# PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

## UNDERSTAND

**11. Use Appropriate Tools** How could you use a graphing calculator to determine whether you have correctly solved a quadratic equation by completing the square?

**12. Error Analysis** Describe and correct the error a student made in solving a quadratic equation by completing the square.

$0 = x^2 + 16x - 5$
$5 = x^2 + 16x + 64$
$5 = (x + 8)^2$
$x = -8 \pm \sqrt{5}$ ✗

**13. Higher Order Thinking** What number do you need to add to $x^2 + \frac{7}{2}x$ in order to create a perfect square trinomial? Explain.

**14. Reason** Does the geometric model hold for finding the number that completes the square of the expression $x^2 - 12x$? Explain.

**15. Error Analysis** When given the equation $-23 = x^2 + 8x$, a student says that you can add 64 to each side of the equation to complete the square. Is the student correct? If not, describe and correct the error.

**16. Construct Arguments** Explain why you should not try to complete the square when solving $0 = x^2 - 4$.

**17. Use Structure** Jacob completed the square to rewrite the equation $f(x) = -2x^2 + 12x - 13$ as $f(x) = -2(x - 3)^2 + 5$. Which form of the equation is more helpful for identifying the key features of the graph? Explain.

## PRACTICE

**Use square roots to solve the quadratic equations.** SEE EXAMPLE 1

**18.** $9 = x^2 + 2x + 1$ **19.** $16 = x^2 - 10x + 25$

**20.** $50 = 2x^2 + 16x + 32$ **21.** $5 = 3x^2 - 36x + 108$

**22.** $7 = x^2 + 4x + 4$ **23.** $-4 = x^2 + 14x + 49$

**Rewrite the equations in the form $(x - p)^2 = q$.** SEE EXAMPLE 2

**24.** $0 = x^2 - 18x + 64$ **25.** $x^2 + 22x + 120.5 = 0$

**26.** $x^2 + 3x - \frac{27}{4} = 0$ **27.** $0 = 4x^2 + 4x - 14$

**28.** $0 = x^2 - \frac{3}{2}x - \frac{70}{8}$ **29.** $x^2 + 0.6x - 19.1 = 0$

**Solve the following quadratic equations by completing the square.** SEE EXAMPLES 3 AND 4

**30.** $x^2 + 8x + 60 = 0$ **31.** $x^2 + 14x = 51$

**32** $4x^2 + 16x - 65 = 0$ **33.** $7x^2 + 56x - 22 = 0$

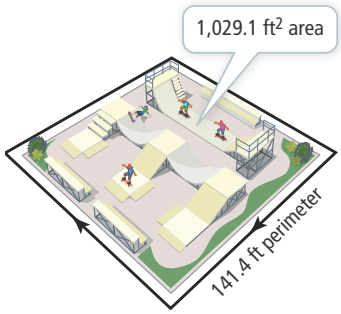
**34.** $3x^2 - 6x + 13 = 0$ **35.** $x^2 - 0.4x - 1.2 = 0$

**36.** $x^2 + 6x = 59$ **37.** $8x^2 + 16x = 42$

**38.** $5x^2 - 25 = 10x$ **39.** $-2x^2 - 12x + 18 = 0$

**40.** $-3x^2 - 24x - 19 = 0$ **41.** $17 - x^2 - 18x = 0$

**42.** What is the length and width of the skate park?




**Write the equation in vertex form. Identify the maximum or minimum value of the graph of the equation.** SEE EXAMPLE 5

**43.** $y = x^2 + 4x - 13$ **44.** $y = x^2 - 14x + 71$

**45.** $y = -2x^2 - 20x - 58$ **46.** $y = -3x^2 + 36x - 93$

**47.** $y = 6x^2 - 42x + 74.5$ **48.** $y = 0.5x^2 + 0.5x + 2.125$

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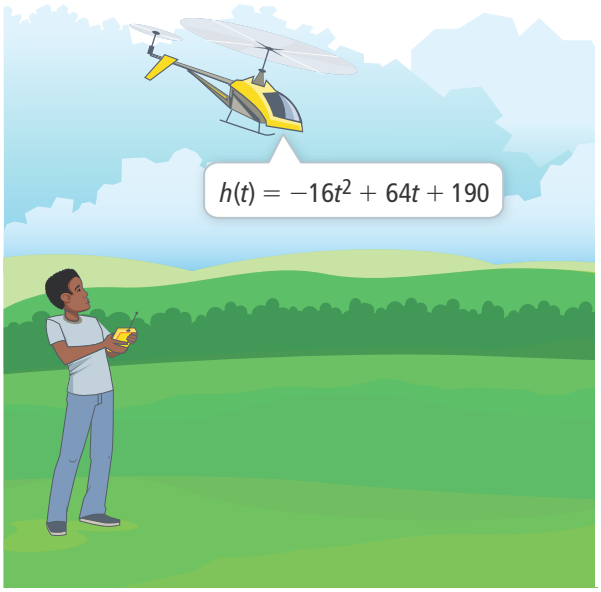
Mixed Review Available Online

### APPLY

**49. Make Sense and Persevere** Keenan launches a model helicopter. The height of the helicopter, in feet, is given by the equation $h = -16t^2 + 64t + 190$, where $t$ is the time in seconds. To the nearest hundredth, how many seconds will it take the helicopter to hit the ground? What is the maximum height of the helicopter?




**50. Use Structure** The decreasing population, $p$, of owls in a national park is being monitored by ecologists and is modeled by the equation $p = -0.4t^2 + 128t + 1{,}200$, where $t$ is the number of months since the ecologists started observing the owls.

**a.** If this model is accurate, when will the population reach its maximum?

**b.** What is the maximum population? Round to the nearest whole number.

**c.** Use the equation to determine in how many months the population of owls will disappear.

**51. Make Sense and Persevere** Between 2000 and 2005, the number of skateboarders $s$ in the United States, in millions, can be approximated by the equation $s = 0.33t^2 + 2.27t + 3.96$, where $t$ represents the number of years since 2000. If this model is accurate, in what year did 9.8 million people skateboard?

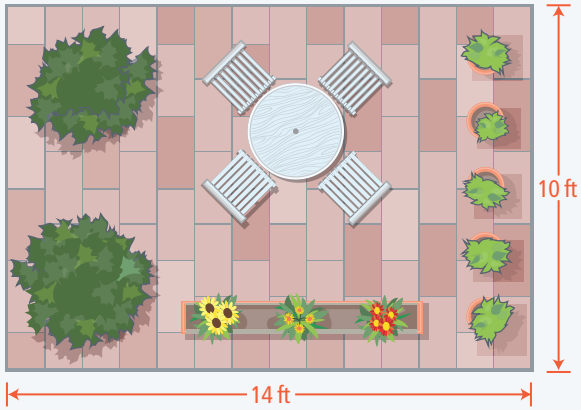
### ASSESSMENT PRACTICE

**52.** The roots of $f(x) = -2x^2 + 8x + 13$ are _____ and _____. The vertex of the parabola is at _____.

**53. SAT/ACT** Solve $x^2 + 2x - 5 = 0$.

Ⓐ $-5, 1$
Ⓑ $-1 \pm \sqrt{5}$
Ⓒ $-1 \pm \sqrt{6}$
Ⓓ $1 \pm \sqrt{5}$
Ⓔ $-3, 1$

**54. Performance Task** Yumiko has a rectangular-shaped patio. She wants to double the area of the patio by increasing the length and width by the same amount.




**Part A** Write a function to calculate the number of feet Yumiko would need to add to the length and width. Explain your reasoning.

**Part B** To the nearest hundredth, what are the new dimensions of the patio?