

## 12-10

## Multiplying Polynomials

 Check Skills You'll Need

## New Vocabulary • monomial • binomial

Write each expression using a single exponent.

1.  $2^3 \cdot 2^5$   $2^{3+5} = 2^8$

2.  $a^2 \cdot a^1 = a^3$

3.  $n^3 \cdot n^8 \cdot n^4 = n^{15}$

4.  $(-x^4) \cdot x^{-5} \cdot x^6$   
 $-x^{4-5+6}$   
 $-x^5$

5.  $(-a)^3 \cdot (-a)^7$   
 $(-a)^{10}$

6.  $(-w)^2 \cdot w^4 \cdot w^{-2}$   
 $w^2 \cdot w^4 \cdot w^{-2}$   
 $w^4$

A polynomial that has only one term, such as  $4a^3$ , is a **monomial**. To multiply monomials, multiply the coefficients and use the properties of exponents.

**1****EXAMPLE****Multiplying Monomials**Simplify:  $(4a^3)(-5a^2)$ 

$$\begin{aligned}
 (4a^3)(-5a^2) &= 4(-5)(a^3)(a^2) \\
 &= -20a^{3+2} \\
 &= -20a^5
 \end{aligned}$$

↑                    ↑  
coefficients

← Use the Commutative Property to rearrange the factors.

← Multiply the coefficients.

← Add the exponents.

## ✓ Check Understanding

**1** Simplify each expression.

a.  $(2y^3)(4y)$

$2 \cdot 4 \cdot y^3 y^1$

$8y^4$

b.  $(-7n^5)(3n^2)$

$-7 \cdot 3 \cdot n^5 \cdot n^2$

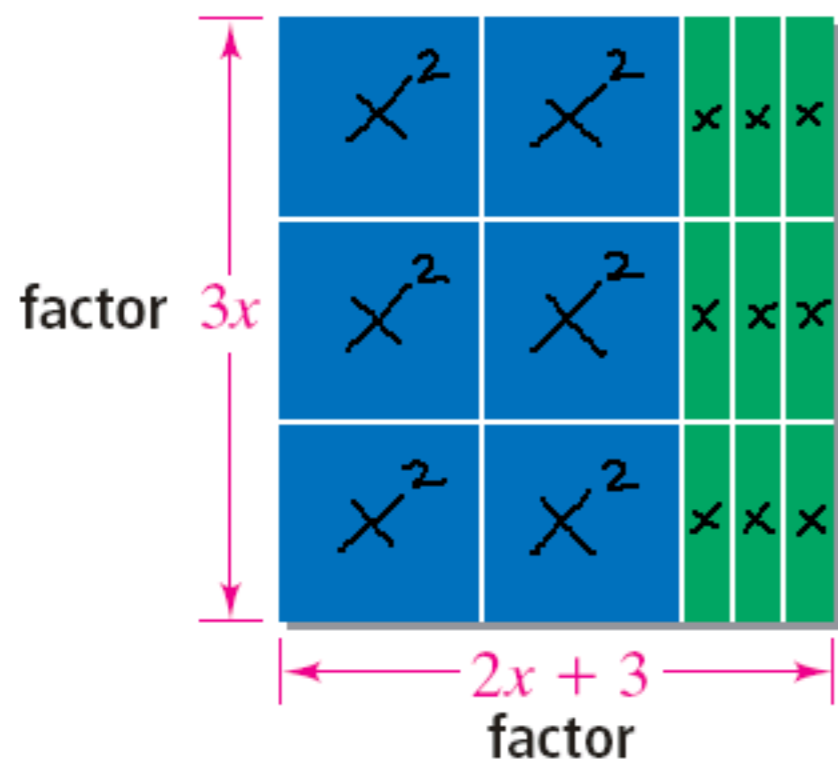
$-21n^7$

c.  $(-2x^4)(-4x^7)$

$(-2)(-4)x^4 x^7$

$8x^{11}$

A **binomial** is a polynomial with two terms. You can use an area model to find the product of a monomial and a binomial. *ie. count the shapes*



$$\text{Area}_{(\text{rectangle})} = \text{base} \cdot \text{height}$$

$$A = 3x(2x + 3) =$$

$\rightarrow$  6 big squares  $6x^2$   
 $\rightarrow$  9 sticks  $\underline{+ 9x}$

You can also use the Distributive Property to find the product of a monomial and a binomial.

$$\begin{aligned}
 A &= 3x(2x + 3) = \\
 &3 \cdot 2 \cdot x \cdot x + 3 \cdot 3 \cdot x \\
 &6x^2 + 9x
 \end{aligned}$$


$6x^2 + 9x$

**2****EXAMPLE****Multiplying a Monomial and a Binomial**Simplify:  $5n(4n - 6)$ 

$$\begin{aligned}5n(4n - 6) &= 5n \cdot 4n - 5n \cdot 6 && \leftarrow \text{Use the Distributive Property.} \\ &= 20n^2 - 30n && \leftarrow \text{Multiply the monomials.}\end{aligned}$$

 **Check Understanding****2** Simplify each expression.


a.  $4y(2y + 7)$



$$4 \cdot 2 \cdot y \cdot y + 4 \cdot 7 \cdot y$$

$$8y^2 + 28y$$

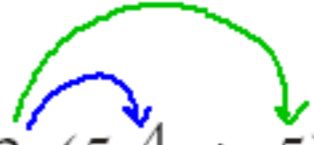
b.  $8b(2b^2 - 9)$



$$8 \cdot 2 \cdot b \cdot b^2 - 8 \cdot 9 \cdot b$$

$$16b^3 - 72b$$

c.  $3r(5r^4 + 5)$



$$3 \cdot 5 \cdot r \cdot r^4 + 3 \cdot 5 \cdot r$$

$$15r^5 + 15r$$

## Reteaching 12-10

- |                  |                   |                   |
|------------------|-------------------|-------------------|
| 1. $6x^2 + 3x$   | 2. $4x^2 + 8x$    | 3. $2y^3$         |
| 4. $15x^3$       | 5. $-4n^4$        | 6. $12x^4$        |
| 7. $-32j^5$      | 8. $3x^4$         | 9. $z^2 + 2z$     |
| 10. $3x^2 - x$   | 11. $2b^2 + 10b$  | 12. $-5x^2 + 20x$ |
| 13. $-2k^3 - 8k$ | 14. $6x^3 - 6x^2$ |                   |

## Practice 12-10

- |                          |                          |                    |
|--------------------------|--------------------------|--------------------|
| 1. $2y^2 + 8y$           | 2. $2x^2 + 4x + 2$       |                    |
| 3. $4n^2 + 8n + 3$       | 4. $x^4$                 | 5. $14x^2$         |
| 6. $-3t^2$               | 7. $-8x^3$               | 8. $10m^4$         |
| 9. $-7x^3$               | 10. $-6x^5$              | 11. $8z^3$         |
| 12. $x^2 + 2x$           | 13. $3b^2 - 15b$         | 14. $2x^3 + 18x^2$ |
| 15. $2a^2 + 16a + 2$     | 16. $8x^3 + 2x^2$        |                    |
| 17. $3l^3 + 12l^2 - 18l$ | 18. $3n^2 + 2n$          |                    |
| 19. $4x^2 + 3x$          | 20. $4k^2 + 14k$         |                    |
| 21. $-4x^3 + 8x^2 - 36x$ | 22. $12x^3 + 18x^2 - 6x$ |                    |

## Combining Like Terms Practice

1.  $-34t$

2.  $6t$

3.  $5f$

4.  $0c + -22$

5.  $9p + -41$

6.  $-2r + 8$

7.  $4g + 45$

8.  $63p + 14b$

9.  $63g + 72w$

10.  $29r + 2k + 70$

11.  $-10r + 3n + 9$

12.  $-4g + 27$

13.  $-33p + -91$

14.  $1m + (-6w)$

15.  $7p + 47$

16.  $-1f + -3$

17.  $27w + -12$

18.  $-4k + 48$

19.  $27w + -99$

20.  $-40n + -144$