

Warm-up

①

Simplify, then evaluate

$$(-2)^3 + 2^4 \cdot (-2)^1 = -8 + 16 \cdot (-2) = -8 + (-32) = -40$$

② simplify to a single exponential

$$\begin{aligned} \text{a) } \frac{(-3)^3 \cdot 3^6 \cdot 5^4}{(-5)^1 \cdot (-3)^4} &= \frac{+3^3 \cdot 3^6 \cdot 5^4}{+5^1 \cdot +3^4} = + \frac{3^9 \cdot 5^4}{5^1 \cdot 3^4} \\ &= \underline{5^3 \cdot 3^5} \end{aligned}$$

$$\begin{aligned} \text{b) } \frac{5^{4a-3}}{5^{a+1} \times 5^{2a-2}} &= \frac{5^{4a-3}}{5^{3a-1}} = 5^{(4a-3) - (3a-1)} \\ &= 5^{(4a-3) + (-3a+1)} \\ &= \underline{5^{a-2}} \end{aligned}$$

HW 1.61

$$8k) \frac{(-2)^5 \overset{\text{add}}{+} (-2)^2}{(-2)^4} = \frac{-32 + 4}{+16}$$

$$= \frac{-28 \div 2}{16 \div 2} = \frac{-14 \div 2}{8 \div 2} = \boxed{-\frac{7}{4}}$$

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

$$(2^2)^3 = \underbrace{2^2 \times 2^2 \times 2^2}_{3 \text{ times}} = \underbrace{(2 \times 2) \times (2 \times 2) \times (2 \times 2)}_{6 \text{ total}} = 2^{6} \quad \begin{matrix} \uparrow \\ 2 \times 3 \end{matrix}$$

$$(a^n)^m = a^{n \cdot m}$$

Power of a Power Rule:

When we raise an exponential to another power, we multiply the powers and keep the base the same.

For example, write as a single exponential:

$$(4^5)^4 = 4^{5 \cdot 4} \\ = 4^{20}$$

$$((-2)^4)^{10} = (-2)^{4 \cdot 10} \\ = (-2)^{40}$$

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

$$(4 \times 6)^2 = \underbrace{(4 \times 6) \times (4 \times 6)}_{\text{reorder}} = \underbrace{(4 \times 4) \times (6 \times 6)}_{\text{reorder}} = 4^2 \times 6^2$$

$$(a \times b)^n = a^n \times b^n$$

Power of a Product Rule:

When we raise a product (multiplication) to a power, we can take each part of the product and raise it to the same power.

For example, simplify to a product of exponential(s):

$$(8 \times 7)^5 = 8^5 \times 7^5$$

$$(8^3 \times 7^2)^5 = (8^3)^5 \times (7^2)^5 \quad (8+7)^5 = \text{Not product} \quad \text{No Rule} \\ = 8^{15} \times 7^{10} \quad \text{BEDMAS} \\ = \underline{15^5}$$

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

$$\left(\frac{7}{8}\right)^3 = \frac{7}{8} \times \frac{7}{8} \times \frac{7}{8} = \frac{7 \times 7 \times 7}{8 \times 8 \times 8} = \frac{7^3}{8^3}$$

Power of a Quotient Rule:

$$\left(\frac{a}{b}\right)^n = (a \div b)^n = \frac{a^n}{b^n}$$

When we raise a ~~product~~ ^{Quotient} (division) to a power, we can take the Numerator as well as the denominator and raise both to the same power.

For example, simplify to a fraction:

$$\left(\frac{5}{12}\right)^3 = \frac{5^3}{12^3}$$

$$\left(\frac{2^3}{3^2}\right)^4 = \frac{(2^3)^4}{(3^2)^4} = \frac{2^{12}}{3^8}$$

All of these are **WRONG!!** Explain why and fix the mistakes!

$$2^3 \times 2^4 = 2^{3+4} = 2^7$$

keep same base

$$5^3 \times 5^4 = 5^{3 \times 4} = 5^{12}$$

$$\frac{3^8}{3^2} = 3^{8-2} = 3^6$$

keep base same

$$\frac{9^6}{9^2} = 9^{6-2} = 9^4$$

$$8^0 = 0$$

$$a^0 = 1$$

$$(6+7)^4 = 6^4 + 7^4$$

add NO Rule

$$(3^4)^9 = 3^{36}$$

mult exp

$$\left(\frac{5}{7}\right)^3 = \frac{5^3}{7^3}$$

power to top and bottom