

NOTES & HOMEWORK

Name _____

Date _____ Period _____

Multiplication & Division Properties of Exponents

Using what you know about multiplying exponents complete the following:

1. $5^3 \cdot 4^4 =$ _____

2. $3^2 \cdot 3^5 =$ _____

3. $1.2^3 \cdot 1.2^3 =$ _____

4. $7^3 \cdot 7^2 =$ _____

Multiplying Powers with the Same Base:

For any nonzero number a and any integers m and n , $a^m \cdot a^n = a^{m+n}$

Example: $3^5 \cdot 3^4 = 3^{5+4} = 3^9$

Simplify each expression:

a.) $c^4 \cdot d^3 \cdot c^2$

$= c^4 \cdot c^2 \cdot d^3$

←Rearrange factors. →

b.) $5x \cdot 2y^4 \cdot 3x^8$

$= (5 \cdot 2 \cdot 3) (x \cdot x^8) (y^4)$

Multiply coefficients. →

← Add exponents of →
powers with the same base.

Try this:

Simplify each expression:

1.) $a \cdot b^2 \cdot a^5 =$ _____

2.) $6x^2 \cdot 3y^3 \cdot 2y^4 =$ _____

3.) $m^2 \cdot n^2 \cdot 7m =$ _____

Division Properties of Exponents

You can use repeated multiplication to simplify fractions. Expand the numerator and denominator using repeated multiplication. Then cancel like terms.

$$\frac{5^6}{5^2} = \frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5} = 5^4$$

Simplify each expression by expanding the numerator and the denominator and then canceling like terms.

1.) $\frac{5^7}{5^3} =$

2.) $\frac{5^{12}}{5^8} =$

3.) $\frac{5^5}{5^1} =$

Dividing Powers with the Same Base:

For any nonzero number a and any integers m and n , $\frac{a^m}{a^n} = a^{m-n}$

Example: $\frac{3^7}{3^2} = 3^{7-2} = 3^5$

Simplify each expression. Use only positive exponents.

a.) $\frac{a^6}{a^{14}} = a^{6-14} \leftarrow$ **Subtract exponents when dividing powers with the same base.**

$$= a^{-8}$$

$$= \frac{1}{a^8} \leftarrow$$
 Rewrite using positive exponents.

b.) $\frac{c^{-1}d^3}{c^5d^{-4}} = c^{-1-5} \cdot d^{3-(-4)} \leftarrow$ **Subtract exponents.**

$$= c^{-6}d^7$$

$$= \frac{d^7}{c^6} \leftarrow$$
 Use positive exponents.

Simplify each expression. Use positive exponents.

1.) $\frac{b^4}{b^9} =$

2.) $\frac{a^2b}{a^4b^3} =$

1. Rewrite each expression with a single exponent.

a. $4^3 \cdot 4^4$

b. $(-3)^5 \cdot (-3)^2$

c. $(-2)^8(-2)^7$

d. $(8^6)(8^3)$

e. $x^9 \cdot x^4$

f. $n^{10} \cdot n^{12}$

g. $(-5)^3(-5)^7$

h. $a^p \cdot a^q$

i. $7^3 \cdot 7^5$

2. Rewrite each expression with a single exponent.

a. $(4^5)^5$

b. $(8^2)^7$

c. $(x^9)^4$

d. $(y^3)^{10}$

e. $(5^3)^7$

f. $[(-3)^3]^2$

g. $(z^8)^2$

h. $(10^9)^3$

i. $(0.5^2)^5$

j. $(100^3)^8$

k. $[(-6)^5]^4$

l. $(t^7)^2$

3. Use the properties of exponents to rewrite each expression.

a. $4x \cdot 3x$

b. $(6m)(2m^2)$

c. $(-5n^2)(4n^4)$

d. $xy^2 \cdot x^2y^4$

e. $8s^5w^6 \cdot 5s^2w^3$

f. $-9m^4n^7 \cdot -m^6n$

g. $(2x^4)^6$

h. $(-4m^5)^2$

i. $(n^6p^2)^5$

4. Evaluate each expression for the given value of the variables.

a. $2x^3$ for $x = -5$

b. $-3y^4$ for $y = -3$

c. $3x^2y^3$ for $x = 3$ and $y = -2$

d. $-5x^3yz^2$ for $x = -2$, $y = 5$, and $z = -3$

5. Use the properties of exponents to rewrite each expression.

a. $(xy^2)^3(x^2y^3)^4$

b. $(2m^3n^2)^4(-mn^5)^2$

c. $(-2s^4w)^3(-4sw^6)^2$

d. $(4a^4b^2)^3(0.5a^7b^3)^2$

1. Eliminate factors equivalent to 1 and rewrite the right side of this equation.

$$\frac{p^3q^5r^2}{pq^3r^2} = \frac{p \cdot p \cdot p \cdot q \cdot q \cdot q \cdot q \cdot q \cdot r \cdot r}{p \cdot q \cdot q \cdot q \cdot r \cdot r}$$

2. Use the properties of exponents to rewrite each expression.

a. $\frac{m^{10}}{m^4}$

b. $\frac{n^8}{n}$

c. $\frac{24x^9}{8x^5}$

d. $\frac{36x^5y^6}{4xy^3}$

e. $\frac{45m^7n^4}{-9m^4n^2}$

g. $\frac{42x^{10}y^5}{6x^3y}$

h. $\frac{-12m^5n^7}{-3m^4n^2}$

i. $\frac{-15r^{12}s^5}{5r^4s^2}$

f. $\frac{-50x^{12}y^8}{-2x^{11}y^6}$