**Got It?** **4.** Suppose the total area of the garden and border in Problem 4 is 150 ft$^2$. What is the side length $x$ of each square plot? Round to the nearest hundredth.

## Lesson Check

### Do you know HOW?

Solve each equation by completing the square.

**1.** $x^2 + 8x = 180$

**2.** $t^2 - 4t - 165 = 0$

**3.** $m^2 + 7m - 294 = 0$

**4.** $2z^2 + 3z = 135$

### Do you UNDERSTAND? ⓒ MATHEMATICAL PRACTICES

ⓒ **5. Vocabulary** Tell whether you would use square roots, factoring, or completing the square to solve each equation. Explain your choice of method.

**a.** $k^2 - 3k = 304$      **b.** $t^2 - 6t + 16 = 0$

ⓒ **6. Compare and Contrast** How is solving a quadratic equation using square roots like completing the square? How is it different?

## Practice and Problem-Solving Exercises ⓒ MATHEMATICAL PRACTICES

Ⓐ **Practice**      Find the value of $c$ such that each expression is a perfect-square trinomial.      **See Problem 1.**

**7.** $x^2 + 18x + c$          **8.** $z^2 + 22z + c$          **9.** $p^2 - 30p + c$

**10.** $k^2 - 5k + c$          **11.** $g^2 + 17g + c$          **12.** $q^2 - 4q + c$

Solve each equation by completing the square. If necessary, round to the nearest hundredth.      **See Problem 2.**

**13.** $g^2 + 7g = 144$          **14.** $r^2 - 4r = 30$          **15.** $m^2 + 16m = -59$

**16.** $a^2 - 2a - 35 = 0$      **17.** $m^2 + 12m + 19 = 0$      **18.** $w^2 - 14w + 13 = 0$

Find the vertex of each parabola by completing the square.      **See Problem 3.**

**19.** $y = x^2 + 4x - 16$      **20.** $y = x^2 + 18x - 307$      **21.** $y = x^2 - 2x - 323$

**22.** $y = x^2 + 6x - 7$      **23.** $y = x^2 + 2x - 28$      **24.** $y = x^2 + 12x - 468$

Solve each equation by completing the square. If necessary, round to the nearest hundredth.      **See Problem 4.**

**25.** $4a^2 - 8a = 24$          **26.** $2y^2 - 8y - 10 = 0$          **27.** $5n^2 - 3n - 15 = 10$

**28.** $4w^2 + 12w - 44 = 0$      **29.** $3r^2 + 18r = 21$          **30.** $2v^2 - 10v - 20 = 8$

**31. Art** The painting shown at the right has an area of 420 in.$^2$. What is the value of $x$?



$x$ in.

$(2x + 5)$ in.

**© 32. Think About a Plan** A park is installing a rectangular reflecting pool surrounded by a concrete walkway of uniform width. The reflecting pool will measure 42 ft by 26 ft. There is enough concrete to cover 460 ft$^2$ for the walkway. What is the maximum width $x$ of the walkway?
- How can drawing a diagram help you solve this problem?
- How can you write an expression in terms of $x$ for the area of the walkway?

**33. Landscaping** A school is fencing in a rectangular area for a playground. It plans to enclose the playground using fencing on three sides, as shown at the right. The school has budgeted enough money for 75 ft of fencing material and would like to make a playground with an area of 600 ft$^2$.
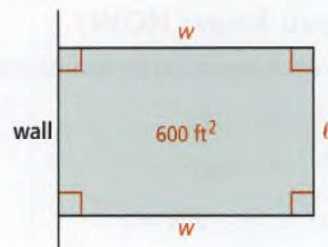
**a.** Let $w$ represent the width of the playground. Write an expression in terms of $w$ for the length of the playground.

**b.** Write and solve an equation to find the width $w$. Round to the nearest tenth of a foot.

**c.** What should the length of the playground be?



Solve each equation. If necessary, round to the nearest hundredth. If there is no real-number solution, write *no solution*.

**34.** $q^2 + 3q + 1 = 0$

**35.** $s^2 + 5s = -11$

**36.** $w^2 + 7w - 40 = 0$

**37.** $z^2 - 8z = -13$

**38.** $4p^2 - 40p + 56 = 0$

**39.** $m^2 + 4m + 13 = -8$

**40.** $2p^2 - 15p + 8 = 43$
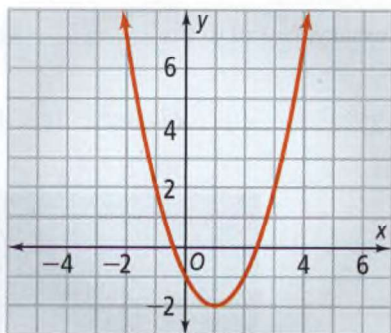
**41.** $3r^2 - 27r = 3$

**42.** $s^2 + 9s + 20 = 0$

**© 43. Error Analysis** A classmate was completing the square to solve $4x^2 + 10x = 8$. For her first step she wrote $4x^2 + 10x + 25 = 8 + 25$. What was her error?

**© 44. Reasoning** Explain why completing the square is a better strategy for solving $x^2 - 7x - 9 = 0$ than graphing or factoring.

**© 45. Open-Ended** Write a quadratic equation and solve it by completing the square. Show your work.

Use each graph to estimate the values of $x$ for which $f(x) = 5$. Then write and solve an equation to find the values of $x$ such that $f(x) = 5$. Round to the nearest hundredth.

**46.** $f(x) = x^2 - 2x - 1$

**47.** $f(x) = -\frac{1}{2}x^2 + 2x + 6$