

Solving Quadratic Equations by Using the Quadratic Formula

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \left| \quad x = \frac{2 \pm \sqrt{24}}{2}$$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)} \quad \left| \quad x = \frac{2 + \sqrt{24}}{2} \text{ or } x = \frac{2 - \sqrt{24}}{2}$$

$$x = \frac{2 \pm \sqrt{4 + 20}}{2} \quad \left| \quad x \approx 3.45 \quad x \approx -1.45 \quad \text{Use a calculator.}$$

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.

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| 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

19. \$63; \$65 20. D 10. no real roots 11. $-\frac{3}{4}$, 4 12. -1.5, 13. 3, 9 14. -2, 15, 0, 15 15. -3, 3, 0, 3 16. no real roots 17. 0.26, 7.74 18. none Answers: 1. -4, -2 2. 4, 8 3. no real roots 4. -4.24; 0.24 5. -3, 5 6. no real roots 7. 1 8. -3.73, -0.27 9. 1, 2
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