

Properties of Exponents

Name: _____

Date: _____

Score: _____ / 26

Quick Review

The **exponent rules**: (1) **Product rule**: $x^a \cdot x^b = x^{a+b}$ (same base \rightarrow add exponents). (2) **Quotient rule**: $\frac{x^a}{x^b} = x^{a-b}$ (same base \rightarrow subtract). (3) **Power rule**: $(x^a)^b = x^{ab}$ (multiply). (4) **Zero exponent**: $x^0 = 1$ (for any $x \neq 0$). (5) **Negative exponent**: $x^{-a} = \frac{1}{x^a}$ (flip to denominator and negate). (6) **Power of product**: $(xy)^a = x^a y^a$. (7) **Power of quotient**: $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$.
Memorize these and most simplification problems become straightforward substitutions.

PRACTICE

Simplify each expression.

1. $x^3 \cdot x^4$ _____

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

3. $\frac{x^8}{x^3}$ _____

4. $(x^2)^4$ _____

5. $(2x)^3$ _____

6. x^{-2} _____

7. x^0 _____

8. $\frac{x^4 \cdot x^2}{x^3}$ _____

9. $(3x^2)^2$ _____

10. $\left(\frac{x}{2}\right)^3$ _____

11. $x^5 \cdot x^{-2}$ _____

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

13. $(xy^3)^2$ _____

14. $(x^3)^{-1}$ _____

15. $\frac{6x^5}{2x^2}$ _____

16. $(2x^3)^4$ _____

17. $x^3 \cdot x^{-5}$ _____

18. $\left(\frac{2x^2}{3}\right)^2$ _____

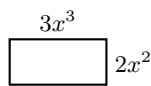
19. $\frac{x^{a+1}}{x^{a-1}}$ _____

20. $(-3x^2)^3$ _____

VISUAL PRACTICE

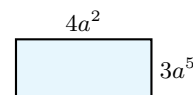
Use the graph, table, chart, or diagram to answer the question.

21. Find the area of the rectangle.



Answer: _____

22. Find the area of the rectangle.



Answer: _____

Word Problems

23. A bacteria population doubles every hour. If it starts at x , write the population after 5 hours. _____

24. A design file is compressed to $\left(\frac{1}{2}\right)^3$ of its original size, then compressed again to $\left(\frac{1}{2}\right)^2$ of that result. What fraction of the original file remains? _____

25. A storage box has side lengths $2x$ inches, $3x$ inches, and x^2 inches. Write a simplified expression for its volume. _____

26. A sensor records one reading every $\frac{1}{1000}$ second. Write the time between readings as a power of 10 with a negative exponent. _____



Scan Me

Answer Keys

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. x^7 2. y^7 3. x^5 4. x^8 5. $8x^3$ 6. $\frac{1}{x^2}$ 7. 1 8. x^3 9. $9x^4$ 10. $\frac{x^3}{8}$ 11. x^3 12. $x^{-4} = \frac{1}{x^4}$ 13. x^2y^6 | <ol style="list-style-type: none"> 14. $\frac{1}{x^3}$ 15. $3x^3$ 16. $16x^{12}$ 17. $\frac{1}{x^2}$ 18. $\frac{4x^4}{9}$ 19. x^2 20. $-27x^6$ 21. $6x^5$ 22. $12a^7$ 23. $32x$ 24. $\frac{1}{32}$ 25. $6x^4$ 26. 10^{-3} second |
|--|--|

Step-by-Step Tutor Notes

1. Work one inverse operation at a time and keep both sides balanced. Add exponents: $3 + 4 = 7$. After simplifying, the answer is x^7 .
2. This is a good place to slow down, check the notation, and simplify cleanly. $2 + 5 = 7$. So the answer is y^7 .
3. Keep the order of operations in view, then simplify without skipping the sign check. Subtract: $8 - 3 = 5$. After simplifying, the answer is x^5 .
4. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Multiply: $2 \cdot 4 = 8$. After simplifying, the answer is x^8 .
5. Start with the definition the problem is testing, then apply it directly. $(2)^3 \cdot x^3 = 8x^3$. So the answer is $8x^3$.
6. Start with the definition the problem is testing, then apply it directly. Negative exponent flips to denominator. So the answer is $\frac{1}{x^2}$.
7. Use the structure of the expression to find the important point, then check that it fits the context. Anything (nonzero) to the 0 is 1. That leads to 1.
8. Work one inverse operation at a time and keep both sides balanced. Combine top: x^6 . Divide: $x^{6-3} = x^3$. After simplifying, the answer is x^3 .
9. Take it one clear step at a time and keep the original question in mind. $9 \cdot x^4$. So the answer is $9x^4$.
10. Start with the definition the problem is testing, then apply it directly. $\frac{x^3}{2^3} = \frac{x^3}{8}$. So the answer is $\frac{x^3}{8}$.
11. Take it one clear step at a time and keep the original question in mind. $5 + (-2) = 3$. So the answer is x^3 .
12. This is a good place to slow down, check the notation, and simplify cleanly. $2 - 6 = -4$. Or write as $\frac{1}{x^4}$. So the answer is $x^{-4} = \frac{1}{x^4}$.
13. Use the structure of the expression to find the important point, then check that it fits the context. Each factor gets the exponent. That leads to x^2y^6 .
14. Work one inverse operation at a time and keep both sides balanced. Multiply: $3 \cdot (-1) = -3$. After simplifying, the answer is $\frac{1}{x^3}$.
15. Use the clue in the question first, then let the arithmetic finish the job. Numbers: $6/2 = 3$. Variables: $x^{5-2} = x^3$. So the answer is $3x^3$.
16. Take it one clear step at a time and keep the original question in mind. $2^4 = 16$ and $x^{3 \cdot 4} = x^{12}$. So the answer is $16x^{12}$.
17. Focus on the main idea of the problem, then simplify carefully. $3 + (-5) = -2$, so $\frac{1}{x^2}$. So the answer is $\frac{1}{x^2}$.
18. This is a good place to slow down, check the notation, and simplify cleanly. Square top and bottom. So the answer is $\frac{4x^4}{9}$.
19. This is a good place to slow down, check the notation, and simplify cleanly. $(a + 1) - (a - 1) = 2$. So the answer is x^2 .
20. Start with the definition the problem is testing, then apply it directly. $(-3)^3 = -27$, x^6 . So the answer is $-27x^6$.
21. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Multiply coefficients and add exponents: $(3x^3)(2x^2) = 6x^5$. After simplifying, the answer is $6x^5$.
22. Work one inverse operation at a time and keep both sides balanced. Multiply the coefficients and add exponents: $4a^2 \cdot 3a^5 = 12a^7$. After simplifying, the answer is $12a^7$.
23. Set up the model from the story, then calculate carefully. Doubling 5 times: $x \cdot 2^5 = 32x$.
24. Both factors have the same base, so add the exponents: $(\frac{1}{2})^3 (\frac{1}{2})^2 = (\frac{1}{2})^5 = \frac{1}{32}$.
25. Multiply: $2 \cdot 3 \cdot 1 = 6$ for the coefficients. For variables: $x \cdot x \cdot x^2 = x^4$. Volume = $6x^4$ cubic inches.
26. $1000 = 10^3$, so $\frac{1}{1000} = 10^{-3}$. The negative exponent is a compact way to show a small fraction of a second.



Scan Me

Want a Full Algebra 1 Textbook? Try Our District of Columbia DC CAPE Made Simple Book!



District of Columbia DC CAPE Algebra I Made Ridiculously Simple

The friendly, step-by-step Algebra 1 textbook
Plain-English explanations, guided practice, and review support.



Full Lessons Inside

Concepts
Practice
Mastery

Important: All our test books contain **unique, completely different tests** from each other! Each book offers fresh practice questions—no repeats!

5 Practice Tests

- ✓ 5 complete practice tests with detailed explanations
- ✓ Perfect foundation for DC CAPE test preparation
- ✓ Builds confidence and test-taking skills
- ✓ High-quality questions aligned with state standards

Start your practice journey!

6 Practice Tests

- ✓ 6 complete practice tests with detailed explanations
- ✓ **Unique tests**—different from the 5 tests book
- ✓ Perfect for more practice after mastering 5 tests
- ✓ Builds even more confidence and test-taking skills
- ✓ Same high-quality questions aligned with standards

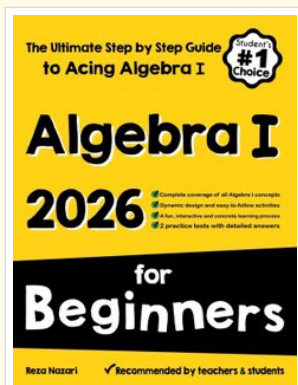
Take your practice to the next level!

7 Practice Tests

- ✓ 7 complete practice tests for maximum preparation
- ✓ **Unique tests**—different from 5 and 6 tests books
- ✓ The most comprehensive practice for Algebra 1
- ✓ Ideal for students aiming for top scores
- ✓ Extensive practice builds mastery and confidence

Go all the way with comprehensive practice!

❑ STUDENT FAVORITE • Master Algebra I From the Ground Up ❑



Algebra I for Beginners

Written by a top math teacher & aligned with national and state Algebra I courses. From linear equations to graphing quadratics — explained the easy way.

- ✓ **Complete coverage** of every Algebra I concept — perfect companion to these worksheets
- ✓ **Step-by-step explanations** with worked examples on every topic
- ✓ **QR codes in every chapter** for free video lessons & bonus practice
- ✓ **2 full-length practice tests** with detailed answer keys

- ✓ 100% Guaranteed
- ✓ Lifetime Support
- ✓ Trusted by Teachers

Start Your Algebra Journey Today! →

★ STUDENT'S #1 CHOICE ★

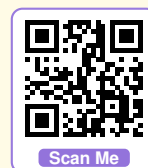
Teacher-recommended • 12,000+ Happy Students

↓ PDF EDITION



Instant download • any device

❑ PAPERBACK



Paperback on Amazon

Hold it in your hands

Pair these free worksheets with *Algebra I for Beginners* and you have a complete self-paced course — concept lessons, daily practice, and full exam-style reviews, all in one path. →

EffortlessMath.com/product/algebra-i-for-beginners