

Multiplication Property of Exponents

Name: _____ Date: _____ Score: _____ / 18

Quick Review and Helpful Hints

When you multiply powers with the *same base*, keep the base and *add* the exponents: $x^a \cdot x^b = x^{a+b}$. When a power is raised to another power, *multiply* the exponents: $(x^a)^b = x^{ab}$. When a product is raised to a power, the power goes to each factor: $(xy)^a = x^a y^a$.

▶ **Example:** Simplify $x^3 \cdot x^5$. **Work:** The base x is the same in both factors, so keep the base and add the exponents: $3 + 5 = 8$. ★ **Answer:** x^8

Practice Problems

Simplify each expression using the properties of exponents.

- | | | | |
|--------------------|-------|-------------------------------|-------|
| 1. $x^2 \cdot x^4$ | _____ | 8. $(3^2)^3$ | _____ |
| 2. $y^5 \cdot y^3$ | _____ | 9. $(xy)^3$ | _____ |
| 3. $2^3 \cdot 2^2$ | _____ | 10. $x^2 \cdot x^3 \cdot x^4$ | _____ |
| 4. $(x^3)^4$ | _____ | 11. $(2x)^4$ | _____ |
| 5. $a^6 \cdot a$ | _____ | 12. $b^7 \cdot b^2$ | _____ |
| 6. $(y^2)^5$ | _____ | 13. $(a^3b)^2$ | _____ |
| 7. $m^4 \cdot m^4$ | _____ | 14. $p^5 \cdot p^0$ | _____ |

Word Problems

15. A square garden has a side length of x^4 feet. Its area is side times side. Write the area as a single power of x . _____
16. A cube has edges of length y^2 inches. Its volume is the edge cubed, $(y^2)^3$. Write the volume as a single power of y . _____
17. A bacteria count can be written as $2^5 \cdot 2^3$. Write this as a single power of 2. _____
18. A rectangle has length x^5 and width x^2 . Write its area as a single power of x . _____



Answer Keys

1. x^6

2. y^8

3. 2^5

4. x^{12}

5. a^7

6. y^{10}

7. m^8

8. 3^6

9. x^3y^3

10. x^9

11. $16x^4$

12. b^9

13. a^6b^2

14. p^5

15. $x^8 \text{ ft}^2$

16. $y^6 \text{ in}^3$

17. 2^8

18. x^7

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 Multiplying powers of the same base just counts factors of x : two plus four makes six. Add the exponents to get x^6 . So the final answer is x^6 .

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 Same base, so add the exponents: $5 + 3 = 8$, giving y^8 . So the final answer is y^8 .

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 add: $3 + 2 = 5$. The answer 2^5 equals 32 if you want a number. 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 A power raised to a power multiplies the exponents: $3 \times 4 = 12$, so x^{12} – it's x^3 used as a factor four times. So the final answer is x^{12} .

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 A lone a means a^1 , so add: $6 + 1 = 7$, giving a^7 . So the final answer is a^7 .

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 Multiply the exponents for a power of a power: $2 \times 5 = 10$, so y^{10} . So the final answer is y^{10} .

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 Same base, add the exponents: $4 + 4 = 8$, giving m^8 . So the final answer is m^8 .

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 Multiply the exponents: $2 \times 3 = 6$, so 3^6 . So the final answer is 3^6 .

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 A power on a product reaches every factor inside, so $(xy)^3 = x^3y^3$. So the final answer is x^3y^3 .

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 Add all three exponents at once: $2 + 3 + 4 = 9$, giving x^9 . So the final answer is x^9 .

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 power applies to both the 2 and the x : $2^4 = 16$ and x^4 , so $16x^4$. So the final answer is $16x^4$.

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 Same base, so add: $7 + 2 = 9$, giving b^9 . So the final answer is b^9 .

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 Send the outer power to each factor: $(a^3)^2 = a^6$ and b^2 , so a^6b^2 . So the final answer is a^6b^2 .

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 Anything to the zero power is 1, so $p^0 = 1$ and $p^5 \cdot 1 = p^5$. So the final answer is p^5 .

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 Area is side times side: $x^4 \cdot x^4 = x^8$ square feet (add the exponents). So the final answer is $x^8 \text{ ft}^2$.

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 Volume is the edge cubed: $(y^2)^3 = y^6$ cubic inches (multiply the exponents). So the final answer is $y^6 \text{ in}^3$.

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 Same base, so add the exponents: $2^5 \cdot 2^3 = 2^8$. So the final answer is 2^8 .

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 Area is length times width: $x^5 \cdot x^2 = x^7$. So the final answer is x^7 .



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