### Problem 4 Using the Discriminant

**How many real-number solutions does $2x^2 - 3x = -5$ have?**

**Plan**

**Can you solve this problem another way?**
Yes. You could actually solve the equation to find any solutions. However, you only need to know the number of solutions, so use the discriminant.

| Think | Write |
|---|---|
| Write the equation in standard form. | $2x^2 - 3x + 5 = 0$ |
| Evaluate the discriminant by substituting 2 for $a$, $-3$ for $b$, and 5 for $c$. | $b^2 - 4ac = (-3)^2 - 4(2)(5)$ $= -31$ |
| Draw a conclusion. | Because the discriminant is negative, the equation has no real-number solutions. |

**Got It?** **4. a.** How many real-number solutions does $6x^2 - 5x = 7$ have?

**b. Reasoning** If $a$ is positive and $c$ is negative, how many real-number solutions will the equation $ax^2 + bx + c = 0$ have? Explain.

## Lesson Check

### Do you know HOW?

**Use the quadratic formula to solve each equation. If necessary, round answers to the nearest hundredth.**

1. $-3x^2 - 11x + 4 = 0$
2. $7x^2 - 2x = 8$
3. How many real-number solutions does the equation $-2x^2 + 8x - 5 = 0$ have?

### Do you UNDERSTAND? MATHEMATICAL PRACTICES

4. **Vocabulary** Explain how the discriminant of the equation $ax^2 + bx + c = 0$ is related to the number of $x$-intercepts of the graph of $y = ax^2 + bx + c$.
5. **Reasoning** What method would you use to solve the equation $x^2 + 9x + c = 0$ if $c = 14$? If $c = 7$? Explain.
6. **Writing** Explain how completing the square is used to derive the quadratic formula.

## Practice and Problem-Solving Exercises MATHEMATICAL PRACTICES

**A Practice** **Use the quadratic formula to solve each equation.** See Problem 1.

7. $2x^2 + 5x + 3 = 0$
8. $5x^2 + 16x - 84 = 0$
9. $4x^2 + 7x - 15 = 0$
10. $3x^2 - 41x = -110$
11. $18x^2 - 45x - 50 = 0$
12. $3x^2 + 44x = -96$
13. $3x^2 + 19x = 154$
14. $2x^2 - x - 120 = 0$
15. $5x^2 - 47x = 156$

**Use the quadratic formula to solve each equation. Round your answer to the nearest hundredth.** See Problem 2.

**16.** $x^2 + 8x + 11 = 0$ **17.** $5x^2 + 12x - 2 = 0$ **18.** $2x^2 - 16x = -25$

**19.** $8x^2 - 7x - 5 = 0$ **20.** $6x^2 + 9x = 32$ **21.** $3x^2 + 5x = 4$

**22. Football** A football player punts a ball. The path of the ball can be modeled by the equation $y = -0.004x^2 + x + 2.5$, where $x$ is the horizontal distance, in feet, the ball travels and $y$ is the height, in feet, of the ball. How far from the football player will the ball land? Round to the nearest tenth of a foot.

**Which method(s) would you choose to solve each equation? Justify your reasoning.** See Problem 3.

**23.** $x^2 + 4x - 15 = 0$ **24.** $9x^2 - 49 = 0$ **25.** $4x^2 - 41x = 73$

**26.** $3x^2 - 7x + 3 = 0$ **27.** $x^2 + 4x - 60 = 0$ **28.** $-4x^2 + 8x + 1 = 0$

**Find the number of real-number solutions of each equation.** See Problem 4.

**29.** $x^2 - 2x + 3 = 0$ **30.** $x^2 + 7x - 5 = 0$ **31.** $x^2 + 3x + 11 = 0$

**32.** $x^2 - 15 = 0$ **33.** $x^2 + 2x = 0$ **34.** $9x^2 + 12x + 4 = 0$

## B Apply

**Use any method to solve each equation. If necessary, round your answer to the nearest hundredth.**

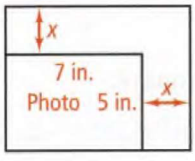
**35.** $3w^2 = 48$ **36.** $3x^2 + 2x - 4 = 0$ **37.** $6g^2 - 18 = 0$

**38.** $3p^2 + 4p = 10$ **39.** $k^2 - 4k = -4$ **40.** $13r^2 - 117 = 0$

**41. Think About a Plan** You operate a dog-walking service. You have 50 customers per week when you charge \$14 per walk. For each \$1 decrease in your fee for walking a dog, you get 5 more customers per week. Can you ever earn \$750 in a week? Explain.

- What quadratic equation in standard form can you use to model this situation?
- How can the discriminant of the equation help you solve the problem?

**42. Sports** Your school wants to take out an ad in the paper congratulating the basketball team on a successful season, as shown below. The area of the photo will be half the area of the entire ad. What is the value of $x$?




**43. Writing** How can you use the discriminant to write a quadratic equation that has two solutions?

**44. Error Analysis** Describe and correct the error at the right that a student made in finding the discriminant of $2x^2 + 5x - 6 = 0$.

$a = 2, b = 5, c = -6$

$b^2 - 4ac = 5^2 - 4(2)(-6)$

$= 25 - 48$

$= -23$