

### 4-3 Multiplying Monomials

**Objective:** To multiply monomials.

Rule of Exponents for Products of Powers	Example
For all positive integers $m$ and $n$ : $a^m \cdot a^n = a^{m+n}$ This means that when you multiply two powers having the same base, you add the exponents.	$x^3 \cdot x^5 = x^{3+5} = x^8$

**CAUTION** Use the rule of exponents for products of powers only when the two powers to be multiplied have the *same base*. For example,

$$m^2 \cdot n^3 = m^2n^3, \text{ not } mn^5$$

<b>Example 1</b>	Simplify: a. $x^2 \cdot x^5$ b. $c^6 \cdot c^3$ c. $a \cdot a^5$
<b>Solution</b>	a. $x^2 \cdot x^5 = x^{2+5} = x^7$ b. $c^6 \cdot c^3 = c^{6+3} = c^9$ c. $a \cdot a^5 = a^1 \cdot a^5 = a^{1+5} = a^6$

**Simplify.**

- |                               |                                |                                |
|-------------------------------|--------------------------------|--------------------------------|
| 1. $x^3 \cdot x^6$            | 2. $c^7 \cdot c^8$             | 3. $a^9 \cdot a^{10}$          |
| 4. $x^2 \cdot x^3 \cdot x$    | 5. $n^2 \cdot n^2 \cdot n^3$   | 6. $c \cdot c^5 \cdot c^2$     |
| 7. $a^2 \cdot a^3 \cdot a^5$  | 8. $x^5 \cdot x^6 \cdot x^7$   | 9. $c^3 \cdot c^6 \cdot c^7$   |
| 10. $m^2 \cdot m^6 \cdot m^8$ | 11. $n^{10} \cdot n \cdot n^3$ | 12. $x \cdot x^9 \cdot x^{10}$ |

<b>Example 2</b>	Simplify $(2x^3)(4x^4)$ .
<b>Solution</b>	$\begin{aligned} (2x^3)(4x^4) &= (2 \cdot 4)(x^3 \cdot x^4) \\ &= 8(x^{3+4}) \\ &= 8x^7 \end{aligned}$ <div style="display: inline-block; vertical-align: middle; margin-left: 10px;">                     { Use the commutative and associative properties of multiplication.                      Use the rule of exponents for products of powers.                 </div>

**Simplify.**

- |                                |                                   |
|--------------------------------|-----------------------------------|
| 13. $(2a^4)(5a^3)$             | 14. $(4x^3)(3x^4)$                |
| 15. $(7m^5)(2m^6)$             | 16. $(5x^4)(3x^2)$                |
| 17. $(-2xy^2)(-3x^2y)$         | 18. $(4a^2b)(-3ab^3)$             |
| 19. $(3ab)(a^2b)(5b^2)$        | 20. $(6x^2y)(2xy^2)(3x)$          |
| 21. $(3cd^4)(-2c^2)(4cd^2)$    | 22. $(5a^3b^2)(-4a^2b^2)(-2ab^3)$ |
| 23. $(-x^2y^2)(3x^2y)(-4xy^3)$ | 24. $(-a^2b)(-5ab^3)(-b^2)$       |

**4-3 Multiplying Monomials** (continued)

**Example 3** Simplify  $\left(\frac{10x^2y}{3}\right)\left(\frac{6x^3y^2}{5}\right)$ .

**Solution**  $\left(\frac{10x^2y}{3}\right)\left(\frac{6x^3y^2}{5}\right) = \left(\frac{\overset{2}{\cancel{10}}x^2y}{\underset{1}{\cancel{3}}}\right)\left(\frac{\overset{2}{\cancel{6}}x^3y^2}{\underset{1}{\cancel{5}}}\right)(x^2 \cdot x^3)(y \cdot y^2) = 4x^5y^3$

**Simplify.**

25.  $\left(\frac{3}{4}r^2\right)\left(\frac{4}{3}t^2\right)$

26.  $\left(\frac{6h^2k^3}{5}\right)\left(\frac{20hk^2}{3}\right)$

27.  $(8a)\left(\frac{3}{4}a^2\right)$

28.  $(12c^2)\left(-\frac{5}{6}cd^2\right)$

29.  $\left(\frac{3a^2}{7}\right)(35a^5)$

30.  $\left(\frac{8x^2y}{5}\right)\left(\frac{15xy^2}{16}\right)$

31.  $\left(-\frac{5}{6}x^3\right)(3xy^2)(-y^2)$

32.  $(3y^2)\left(\frac{2}{3}y^2\right)\left(\frac{1}{2}y\right)$

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

**Solution**  $(2x^3)(-4x^2) + (5x^2)(3x^3) = \underbrace{(2)(-4)(x^3 \cdot x^2)}_{-8x^5} + \underbrace{(5 \cdot 3)(x^2 \cdot x^3)}_{15x^5}$   
 $= \underbrace{-8x^5 + 15x^5}_{7x^5}$   
 $= 7x^5$

**Simplify.**

33.  $(2x)(3x^3) + (5x^2)(4x^2)$

34.  $(3x^5)(4x) - (5x^3)(2x^3)$

35.  $(6x^2)(2x^3) + (3x)(5x^4)$

36.  $(6x^5)(4x^2) - (2x^3)(12x^4)$

37.  $(3a^4)(-2a^3) + (2a^2)(a^5)$

38.  $(4y^2)(4y) - (5y^2)(3y)$

**Mixed Review Exercises**

**Simplify.**

1.  $3 + 4^2$

2.  $(3 + 4)^2$

3.  $3a^2 + 5b^2 - a^2 - 2b^2$

4.  $2 \cdot 5^2$

5.  $(2 \cdot 5)^2$

6.  $2x^2 - 3x + 4 + 5x + 3x^2$

**Solve.**

7.  $3(y + 2) = 24$

8.  $10z = 20 + 5z$

9.  $6n - 12 = 2n$

10.  $\frac{n}{4} + 2 = 5$

11.  $3(x - 2) = 9$

12.  $\frac{x}{3} - 1 = 2$