REVIEW: Quotient of Powers Property

Name _____

Key Concept and Vocabulary

Quotient of Powers Property

To divide powers with the same base, subtract their exponents.

Numbers: $\frac{3^6}{3^4} = 3^{6-4} = 3^2$

Algebra: $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$

Visual Model

$$\frac{3^6}{3^4} = \frac{\cancel{3}^{1} \cdot \cancel{3}^{1} \cdot \cancel{3}^{1} \cdot \cancel{3}^{1} \cdot 3 \cdot 3}{\underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}} \cdot \underset{1}{\cancel{3}}} = 3 \cdot 3 = 3^2$$

$$\frac{(-4)^4}{(-4)^2} = \frac{\cancel{(-4)}^{1} \cdot \cancel{(-4)}^{1} \cdot (-4) \cdot (-4)}{\underset{1}{\cancel{(-4)}} \cdot \underset{1}{\cancel{(-4)}}}$$

$$= (-4) \cdot (-4)$$

$$= (-4)^2$$

Skill Examples

1. $\frac{7^5}{7^2} = 7^{5-2} = 7^3$
2. $\frac{(-5)^9}{(-5)^4} = (-5)^{9-4} = (-5)^5$
3. $\frac{x^8}{x^6} = x^{8-6} = x^2$

Application Example

4. The population of a city is about $4 \cdot 5^6$. The land area is about 5^4 square miles. Find the average number of people per square mile.

$$\text{People per square mile} = \frac{4 \cdot 5^6}{5^4}$$

$$= 4 \cdot \frac{5^6}{5^4}$$

$$= 4 \cdot 5^2$$

$$= 100$$

∴ There are about 100 people per square mile.

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Check your answers at BigIdeasMath.com.

Simplify the expression. Write your answer as a power.

5. $\frac{9^5}{9^4} =$ _____
6. $\frac{4^6}{4^2} =$ _____
7. $\frac{2^7}{2^5} =$ _____
8. $\frac{(-6)^7}{(-6)^3} =$ _____
9. $\frac{(-3)^8}{(-3)^5} =$ _____
10. $\frac{(-8)^4}{(-8)^3} =$ _____
11. $\frac{n^9}{n^5} =$ _____
12. $\frac{b^8}{b^2} =$ _____
13. $\frac{y^{12}}{y^7} =$ _____
14. $\frac{6^5 \cdot 6^2}{6^6} =$ _____
15. $\frac{5^4 \cdot 5^5}{5^7} =$ _____
16. $\frac{a^8}{a^2 \cdot a^4} =$ _____
17. $\frac{3^{10}}{3^4} \cdot \frac{3^7}{3^5} =$ _____
18. $\frac{8^5}{8^2} \cdot \frac{8^7}{8^3} =$ _____
19. $\frac{w^{14}}{w^3} \cdot \frac{w^6}{w^4} =$ _____

20. **SOUND INTENSITY** The sound intensity of busy street traffic is 10^7 times greater than the quietest noise a person can hear. The sound intensity of the front rows at a rock concert is 10^{11} times greater than the quietest noise a person can hear. How many times more intense is the sound in the front rows of a rock concert than the sound of busy street traffic? _____