

**3.4****Using the Quadratic Formula**

For use with Exploration 3.4

**Essential Question** How can you derive a general formula for solving a quadratic equation?

**1 EXPLORATION: Deriving the Quadratic Formula**

**Work with a partner.** Analyze and describe what is done in each step in the development of the Quadratic Formula.

Step	Justification
$ax^2 + bx + c = 0$	_____
$ax^2 + bx = -c$	_____
$x^2 + \frac{b}{a}x = -\frac{c}{a}$	_____
$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$	_____
$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{4ac}{4a^2} + \frac{b^2}{4a^2}$	_____
$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$	_____
$x + \frac{b}{2a} = \pm\sqrt{\frac{b^2 - 4ac}{4a^2}}$	_____
$x = -\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2 a }$	_____
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;">           The result is the Quadratic Formula.         </div> <span style="font-size: 2em; vertical-align: middle;">→</span> $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	_____

**3.4 Using the Quadratic Formula (continued)****2 EXPLORATION:** Using the Quadratic Formula

**Work with a partner.** Use the Quadratic Formula to solve each equation.

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

b.  $x^2 - 2x + 2 = 0$

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

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

e.  $x^2 - 6x + 10 = 0$

f.  $x^2 + 4x + 6 = 0$

**Communicate Your Answer**

- How can you derive a general formula for solving a quadratic equation?
- Summarize the following methods you have learned for solving quadratic equations: graphing, using square roots, factoring, completing the square, and using the Quadratic Formula.

**3.4****Notetaking with Vocabulary**

For use after Lesson 3.4

In your own words, write the meaning of each vocabulary term.

Quadratic Formula

discriminant

**Core Concepts****The Quadratic Formula**

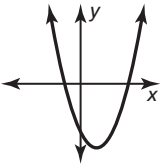
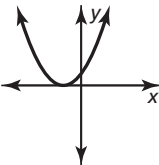
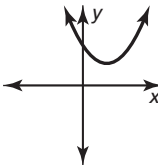
Let  $a$ ,  $b$ , and  $c$  be real numbers such that  $a \neq 0$ . The solutions of the quadratic

equation  $ax^2 + bx + c = 0$  are  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .

**Notes:**

**3.4** Notetaking with Vocabulary (continued)

**Analyzing the Discriminant of  $ax^2 + bx + c = 0$**

Value of discriminant	$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
Number and type of solutions	Two real solutions	One real solution	Two imaginary solutions
Graph of $y = ax^2 + bx + c$	 <p>Two <math>x</math>-intercepts</p>	 <p>One <math>x</math>-intercept</p>	 <p>No <math>x</math>-intercept</p>

**Notes:**

**3.4** Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–3, solve the equation using the Quadratic Formula. Use a graphing calculator to check your solution(s).

1.  $x^2 - 7x - 18 = 0$

2.  $w^2 = 4w - 1$

3.  $-7z = -4z^2 - 3$

In Exercises 4–6, find the discriminant of the quadratic equation and describe the number and type of solutions of the equation.

4.  $b^2 + 34b + 289 = 0$

5.  $x^2 = 3 - 8x$

6.  $4q^2 + 1 = 3q$

7. A baseball player hits a foul ball straight up in the air from a height of 4 feet off the ground with an initial velocity of 85 feet per second.
- Write a quadratic function that represents the height  $h$  of the ball  $t$  seconds after it hits the bat.
  - When is the ball 110 feet off the ground? Explain your reasoning.
  - The catcher catches the ball 6 feet from the ground. How long is the ball in the air?