

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,

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

Example 1 Simplify: a. $x^2 \cdot x^5$ b. $c^6 \cdot c^3$ c. $a \cdot a^5$

Solution

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.

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|-------------------------------|--------------------------------|--------------------------------|
| 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. $x \cdot x^9 \cdot x^{10}$ |

Example 2 Simplify $(2x^3)(4x^4)$.

Solution $(2x^3)(4x^4) = (2 \cdot 4)(x^3 \cdot x^4)$ { Use the commutative and associative properties of multiplication.
 $= 8(x^3 + 4)$
 $= 8x^7$ Use the rule of exponents for products of powers.

Simplify.

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|--------------------------------|-----------------------------------|
| 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 $\left(\frac{10x^2y}{3}\right)\left(\frac{6x^3y^2}{5}\right) = \left(\frac{\cancel{10}^2}{\cancel{3}_1} \cdot \frac{\cancel{6}_2}{\cancel{5}_1}\right)(x^2 \cdot x^3)(y \cdot y^2) = 4x^5y^3$

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

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