

## Solving Quadratics Quadratic Formula

### Common Core Georgia Performance Standards

MCC9–12.N.CN.7

MCC9–12.A.CED.1★

MCC9–12.A.REI.4a

MCC9–12.A.REI.4b

### Introduction

Completing the square can be a long process, and not all quadratic expressions can be factored. Rather than completing the square or factoring, we can use a formula that can be derived from the process of completing the square. This formula, called the quadratic formula, can be used to solve any quadratic equation in standard form,  $ax^2 + bx + c = 0$ .

### Key Concepts

- A quadratic equation in standard form,  $ax^2 + bx + c = 0$ , can be solved for  $x$  by using the **quadratic formula**:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
- Solutions of quadratic equations are also called **roots**.

### Example 3

Solve  $2x^2 - 5x = 12$  using the quadratic formula.

### Example 4

Solve  $x^2 = 2x - 1$  using the quadratic formula.

\*\*\*We can also solve using **poly-solve** on the calculator.

Examples : Check example 3 and 4 in the calculator.

**\*\*When solving a quadratic word problem, if the question is asking for when an object will hit the ground or something similar, you are finding the x-intercepts. Set up the equation and solve using one of the methods we have learned.**

### Practice 5.2.4: Applying the Quadratic Formula

For problems 1 and 2, find the discriminant. Write the number and type of roots of the equation.

1.  $4x^2 + 4x + 1 = 0$

2.  $x^2 + 3x = -2x - 6$

For problems 3–6, solve using the quadratic formula.

3.  $-2x^2 + 3x + 4 = 0$

4.  $16 - 8x - x^2 = 0$

5.  $3x^2 + 7x + 12 = 0$

6.  $-32x = 2x^2 - x - 51$

Read each scenario and use your knowledge of the quadratic formula to answer the questions.

7. The height of a softball in meters  $x$  seconds after it has been thrown is given by  $-4.9x^2 + 9x + 1.2$ . When does the ball hit the ground?
8. A company sells about  $20x - x^2$  units each month, where  $x$  is the price of one unit. For what price(s) does the company sell 100 units?
9. As part of a science experiment, Carson designs and creates a cushioned egg carrier. He puts an egg inside it, and then drops it from a window to see whether his design can safely cushion the egg and keep it from breaking. The egg's height in feet  $x$  seconds after being dropped is given by  $27 - 16x^2$ . After how many seconds will the egg hit the ground?
10. How does the quadratic formula show the number and type of solutions of a quadratic equation?

**Closing:** What are the three methods we have learned for solving quadratic equations? What relationship does the solution to the quadratic equation have to the graph of the quadratic? Write and solve a word problem that would result in a quadratic equation.