

7-3

Exponents and Division

1

EXAMPLE

Dividing Powers by Writing Factors

Write $\frac{7^5}{7^3}$ using a single exponent.

$$\frac{7^5}{7^3} = \frac{\cancel{7} \cdot \cancel{7} \cdot \cancel{7} \cdot \cancel{7} \cdot \cancel{7}}{\cancel{7} \cdot \cancel{7} \cdot \cancel{7}}$$

← Write out the factors in the numerator and denominator. Then divide the common factors.

$$= \frac{7 \cdot 7}{1}$$

← Rewrite the numerator and denominator.

$$= 7^2 = 49$$

← Write the result using exponents.

✓ Check Understanding

1

Write each expression using a single exponent.

a. $\frac{4^7}{4^5} = 4^2$ $\frac{\cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4}}{\cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4} \cdot \cancel{4}}$

$$4^{7-5}$$

b. $\frac{10^5}{10^2} = 10^3$

$$10^{5-2}$$

c. $\frac{a^6}{a^5} = a^1$

$$a^{6-5}$$

Key Concepts

Dividing Powers With the Same Base

To divide nonzero numbers or variables with the same nonzero base, subtract the exponents.

Arithmetic

$$\frac{8^5}{8^3} = 8^{(5 - 3)} = 8^2$$

Algebra

$$\frac{a^m}{a^n} = a^{(m - n)}, \text{ where } a \neq 0$$

2

EXAMPLE

Dividing Powers by Subtracting Exponents

Write $\frac{m^{12}}{m^5}$ using a single exponent.

$$\frac{m^{12}}{m^5} = m^{(12 - 5)} \quad \leftarrow \text{Subtract exponents with the same base.}$$

$$= m^7 \quad \leftarrow \text{Simplify.}$$

✓ Check Understanding

2 Write each expression using a single exponent.

a. $\frac{w^8}{w^2}$ w^6

b. $\frac{t^{18}}{t^8}$ t^{10}

c. $\frac{7^6}{7^3}$ 7^3

d. **Mental Math** Find the value of $\frac{123^5}{123^4}$. **123**

Key Concepts

Zero as an Exponent

For any nonzero number a , $a^0 = 1$.

Example $9^0 = 1$

What does the exponent 0 mean? Consider finding the quotient $\frac{3^5}{3^5}$.

START HERE
← GO EITHER WAY →

$$3^0 = 3^{5-5} = \frac{3^5}{3^5} = \frac{\cancel{3} \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3}}{\cancel{3} \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3} \cdot \cancel{3}} = \frac{1}{1} = 1$$

3 EXAMPLE Expressions With a Zero Exponent

Simplify each expression.

a. $(-8)^0$
 $(-8)^0 = 1$ ← Simplify.

b. m^0
 $m^0 = 1$ ← Simplify.

✓ Check Understanding

3 Simplify each expression.

a. $(-9)^0$ **1**

b. $(2r)^0$ **1**

c. $2r^0$ **2**

d. **Reasoning** Is $(-1)^0$ a positive or a negative number? Explain.
Positive; any number to the power of zero is equal to one.

Note the parenthesis!
The base is "2r."

Note the base is just r.

↓ "2 times r^0 "

To understand negative exponents, consider finding the quotient $\frac{6^2}{6^5}$.

If you subtract exponents, $\frac{6^2}{6^5} = 6^{(2-5)} = \frac{6^{-3}}{1}$.

Note the exponent will become positive if you

If you write factors, $\frac{6^2}{6^5} = \frac{6^1 \cdot 6^1}{1 \cdot 6 \cdot 1 \cdot 6 \cdot 6 \cdot 6} = \frac{1}{6 \cdot 6 \cdot 6} = \frac{1}{6^3}$.

move the base to the other side of the fraction bar

Notice that $\frac{6^2}{6^5} = 6^{-3}$ and $\frac{6^2}{6^5} = \frac{1}{6^3}$. This suggests the following rule.

Key Concepts

Negative Exponents

For any nonzero number a and integer n , $a^{-n} = \frac{1}{a^n}$.

Example $8^{-5} = \frac{1}{8^5}$

4**EXAMPLE****Expressions With Negative Exponents**

Simplify each expression.

a. 3^{-2}

$$3^{-2} = \frac{1}{3^2}$$

$$= \frac{1}{9}$$

Write the
← expression using a →
positive exponent.

← Simplify.

b. $(y)^{-6}$

$$(y)^{-6} = \frac{1}{y^6}$$

 **Check Understanding****4** Simplify each expression.

a. 3^{-1} $\frac{1}{3}$

$$\frac{1}{3^1}$$

b. w^{-4} $\frac{1}{w^4}$

$$\frac{1}{w^4}$$

c. $(-2)^{-3}$ $-\frac{1}{8}$

$$\frac{1}{(-2)^3} = \frac{1}{-8} = -\frac{1}{8}$$

Assignment: P. 379, #1-22 & WB 7-3