

Write out what each of the following exponents means as an extended product and find its value.

$$(a) 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$$

$$(b) 3^2 = 3 \cdot 3 = 9$$

$$(c) 5^3 = 5 \cdot 5 \cdot 5 = 125$$

Write out what each of the following terms involving exponents means as an extended product.

Consider carefully your order of operations and remember that exponents come before multiplication.

(a) x^3

$$x \cdot x \cdot x$$

$$x^n = \underbrace{x \cdot \dots \cdot x}_{n \text{ \# of times}}$$

(b) x^2y^4

$$x \cdot x \cdot y \cdot y \cdot y \cdot y$$

(c) $(2x)^2$

$$\begin{aligned} & (2x)(2x) \\ & 2 \cdot 2 \cdot x \cdot x \end{aligned}$$

(d) $4x^4y^3$

$$4 \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$$

(e) $(9x^2)^3$

$$9 \cdot 9 \cdot 9 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$$

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

$$-4 \cdot -4 \cdot x \cdot x \cdot x$$

$$-4 \cdot -4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$$

Exercise #3: Write out each of the following products and then express them in the form x^n .

(a) x^2x^3

$x \cdot x \cdot x \cdot x \cdot x$

x^5

(b) x^5x^2

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

x^7

(c) x^4x^4

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

x^8

Exercise #4: So, what's the pattern? Can you give a generic rule for what happens when we multiply two terms that have the same **base**?

EXPONENT RULE #1: $x^a \cdot x^b =$

x^{a+b}

Exercise #5: Quickly write each of the following products as a variable raised to a single power.

(a) x^4x^9

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

(c) y^2y^6

$$x^{13}$$

$$x^9$$

$$y^8$$

Exercise #6: The steps to simplifying the product: $5x^3 \cdot 2x^7$ to simplest terms are shown below. Write in what justifies each step.

Step 1: $5x^3 \cdot 2x^7 = 5 \cdot 2 \cdot x^3 \cdot x^7$

Justification: COMMUTATIVE

Step 2: $5 \cdot 2 \cdot x^3 \cdot x^7 = (5 \cdot 2) \cdot (x^3 \cdot x^7)$

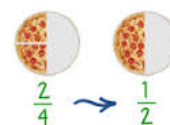
Justification: ASSOCIATIVE

Step 3: $(5 \cdot 2) \cdot (x^3 \cdot x^7) = 10x^{10}$

Justification: LAWS of EXPONENTS

(EXP. RULE #1)

Exercise #7: Rewrite each of the following as equivalent expressions in simplest exponential form.



(a) $2x^7 \cdot 8x^5$

$2 \cdot 8 \cdot x^7 \cdot x^5$
 $16x^{12}$

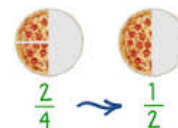
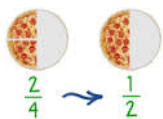
(b) $(-4x^3)(2x^2)$

$-4 \cdot 2 \cdot x^3 \cdot x^2$
 $-8x^5$

(c) $(-6x^3)^2$

$-6^2(x^3)^2$
 $-6 \cdot -6 \cdot x^3 \cdot x^3$
 $36x^6$

Humphrey!



$$(2^3)^4$$

$$(2 \cdot 2 \cdot 2)^4$$

$$(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$$