

# 15-1

## Simplifying Polynomials

Objective: To simplify polynomials.

### CONNECTION

Since Chapter 1, you have been writing variable expressions and simplifying some expressions. In this lesson you will simplify *polynomials*. Each expression below is a **polynomial**, a variable expression consisting of one or more *terms*.

$$3x^2 \quad -4t \quad 2a^2 - 3ab + 2b^2 \quad x^3 - 1$$

Some polynomials have special names.

A **monomial** has one term. Examples:  $3x^2$  and  $-4t$

A **binomial** has two terms. Example:  $x^3 - 1$

A **trinomial** has three terms. Example:  $2a^2 - 3ab + 2b^2$

When you are working with a polynomial, it is often helpful to write the polynomial in **standard form**. To do this, write the terms in order from the highest to the lowest power of one of the variables.

### Terms to Know

- *polynomial*
- *monomial*
- *binomial*
- *trinomial*
- *standard form*

### Example 1

Write each polynomial in standard form.

a.  $4x^2 + x - 3x^3$

b.  $8c^3 + 7 - 9c + 2c^4$

### Solution

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

b.  $8c^3 + 7 - 9c + 2c^4$   
 $= 2c^4 + 8c^3 - 9c + 7$

 Check Your Understanding

1. In Example 1(a) and in Example 1(b), list the powers in order.
2. In Example 1(b), why is 7 the last term?

*Like terms* have the same variables raised to the same powers. To *simplify* a polynomial, you combine like terms and write the resulting polynomial in standard form.

### Example 2

Simplify  $12c^3 - 4c^2 - 8c^3 - 5 + 7c^2 - 4c$ .

### Solution

$$12c^3 - 4c^2 - 8c^3 - 5 + 7c^2 - 4c$$

$$= (12c^3 - 8c^3) + (-4c^2 + 7c^2) - 5 - 4c$$

$$= 4c^3 + 3c^2 - 5 - 4c$$

$$= 4c^3 + 3c^2 - 4c - 5$$

← Group like terms.

← Combine like terms.

← Write in standard notation.

 Check Your Understanding

3. In Example 2, why does  $4c^3$  come before  $3c^2$ ?
4. In Example 2, why are  $4c^3$ ,  $3c^2$ , and  $4c$  not combined?

## Guided Practice

### COMMUNICATION «Reading»

Replace each ? with the correct word or expression.

- «1. A ? is a variable expression with one or more terms. A ? has one term, a ? has two terms, and a ? has three terms.
- «2. A polynomial is in ? form when its terms are arranged in order of highest to lowest powers. To simplify a polynomial, you ? and write the resulting polynomial in standard form.

Is the polynomial a *monomial*, a *binomial*, or a *trinomial*?

3.  $ab + 3$       4.  $x + y - 2xy$       5.  $5$       6.  $-t^6$

Tell whether the terms are *like terms* or *unlike terms*.

7.  $3m^3, 5m^3$       8.  $7x^4, 4x^7$       9.  $xy^3, xy$       10.  $3ab$

Write each polynomial in standard form.

11.  $3g^3 + 4g^4 - 3g + 8 - 7g^2$       12.  $4k - 8k^4 + 7k^2 - 9k^3$   
13.  $5a + 8a^7 - 2a^3 + 9a^5 - 6$       14.  $7x^3 + 2x - 5x^8 + 9 -$

Simplify.

15.  $5x^3 + 6x - 2x^3 + 8x - x^2 + 5$   
16.  $7c^2 + 8c + 2c^2 - 9c^3 - 5c - 7$   
17.  $4 - 5a^3 - 2a^2 + 5a - 4a^3 + 8a^2$   
18.  $3n - 7 + 8n^2 + 5n^3 - 3n^2 - 8n$