

8-2 Study Guide and Intervention

Multiplying a Polynomial by a Monomial

Polynomial Multiplied by Monomial The Distributive Property can be used to multiply a polynomial by a monomial. You can multiply horizontally or vertically. Sometimes multiplying results in like terms. The products can be simplified by combining like terms.

Example 1 Find $-3x^2(4x^2 + 6x - 8)$.

Horizontal Method

$$\begin{aligned} & -3x^2(4x^2 + 6x - 8) \\ &= -3x^2(4x^2) + (-3x^2)(6x) - (-3x^2)(8) \\ &= -12x^4 + (-18x^3) - (-24x^2) \\ &= -12x^4 - 18x^3 + 24x^2 \end{aligned}$$

Vertical Method

$$\begin{array}{r} 4x^2 + 6x - 8 \\ (\times) \quad \quad \quad -3x^2 \\ \hline -12x^4 - 18x^3 + 24x^2 \end{array}$$

The product is $-12x^4 - 18x^3 + 24x^2$.

Example 2 Simplify $-2(4x^2 + 5x) - x(x^2 + 6x)$.

$$\begin{aligned} & -2(4x^2 + 5x) - x(x^2 + 6x) \\ &= -2(4x^2) + (-2)(5x) + (-x)(x^2) + (-x)(6x) \\ &= -8x^2 + (-10x) + (-x^3) + (-6x^2) \\ &= (-x^3) + [-8x^2 + (-6x^2)] + (-10x) \\ &= -x^3 - 14x^2 - 10x \end{aligned}$$

Exercises

Find each product.

1. $x(5x + x^2)$

$$5x^2 + x^3$$

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

$$4x^3 + 3x^2 + 2x$$

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

$$-4xy^2 - 8x^2y$$

4. $-2g(g^2 - 2g + 2)$

$$-2g^3 + 4g^2 - 4g$$

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

$$3x^5 + 3x^4 + 3x^3$$

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

$$-8x^4 + 8x^2 - 12x$$

7. $-4ax(10 + 3x)$

$$\begin{array}{l} \cancel{-40ax} \\ -40ax - 12ax^2 \end{array}$$

8. $3y(-4x - 6x^3 - 2y)$

$$-12xy - 18x^3y - 6y^2$$

9. $2x^2y^2(3xy + 2y + 5x)$

$$6x^3y^3 + 4x^2y^3 + 10x^3y^2$$

Simplify each expression.

10. $x(3x - 4) - 5x$

$$3x^2 - 4x - 5x \Rightarrow \boxed{3x^2 - 9x}$$

11. $-x(2x^2 - 4x) - 6x^2$

$$-2x^3 + 4x^2 - 6x^2 \Rightarrow \boxed{-2x^3 - 2x^2}$$

12. $6a(2a - b) + 2a(-4a + 5b)$

$$(12a^2 - 6ab) + (-8a^2 + 10ab)$$

$$\boxed{4a^2 + 4ab}$$

13. $4r(2r^2 - 3r + 5) + 6r(4r^2 + 2r + 8)$

14. $4n(3n^2 + n - 4) - n(3 - n)$

15. $2b(b^2 + 4b + 8) - 3b(3b^2 + 9b - 18)$

16. $-2z(4z^2 - 3z + 1) - z(3z^2 + 2z - 1)$

17. $2(4x^2 - 2x) - 3(-6x^2 + 4) + 2x(x - 1)$

8-2 Study Guide and Intervention *(continued)*

Multiplying a Polynomial by a Monomial

Solve Equations with Polynomial Expressions Many equations contain polynomials that must be added, subtracted, or multiplied before the equation can be solved.

Example Solve $4(n - 2) + 5n = 6(3 - n) + 19$.

$4(n - 2) + 5n = 6(3 - n) + 19$	Original equation
$4n - 8 + 5n = 18 - 6n + 19$	Distributive Property
$9n - 8 = 37 - 6n$	Combine like terms.
$15n - 8 = 37$	Add $6n$ to both sides.
$15n = 45$	Add 8 to both sides.
$n = 3$	Divide each side by 15.

The solution is 3.

Exercises

Solve each equation.

1. $2(a - 3) = 3(-2a + 6)$

$(2a - 6) = (-6a + 18)$
 $8a = 24$ $a = 3$

3. $3x(x - 5) - 3x^2 = -30$

$3x^2 - 15x - 3x^2 = -30$
 $x = 2$

5. $4(2p + 1) - 12p = 2(8p + 12)$

$8p + 4 - 12p = 16p + 24$

$p = -1$

7. $-2(4y - 3) - 8y + 6 = 4(y - 2)$

$(-8y + 6) - 8y + 6 = 4y - 8$

9. $3(x^2 - 2x) = 3x^2 + 5x - 11$

2. $3(x + 5) - 6 = 18$

$3x + 15 - 6 = 18$
 $3x + 15 = 24$
 $3x = 9$
 $x = 3$

4. $6(x^2 + 2x) = 2(3x^2 + 12)$

6. $2(6x + 4) + 2 = 4(x - 4)$

8. $x(x + 2) - x(x - 6) = 10x - 12$

10. $2(4x + 3) + 2 = -4(x + 1)$

11. $3(2h - 6) - (2h + 1) = 9$

12. $3(y + 5) - (4y - 8) = -2y + 10$

13. $3(2a - 6) - (-3a - 1) = 4a - 2$

14. $5(2x^2 - 1) - (10x^2 - 6) = -(x + 2)$

15. $3(x + 2) + 2(x + 1) = -5(x - 3)$

16. $4(3p^2 + 2p) - 12p^2 = 2(8p + 6)$