

EXPLORE & REASON

You can complete the square to solve the general quadratic equation,
 $ax^2 + bx + c = 0$.

$$ax^2 + bx + c = 0$$

$$ax^2 + bx = -c$$

$$x^2 + \left(\frac{b}{a}\right)x = -\frac{c}{a}$$

$$x^2 + \left(\frac{b}{a}\right)x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{c}{a}$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

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

A. **Construct Arguments** Justify each step in this general solution. © MP.3

B. What must be true of the value of $b^2 - 4ac$ if the equation $ax^2 + bx + c = 0$ has two non-real solutions? If it has just one solution?

HABITS OF MIND

Communicate Precisely Why is there a \pm in the second to last step of the derivation of the Quadratic Formula? © MP.6

**EXAMPLE 1** **Try It! Solve Quadratic Equations**

1. Solve using the Quadratic Formula.

a. $2x^2 + 6x + 3 = 0$

b. $3x^2 - 2x + 7 = 0$

EXAMPLE 2 **Try It! Choose a Solution Method**

2. Solve the equation $6x^2 + x - 15 = 0$ using the Quadratic Formula and one other method.

HABITS OF MIND

Construct Arguments Is it possible for a quadratic equation to have one real solution and one complex solution? Explain. © MP.3

EXAMPLE 3 **Try It! Identify the Number of Real-Number Solutions**

3. Describe the nature of the solutions for each equation.

a. $16x^2 + 8x + 1 = 0$

b. $2x^2 - 5x + 6 = 0$

**EXAMPLE 4** **Try It! Interpret the Discriminant**

4. According to the model of Rachel's serve, will the ball reach a height of 3 meters?

HABITS OF MIND

Reason Create a quadratic equation that has two complex solutions. © MP.2

EXAMPLE 5 **Try It! Use the Discriminant to Find a Particular Equation**

5. Determine the value(s) of b that ensure $5x^2 + bx + 5 = 0$ has two non-real solutions.

HABITS OF MIND

Use Appropriate Tools Why is the Quadratic Formula helpful? © MP.5



Do You UNDERSTAND?

- ESSENTIAL QUESTION** How can you use the Quadratic Formula to solve quadratic equations or to predict the nature of their solutions?
- Vocabulary** Why is the discriminant a useful tool to use when solving quadratic equations?
- Error Analysis** Rick claims that the equation $x^2 + 5x + 9 = 0$ has no solution. Jenny claims that there are two solutions. Explain how Rick could be correct, and explain how Jenny could be correct. © MP.3
- Use Appropriate Tools** What methods can you use to solve quadratic equations? © MP.5

Do You KNOW HOW?

- Describe the number and type of solutions of the equation $2x^2 + 7x + 11 = 0$.
- Use the Quadratic Formula to solve the equation $x^2 + 6x - 10 = 0$.
- At time t seconds, the height, h , of a ball thrown vertically upward is modeled by the equation $h = -5t^2 + 33t + 4$. About how long will it take for the ball to hit the ground?
- Use the Quadratic Formula to solve the equation $x^2 - 8x + 16 = 0$. Is this the only way to solve this equation? Explain.

