

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:

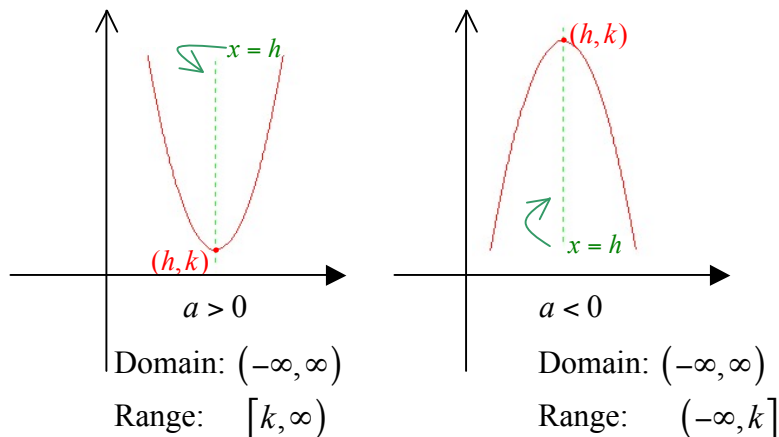
1. Vertex
2. Axis of symmetry
3. y -intercept
4. x -intercept(s) or real zeros
5. Domain and range

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 $f(x) = -(x+1)^2 - 9$ 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 $f(x) = x^2 - 8x$ in standard form by completing the square.

4.1.13

Rewrite the quadratic function $f(x) = 3x^2 + 6x - 4$ 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 $f(x) = 3x^2 + 6x - 4$ 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.