MTH1W Grade 9 Mathematics

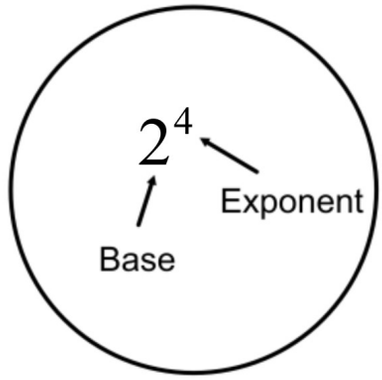
5.1 Multiplying and Dividing Powers with the Same Base

Goal(s) *- To identify the resulting exponent when two powers are multiplied/divided*

- Simplify expressions involving multiplication/division of powers

Jun 19-8:29 AM

Recall that a **power** is a product of identical factors and consists of two parts: a ***base*** and an ***exponent***.



Power

The base is the ***identical factor***, and the exponent tells how many ***factors*** there are.

$$2^4 = 2 \times 2 \times 2 \times 2$$

exponential form — expanded form

Evaluate means "work out"

$\Rightarrow 2^4 = 16$

For each power: **identify the base**, **identify the exponent**, and **then evaluate**.

	Base	Exponent
$4^3 =$ 64	4	3
$(-3)^2 =$ 9	−3	2
$2^{-3} =$ $\frac{1}{8}$	2	−3
$\left(\frac{3}{4}\right)^4 =$ $\frac{81}{256}$	$\frac{3}{4}$	4

Investigating the Power Rules

Complete each table below. Is there a relationship between the exponents in the first column and the exponent in the last column?

	Expanded Form	Single Power
$3^2 \times 3^4$	$(3\times3)\times(3\times3\times3\times3)$	3^6
$6^4 \times 6^1$	$(6\times6\times6\times6)\times(6)$	6^5
$n^3 \times n^6$	$(n\times n\times n)\times(n\times n\times n\times n\times n\times n)$	n^9

Relationship?

The simplified power is a result of ADDING the exponents together. This will always work as long as the bases are the same as each other.

$\Rightarrow x^m \times x^n = x^{m+n}$

Investigating the Power Rules

Complete each table below. Is there a relationship between the exponents in the first column and the exponent in the last column?

	Expanded Form	Single Power
$5^7 \div 5^2$	$\frac{5\times5\times5\times5\times5\times5\times5}{5\times5}$	5^5
$7^4 \div 7^1$	$\frac{7\times7\times7\times7}{7}$	7^3
$n^8 \div n^6$	$\frac{n\times n\times n\times n\times n\times n\times n\times n}{n\times n\times n\times n\times n\times n}$	n^2

Relationship?

The simplified power is a result of SUBTRACTING the exponents. This will always work as long as the bases are the same. $\Rightarrow x^m \div x^n = x^{m-n}$

Product Rule

When multiplying powers with the same base, **add the exponents** to write the product as a **single power**.

$$x^a \times x^b = x^{a+b}$$

Quotient Rule

When dividing powers with the same base, **subtract the exponents** to write the quotient as a **single power**.

$$x^a \div x^b = x^{a-b}$$

Write each product as a single power. Then evaluate the power.

$4^2 \times 4^3 =$ $4^{2+3} = 4^5 \Rightarrow 1024$

$(-5)^7 \div (-5)^2 =$ $(-5)^{7-2} = (-5)^5 \Rightarrow -3125$

$12^2 \times 12^4 \div 12^5 =$ $12^{2+4-5} = 12^1 \Rightarrow 12$

$\frac{(-9)^7 \div (-9)^{-3}}{(-9)^{11}} =$ $(-9)^{7-(-3)-11} = (-9)^{-1} \Rightarrow -\frac{1}{9}$

reciprocal of base exponent becomes positive

Rewrite with a single power.

$k^4 \times k^{-9} =$ $k^{4+(-9)} = k^{-5}$

$-2a^2 \times 5a^3 =$ $(-2 \times 5)(a^{2+3})$

$= -10a^5$

coefficients follow the regular rules of math