

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:

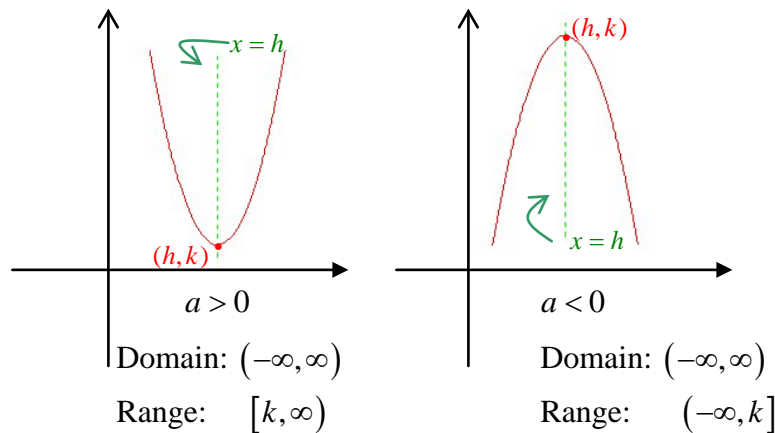
1. Vertex
2. Axis of symmetry
3. y -intercept
4. x -intercept(s) or real zeros
5. Domain and range

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) .



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 if 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

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

4.1.23

Use the quadratic function _____ to address the following questions.

- Use the vertex formula to determine the vertex. The vertex is _____ .
- Does the graph “open up” or “open down”? _____
- What is the equation of the axis of symmetry? $x =$ _____
- 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.)
- Find the y -intercept. The y -intercept is _____. (Type an integer or a fraction. Type N if there is no y -intercept.)
- Sketch the graph.

Objective 5: Determining the Equation of a Quadratic Function Given its 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 $f(x) = ax^2 + bx + c$.

$f(x) =$ _____