Warm Up

Simplify:

$$3x^4y^3 \cdot 4y^4z^2 \cdot 2xy^2z^3$$

$3 \cdot 4 \cdot 2 = 24$

$24x^5y^9z^5$

Homework Questions?

Why are Mr. and Mrs. Number So Happy?

Find the simplest form for each expression below in the adjacent answer column. The letter of the exercise goes in the box that contains the number of the corresponding answer.

E $x^3 \cdot x^4$	19 $-3x^6$
O $3x^2 \cdot x$	14 $3x^3$
T $2x^2 \cdot 3x$	25 x^9
I $x \cdot x^2 \cdot x^3$	7 x^7
A $x^4(-3x^2)$	10 x^6
H $(-2x^2)(-2x)$	2 $4x^3$
E $x(-x^4)(-x^4)$	23 $6x^3$

T $(u^2v)(-6uv^2)$	21 $-8u^6v^4$
E $v(uv^2)(u^3v)$	3 u^4v^4
G $(4uv)(-u)(2u^4v)$	12 $-8u^6v^2$
A $(-3u^2)(-u^2v^2)(2uv)$	17 u^3v^7
L $(-u^2)(-6u^2v^3)(-u^3v^4)$	5 $6u^5v^3$
I $(-2u)(u^2v)(4u^3v^3)$	13 $-6u^3v^3$
V $(\frac{1}{2}u^2v^3)(2uv^4)$	24 $-6u^7v^7$

R $(ab^2)(a^2b)$	18 $5a^6b^4$
A $(3ab)(2a^3b)$	6 a^3b^3
G $ab(-4ab^3)$	26 $12a^2b^8$
E $(-a^4b)(-5a^2b^3)$	8 $-4a^2b^4$
T $(-2a^3b)(2ab^3)$	11 $-12a^3b^7$
N $(6a^2b^2)(-2ab^5)$	1 $-4a^4b^4$
O $(-4ab^4)(-3ab^4)$	16 $6a^4b^2$

L $(-b^2)(9a^2b^3)$	22 $--a^3b^5c^2$
Y $(3a^2c)(-3bc^2)$	27 $-ab^3c^2$
E $c(-ab)(a^2b^2c^2)$	28 $-a^3b^3c^3$
O $(-3a^2c)(-3b^2c)$ $(-3 \cdot -3) = 9$	15 $9a^3b^3c^5$
T $\boxed{(-ab)(-b^2c^2)(-a^2b^2)}$	4 $-9a^2bc^3$
H $(a^2bc^2)(b^2c^3)(9a)$	20 $-9a^2b^5$
N $(3b^2)(\frac{1}{3}abc)(-c)$	9 $9a^2b^2c^2$

will my answer be neg or pos?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

$$(3b^2)(\tfrac{1}{3}abc)(-1c)$$

$$(3 \cdot \tfrac{1}{3} \cdot -1)\, b^2 \cdot b \cdot c \cdot c$$

$$-1b^3c^2$$

$$-b^3c^2$$

If I multiplied 6 negative numbers will my answer be negative or positive?

mult 5 neg #'s $\rightarrow$ neg

mult 15 neg #'s $\rightarrow$ neg

mult 10 neg #'s $\rightarrow$ positive

$$(-1)(-1) = 1$$

$$(-1)(-1)(-1) = -1$$

$$(-1)(-1)(-1)(-1) = 1$$

When multiplying an **even** number of negative numbers, the product is **positive.**

When multiplying an **odd** number of negative numbers, the product is **negative.**

Part B

When a number is raised to a power and then raised to a power again, the result follows a consistent pattern. Copy and complete the table below in your notebook. Expand each expression into factored form and then rewrite it with new exponents as shown in the example.

$(5^2)^5$

Original Form	Factored Form	Simplified Exponent Form
$(5^2)^5$	$(5 \cdot 5)(5 \cdot 5)(5 \cdot 5)(5 \cdot 5)(5 \cdot 5)$	5^{10}
$(2^2)^4$	$(2 \cdot 2)(2 \cdot 2)(2 \cdot 2(2 \cdot 2)$	2^8
$(3^7)^2$	$(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{14}
$(x^3)^5$	$(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)$	$= x^{15}$
$(x^3y^2)^2$	$(x \cdot x \cdot x \cdot y \cdot y)(x \cdot x \cdot x \cdot y \cdot y)$	$x^6 y^4$

1. Work with your group to describe the pattern between the exponents in the original form and the exponent(s) in the simplified exponent form. **Write a statement to describe the relationship you see.**

To find the answer for a number to power raised to another power we can multiply the exponents

$$(x^a)^b = x^{a \cdot b}$$

2. Visualize $(20^{12})^8$ written in factored form.

   a. What is multiplied (what is the base)? 20

   b. How many times is it multiplied? $96 = 12 \cdot 8$

   c. Use the expression you visualized to help you rewrite the expression in simplified exponent form.

   20^{96}

   d. Describe in detail how you figured out what exponent to use in the simplified exponent form.

   e. In Part A, #2 you visualized the factored form of the expression $20^{12} \cdot 20^8$. Compare the **factored** form of that expression to the **factored** form of $(20^{12})^8$ from above. How are the two expressions different?

   $20^{12} \cdot 20^8 = 20^{20}$

   $(20^{12})^8 = 20^{96}$

$(x^2)^3 = x^6$

$(xy^2)^4 = x^4y^8$

$(2x^3y)^3 = \cancel{6}x^9y^3$

$2^3 \cdot x^{3\cdot3} \cdot y^{1\cdot3} = 8x^9y^3$

$(x^2)^5 \cdot (x^3) = x^{13}$

$x^{10}\, x^3 = x^{13}$

$(4x^2b)^2 = 16x^4b^2$

$(-3ab^4)^3 = -27a^3b^{12}$

$(-4xy)^3(-2x^2)^3$

$-4^3x^3y^3 \cdot -8x^6$

$-64(-8)x^9y^3 = 512x^9y^3$

NAME ______________________________ DATE ____________ PERIOD _____

8-1 Study Guide and Intervention *(continued)*

Multiplying Monomials

Powers of Monomials An expression of the form $(x^m)^n$ is called a **power of a power** and represents the product you obtain when x^m is used as a factor n times. To find the power of a power, multiply exponents.

Power of a Power	For any number a and all integers m and n, $(a^m)^n = a^{mn}$.
Power of a Product	For any number a and all integers m and n, $(ab)^m = a^m b^m$.

Example **Simplify $(-2ab^2)^3(a^2)^4$.**

$(-2ab^2)^3(a^2)^4 = (-2ab^2)^3(a^8)$ Power of a Power

$= (-2)^3(a^3)(b^2)^3(a^8)$ Power of a Product

$= (-2)^3(a^3)(a^8)(b^2)^3$ Commutative Property

$= (-2)^3(a^{11})(b^2)^3$ Product of Powers

$= -8a^{11}b^6$ Power of a Power

The product is $-8a^{11}b^6$.

Exercises

Simplify.

1. $(y^5)^2$

2. $(n^7)^4$

3. $(x^2)^5(x^3)$

4. $-3(ab^4)^3$

5. $(-3ab^4)^3$

6. $(4x^2b)^3$

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

8. $(4x)^2(b^3)$

9. $(x^2y^4)^5$

10. $(2a^3b^2)(b^3)^2$

11. $(-4xy)^3(-2x^2)^3$

12. $(-3j^2k^3)^2(2j^2k)^3$

13. $(25a^2b)^3\left(\frac{1}{5}abc\right)^2$

14. $(2xy)^2(-3x^2)(4y^4)$

15. $(2x^3y^2z^2)^3(x^2z)^4$

16. $(-2n^6y^5)(-6n^3y^2)(ny)^3$

17. $(-3a^3n^4)(-3a^3n)^4$

18. $-3(2x)^4(4x^5y)^2$

Homework

Finish Classwork