Section 4.1   Quadratic Functions

Objective 1: Understanding the Definition of a Quadratic Function and its Graph

Definition   **Quadratic Function**

A **quadratic function** is a function of the form $f(x) = ax^2 + bx + c$ where a, b and c are real numbers with $a \neq 0$. Every quadratic function has a "u-shaped" graph called a *parabola*.

The five basic characteristics of a parabola:

1. Vertex
2. Axis of symmetry
3. y-intercept
4. x-intercept(s) or real zeros
5. Domain and range

Objective 2: Graphing Quadratic Functions Written in Standard Form

Standard Form of a Quadratic Function

A quadratic function is in **standard form** if it is written as $f(x) = a(x-h)^2 + k$.
The graph is a parabola with vertex (h, k).

$a > 0$

Domain: $(-\infty, \infty)$
Range: $[k, \infty)$

$a < 0$

Domain: $(-\infty, \infty)$
Range: $(-\infty, k]$
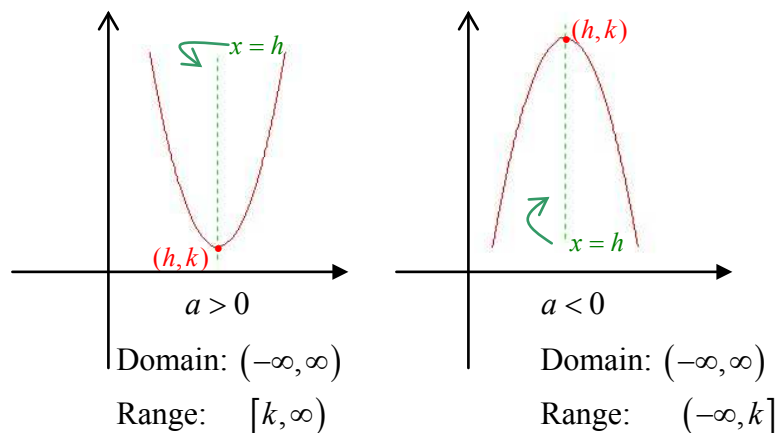
4.1.6
Given the quadratic function _____ in standard form, address the following:

a) What are the coordinates of the vertex? The vertex is _____.

b) Does the graph "open up" or "open down"? _____

c) What is the equation of the axis of symmetry? _____

d) Find any x-intercepts. x = _____ (Type an exact answer, using radicals as needed. Simplify your answer. Do not factor. Use a comma to separate answers as needed. Type N if there is no x-intercept.)

e) Find the y-intercept. The y-intercept is _____. (Type an integer or a fraction. Type N is there is no y-intercept.)

f) Sketch the graph.

g) State the domain and range in interval notation.

The domain of f is the interval _____.

The range of f is the interval _____ .

Objective 3: Graphing Quadratic Functions by Completing the Square

When a quadratic function is written in standard form $f(x) = a(x-h)^2 + k$, it is fairly straight- forward to determine its graph. Therefore, to graph a quadratic function of the form $f(x) = ax^2 + bx + c$, we can "convert" it into standard form by completing the square.

4.1.11
Rewrite the quadratic function _____ in standard form by completing the square.

4.1.13
Rewrite the quadratic function _____ in standard form by completing the square.

Objective 4: Graphing Quadratic Functions Using the Vertex Formula

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Formula for the Vertex of a Parabola

Given a quadratic function of the form $f(x) = ax^2 + bx + c$, $a \neq 0$,

the vertex of the parabola is $\left(-\dfrac{b}{2a}, f\left(-\dfrac{b}{2a} \right) \right)$.

4.1.23

Use the quadratic function _____ to address the following questions.

a) Use the vertex formula to determine the vertex. The vertex is _____ .

b) Does the graph "open up" or "open down"? _____

c) What is the equation of the axis of symmetry? $x = $ _____

d) Find any intercepts. $x = $ _____ (Type an exact answer, using radicals as needed. Simplify your answer. Do not factor. Use a comma to separate answers as needed. Type N if there is no x-intercept.)

e) Find the y-intercept. The y-intercept is _____. (Type an integer or a fraction. Type N is there is no y-intercept.)

f) Sketch the graph.

4.1.33
Analyze the graph of the given function to address the following questions about the quadratic function it represents.

a) Is the leading coefficient positive or negative? _____

b) What is the value of h? _____ What is the value of k? _____

c) What is the value of the leading coefficient a? _____

d) Write the equation of the function in standard form $f(x) = a(x-h)^2 + k$.

$f(x) =$ _____

e) Write the equation of the function in the form $f(x) = ax^2 + bx + c$.

$f(x) =$ _____