MCF3M

Exponent Laws

Name: _____

Complete each table.

	Expanded Form	Single Power
$3^2 \times 3^4$	$(3 \times 3) \times (3 \times 3 \times 3 \times 3)$	3^6
$4^3 \times 4^3$	$(4\times4\times4)\times(4\times4\times4)$	4^6
$6^4 \times 6$	$(6\times6\times6\times6)\times6$	6^5
$2^4 \times 2^2 \times 2^3$		2^9
$k^3 \times k^5$		k^8

	Expanded Form	Single Power
$5^5 \div 5^3$	$\frac{5\times5\times\cancel{5}\times\cancel{5}\times\cancel{5}}{\cancel{5}\times\cancel{5}\times\cancel{5}}$	5^2
$7^4 \div 7$	$\frac{7\times7\times7\times\cancel{7}}{\cancel{7}}$	7^3
$10^6 \div 10^4$		10^2
$2^7 \div 2^6$		2^1
$p^8 \div p^5$		p^3

Do you notice any patterns?

Product Rule: When multiplying powers with the same base, add the exponents.

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

Quotient Rule: When dividing powers with the same base, subtract the exponents.

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

Examples: Write each product or quotient as a single power. Then evaluate.

a) $3^2 \times 3^3 = 3^5 = 243$

b) $5^2 \times 5 \times 5^2 = 5^5 = 3125$

c) $(-2)^4 \times (-2)^3 = (-2)^7 = -128$

d) $\left(\frac{1}{2}\right)^3 \times \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^5 = \frac{1^5}{2^5} = \frac{1}{32}$

e) $0.1^4 \times 0.1^2 = 0.1^6 = 0.000001$

f) $8^7 \div 8^5 = 8^2 = 64$

g) $4^7 \div 4 \div 4^3 = 4^3 = 64$

h) $\frac{(-0.5)^6}{(-0.5)^3} = (-0.5)^3 = -0.125$

i) $\frac{\left(\frac{3}{4}\right)^3 \times \left(\frac{3}{4}\right)^2}{\left(\frac{3}{4}\right)^5} = \frac{\left(\frac{3}{4}\right)^5}{\left(\frac{3}{4}\right)^5} = \left(\frac{3}{4}\right)^0 = 1$

Complete the table.

	Expanded Form	Single Power
$(2^2)^3$	$(2^2) \times (2^2) \times (2^2)$ $= (2 \times 2) \times (2 \times 2) \times (2 \times 2)$	2^6
$(5^3)^4$		5^{12}
$(10^4)^2$		10^8

Do you notice a pattern?

Power of a Power Rule:
A power of a power can be written as a single power by multiplying the exponents.

$$(x^a)^b = x^{ab}$$

Examples: Write each as a single power, then evaluate.

a) $(3^2)^4 = 3^8$
$= 6561$

b) $[(-2)^3]^4 = (-2)^{12}$
$= 4096$

c) $\left[\left(\frac{2}{3}\right)^2\right]^2 = \left(\frac{2}{3}\right)^4$
$= \frac{2^4}{3^4} = \frac{16}{81}$

d) $(0.2^3)^2 = 0.2^6$
$= 0.000064$

Simplify each algebraic expression by applying the exponent laws.

a) $y^3 \times y^5 = y^8$

b) $6p^7 \div 3p^3 = 2p^4$

c) $a^2b^3 \times a^6b^4 = a^8b^7$

d) $\frac{-2uv^3 \times 8u^2v^2}{(4uv^2)^2} = \frac{-16u^3v^5}{16u^2v^4}$
$= -uv$