

## 4-5 Multiplying Polynomials by Monomials

**Objective:** To multiply a polynomial by a monomial.

**Example 1** Multiply:  $x(x + 4)$

**Solution 1**  $x(x + 4) = x(x) + x(4)$   
 $= x^2 + 4x$

**Solution 2**  $x + 4$   
 $\frac{x}{x^2 + 4x}$  Multiply each term by  $x$ .

**Multiply.**

1.  $3(x - 2)$

2.  $-2(x + 3)$

3.  $c(c - 4)$

4.  $a(3 - 2a)$

5.  $-2b(3 - 4b)$

6.  $-3c(4c + 1)$

7.  $5y(y + 6)$

8.  $-z(4 - 5z)$

**Example 2** Multiply:  $-2x(3x^2 - 2x + 1)$

**Solution 1** Multiply each term of the polynomial  $3x^2 - 2x + 1$  by the monomial  $-2x$ .

$$\begin{aligned} -2x(3x^2 - 2x + 1) &= -2x(3x^2) - 2x(-2x) - 2x(1) \\ &= -6x^3 + 4x^2 - 2x \end{aligned}$$

**Solution 2**

$$\begin{array}{r} 3x^2 - 2x + 1 \\ -2x \\ \hline -6x^3 + 4x^2 - 2x \end{array}$$

**Multiply.**

9.  $3x(x^2 - x - 2)$

10.  $-2x(x^2 - 4x + 5)$

11.  $-4x(2x^2 - 3x - 7)$

12.  $5x^2(x^2 + x - 3)$

13.  $-6x^2(x^2 - x - 12)$

14.  $4x^3(x^2 - 3x - 6)$

15.  $\frac{3a^2 - 4a - 6}{2a}$

16.  $\frac{4a^2 - 5a - 7}{5a}$

17.  $\frac{5x^2 - x - 3}{2x^2}$

18.  $\frac{2k^2 - 3k - 5}{-4k^3}$

**Example 3** Multiply:  $4x^2y(5x^2 - 3xy + 2y^2)$

**Solution** Multiply each term of the polynomial by  $4x^2y$ .

$$\begin{aligned} 4x^2y(5x^2 - 3xy + 2y^2) &= 4x^2y(5x^2) + 4x^2y(-3xy) + 4x^2y(2y^2) \\ &= 20x^4y - 12x^3y^2 + 8x^2y^3 \end{aligned}$$

**Multiply.**

19.  $3x^2y(4x^2 - 5xy - 2y^2)$

20.  $xy^2(x^2 - 4xy - 5y^2)$

21.  $-2xy(4x^2 - 3xy + y^2)$

22.  $\frac{1}{3}x^2y(6x^2 - 12xy + 9y^2)$

### 4-5 Multiplying Polynomials by Monomials (continued)

Multiply.

23.  $2xy^2(3x^2 - 7xy - 2y^2)$

24.  $-4x^3y(x^2 - 3xy - 6y^2)$

25.  $5xy(2x^2 - 4xy + y^2)$

26.  $\frac{1}{2}x^2y^2(6x^2 - 4xy - 8y^2)$

**Example 4** Simplify  $3n(n + 2) + n(5 - n)$ .

**Solution**  $3n(n + 2) + n(5 - n) = 3n(n) + 3n(2) + n(5) - n(n)$  { Use the distributive property.  
 $= 3n^2 + 6n + 5n - n^2$   
 $= 2n^2 + 11n$  } Combine similar terms.

Simplify.

27.  $2x(x - 3) + 3x(x + 2)$

28.  $4x(3 - 2x) + 5x(x - 1)$

29.  $5x^2(2x - 1) - 2x(3x^2 - 4x)$

30.  $3y(4y^2 - 3y) - 2y^2(y + 1)$

31.  $2n^2(4n - 5) - 3n(2n^2 - 7n)$

32.  $2x(5x^2 - 3x) - x^2(x + 6)$

**Example 5** Solve  $n(2 - 3n) + 3(n^2 - 4) = 0$ .

**Solution**  $n(2 - 3n) + 3(n^2 - 4) = 0$  Use the distributive property.  
 $2n - 3n^2 + 3n^2 - 12 = 0$  Combine similar terms.  
 $2n - 12 = 0$   
 $2n = 12$  { To undo the subtraction of 12 from 2n, add 12 to each side. To undo the multiplication of n by 2, divide each side by 2.  
 $n = 6$   
 The solution set is {6}.

Solve.

33.  $2(x - 1) + 3 = 7$

34.  $3(y - 2) + 1 = 10$

35.  $2(2m - 3) - 3(2m - 1) = 9$

36.  $4(3a - 1) - 5(1 - a) = 8$

37.  $y(3 - 2y) + 2(y^2 - 6) = 0$

38.  $0 = 3(1 - 2x) - 5(3 - x)$

39.  $x(2 - 3x) + 3(x^2 - 6) = 0$

40.  $2x(1 - 3x) + 6(x^2 - 2) = 0$

### Mixed Review Exercises

Simplify.

1.  $(2xy^2)^3$

2.  $(-4a^4b^3)^2$

3.  $(-2n)^4$

4.  $(2a^2b)^2(3ab^2)^3$

5.  $(3x^2)(4x^3) + (2x^3)(5x^2)$

6.  $(4n^3)n^2 - n^3(3n^2)$

7.  $(6p - 2q + 4) + (2p + 3q)$

8.  $(3x + y - 2) - (y - x - 3)$

9.  $(4x^3)^2(2x^2y)^3$

10.  $(7x^5)(2x) + (6x^4)(4x^2)$