

Lesson 12-3

Example 1 Expressions Involving Monomials

a. Find $\frac{2x^3y}{21z} \cdot \frac{7z}{10x^2}$.

Method 1 Divide by the greatest common factor after multiplying.

← Multiply the numerators.

$$\frac{2x^3y}{21z} \cdot \frac{7z}{10x^2} = \frac{14x^3yz}{210x^2z}$$

← Multiply the denominators.

$$= \frac{\cancel{14x^2z}(xy)}{\cancel{14x^2z}(15)}$$

The GCF is $14x^2z$.

$$= \frac{xy}{15}$$

Simplify.

Method 2 Divide by the common factors before multiplying.

$$\frac{2x^3y}{21z} \cdot \frac{7z}{10x^2} = \frac{\overset{1\ x}{\cancel{2}x^3y}}{\underset{3\ 1}{\cancel{21}z}} \cdot \frac{\overset{1\ 1}{\cancel{7}z}}{\underset{5\ 1}{\cancel{10}x^2}} \quad \text{Divide by common factors 2, 7, } x^2, \text{ and } z.$$

$$= \frac{xy}{15} \quad \text{Multiply.}$$

b. Find $\frac{-5a^2b}{9xy} \cdot \frac{12x^2y}{25a^2b}$.

$$\frac{-5a^2b}{9xy} \cdot \frac{12x^2y}{25a^2b} = \frac{\overset{-1\ 1\ 1}{\cancel{-5}a^2b}}{\underset{3\ 1\ 1}{\cancel{9}xy}} \cdot \frac{\overset{4\ x\ 1}{\cancel{12}x^2y}}{\underset{5\ 1\ 1}{\cancel{25}a^2b}}$$

$$= -\frac{4x}{15}$$

Divide by common factors 5, 3, a^2 , b , x and y .

Multiply.

Example 2 Expressions Involving Polynomials

a. Find $\frac{a^2-a-2}{a+3} \cdot \frac{a+3}{a+1}$.

$$\frac{a^2-a-2}{a+3} \cdot \frac{a+3}{a+1} = \frac{(a+1)(a-2)}{a+3} \cdot \frac{a+3}{a+1}$$

Factor the numerator.

$$= \frac{(a+1)(a-2)(a+3)}{(a+3)(a+1)}$$

The GCF is $(a+1)(a+3)$.

$$= a-2$$

Simplify.

b. Find $\frac{b^2-9}{3} \cdot \frac{6}{b-3}$.

$$\frac{b^2-9}{3} \cdot \frac{6}{b-3} = \frac{(b-3)(b+3)}{3} \cdot \frac{6}{b-3}$$

Factor the numerator.

$$= \frac{(b-3)(b+3)6}{3(b-3)}$$

The GCF is $3(b-3)$.

$$= \frac{(b+3)2}{1}$$

Multiply.

$$= 2b+6$$

Simplify.

Example 3 Dimensional Analysis

The rate that water flows over Niagara Falls is approximately 7859 cubic yards per second. How many cubic feet per hour is this?

$$\frac{7859 \text{ yard}^3}{1 \text{ second}} \cdot \frac{3^3 \text{ feet}^3}{1 \text{ yard}^3} \cdot \frac{60 \text{ seconds}}{1 \text{ minute}} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}}$$

$$= \frac{7859 \text{ yard}^3}{1 \text{ second}} \cdot \frac{3^3 \text{ feet}^3}{1 \text{ yard}^3} \cdot \frac{60 \text{ seconds}}{1 \text{ minute}} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}}$$

$$= \frac{(7859 \cdot 27 \cdot 60 \cdot 60) \text{ feet}^3}{(1 \cdot 1 \cdot 1 \cdot 1) \text{ hour}}$$

Simplify.

$$= \frac{763894800 \text{ feet}^3}{1 \text{ hour}}$$

Multiply.

The rate of the water is approximately 763,894,800 cubic feet per hour.