

# Multiplication Property of Exponents

Name: \_\_\_\_\_

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## 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.  $x^2 \cdot x^4$

\_\_\_\_\_

2.  $y^5 \cdot y^3$

\_\_\_\_\_

3.  $2^3 \cdot 2^2$

\_\_\_\_\_

4.  $(x^3)^4$

\_\_\_\_\_

5.  $a^6 \cdot a$

\_\_\_\_\_

6.  $(y^2)^5$

\_\_\_\_\_

7.  $m^4 \cdot m^4$

\_\_\_\_\_

8.  $(3^2)^3$

\_\_\_\_\_

9.  $(xy)^3$

\_\_\_\_\_

10.  $x^2 \cdot x^3 \cdot x^4$

\_\_\_\_\_

11.  $(2x)^4$

\_\_\_\_\_

12.  $b^7 \cdot b^2$

\_\_\_\_\_

13.  $(a^3b)^2$

\_\_\_\_\_

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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