2

## **7.3** Special Products of Polynomials For use with Exploration 7.3

**Essential Question** What are the patterns in the special products  $(a + b)(a - b), (a + b)^2$ , and  $(a - b)^2$ ?



Work with a partner. Write the product of two binomials modeled by each rectangular array of algebra tiles.

**a.** 
$$(x + 2)(x - 2) =$$
  
**b.**  $(2x - 1)(2x + 1) =$   
**c.**  $(x + 2)(x - 2) =$   
**b.**  $(2x - 1)(2x + 1) =$   
**c.**  $(x + 2)(x - 2) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
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**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x - 2)(x + 1) =$   
**c.**  $(x + 2)(x + 2)(x + 1) =$   
**c.**  $(x$ 

**EXPLORATION:** Finding the Square of a Binomial Pattern

#### Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

**Work with a partner.** Draw the rectangular array of algebra tiles that models each product of two binomials. Write the product.

**a.** 
$$(x + 2)^2 =$$
\_\_\_\_\_ **b.**  $(2x - 1)^2 =$ \_\_\_\_\_

## 7.3 Special Products of Polynomials (continued)

## Communicate Your Answer

**3.** What are the patterns in the special products  $(a + b)(a - b), (a + b)^2$ , and  $(a - b)^2$ ?

**4.** Use the appropriate special product pattern to find each product. Check your answers using algebra tiles.

**a.** 
$$(x+3)(x-3)$$
 **b.**  $(x-4)(x+4)$  **c.**  $(3x+1)(3x-1)$ 

**d.** 
$$(x + 3)^2$$
 **e.**  $(x - 2)^2$  **f.**  $(3x + 1)^2$ 

Name



## **Core Concepts**

#### Square of a Binomial Pattern

Algebra

Example

$$(a + b)^{2} = a^{2} + 2ab + b^{2}$$

$$(x + 5)^{2} = (x)^{2} + 2(x)(5) + (5)^{2}$$

$$= x^{2} + 10x + 25$$

$$(a - b)^{2} = a^{2} - 2ab + b^{2}$$

$$(2x - 3)^{2} = (2x)^{2} - 2(2x)(3) + (3)^{2}$$

$$= 4x^{2} - 12x + 9$$

Notes:

### **Sum and Difference Pattern**

Algebra

Example

 $(a + b)(a - b) = a^2 - b^2$   $(x + 3)(x - 3) = x^2 - 9$ 

Notes:

# Worked-Out Examples

### Example #1

#### Find the product

$$(5p + 2)^2 = (5p)^2 + 2(5p)(2) + 2^2$$
  
=  $25p^2 + 20p + 4$ 

### Example #2

#### Find the product

$$(2k - 4)(2k + 4) = (2k)^2 - 4^2$$
$$= 4k^2 - 16$$

7.3 Practice (continued)

# **Practice A**

In Exercises 1–18, find the product.

**1.** 
$$(a+3)^2$$
 **2.**  $(b-2)^2$  **3.**  $(c+4)^2$ 

**4.** 
$$(-2x+1)^2$$
 **5.**  $(3x-2)^2$  **6.**  $(-4p-3)^2$ 

**7.** 
$$(3x + 2y)^2$$
 **8.**  $(2a - 3b)^2$  **9.**  $(-4c + 5d)^2$ 

**10.** 
$$(x-3)(x+3)$$
 **11.**  $(q+5)(q-5)$  **12.**  $(t-11)(t+11)$ 

### 7.3 Practice (continued)

**13.** 
$$(5a-1)(5a+1)$$
 **14.**  $(\frac{1}{4}b+1)(\frac{1}{4}b-1)$  **15.**  $(\frac{1}{2}c+\frac{1}{3})(\frac{1}{2}c-\frac{1}{3})$ 

**16.** 
$$(-m+2n)(-m-2n)$$
 **17.**  $(-3j-2k)(-3j+2k)$  **18.**  $\left(6a+\frac{1}{2}b\right)\left(-6a+\frac{1}{2}b\right)$ 

In Exercises 19–24, use special product patterns to find the product.

**19.**  $18 \bullet 22$  **20.**  $49 \bullet 51$  **21.**  $19\frac{3}{5} \bullet 20\frac{2}{5}$ 

**22.** 
$$(31)^2$$
 **23.**  $(20.7)^2$  **24.**  $(109)^2$ 

**25.** Find k so that  $kx^2 - 12x + 9$  is the square of a binomial.

# **Practice B**

In Exercises 1–9, find the product.

1.  $(-6p+3)^2$ 2.  $(3c-d)^2$ 3.  $(5x+2y)^2$ 4. (9+4q)(9-4q)5.  $(\frac{2}{3}+g)(\frac{2}{3}-g)$ 6. (3m+8n)(3m-8n)7. (8-3u)(8+3u)8. (-c+9)(-c-9)9. (-3s-7t)(-3s+7t)

In Exercises 10–12, use special product patterns to find the product.

- **10.**  $27^2$  **11.**  $40.5^2$  **12.**  $5\frac{1}{4} \bullet 4\frac{3}{4}$
- **13.** Describe and correct the error in finding the product.

$$(x + 5)(x - 5) = x^{2} + 5^{2}$$
$$= x^{2} + 25$$

- **14.** A circular helicopter landing pad has a radius of 200 feet. Inside the circular pad, red paint covers the outer area evenly, with a width of x feet. White paint covers the inner area.
  - **a.** Write a polynomial that represents the area of the circle that is painted white. Write your answer in terms of  $\pi$ .
  - **b.** Use the polynomial in part (a) to find the area of the circle that is painted white when x = 100.

In Exercises 15 and 16, find the product.

- **15.**  $(3x^2 + 7y^2)^2$  **16.**  $(z^4 3w^3)(z^4 + 3w^3)$
- **17.** Find k so that  $25x^2 + 40x + k$  is the square of a binomial.
- **18.** Find two numbers a and b such that  $(a b)^2 < (a + b)(a b) < (a + b)^2$ . Find two numbers a and b such that this is not true.