

Mathematics 9

Section 2.4 - Exponent Laws I

We have looked at how exponents can be dealt with individually, and now we will look at how exponents can be combined to make more simple expressions.

We know that an exponent tells us How Many Times To Multiply A # By Itself

and that we CANNOT combine numbers with exponents joined by ADDITION OR SUBTRACTION, we must evaluate the individual powers first:

$$3^2 + 6^3 = 9 + 216 = 225$$

However, when we multiply and divide powers, the rules are quite different.

Multiplying

Consider the following situation:

$$4^3 \times 4^2$$

WRITE AS REPEATED MULTIPLICATION

$$(4)(4)(4) \times (4)(4)$$

GET RID OF MULTIPLICATION SYMBOL

$$(4)(4)(4)(4)(4)$$

How CAN WE REWRITE AS A SINGLE POWER?

$$4^5$$

What have we actually done?

ADDED THE EXPONENTS

WHenever WE HAVE TWO POWERS BEING MULTIPLIED THAT HAVE THE EXACT SAME BASE, WE CAN SIMPLY ADD THE EXPONENTS

Exponent Law for Products of Powers

$$x^m \cdot x^n = x^{m+n}$$

Dividing

Consider the following situation:

$$7^9 \div 7^4$$

WRITE AS A FRACTION

$$\frac{7^9}{7^4}$$

WRITE TOP & BOTTOM WITH REPEATED MULTIPLICATION

$$\frac{(7)(7)(7)(7)(7)(7)(7)(7)(7)}{(7)(7)(7)(7)}$$

$$(7)(7)(7)(7)$$

CANCEL OFF 7s AS PAIRS AS

$$\frac{7}{7} = 1$$

$$\frac{(7)(7)(7)(7)(\cancel{7})(\cancel{7})(\cancel{7})(\cancel{7})}{(\cancel{7})(\cancel{7})(\cancel{7})(\cancel{7})}$$

$$(\cancel{7})(\cancel{7})(\cancel{7})(\cancel{7})$$

THIS LEAVES US WITH

$$(7)(7)(7)(7)(7)$$

WRITTEN AS A SINGLE POWER:

$$7^5$$

What have we actually done?

- SUBTRACTED THE EXPONENTS

WHENEVER WE HAVE 2 POWERS BEING DIVIDED THAT HAVE THE EXACT SAME BASE, WE CAN SIMPLY SUBTRACT THE EXPONENTS

Exponent Law for Quotients of Powers

$$x^m \div x^n = x^{m-n}$$

Examples:

$$\begin{aligned} & 1/ \quad 5^4 \times 5^8 \div 5^9 \\ & \quad 5^{4+8} \div 5^9 \\ \text{SIMPLIFY} & \quad 5^{12} \div 5^9 \\ & \quad 5^{12-9} \\ & \quad 5^3 = 125 \end{aligned}$$

EVALUATE

$$2/ \quad (-3)^5 [(-3)^5 \div (-3)^2] - 3^2$$

$$(-3)^5 [(-3)^3] - 3^2$$

$$(-3)^{5+3} - 3^2$$

$$(-3)^8 - 3^2$$

$$6561 - 9$$

$$6552$$

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