

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?

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

↑ ↑
Same base
5 3
5+3 = 8 total

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

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:

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

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

$$6^2 \times 6^4 \times (-6)^7 = 6^6 \times (-6)^7$$

$(-6)^7 \text{ odd} \Rightarrow \text{neg}$

$$= -6^7$$
$$= 6^6 \times -6^7 = -6^{13}$$

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

$$\frac{2^5}{2^3} = \frac{\cancel{2} \times \cancel{2} \times \cancel{2} \times 2 \times 2}{\cancel{2} \times \cancel{2} \times \cancel{2}} = 2^2 \leftarrow 5-3$$

Quotient Rule:

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

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:

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

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

$$\frac{(-6)^9}{6^4 \times (-6)^3} = \frac{(-6)^6}{6^4} = \frac{6^6}{6^4} = 6^2$$

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 with any base

$$a^0 = 1$$

$$\frac{3^4}{3^4} = \frac{81}{81} = 1$$

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

0^0 is undefined

$$\frac{0^4}{0^4} = \frac{0}{0} \leftarrow \text{undefined}$$

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

$$\frac{81}{27} = 3$$

$3^1 = 3$
We could do this with any base

$$a^1 = a$$

What happens if the bases are different?

Simplify:

$$(-4)^8 = +4^8 \quad \text{even}$$

$$(-3)^3 = -3^3 \quad \text{odd}$$

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