

~ Unit 5, Page 19 ~

Properties of Exponents

Explore...look for patterns

Objectives: I can apply the properties of exponents to simplify expressions involving integral exponents.

Complete to see why the rules for exponents work.

Multiplication
ADD

$$1. 4^5 \cdot 4^2 = (\underbrace{4}_{\text{4}})(\underbrace{4}_{\text{4}})(\underbrace{4}_{\text{4}})(\underbrace{4}_{\text{4}})(\underbrace{4}_{\text{4}}) \cdot (\underbrace{4}_{\text{4}})(\underbrace{4}_{\text{4}}) = 4^{5+2} = \boxed{4^7}$$

$$2. 8^3 \cdot 8 = (\underbrace{8}_{\text{8}})(\underbrace{8}_{\text{8}})(\underbrace{8}_{\text{8}}) \cdot (\underbrace{8}_{\text{8}}) = 8^{3+1} = \boxed{8^4}$$

$$3. 4^5 \div 4^2 = \frac{4^5}{4^2} = \frac{\underbrace{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}_{\text{4} \cdot \text{4}}}{\underbrace{4 \cdot 4}_{\text{4} \cdot \text{4}}} = 4^{5-2} = \boxed{4^3}$$

$$4. 8^3 \div 8 = \frac{8^3}{8} = \frac{\underbrace{8 \cdot 8 \cdot 8}_{\text{8}}}{\underbrace{8}_{\text{8}}} = 8^{3-1} = \boxed{8^2}$$

$$5. \frac{6^3}{6^3} = 6^{3-3} = 6^0 = 1 \quad \text{Also, } \frac{6^3}{6^3} = \frac{\underbrace{6 \cdot 6 \cdot 6}_{\text{6} \cdot \text{6} \cdot \text{6}}}{\underbrace{6 \cdot 6 \cdot 6}_{\text{6} \cdot \text{6} \cdot \text{6}}} = 1. \quad \text{So, } 6^0 = \boxed{1}$$

Division
SUBTRACT

To help with HW problems

Complete to write each product or quotient as one power.

$$6. 12^3 \cdot 12^2 = 12^{3+2} = 12^5$$

$$7. 9^4 \cdot 9^3 = 9^{4+3} = 9^7$$

$$8. \frac{7^6}{7^2} = 7^{6-2} = 7^4$$

$$9. \frac{12^6}{12^4} = 12^{6-4} = 12^2$$

Write each product or quotient as one power.

$$10. 10^4 \cdot 10^6 = 10^{10}$$

$$11. 5^5 \cdot 5 = 5^6$$

$$12. 4^5 \cdot 4^1 \cdot 4^3 = 4^9$$

$$13. \frac{15^6}{15^2} = 15^4$$

$$14. \frac{9^5}{9^1} = 9^4$$

$$15. \frac{2^{10}}{2^2} = 2^8$$

Extra Examples

$$\begin{aligned} \textcircled{1} (3x^4)(5x^3) &= \\ (3 \cdot 5)(x^4)(x^3) &= \\ 15x^{4+3} &= \\ \boxed{15x^7} & \end{aligned}$$

$$\begin{aligned} \textcircled{2} \frac{(-7)^9}{(-7)^1} &= \\ = (-7)^{9-1} &= \\ \boxed{(-7)^8} & \end{aligned}$$

3 Rules

Properties of Exponents

To multiply powers with the same base, keep the base and **add exponents**.

$$x^a \cdot x^b = x^{a+b}$$

$$4^5 \cdot 4^2 = 4^{5+2} = 4^7$$

$$8^3 \cdot 8 = 8^{3+1} = 8^4$$

To divide powers with the same base, keep the base and **subtract exponents**.

$$x^a \div x^b = x^{a-b}$$

$$4^5 \div 4^2 = 4^{5-2} = 4^3$$

$$8^3 \div 8 = 8^{3-1} = 8^2$$

Any nonzero number raised to the zero power equals 1.

$$x^0 = 1 \text{ with } x \neq 0$$

$$17^0 = 1$$

And, don't forget!
ANY base raised to a **NEGATIVE exponent** results in a **FRACTION**!

Remember from before...

For this assignment