

**Chapter
9****Fair Game Review**

Find the square root(s).

1. $-\sqrt{36}$

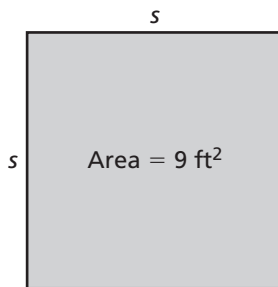
2. $\sqrt{121}$

3. $\sqrt{\frac{4}{49}}$

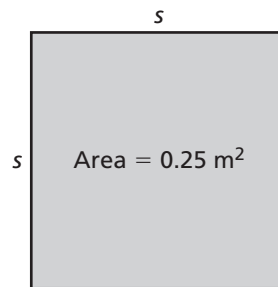
4. $\pm\sqrt{2.25}$

Find the side length of the square.

5.



6.



7. Simplify $\sqrt{20}$.

8. Simplify $\sqrt{63}$.

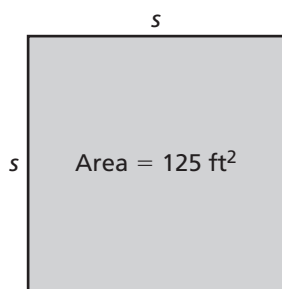
9. Simplify $\sqrt{108}$.

10. Simplify $\sqrt{288}$.

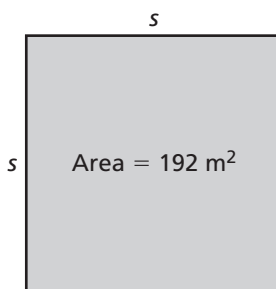
**Chapter
9****Fair Game Review** (continued)

Find the side length of the square.

11.



12.



Factor the trinomial.

13. $y^2 - 6y + 9$

14. $b^2 + 18b + 81$

15. $n^2 + 28n + 196$

16. $h^2 - 16h + 64$

17. The surface area (in square inches) of a square card table can be represented by $x^2 - 50x + 625$.

a. Write an expression that represents the side length of the table.

b. Write an expression for the perimeter of the table.

9.1**Solving Quadratic Equations by Graphing**

For use with Activity 9.1

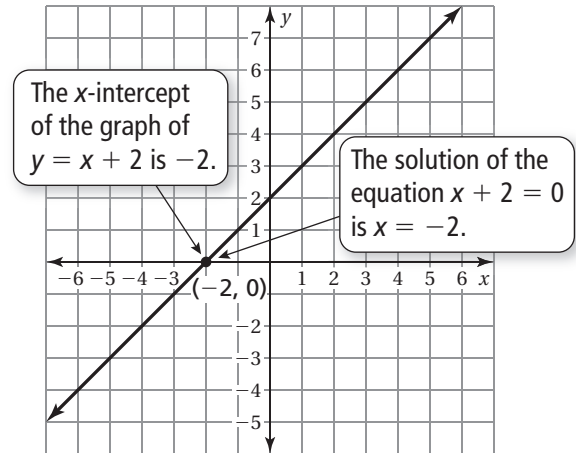
Essential Question How can you use a graph to solve a quadratic equation in one variable?

Earlier in the book, you learned that the x -intercept of the graph of

$$y = ax + b \quad 2 \text{ variables}$$

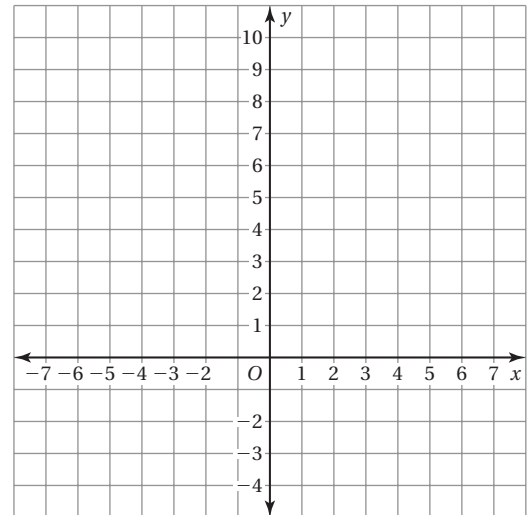
is the same as the solution of

$$ax + b = 0. \quad 1 \text{ variable}$$


1 ACTIVITY: Solving a Quadratic Equation by Graphing

Work with a partner.

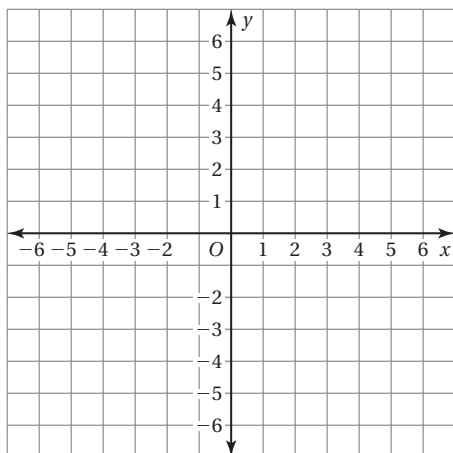
- Sketch the graph of $y = x^2 - 2x$.
- What is the definition of an x -intercept of a graph? How many x -intercepts does this graph have? What are they?
- What is the definition of a solution of an equation in x ? How many solutions does the equation $x^2 - 2x = 0$ have? What are they?
- Explain how you can verify that the x -values found in part (c) are solutions of $x^2 - 2x = 0$.



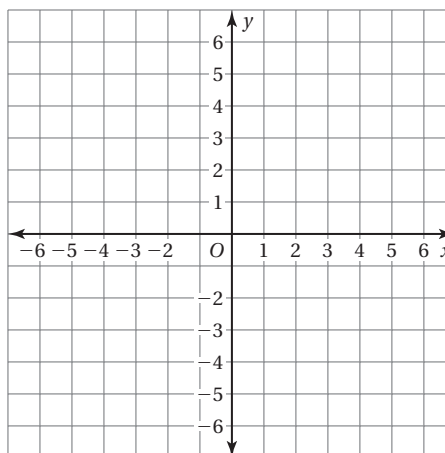
9.1 Solving Quadratic Equations by Graphing (continued)**2 ACTIVITY:** Solving Quadratic Equations by Graphing

Work with a partner. Solve each equation by graphing.

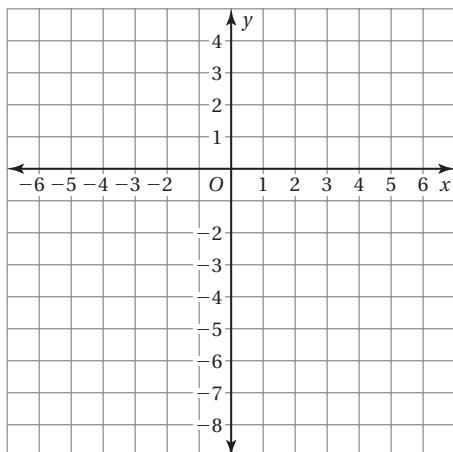
a. $x^2 - 4 = 0$



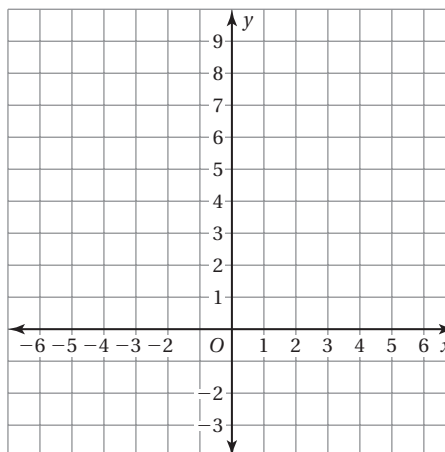
b. $x^2 + 3x = 0$



c. $-x^2 + 2x = 0$



d. $x^2 - 2x + 1 = 0$



9.1 Solving Quadratic Equations by Graphing (continued)

What Is Your Answer?

3. IN YOUR OWN WORDS How can you use a graph to solve a quadratic equation in one variable?

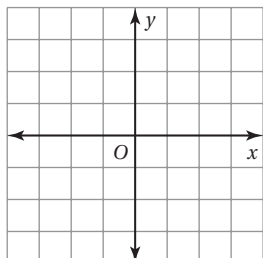
4. After you find a solution graphically, how can you check your result algebraically? Use your solutions in Activity 2 as examples.

9.1**Practice**

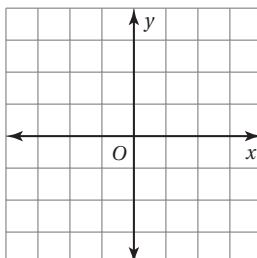
For use after Lesson 9.1

Solve the equation by graphing. Check your solution(s).

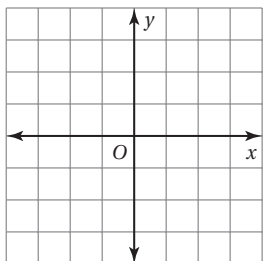
1. $2x^2 + 8x = 0$



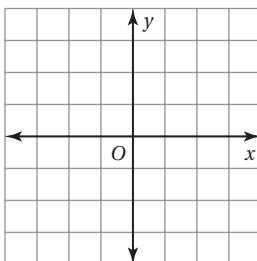
2. $x^2 + 2x + 1 = 0$



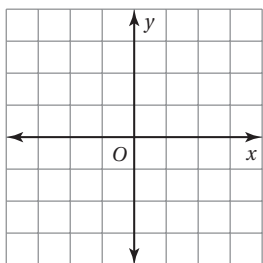
3. $x^2 - 4x + 5 = 0$



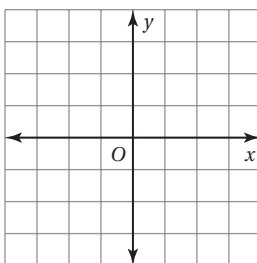
4. $x^2 - 5x + 6 = 0$



5. $-x^2 - 10x - 25 = 0$



6. $-x^2 - 2x + 3 = 0$



7. The height h (in feet) of a javelin thrown at a track and field competition can be modeled by $h = -16t^2 + 50t + 6$, where t is time in seconds. After how many seconds is the javelin 30 feet above the ground?

9.2**Solving Quadratic Equations Using Square Roots**

For use with Activity 9.2

Essential Question How can you determine the number of solutions of a quadratic equation of the form $ax^2 + c = 0$?

1 ACTIVITY: The Number of Solutions of $ax^2 + c = 0$

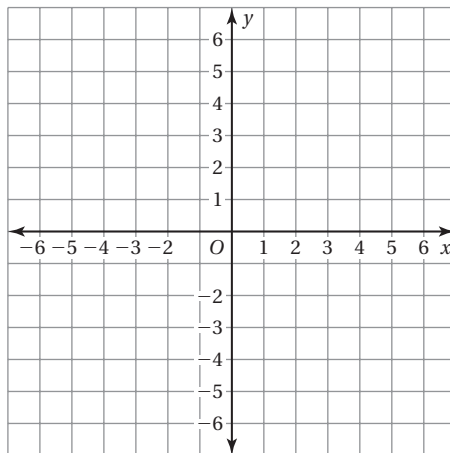
Work with a partner. Solve each equation by graphing. Explain how the number of solutions of

$$ax^2 + c = 0 \quad \text{Quadratic equation}$$

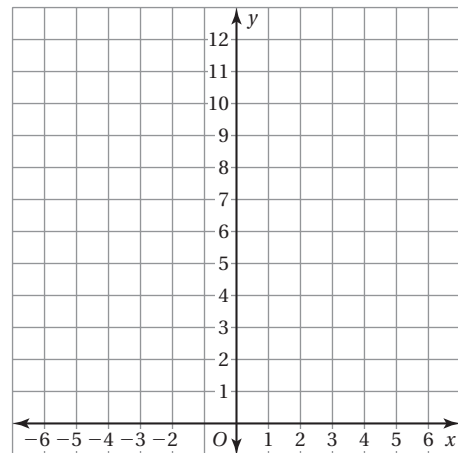
relates to the graph of

$$y = ax^2 + c. \quad \text{Quadratic function}$$

a. $x^2 - 4 = 0$

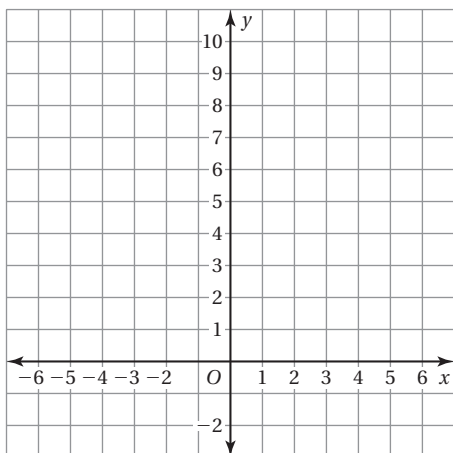


b. $2x^2 + 5 = 0$

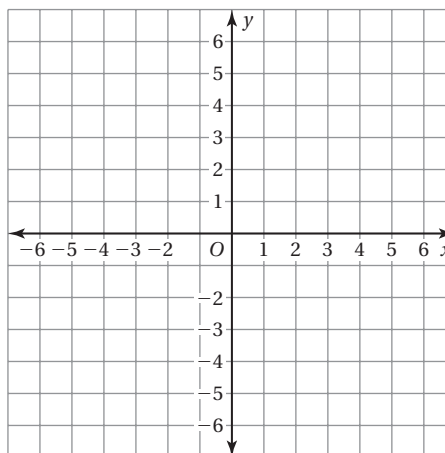


9.2 Solving Quadratic Equations Using Square Roots (continued)

c. $x^2 = 0$



d. $x^2 - 5 = 0$

**2 ACTIVITY: Estimating Solutions**

Work with a partner. Complete each table. Use the completed tables to estimate the solutions of $x^2 - 5 = 0$. Explain your reasoning.

a.

x	$x^2 - 5$
2.21	
2.22	
2.23	
2.24	
2.25	
2.26	

b.

x	$x^2 - 5$
-2.21	
-2.22	
-2.23	
-2.24	
-2.25	
-2.26	

9.2 Solving Quadratic Equations Using Square Roots (continued)**3 ACTIVITY:** Using Technology to Estimate Solutions

Work with a partner. Two equations are equivalent when they have the same solutions.

- a. Are the equations $x^2 - 5 = 0$ and $x^2 = 5$ equivalent? Explain your reasoning.
- b. Use the square root key on a calculator to estimate the solutions of $x^2 - 5 = 0$. Describe the accuracy of your estimates.
- c. Write the *exact* solutions of $x^2 - 5 = 0$.

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you determine the number of solutions of a quadratic equation of the form $ax^2 + c = 0$?
5. Write the exact solutions of each equation. Then use a calculator to estimate the solutions.
 - a. $x^2 - 2 = 0$
 - b. $3x^2 - 15 = 0$
 - c. $x^2 = 8$

9.2**Practice**

For use after Lesson 9.2

Solve the equation using square roots.

1. $x^2 - 64 = 0$

2. $x^2 + 18 = 0$

3. $x^2 - 11 = -11$

4. $3x^2 - 75 = 0$

5. $2x^2 + 12 = 9$

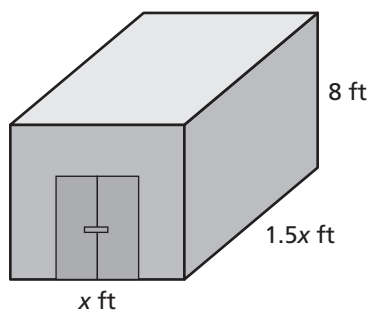
6. $-6x^2 + 4 = 4$

Solve the equation using square roots. Use a graphing calculator to check your solution(s).

7. $(x - 4)^2 = 49$

8. $16(x + 3)^2 = 36$

9. The volume of a shed is 972 cubic feet.
Find the width x of the shed.

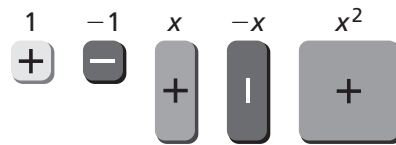


9.3**Solving Quadratic Equations by Completing the Square** For use with Activity 9.3

Essential Question How can you use “completing the square” to solve a quadratic equation?

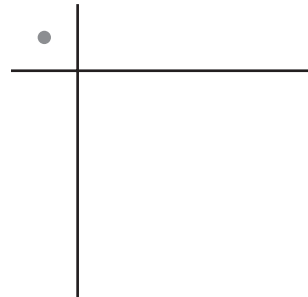
1 EXAMPLE: Solving by Completing the Square

Work with a partner. Five different algebra tiles are shown at the right. Solve $x^2 + 4x = -2$ by completing the square.



Step 1: Use algebra tiles to model the equation

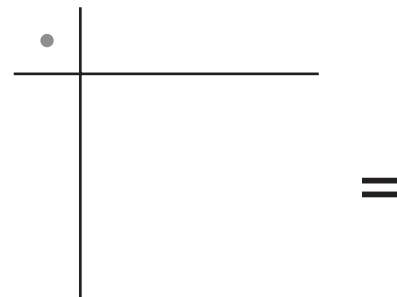
$$x^2 + 4x = -2.$$



Step 2: Add four yellow tiles to the left side of the equation so that it is a perfect square. Balance the equation by also adding four yellow tiles to the right side.

$$x^2 + 4x + 4 = -2 + 4$$

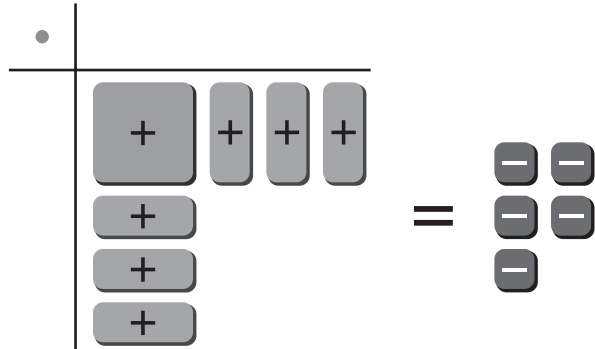
$$(x + 2)^2 = 2$$



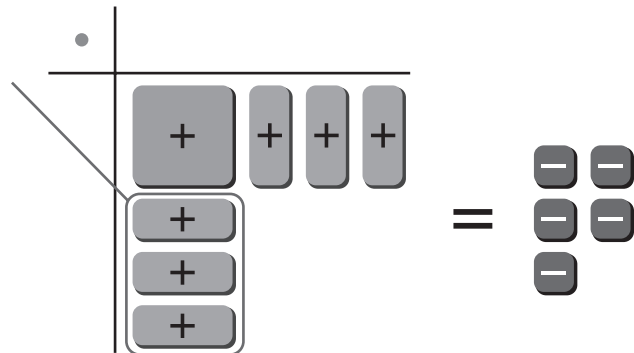
Step 3: Take the square root of each side of the equation and simplify.

9.3 Solving Quadratic Equations by Completing the Square (continued)**2 ACTIVITY:** Solving by Completing the Square**Work with a partner.**

- Write the equation modeled by the algebra tiles.
- Use algebra tiles to complete the square.
- Write the solutions of the equation.
- Check each solution.

**3 ACTIVITY:** Writing a Rule**Work with a partner.**

- What does this group of tiles represent?
- How is the coefficient of x for this group of tiles related to the coefficient of x in the equation from Activity 2?
- How is it related to the number of tiles you add to each side when completing the square?



9.3 Solving Quadratic Equations by Completing the Square (continued)

- **WRITE A RULE** Fill in the blanks.

To complete the square, take _____ of the
coefficient of the x -term and _____ it.
_____ this number to each side of the equation.

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use “completing the square” to solve a quadratic equation?

5. Solve each quadratic equation by completing the square.

a. $x^2 - 2x = 1$

b. $x^2 - 4x = -1$

c. $x^2 + 4x = -3$

9.3**Practice**

For use after Lesson 9.3

Complete the square for the expression. Then factor the trinomial.

1. $x^2 + 8x$

2. $x^2 - 6x$

3. $x^2 - 20x$

4. $x^2 + 7x$

Solve the equation by completing the square.

5. $x^2 - 2x = 8$

6. $x^2 + 12x + 9 = -5$

7. $x^2 + 5x + 13 = 1$

8. $2x^2 - 6x + 3 = 11$

9. Your backyard is rectangular and has an area of 760 square meters. The length of the yard is 18 meters more than the width. Find the length and width of the backyard.

9.4**Solving Quadratic Equations Using the Quadratic Formula** For use with Activity 9.4

Essential Question How can you use the discriminant to determine the number of solutions of a quadratic equation?

1 ACTIVITY: Deriving the Quadratic Formula

Work with a partner. The following steps show one method of solving $ax^2 + bx + c = 0$. Explain what was done in each step.

$$ax^2 + bx + c = 0$$

1. Write the equation.

$$4a^2x^2 + 4abx + 4ac = 0$$

2. _____

$$4a^2x^2 + 4abx + 4ac + b^2 = b^2$$

3. _____

$$4a^2x^2 + 4abx + b^2 = b^2 - 4ac$$

4. _____

$$(2ax + b)^2 = b^2 - 4ac$$

5. _____

$$2ax + b = \pm\sqrt{b^2 - 4ac}$$

6. _____

$$2ax = -b \pm \sqrt{b^2 - 4ac}$$

7. _____

$$\text{Quadratic Formula: } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

8. _____

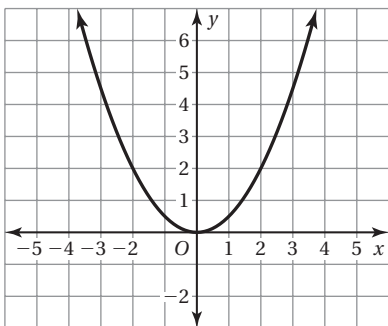
9.4 Solving Quadratic Equations Using the Quadratic Formula (continued)**2 ACTIVITY:** Deriving the Quadratic Formula by Completing the Square

- Solve $ax^2 + bx + c = 0$ by completing the square. (*Hint:* Subtract c from each side, divide each side by a , and then proceed by completing the square.)
- Compare this method with the method in Activity 1. Explain why you think $4a$ and b^2 were chosen in Steps 2 and 3 of Activity 1.

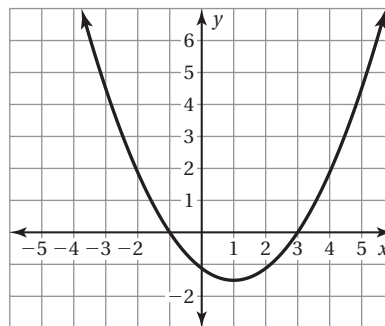
3 ACTIVITY: Writing a Rule

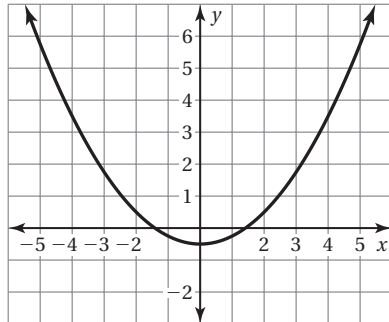
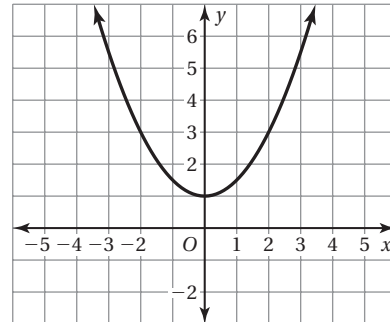
Work with a partner. In the quadratic formula in Activity 1, the expression under the radical sign, $b^2 - 4ac$, is called the **discriminant**. For each graph, decide whether the corresponding discriminant is equal to 0, is greater than 0, or is less than 0. Explain your reasoning.

a. 1 rational solution



b. 2 rational solutions



9.4 Solving Quadratic Equations Using the Quadratic Formula (continued)**c.** 2 irrational solutions**d.** no real solutions**What Is Your Answer?**

4. IN YOUR OWN WORDS How can you use the discriminant to determine the number of solutions of a quadratic equation?

5. Use the quadratic formula to solve each quadratic equation.

a. $x^2 + 2x - 3 = 0$

b. $x^2 - 4x + 4 = 0$

c. $x^2 + 4x + 5 = 0$

6. Use the Internet to research *imaginary numbers*. How are they related to quadratic equations?

9.4**Practice**

For use after Lesson 9.4

Solve the equation using the quadratic formula. Round to the nearest tenth, if necessary.

1. $x^2 + 3x - 18 = 0$

2. $x^2 + 8x + 16 = 0$

3. $x^2 - 5x + 7 = 0$

4. $3x^2 - 10x - 8 = 0$

5. $4x^2 - 12x = -9$

6. $4x - 3 = 2x^2$

7. $x^2 + 2x - 6 = 0$

8. $-2x^2 - 11x = -5$

9. The deer population in a forest from 2000 to 2010 can be modeled by $y = -0.1x^2 + 1.1x + 3$, where y is hundreds of deer and x is the number of years since 2000.

- a. When was the deer population about 500?
- b. Do you think this model can be used for future years? Explain your reasoning.

Use the discriminant to determine the number of real solutions of the equation.

10. $x^2 + 8x + 13 = 0$

11. $2x^2 - 6x = -9$

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

**Extension
9.4****Practice**

For use after Extension 9.4

Solve the equation using two different methods.

1. $x^2 - 7x - 18 = 0$

2. $x^2 + 5x - 3 = 0$

3. $2x^2 + 2 = 4x$

4. $4x^2 + 11x - 3 = 0$

Solve the equation using any method. Explain your choice of method.

5. $x^2 - x - 20 = 0$

6. $3x^2 = 27$

7. $x^2 + 4x = -4$

8. $x^2 + 5x + 8 = 0$

Extension
9.4**Practice (continued)**

9. $x^2 - 12x + 22 = -13$

10. $6x^2 + 2x = 9$

11. $-2x^2 - 10x - 12 = 4$

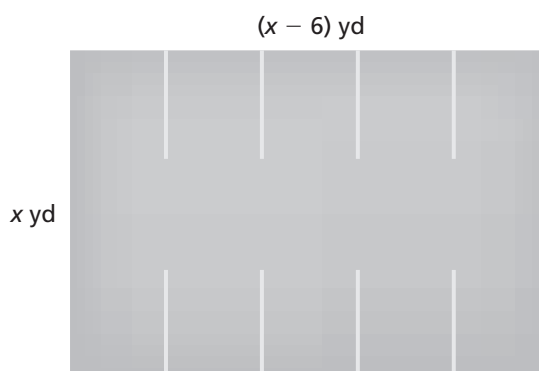
12. $2x^2 - 1 = 9x + 17$

13. The height h (in feet) of an arrow shot from a bow can be modeled by $h = -16t^2 + 96t + 5$, where t is time in seconds.

a. When will the arrow hit the ground?

b. After how many seconds is the arrow 133 feet in the air?

14. The area of the parking lot is 247 square yards. Find the dimensions of the parking lot.



9.5**Solving Systems of Linear and Quadratic Equations**

For use with Activity 9.5

Essential Question How can you solve a system of two equations when one is linear and the other is quadratic?

1 ACTIVITY: Solving a System of Equations

Work with a partner. Solve the system of equations using the given strategy. Which strategy do you prefer? Why?

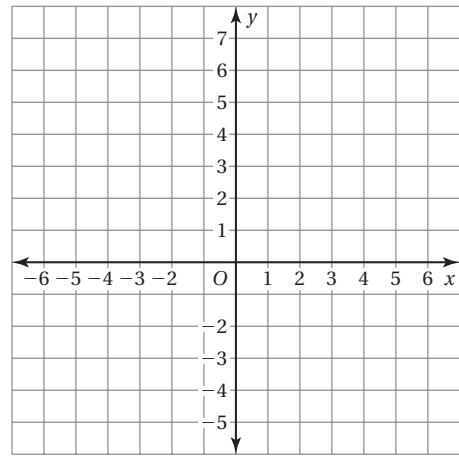
System of Equations:

$$y = x + 2 \quad \text{Linear}$$

$$y = x^2 + 2x \quad \text{Quadratic}$$

a. Solve by Graphing

Graph each equation and find the points of intersection of the line and the parabola.

**b. Solve by Substitution**

Substitute the expression for y from the quadratic equation into the linear equation to obtain

$$x^2 + 2x = x + 2.$$

Solve this equation and substitute each x -value into the linear equation $y = x + 2$ to find the corresponding y -value.

c. Solve by Elimination

Eliminate y by subtracting the linear equation from the quadratic equation to obtain

$$\begin{array}{r} y = x^2 + 2x \\ y = \quad \quad x + 2 \\ \hline 0 = x^2 + \quad x - 2. \end{array}$$

Solve this equation and substitute each x -value into the linear equation $y = x + 2$ to find the corresponding y -value.

9.5 Solving Systems of Linear and Quadratic Equations (continued)**2 ACTIVITY:** Analyzing Systems of Equations

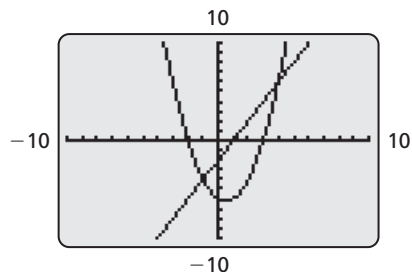
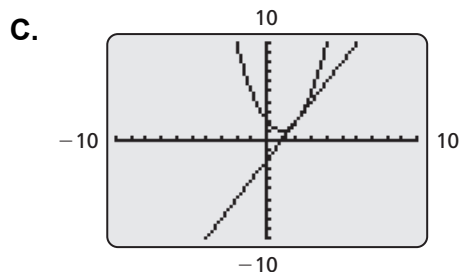
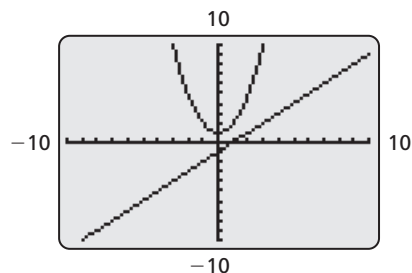
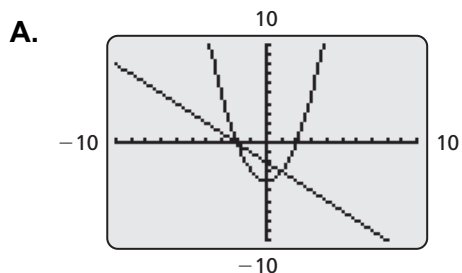
Work with a partner. Match each system of equations with its graph. Then solve the system of equations.

a. $y = x^2 - 4$
 $y = -x - 2$

b. $y = x^2 - 2x + 2$
 $y = 2x - 2$

c. $y = x^2 + 1$
 $y = x - 1$

d. $y = x^2 - x - 6$
 $y = 2x - 2$



9.5 Solving Systems of Linear and Quadratic Equations (continued)**What Is Your Answer?**

3. IN YOUR OWN WORDS How can you solve a system of two equations when one is linear and the other is quadratic?

4. Summarize your favorite strategy for solving a system of two equations when one is linear and the other is quadratic.

5. Write a system of equations (one linear and one quadratic) that has the following number of solutions.

a. no solutions

b. one solution

c. two solutions

Your systems should be different from those in the activities.

9.5**Practice**

For use after Lesson 9.5

Solve the system by substitution. Check your solution(s).

1. $y = x^2 + 5x - 4$
 $y = 3x - 1$

2. $y = 4x + 2$
 $y = x^2 + 6$

3. $y = -3x^2$
 $y - 1 = 2x$

4. $y - x = 2x^2 - 5$
 $y = x + 3$

Solve the system by elimination. Check your solution(s).

5. $y = 4 - 2x$
 $y = -x^2 + 2x$

6. $y = x^2 + 5x + 8$
 $y = -2x + 2$

7. $y + 6x = 7$
 $y = -2x^2 + 9x$

8. $y - 4 = x^2 + 5x$
 $y = 3x - 2$

9. The weekly profit y (in dollars) for two street vendors can be modeled by the following equations, where x is the number of weeks since the beginning of the year.

$$y = -x^2 + 9x + 100$$

$$y = 5x + 103$$

When is the weekly profit for each vendor the same?