Name_____ Date_____

10.3 Quotient of Powers Property

For use with Activity 10.3

Essential Question How can you divide two powers that have the same base?

1 ACTIVITY: Finding Quotients of Powers

Work with a partner.

a. Complete the table.

Quotient	Repeated Multiplication Form	Power
$\frac{2^4}{2^2}$		
$\frac{(-4)^5}{(-4)^2}$		
$\frac{7^7}{7^3}$		
$\frac{8.5^9}{8.5^6}$		
$\frac{10^8}{10^5}$		
$\frac{3^{12}}{3^4}$		
$\frac{(-5)^7}{(-5)^5}$		
$\frac{11^4}{11^1}$		

b. INDUCTIVE REASONING Describe the pattern in the table. Then write a rule for dividing two powers that have the same base.

$$\frac{a^m}{a^n} = a^{\_\_\_\_}$$

Reducing Algebraic Fractions to Lowest Terms

Algebraic fractions can be reduced to lowest terms. First, reduce the fraction formed by the coefficients to lowest terms and then divide the like bases.

Remember, when dividing, subtract the exponents.

EXAMPLE 1

Reduce: $\dfrac{20x^3y}{5x^2y^2}$

$$\frac{20x^3y}{5x^2y^2} = \frac{20}{5} \cdot x^{3-2} \cdot y^{1-2}$$
$$= 4x^1 \cdot y^{-1} = 4x \cdot \frac{1}{y} = \frac{4x}{y}$$

EXAMPLE 2

Reduce: $\dfrac{a^2b^3c}{a^3b^5}$

$$\frac{a^2b^3c}{a^3b^5} = a^{2-3} \cdot b^{3-5} \cdot c^1$$
$$= a^{-1} \cdot b^{-2} \cdot c^1 = \frac{1}{a} \cdot \frac{1}{b^2} \cdot c$$
$$= \frac{c}{ab^2}$$

EXAMPLE 3

Reduce: $\dfrac{8rst^3}{16st^2}$

$$\frac{8rst^3}{16st^2} = \frac{8}{16} \cdot r^1 \cdot s^{1-1} \cdot t^{3-2}$$
$$= \frac{1}{2} \cdot r^1 \cdot s^0 \cdot t^1 = \frac{rt}{2}$$

Remember, $s^0 = 1$.

PRACTICE

Reduce to lowest terms.

	a	b	c	d	e
1.	$\dfrac{x^3y^2}{x^2y^2} =$	$\dfrac{a^2b^2}{a^3b} =$	$\dfrac{a^4b^2}{a^2b^4} =$	$\dfrac{x^6y^3z}{x^4yz^2} =$	$\dfrac{xy^3z^6}{x^2y^2z^4} =$
2.	$\dfrac{6x^2y^4}{2x^3y^2} =$	$\dfrac{12x^3y^5}{3x^4y^2} =$	$\dfrac{8ab^2c^3}{16a^2b^2c^3} =$	$\dfrac{25a^3b^2c^3}{5ab^2c^3} =$	$\dfrac{6a^4b^2c}{24a^2b^3c^4} =$
3.	$\dfrac{15x^3y}{-5x^3y^2} =$	$\dfrac{-5x^2y}{10xy^2} =$	$\dfrac{16x^4y}{-4x^3y^2} =$	$\dfrac{10x^3y^2}{-5x^4y} =$	$\dfrac{-8xy^5}{24x^2y^3} =$
4.	$\dfrac{4ab^2}{-20a^3b} =$	$\dfrac{-15x^2y^3}{5x^3y^2} =$	$\dfrac{-24x^2y^4}{6x^4y^2} =$	$\dfrac{7a^3b^2}{-35a^2b^3} =$	$\dfrac{-48xy^2z^3}{8x^3y^2z} =$
5.	$\dfrac{-15xy}{-5x^2y^2} =$	$\dfrac{-6xy^3z^5}{-36x^2y^2z^4} =$	$\dfrac{-7x^4y^3}{-14x^2y^4} =$	$\dfrac{-16a^3b^4}{-8a^4b^3} =$	$\dfrac{-35ab^3}{-7a^2b} =$
6.	$\dfrac{8a^2y}{12ay^2} =$	$\dfrac{16xy^2}{10x^3y} =$	$\dfrac{12ab^2c}{18a^2bc} =$	$\dfrac{10ab^2c^3}{15a^3b^2c} =$	$\dfrac{14a^4b^2c}{12a^3b^3c^3} =$

Study Guide for 8.1-8.5 (Not 8.2)

Simplify each expression. Use only positive exponents.

1. $(2t)^{-6}$

2. $5m^5m^{-8}$

3. $(4.5)^4(4.5)^{-2}$

4. $(m^7t^{-5})^2$

5. $(x^2n^4)(n^{-8})$

6. $(w^{-2}j^{-4})^{-3}(j^7j^3)$

7. $(t^6)^3(m)^2$

8. $(3n^4)^2$

9. $r^5/g^{-3} \longrightarrow \frac{r^5}{g^{-3}}$

10. $1/a^{-4} \longrightarrow \frac{1}{a^{-4}}$

11. $w^7/w^{-6} \longrightarrow \frac{w^7}{w^{-6}}$

12. $6/t^{-4} \rightarrow \frac{6}{t^{-4}}$

13. $a^2b^{-7}c^4/a^5b^3c^{-2} \rightarrow \frac{a^2b^{-7}c^4}{a^5b^3c^{-2}}$

14. $(2t^5)^3/4t^8t^{-1} \rightarrow \frac{(2t^5)^3}{4t^8t^{-1}}$

15. $(a^6/a^7)^{-3} \rightarrow \left(\frac{a^6}{a^7}\right)^{-3}$

16. $(c^5c^{-3}/c^{-4})^{-2} \rightarrow \left(\frac{c^5c^{-3}}{c^{-4}}\right)^{-2}$

Evaluate each expression for m = 2, t = -3, w = 4, and z = 0

17. t^m

18. t^{-m}

19. $(w * t)^m$

20. $w^m * t^m$

21. $(w^z)^m$

22. $w^m w^z$

8.EE Raising to the zero and negative powers

Task

In this problem c represents a positive number.

The quotient rule for exponents says that if m and n are positive integers with $m > n$, then

$$\frac{c^m}{c^n} = c^{m-n}.$$

After explaining to yourself why this is true, complete the following exploration of the quotient rule when $m \leq n$:

a. What expression does the quotient rule provide for $\frac{c^m}{c^n}$ when $m = n$?

b. If $m = n$, simplify $\frac{c^m}{c^n}$ without using the quotient rule.

c. What do parts (a) and (b) above suggest is a good definition for c^0?

d. What expression does the quotient rule provide for $\frac{c^0}{c^n}$?

e. What expression do we get for $\frac{c^0}{c^n}$ if we use the value for c^0 found in part (c)?

f. Using parts (d) and (e), propose a definition for the expression c^{-n}.

Algebra 1 **Unit 7 Exponent Rules Worksheet #2**

Simplify each expression below using exponent rules. Your final answer should not include any negative exponents. You MUST show work in order to receive credit.

1. $x^5 \bullet x^2$	2. $y^3 \bullet y \bullet y^4$	3. $b^4 \bullet b^{-4}$
4. $7x^3y^2 \bullet 5xy^9$	5. $a^{10} \bullet a^2 \bullet a^{-6}$	6. $\left(z^5\right)^5$
7. $\left(b^7\right)^2$	8. $\left(m^{-8}\right)^{-3}$	9. $\left(x^2y^4m^3\right)^8$
10. $\left(3x^2\right)^4$	11. $(2ab)^5$	12. $\left(2x^3y\right)^6$
13. $\left(m^7\right)^4 \bullet m^3$	14. $p^2 \bullet \left(p^5\right)^2$	15. $\frac{x^5}{x^2}$
16. $\frac{c^4}{c^8}$	17. $\frac{5x^{-4}}{x^{-9}}$	18. $\frac{x^3 \bullet x^4}{x^2}$

19. $\left(\frac{6}{z^4}\right)^3$	20. $\left(\frac{a^3}{b^5}\right)^4$	21. $\left(\frac{3x^4}{y^6}\right)^5$
22. $\left(\frac{m^4}{5n^9}\right)^3$	23. $\left(\frac{3x^7}{2y^{12}}\right)^4$	24. $(8m)^0$
25. $5x^0y^5$	26. $2x^{-2}$	27. $5m^{-3}n^4$
28. $3x^{-2}y^{-5}$	29. $\left(x^{-2}y^2\right)^{-3}$	30. $\left(4x^4y^{-3}\right)^{-2}$
31. $\left(f^{-3}g^5h^8\right)^{-3}$	32. $\left(x^2\right)^4 \bullet 3x^5$	33. $\left(3x^3\right)^2 \bullet (2x)^3$

34. $\left(5x^2y^3\right)^2 \bullet \left(2x^3y^4\right)^3$

35. $\dfrac{x^8}{2y} \bullet \dfrac{5y^2}{x^3}$

36. $\dfrac{x^3y}{xy^5} \bullet \dfrac{x^2y^9}{x^8}$

37. $\left(\dfrac{r^2t^{-3}}{r^{-3}t^5}\right)^{-8}$

38. $\left(\dfrac{x^4y^{-7}}{x^{-2}y^4}\right)^2$

39. $\left(\dfrac{x^{-3}y^{-8}}{x^4y^{-2}}\right)^{-7}$

40. $\left(\dfrac{m^3p^5}{n^7}\right)^6 \bullet \left(\dfrac{m^2n^0p^3}{m^4n^2}\right)^3$

BONUS: $\left(5x^7y^3z^{-1}\right)^2 \bullet \left(2xy^{-5}\right)^3 \bullet \left(2y^{-3}z^2\right)^3$