

9.1: Square Root Method

We will be studying several different methods for solving quadratic equations in this chapter. However, before we get into these methods, it is important to review two simple methods – Graphing and the Zero Product Property

Solving Quadratic Equations Graphically

The general form of a **quadratic function** is

$$f(x) = ax^2 + bx + c, \quad \text{with } a \neq 0$$

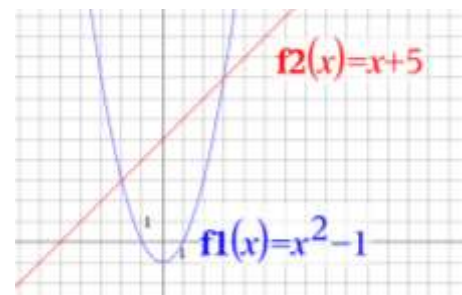
The graph of a quadratic equation is a **parabola**. When working with quadratic *equations* the graph of the function can be very useful.

Try This. Solve this quadratic equation graphically. $x^2 - 1 = x + 5$

Method 1: Graphing two functions

Step 1: Split equation into two functions and graph (*change window settings if necessary*)

$$Y_1 = x^2 - 1 \quad \text{and} \quad Y_2 = x + 5$$



Step 2: Locate intersection points

- Go to “CALC” menu
- Select “intersect”
- First Curve – ENTER
- Second Curve – ENTER
- Move left or right to guess – ENTER

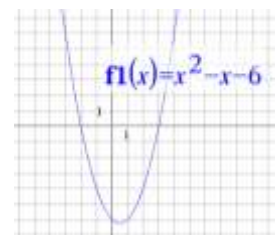
Step 3: Read the X-value at the bottom of the screen

Key: the solution is the X-value. There is no Y in the original equation.

Method 2: Graphing the standard form equation

Step 1: Write the quadratic equation in standard form.

$$\begin{aligned} x^2 - 1 &= x + 5 \\ x^2 - x - 6 &= 0 \end{aligned}$$



Step 2: Graph the corresponding function.

$$y = x^2 - x - 6$$

Step 2: Locate zeros (a.k.a. x -intercepts) →

Step 3: Read the X-value at the bottom of the screen

- Go to “CALC” menu
- Select “zero”
- Move to the left of the zero – ENTER
- Move to the right of the zero – ENTER
- Move left or right to guess – ENTER

Solving quadratic equations with the Principle of Square Roots

***** Principle of Square Roots:**

Every positive real number has _____ square roots

$$\text{If } a^2 = b,$$

$$\text{Then } a = \sqrt{b} \text{ or } a = -\sqrt{b}$$

Example 1: Solve using the Principle of Square Roots

a) $x^2 - 16 = 0$

b) $2x^2 = 40$

*** Note: This method only works when the polynomial is a square trinomial or has no x-term.*

c) $5x^2 - 4 = 0$

d) $2x^2 + 50 = 0$

e) $(x - 3)^2 + 15 = 0$

Steps for solving quadratic equations with the square root method:

1. Isolate the Quadratic Term and make its coefficient 1.
2. Square root both sides.
3. Simplify the radical
4. Check the solutions.

Sometimes, there is a x term in the problem, but we can still use the square root method if it can be factored into a binomial squared.

Remember the special Product:

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

Example 2: Solve by factoring then using the Principle of Square Roots.

a) $x^2 + 8x + 16 = 20$

b) $9x^2 + 24x + 16 = 169$