

3.5 Solving Quadratic Functions

It is very easy to solve

$$5x - 1 = 4$$

or

$$3x^2 - 12 = 0$$

$$\frac{5x}{5} = \frac{5}{5}$$

$$x = 1$$

$$3x^2 = 12$$

$$x^2 = 4$$

$$x = \pm 2$$

However, when we need to solve

$$x^2 - 6x + 8 = 0$$

or

$$2x^2 + 5x - 5 = 7$$

it gets more complicated.

Solving for x means to find the value(s) of x to satisfy (make true) the equation/function. With a linear function, there is one way to solve.

A quadratic has at least 4 methods!!

The use of each method depends on the problem and how comfortable you are.

1. Graphing Calculator

- my least favourite method. While it works everytime, you aren't "learning" or practicing your math. This method is great on those pesky questions.

2. Completing the Square

- I do not use this method. However, once you have vertex form, this is a powerful method.

3. Factoring.

- This **is not partial factoring!**
- If you can fully factor into zeros form, the the answers are in the equation.

4. Quadratic Formula.

- Works every time. Be careful with the steps. Master this method and will never sweat again while solving Q. fns!!



Very important:

In order to solve a quadratic, you **must** rearrange the equation to $\boxed{} = 0$.

This is why solving quadratics is finding the zeros!

Examples of each method:

1. Graphing Calculator:

- I really, really, truly really want you to become experts at algebra. Use this as a last resort or as a way to check your work. If you want to know this method, talk to me.

2. Completing the square.

$$f(x) = -3(x-4)^2 + 27$$

$$0 = -3(x-4)^2 + 27$$

$$-27 = -3(x-4)^2$$

$$\sqrt{9} = (x-4)^2$$

$$\pm 3 = x - 4$$

$$\pm 3 + 4 = x$$

$$x = 7 \text{ and } x = 1$$

$$g(x) = 4(x+5)^2 - 32$$

$$32 = 4(x+5)^2$$

$$8 = (x+5)^2$$

$$\pm\sqrt{8} = x + 5$$

$$\pm\sqrt{8} - 5 = x$$

$$\pm 2.83 - 5 = x$$

$$x = -2.17 \text{ and } -7.83 = x$$

3. Factoring

$$f(x) = x^2 + 18x + 80$$

$$f(x) = (x+8)(x+10)$$

$$x = -8 \text{ and } x = -10$$

$$g(x) = 2x^2 + 5x - 5$$

$$g(x) = 7$$

$$7 = 2x^2 + 5x - 5$$

$$0 = 2x^2 + 5x - 12$$

$$\begin{array}{l} \textcircled{x} -24 \\ \textcircled{4} 5 \end{array}$$

$$0 = 2x^2 + 8x - 3x - 12$$

$$8, -3$$

$$0 = (2x - 3)(x + 4)$$

$$x = \frac{3}{2} \text{ and } x = -4$$

4. Quadratic Formula.

$$f(x) = -3x^2 - 8x + 14$$

a b c

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(-3)(14)}}{2(-3)}$$

$$x = \frac{8 \pm \sqrt{232}}{-6}$$

$$x = \frac{8 \pm 15.23}{-6}$$

$$x = \frac{8 + 15.23}{-6}$$

$$x = -3.87$$

$$x = \frac{8 - 15.23}{-6}$$

$$x = 1.21$$

$$5x(x+3.4) = 2x^2 + 9x - 5$$

$$5x^2 + 17x = \underbrace{2x^2 + 9x - 5}$$

$$3x^2 + 8x + 5 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-8 \pm \sqrt{8^2 - 4(3)(5)}}{2(3)}$$

$$x = \frac{-8 \pm \sqrt{4}}{6}$$

$$\Rightarrow x = \frac{-8 \pm 2}{6}$$

$$x = \frac{-8 - 2}{6}$$

$$x = -\frac{5}{3}$$

$$x = \frac{-8 + 2}{6}$$

$$x = -1$$