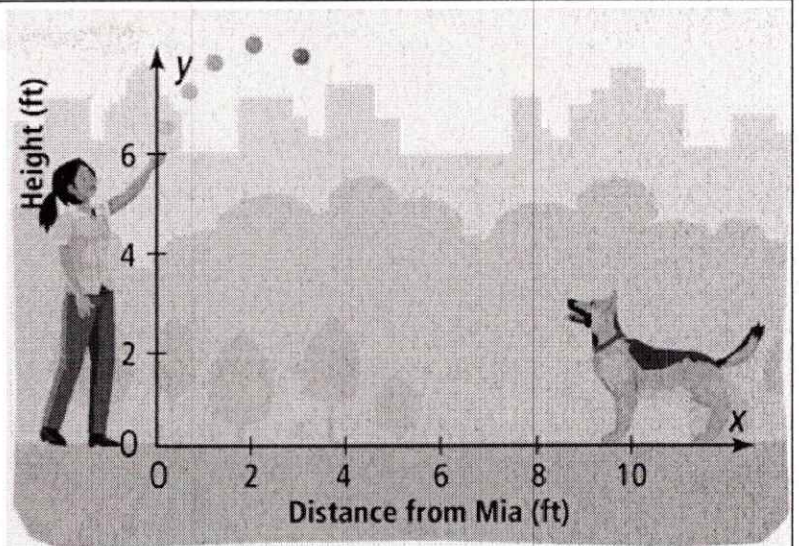
EXAMPLE 4 - Analyze the Structure of Different Forms (See online animation.)

Mia tosses the ball to her dog. The function

$f(x) = -0.5(x-2)^2 + 8$ represents the ball's path.

A. what does the vertex form of the function tell you about the situation?

the vertex (2,8)
at 2 feet the ball is
8ft high



B. What does the standard form of a function tell you about the situation? Rewrite the function in standard form.

$$\begin{aligned} f(x) &= -0.5(x-2)(x-2) + 8 \\ &= -0.5(x^2 - 4x + 4) + 8 \\ &= -0.5x^2 - 2x + 2 + 8 \\ f(x) &= -0.5x^2 - 2x + 10 \end{aligned}$$

Tells us the y-intercept
(0,10) which is
how high the ball
starts

