

Math 9 Section 1.6 – Exponent Rules Part 1

Homework: Section 1.6 on Pg. 34; 1-3all,4-9left – Answers on Pg. 364

Write the following in repeated factor form, then as a single exponential. What do you notice?

$$2^5 \times 2^3 = \frac{(2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2)}{2^5 \quad 2^3} = 2^8$$

Same base
5+3 = 8 total 2's

$$a^n \times a^m = a^{n+m}$$

Product Rule:

When we multiply two exponentials with the same base we can add the exponents and keep the base the same.

For example, write the following as a single exponential:

$$5^2 \times 5^9 = 5^{2+9} = 5^{11}$$

$$(-4)^6 \times (-4)^7 = (-4)^{6+7} = (-4)^{13}$$

$$6^6 \times 6^4 \times (-6)^7 = 6^6 \times 6^4 \times (-6)^7$$

$\Rightarrow (-6)^7$ is neg
 $(-6)^7 = -6^7$
 $6^6 \times -6^7 = -6^{13}$

Write the following in repeated factor form, then as a single exponential. What do you notice?

$$\frac{2^5}{2^3} = \frac{\cancel{2} \times \cancel{2} \times \cancel{2} \times 2 \times 2}{\cancel{2} \times \cancel{2} \times \cancel{2}} = \frac{5 \text{ 2's}}{3 \text{ 2's}} = 2^2$$

5-3

$$\frac{a^n}{a^m} = a^n \div a^m = a^{n-m}$$

Quotient Rule:

When we divide two exponentials with the same base we can subtract the exponents and keep the base the same.

For example, write the following as a single exponential:

$$5^9 \div 5^2 = 5^{9-2} = \underline{5^7}$$

$$(-4)^7 \div (-4)^6 = (-4)^{7-6} = (-4)^1 = \underline{-4}$$

$$\frac{(-6)^9}{6^4 \times (-6)^3} = \frac{(-6)^6}{6^4}$$

$(-6)^6$ is \oplus since power is even

$$(-6)^6 = +6^6$$

$$= \frac{6^6}{6^4} = \boxed{6^2}$$

Proof for why $a^0 = 1$ and $a^1 = a$:

Quotient Rule:

$$\frac{3^4}{3^4} = 3^{4-4} = 3^0$$

$$3^0 = 1$$

We could do this for any other base

$$\frac{81}{81} = 1$$

$$\boxed{a^0 = 1}$$

$$\frac{0^4}{0^4} = 0^0$$

0^0 is undefined

$$\frac{0^4}{0^4} = \frac{0}{0}$$

Can't divide by zero \Rightarrow undefined

$$\frac{3^5}{3^4} = 3^{5-4} = 3^1$$

$$\frac{3^5}{3^4} = \frac{243}{81} = 3$$

$$3^1 = 3$$

We could do this for any other base

$$\Rightarrow \boxed{a^1 = a}$$

What happens if the bases are different?

Simplify:

$$\frac{(-4)^8 \times 3^6}{4^4 \times (-3)^3} = \frac{4^8 \times 3^6}{4^4 \times \ominus 3^3} = \ominus \frac{4^8 \times 3^6}{4^4 \times 3^3}$$

$$\begin{aligned} (-4)^8 &= +4^8 \\ (-3)^3 &= -3^3 \end{aligned}$$

$$= \ominus 4^4 \times 3^3$$