

Division Property of Exponents

Name: _____

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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. $\frac{x^6}{x^2}$

8. $\left(\frac{x}{y}\right)^3$

2. $\frac{y^9}{y^5}$

9. $\frac{15a^6}{5a^4}$

3. $\frac{2^8}{2^3}$

10. $\frac{b^{12}}{b^7}$

4. $\frac{a^{10}}{a}$

11. $\frac{20m^9}{4m^9}$

5. $\frac{m^5}{m^5}$

12. $\frac{p^5q^8}{p^2q^3}$

6. $\frac{12x^7}{4x^2}$

13. $\frac{x^{10}}{x^4}$

7. $\frac{x^8y^4}{x^3y}$

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 .

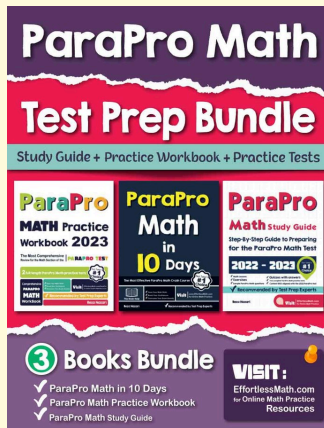
17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Height is volume over base area: $\frac{24y^7}{6y^3} = 4y^4$. So the final answer is $4y^4$.

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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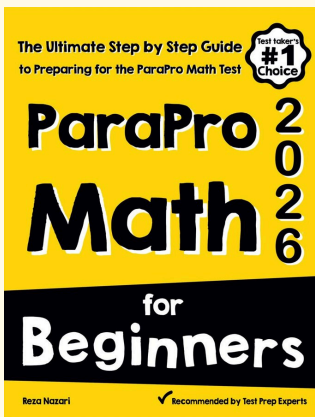
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