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LEARNING OBJECTIVE: We will multiply and divide different exponents with the same base. (G8M1L2)

CONCEPT DEVELOPMENT:

Multiplying Different Exponents with the Same Base:

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

Examples:

$3^3 \cdot 3^4 = 3^{3+4} = 3^7$

$\underbrace{(3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3)}_{7 \text{ times}}$

3^7

$\left(-\frac{4}{5}\right)^3 \cdot \left(-\frac{4}{5}\right)^6 = \left(-\frac{4}{5}\right)^{3+6} = \left(-\frac{4}{5}\right)^9$

Non-Examples:

$3^6 \cdot 7^4 = \cancel{21^{10}}$

$729 \cdot 2401$

$= 1{,}750{,}329$

$(-2)^7 \cdot 2^5$

DIFFERENT BASE!!

Dividing Different Exponents with the Same Base:

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

Examples

BASE: 17

$\left(\frac{17^7}{17^4}\right) = 17^{7-4} = 17^3$

$\frac{\cancel{17} \cdot \cancel{17} \cdot \cancel{17} \cdot \cancel{17} \cdot 17 \cdot 17 \cdot 17}{\cancel{17} \cdot \cancel{17} \cdot \cancel{17} \cdot \cancel{17}} = 17^3$

$\frac{\left(\frac{8}{5}\right)^{23}}{\left(\frac{8}{5}\right)^{12}} = \left(\frac{8}{5}\right)^{\boxed{23-12}} = \left(\frac{8}{5}\right)^{11}$

Non-Example

$\frac{12^4}{3^2} \neq 4^2$

$12^4 = 12 \cdot 12 \cdot 12 \cdot 12$

$3 \cdot 4 \cdot 3 \cdot 4 \cdot 3 \cdot 4 \cdot 3 \cdot 4$

$\frac{3^4 \cdot 4^4}{3^2} = 3^2 \cdot 4^4$

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GUIDED PRACTICE:

Steps to Multiplying Different Exponents with the Same Base

1. Make sure that your terms all have the same base.
2. Rewrite the expression by adding the exponents with the same base.

What's the base? x $x^4 \cdot x^{34}$ $\underbrace{(x \cdot x \cdot x \cdot x)}_{4\text{ times}} \cdot \underbrace{(x \cdot x \cdot x \ldots x)}_{34\text{ times}}$ x^{4+34} $\boxed{x^{38}}$	$\left(\frac{3}{5}\right)^9 \cdot \left(\frac{3}{5}\right)^3 = \left(\frac{3}{5}\right)^{9+3}$ $\boxed{\left(\frac{3}{5}\right)^{12}}$
BASE? $(-10)^3 \cdot (-10)^2 \cdot (-10)^6$ $(-10)^{3+2+6}$ $\boxed{(-10)^{11}}$	$3^3 \cdot 3^6 \cdot 3^{19} \cdot 3^{11}$ $3^{3+6+19+11}$ $\boxed{3^{39}}$
WHAT'S THE BASE -4 & 17 $(-4)^2 \cdot 17^5 \cdot (-4)^3 \cdot 17^7$ $(-4)^{2+3} \cdot 17^{5 \cdot 7}$ $\boxed{(-4)^5 \cdot 17^{12}}$	BASE: 3 & 2 $3^2 \cdot 2^3 \cdot 3^4 \cdot 2^4$ $3^{2+4} \cdot 2^{3+4}$ $3^6 \cdot 2^7$
BASE: 3! $3^7 \cdot 9$ $9 \to 3$ $3^7 \cdot 3^2$ $3^{7+2} = \boxed{3^9}$	BASE: 2 $2^3 \cdot 4^4$ $4 = 2^2$ $4^4 = 2^8$ $2 \cdot 2 \cdot 2 \cdot 4 \cdot 4 \cdot 4 \cdot 4$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ $2^3 \cdot 2^8 = \boxed{2^{11}}$
BASE: x $(2x^3)(17x^7)$ $2 \cdot x^3 \cdot 17 \cdot x^7$ $2 \cdot 17 \cdot x^3 \cdot x^7$ $\boxed{34x^{10}}$	BASE: y $(4y^7)(6y^3)$ $\boxed{24y^{10}}$
$5^4 \cdot 2^{11}$ CANNOT COMBINE!	$12^4 \cdot 25^2$ CANNOT COMBINE!

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Steps to Dividing Different Exponents with the Same Base
1. Make sure that your terms all have the same base.
2. Rewrite the expression by subtracting the exponents with the same base

BASE: 7 $\frac{7^9}{7^6}$ 7^{9-6} $\boxed{7^3}$	BASE: -15 $\frac{(-15)^5}{(-15)^2}$ $(-15)^{5-2}$ $(-15)^3$
BASE: $\left(\frac{8}{5}\right)$ $\frac{\left(\frac{8}{5}\right)^{11}}{\left(\frac{8}{5}\right)^{2}}$ $\boxed{\left(\frac{8}{5}\right)^9}$	BASE: $\left(\frac{a}{b}\right)$ $\frac{\left(\frac{a}{b}\right)^{17}}{\left(\frac{a}{b}\right)^{11}}$ $\boxed{\left(\frac{a}{b}\right)^6}$
BASE: 2 $\frac{2^9}{8^2}$ 8 $2\cdot2\cdot2$ $\frac{2^9}{8\cdot8} = \frac{2^9}{2\cdot2\cdot2\cdot2\cdot2\cdot2}$ $= \frac{2^9}{2^6} = 2^{9-6} = \boxed{2^3}$	BASE: 3 $\frac{3^{23}}{27}$ 27 $3 \quad 9$ $3 \quad 3$ $\frac{3^{23}}{3^3} = 3^{23-3} = \boxed{3^{20}}$
BASE: 2 & 75 $\frac{2^5}{2^2}\cdot\frac{75^8}{75^3}$ $(2^{5-2})(75^{8-3})$ $\boxed{2^3\cdot75^5}$	BASES: -8 & -3 $\frac{(-8)^{13}\cdot(-3)^{86}}{(-8)^3\cdot(-3)^2}$ $(-8)^{13-3}\cdot(-3)^{86-2}$ $(-8)^{10}\cdot(-3)^{84}$
BASE: x $\frac{5}{x^3}\frac{(3x^8)}{1} = \frac{5}{x^3}\cdot\frac{3x^8}{1}$ $\frac{5\cdot3\cdot x^8}{1\cdot x^3} = \frac{15x^8}{x^3} = 15x^{8-3}$ $\boxed{15x^5}$	$\frac{5}{x^3}\frac{(-4x^6)}{1}$ $\frac{5}{x^3}\cdot\frac{-4x^6}{1} = \frac{-20x^6}{x^3} = \boxed{-20x^3}$
$\frac{6}{x^7}\frac{(3x^8)}{1}$ $\frac{6\cdot3\cdot x^8}{x^7} = \frac{18x^8}{x^7} = 18x^1 = 18x$	* $\frac{6}{x^5}(-15x^6)$

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Independent Practice:

$5^3 \times 25$	$\frac{2^{13}}{8}$
$5x^2 \cdot 3x^3 \cdot 2y^7$	$(-19)^5 \cdot (-19)^{11}$
$\frac{7^{10}}{7^3}$	$\frac{\left(-\frac{9}{7}\right)^m}{\left(-\frac{9}{7}\right)^n}$
$\frac{ab^3}{b^2}$	$2.7^4 \cdot 2.7^{18}$
$\left(\frac{1}{5}\right)^2 \cdot \left(\frac{1}{5}\right)^{15}$	$4x^7 \cdot 3x^{12}$

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Activating Prior Knowledge:

We know how to rewrite repeated multiplication:

$3 \times 3 \times 3$ 3^3	$\underbrace{3 \times 3 \times 3 \times 3}$ 3^4 ← EXPONENT BASE

Closure:

Simplify: $23^a \cdot 23^b$

Teacher Notes:

Complete Ponzi Pyramid Scheme after this lesson