

Skill Check:

Evaluate

$$-11^3$$

10-2 product of powers property

Vocabulary:

1.) Products of powers of property

$$(4^6)(4^6)(4^6)$$

4^{18}

a.) to multiply powers with the same base, add their exponents

$$\text{ex: } \underline{4^2} \cdot 4^3 = 4^{2+3} = 4^5$$
$$4 \times 4 \times 4 \times 4 \times 4 = 4^5$$

b.) To find the power of a power, multiply the exponents

$$(4^6)^3 = 4^{6 \cdot 3} = 4^{18}$$

c.) To find the power of a product, find the power of each factor and multiply.

$$(3 \cdot 2)^5 = 3^5 \cdot 2^5$$

Example 1:
Multiplying powers
with the same base

→ Add exponents

1.) $2^4 \cdot 2^5$

$$2^{4+5} = 2^9$$

2.) $-5^1 \cdot (-5)^6$

$$(-5)^{1+6} = (-5)^7$$

3.) $x^3 \cdot x^7$

$$x^{3+7} = x^{10}$$

Example 2:
Finding the power of a
power

Mult. exponents
(distribute)

1.) $(3^4)^3$

$$3^{4 \times 3} = 3^{12}$$

2.) $(w^5)^4$

$$w^{5 \times 4} = w^{20}$$

**Example 3:
Finding a power of
a product**

1.) $(2x)^3$

$$2^3 x^3 = 8x^3$$

2.) $(3xy)^2$

$$3^2 x^2 y^2 = 9x^2 y^2$$

Practice:

1.) $6^2 \cdot 6^4$

2.) $\left(-\frac{1}{2}\right)^3 \cdot \left(-\frac{1}{2}\right)^6$

3.) $\left((-4)^3\right)^2$

4.) $(5y)^4$

In general, if x is any number and m, n are positive integers, then

$$x^m \cdot x^n = x^{m+n}$$

because

$$x^m \times x^n = \underbrace{(x \cdots x)}_{m \text{ times}} \times \underbrace{(x \cdots x)}_{n \text{ times}} = \underbrace{(x \cdots x)}_{m+n \text{ times}} = x^{m+n}.$$

Exercise 1

$$14^{23} \times 14^8 =$$

Exercise 2

$$(-72)^{10} \times (-72)^{13} =$$

Exercise 3

$$5^{94} \times 5^{78} =$$

Exercise 4

$$(-3)^9 \times (-3)^5 =$$

Exercise 5

Let a be a number.

$$a^{23} \cdot a^8 =$$

Exercise 6

Let f be a number.

$$f^{10} \cdot f^{13} =$$

Exercise 7

Let b be a number.

$$b^{94} \cdot b^{78} =$$

Exercise 8

Let x be a positive integer. If $(-3)^9 \times (-3)^x = (-3)^{14}$, what is x ?

What would happen if there were more terms with the same base? Write an equivalent expression for each problem.

Exercise 9

$$9^4 \times 9^6 \times 9^{13} =$$

Exercise 10

$$2^3 \times 2^5 \times 2^7 \times 2^9 =$$

Can the following expressions be written in simpler form? If so, write an equivalent expression. If not, explain why not.

Exercise 11

$$6^5 \times 4^9 \times 4^3 \times 6^{14} =$$

Exercise 14

$$2^4 \times 8^2 = 2^4 \times 2^6 =$$

Exercise 12

$$(-4)^2 \cdot 17^5 \cdot (-4)^3 \cdot 17^7 =$$

Exercise 15

$$3^7 \times 9 = 3^7 \times 3^2 =$$

Exercise 13

$$15^2 \cdot 7^2 \cdot 15 \cdot 7^4 =$$

Exercise 16

$$5^4 \times 2^{11} =$$

