Division Property of Exponents

Name: _____	Date: _____	Score: _____ / 18

Quick Review and Helpful Hints

When you divide powers with the *same base*, keep the base and *subtract* the exponents: $\frac{x^a}{x^b} = x^{a-b}$ (for $x \neq 0$). When a quotient is raised to a power, the power applies to top and bottom: $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$. Divide the number coefficients separately from the variables.

▷ **Example:** Simplify $\frac{x^7}{x^3}$. **Work:** The base x is the same on top and bottom, so keep the base and subtract the exponents: $7 - 3 = 4$.

★ **Answer:** x^4

Practice Problems

Simplify each quotient. Assume no variable equals zero.

1. $\frac{x^6}{x^2}$ _____
2. $\frac{y^9}{y^5}$ _____
3. $\frac{2^8}{2^3}$ _____
4. $\frac{a^{10}}{a}$ _____
5. $\frac{m^5}{m^5}$ _____
6. $\frac{12x^7}{4x^2}$ _____
7. $\frac{x^8y^4}{x^3y}$ _____
8. $\left(\frac{x}{y}\right)^3$ _____
9. $\frac{15a^6}{5a^4}$ _____
10. $\frac{b^{12}}{b^7}$ _____
11. $\frac{20m^9}{4m^9}$ _____
12. $\frac{p^5q^8}{p^2q^3}$ _____
13. $\frac{x^{10}}{x^4}$ _____
14. $\frac{6^9}{6^6}$ _____

Word Problems

15. A rectangle has area x^9 square units and width x^4 units. Its length is area divided by width. Write the length as a power of x. _____

16. A jar holds 10^8 tiny grains, split equally among 10^2 bags. How many grains per bag? Write the answer as a power of 10. _____

17. The volume of a box is $24y^7$ and its base area is $6y^3$. The height is volume divided by base area. Find the height. _____

18. A design file scales both the width and height by the same factor a^6. The ratio includes $\frac{a^6}{a^6}$. Simplify the ratio factor. _____

Answer Keys

1. x^4
2. y^4
3. 2^5
4. a^9
5. 1
6. $3x^5$
7. x^5y^3
8. $\frac{x^3}{y^3}$
9. $3a^2$
10. b^5
11. 5
12. p^3q^5
13. x^6
14. 6^3
15. x^5
16. 10^6
17. $4y^4$
18. 1

Step-by-Step Explanations

1. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Dividing powers of the same base cancels matching factors, so you subtract the exponents: $6 - 2 = 4$, giving x^4. So the final answer is x^4.

2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the exponents: $9 - 5 = 4$, so y^4. So the final answer is y^4.

3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Keep the base 2 and subtract: $8 - 3 = 5$, so 2^5 (which is 32). So the final answer is 2^5.

4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The lone a is a^1, so $10 - 1 = 9$, giving a^9. So the final answer is a^9.

5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Equal exponents subtract to 0, and $m^0 = 1$ – any quantity divided by itself is 1. So the final answer is 1.

6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Handle numbers and variables separately: $12 \div 4 = 3$ and $x^{7-2} = x^5$, giving $3x^5$. So the final answer is $3x^5$.

7. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract exponents base by base: $x^{8-3} = x^5$ and $y^{4-1} = y^3$, so x^5y^3. So the final answer is x^5y^3.

8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is A power on a quotient reaches top and bottom: $\frac{x^3}{y^3}$. So the final answer is $\frac{x^3}{y^3}$.

9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Divide the coefficients ($15 \div 5 = 3$) and subtract exponents ($6 - 4 = 2$): $3a^2$. So the final answer is $3a^2$.

10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the exponents: $12 - 7 = 5$, so b^5. So the final answer is b^5.

11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The variables cancel completely ($m^{9-9} = m^0 = 1$), leaving just $20 \div 4 = 5$. So the final answer is 5.

12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract within each base: $p^{5-2} = p^3$ and $q^{8-3} = q^5$, giving p^3q^5. So the final answer is p^3q^5.

13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the exponents: $10 - 4 = 6$, so x^6. So the final answer is x^6.

14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Same base 6, subtract: $9 - 6 = 3$, so 6^3. So the final answer is 6^3.

15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Length is area divided by width: $\frac{x^9}{x^4} = x^5$. So the final answer is x^5.

16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Split the grains evenly among the bags: $\frac{10^8}{10^2} = 10^6$ per bag. So the final answer is 10^6.

17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Height is volume over base area: $\frac{24y^7}{6y^3} = 4y^4$. So the final answer is $4y^4$.

18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is A quantity divided by itself is 1, since $a^{6-6} = a^0 = 1$. So the final answer is 1.

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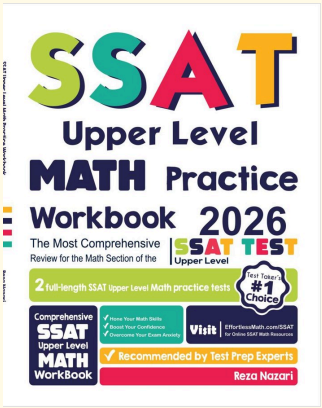

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