

Lesson 8-1

Example 1 Identify Monomials

Determine whether each expression is a monomial. Explain your reasoning.

	Expression	Monomial?	Reason
a.	$6m$	yes	This is a product of a number and a variable.
b.	$\frac{3a}{b}$	no	The expression is the quotient not the product of two variables.
c.	4	yes	4 is a real number and an example of a constant.
d.	$-\frac{2x^2y}{3}$	yes	$-\frac{2x^2y}{3} = -\frac{2}{3}x^2y$. The expression is the product of a number, $-\frac{2}{3}$, and two variables.
e.	$6 - 3r^2$	no	The expression involves subtraction, not the product, of two variables.

Example 2 Product of Powers

Simplify each expression.

a. $(3a^2)(-2a^9)$
 $(3a^2)(-2a^9) = (3)(-2)(a^2 \cdot a^9)$ Commutative and Associative Properties
 $= (3 \cdot -2)(a^{2+9})$ Product of Powers
 $= -6a^{11}$ Simplify.

b. $\left(-\frac{1}{3}r^2s^7\right)(6r^3s^2)$
 $\left(-\frac{1}{3}r^2s^7\right)(6r^3s^2) = \left(-\frac{1}{3}\right)(6)(r^2r^3)(s^7 \cdot s^2)$ Commutative and Associative Properties
 $= -2(r^{2+3})(s^{7+2})$ $-\frac{1}{3} \cdot 6 = -2$; Product of Powers
 $= -2r^5s^9$ Simplify.

Example 3 Power of a Power

Simplify $\left\{\left[\left(\frac{2}{3}\right)^2\right]^4\right\}^3$.

$$\left\{\left[\left(\frac{2}{3}\right)^2\right]^4\right\}^3 = \left[\left(\frac{2}{3}\right)^{2 \cdot 4}\right]^3$$

Power of a Power

$$= \left[\left(\frac{2}{3} \right)^8 \right]^3$$

Simplify.

$$= \left(\frac{2}{3} \right)^{8 \cdot 3}$$

Power of a Power

$$= \left(\frac{2}{3} \right)^{24} \text{ or } \frac{16777216}{282429536481}$$

Simplify.

Example 4 Power of a Product

GEOMETRY Express the area of the circle as a monomial.

$$\begin{aligned} \text{Area} &= \pi r^2 && \text{Formula for the area of a circle} \\ &= \pi(3xy)^2 && r = 3xy \\ &= \pi \cdot 3^2 x^2 y^2 && \text{Power of a Product} \\ &= 9\pi x^2 y^2 && \text{Simplify.} \end{aligned}$$



The area of the circle is $9\pi x^2 y^2$ square units.

Example 5 Simplify Expressions

Simplify $(-4c^2d)^3[(2c^3d)^4]^2$.

$$\begin{aligned} (-4c^2d)^3[(2c^3d)^4]^2 &= (-4c^2d)^3(2c^3d)^8 && \text{Power of a Power} \\ &= (-4)^3(c^2)^3d^3 \cdot (2)^8(c^3)^8d^8 && \text{Power of a Product} \\ &= -64c^6d^3 \cdot (256)c^{24}d^8 && \text{Power of a Power} \\ &= -64(256) \cdot c^6 \cdot c^{24} \cdot d^3 \cdot d^8 && \text{Commutative Property} \\ &= -16384c^{30}d^{11} && \text{Product of Powers} \end{aligned}$$