



1.4 Quadratic Equations

In Exercises 1–6, write the quadratic equation in general form.

$$4. 13 - 3(x + 7)^2 = 0$$

In Exercises 7–20, solve the quadratic equation by factoring.

8. $9x^2 - 1 = 0$

12. $4x^2 + 12x + 9 = 0$

Extracting Square Roots

In Exercises 21–34, solve the equation by extracting square roots. List both the exact solution and the decimal solution rounded to two decimal places.

26. $9x^2 = 36$

32. $(4x + 7)^2 = 44$

Completing the Square

To **complete the square** for the expression $x^2 + bx$, add $(b/2)^2$, which is the square of half the coefficient of x . Consequently,

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2.$$

In Exercises 35–44, solve the quadratic equation by completing the square.

38. $x^2 - 2x - 3 = 0$

42. $9x^2 - 12x = 14$

In Exercises 45–50, rewrite the quadratic portion of the algebraic expression as the sum or difference of two squares by completing the square.

46. $\frac{1}{x^2 - 12x + 19}$

Graphical Analysis In Exercises 51–58, use a graphing utility to graph the equation. Use the graph to approximate any x -intercepts of the graph. Set $y = 0$ and solve the resulting equation. Compare the result with the x -intercepts of the graph.

54. $y = 9 - (x - 8)^2$

The Quadratic Formula

The solutions of a quadratic equation in the general form

$$ax^2 + bx + c = 0, \quad a \neq 0$$

are given by the **Quadratic Formula**

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

Solutions of a Quadratic Equation

The solutions of a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$, can be classified as follows. If the discriminant $b^2 - 4ac$ is

1. *positive*, then the quadratic equation has *two* distinct real solutions and its graph has *two* x -intercepts.
2. *zero*, then the quadratic equation has *one* repeated real solution and its graph has *one* x -intercept.
3. *negative*, then the quadratic equation has *no* real solutions and its graph has *no* x -intercepts.

In Exercises 59–66, use the discriminant to determine the number of real solutions of the quadratic equation.

64. $\frac{4}{7}x^2 - 8x + 28 = 0$

In Exercises 67–90, use the Quadratic Formula to solve the equation.

74. $6x = 4 - x^2$

88. $(z + 6)^2 = -2z$

110. *Dimensions of a Corral* A rancher has 100 meters of fencing to enclose two adjacent rectangular corrals (see figure). The rancher wants the enclosed area to be 350 square meters. What dimensions should the rancher use to obtain this area?



