10-4 Solving Quadratic Equations by Using the Quadratic Formula (Pages 546–552)

You can use the quadratic formula to solve any quadratic equation involving any variable.

The Quadratic Formula	The solutions of a quadratic equation in the form $ax^2 + bx + c = 0$, where $a \neq 0$, are given by the formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Example

Use the Quadratic Formula to solve $x^2 - 2x - 5 = 0$.

In the equation $x^2 - 2x - 5 = 0$, $a = 1$, $b = -2$, and $c = -5$.
Substitute these values into the Quadratic Formula.

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

$x = \dfrac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)}$

$x = \dfrac{2 \pm \sqrt{4 + 20}}{2}$

$x = \dfrac{2 \pm \sqrt{24}}{2}$

$x = \dfrac{2 + \sqrt{24}}{2}$ or $x = \dfrac{2 - \sqrt{24}}{2}$

$x \approx 3.45 \qquad x \approx -1.45 \qquad$ Use a calculator.

The solutions are approximately 3.45 and −1.45.

Practice

Solve each equation by using the Quadratic Formula. Approximate irrational roots to the nearest hundredth.

1. $x^2 + 6x + 8 = 0$ **2.** $n^2 - 12n + 32 = 0$ **3.** $c^2 + 4c + 8 = 0$

4. $p^2 + 4p - 1 = 0$ **5.** $d^2 - 2d - 15 = 0$ **6.** $5h^2 + 4h + 4 = 0$

7. $3e^2 - 6e + 3 = 0$ **8.** $2m^2 + 8m + 2 = 0$ **9.** $g^2 - 3g + 2 = 0$

10. $4k^2 + 2k + 3 = 0$ **11.** $3f^2 - 11f - 4 = 0$ **12.** $4v^2 + 12v + 9 = 0$

13. $x^2 - 12x = -27$ **14.** $3x^2 + 6x = 1$ **15.** $3x - 1 = -x^2$

16. $2x(x + 1) = -5$ **17.** $x^2 = 2(4x - 1)$ **18.** $2(x^2 + 3) = 3x$

19. Automotive Sales Mark decided that the price of a car tire is a quadratic function of the radius of the tire. He modeled this using the equation $p = -r^2 + 36r - 255$, where p is the price of the tire in dollars and r is the radius of the tire in inches. Find the price that the model predicts for a tire of radius 14 inches. Then find the price the model predicts for a tire of radius 16 inches.

20. **Standardized Test Practice** For a certain quadratic equation, the value of $b^2 - 4ac$ is −8. How many real number roots does the equation have?

  A 3 roots   **B** 2 roots   **C** 1 root   **D** 0 roots