Class 8 Exponents and Powers Worksheet

By Thinking Juggernaut

Class: 8th Standard **Subject:** Mathematics **Total Questions:** 24 **Total Marks:** 24

Understanding Exponents and Powers

What are Exponents?

An exponent (or power) tells us how many times to multiply a number by itself. In a^n, 'a' is called the base and 'n' is called the exponent or power.

For example: $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Laws of Exponents:

Law 1: Product of Powers

$a^m \times a^n = a^{m+n}$

Example: $2^3 \times 2^4 = 2^7 = 128$

Law 2: Quotient of Powers

$a^m \div a^n = a^{m-n}$ (where $a \neq 0$)

Example: $5^6 \div 5^2 = 5^4 = 625$

Law 3: Power of a Power

$(a^m)^n = a^{m \times n}$

Example: $(3^2)^4 = 3^8$

Law 4: Power of a Product

$(ab)^n = a^n \times b^n$

Example: $(2 \times 3)^2 = 2^2 \times 3^2 = 4 \times 9 = 36$

Law 5: Power of a Quotient

$(a/b)^n = a^n / b^n$ (where $b \neq 0$)

Example: $(4/2)^3 = 4^3 / 2^3 = 64/8 = 8$

Law 6: Zero Exponent

$a^0 = 1$ (where $a \neq 0$)

Example: $100^0 = 1$

Law 7: Negative Exponent

$a^{-n} = 1/a^n$ (where $a \neq 0$)

Example: $2^{-3} = 1/2^3 = 1/8$

Standard Form (Scientific Notation):

Any number can be expressed as $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

- Example: $5,300 = 5.3 \times 10^3$
- Example: $0.0042 = 4.2 \times 10^{-3}$

Sample Problem with Visual Explanation

Problem: Simplify: $(2^3)^4 \times 2^5 \div 2^{10}$

Step-by-Step Solution

Step 1: Apply Power of a Power Law
$(2^3)^4 = 2^{3\times4} = 2^{12}$

Step 2: Rewrite the Expression
$2^{12} \times 2^5 \div 2^{10}$

Step 3: Apply Product Law (add exponents when multiplying)
$2^{12+5} \div 2^{10} = 2^{17} \div 2^{10}$

Step 4: Apply Quotient Law (subtract exponents)
$2^{17-10} = 2^7 = 128$

Key Points to Remember:

• When bases are same and we multiply: ADD the exponents

- When bases are same and we divide: SUBTRACT the exponents
- Power of a power: MULTIPLY the exponents
- Always simplify step by step - don't try to do everything at once!
- Verification: $2^7 = 2×2×2×2×2×2×2 = 128$ ✓

Part A: Warm-up Practice

☆ Easy Level - 8 Questions

Q1. Evaluate: 3^4

Q2. Simplify: $5^3 × 5^2$

Q3. What is the value of 7^0?

Q4. Express 2^{-3} as a positive power.

Q5. Fill in the blank: $10^6 ÷ 10^2 = 10$——

Q6. Simplify: $(2^3)^2$

Q7. True or False: Any number (except zero) raised to the power 0 equals 1.

Q8. Express 1,000 in exponential form with base 10.

Part B: Practice Zone

☆☆ Medium Level - 10 Questions

Q9. Simplify: $(3^4 \times 3^5) \div 3^6$

Q10. Express 0.000025 in standard form.

Q11. Evaluate: $(-2)^4$

Q12. Match the expressions with their simplified forms:

Column A	Column B
(i) $2^5 \times 2^3$	(a) 2^6
(ii) $(2^3)^2$	(b) 2^8
(iii) $2^{10} \div 2^4$	(c) 2^{15}
(iv) $2^5 \times 2^{10}$	(d) 2^2

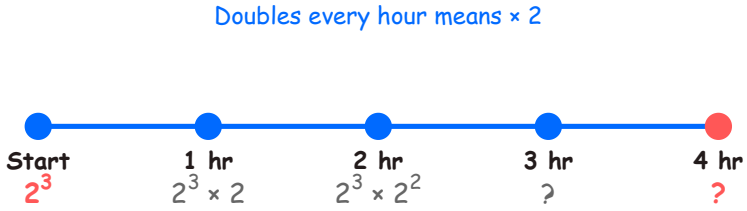
Write your answers: (i) → ____, (ii) → ____, (iii) → ____, (iv) → ____

Q13. **Word Problem:** The population of a city is 2.5 million. Express this in standard form.

Q14. Simplify and express with positive exponents: $5^{-2} \times 5^5$

Q15. Find the value of x: $2^x = 128$

Q16. **Picture-based Problem:** A bacteria culture doubles every hour. If there are 2^3 bacteria initially, how many will there be after 4 hours?



THINKING JUGGERNAUT

Q17. Simplify: $(4^2)^3 \times 4^{-5}$

Q18. **Real-life Problem:** The mass of Earth is approximately 5,970,000,000,000,000,000,000,000 kg. Express this in standard form.

Part C: Challenge Yourself!

☆☆☆ Hard Level - 6 Questions

Q19. Simplify: $[(2^3)^2 \times 2^5] \div [(2^4)^3]$

Q20. If $3^{x+2} = 243$, find the value of x.

Q21. Simplify and express with positive exponents: $(2^{-1} + 3^{-1})^{-1}$

Q22. **Complex Problem:** The speed of light is 3×10^8 m/s. The distance from Earth to the Sun is 1.5×10^{11} m. How long does light take to reach Earth from the Sun? Express your answer in standard form. (Time = Distance ÷ Speed)

Q23. Prove that: $(a^m)^n \div (a^n)^m = 1$ for any non-zero value of a.

Q24. **Challenge Problem:** If $2^x = 3^y = 6^{-z}$, prove that: $1/x + 1/y + 1/z = 0$
(Hint: Express 6 as 2 × 3)

🔑 Answer Key

Part A: Warm-up Practice (Easy)

Q1. $3^4 = 3 \times 3 \times 3 \times 3 = 81$

Q2. $5^3 \times 5^2 = 5^{3+2} = 5^5 = 3{,}125$

Q3. $7^0 = 1$ *(Any non-zero number raised to power 0 is 1)*

Q4. $2^{-3} = 1/2^3 = 1/8$

Q5. $10^6 \div 10^2 = 10^{6-2} = 10^4$

Q6. $(2^3)^2 = 2^{3\times2} = 2^6 = 64$

Q7. True

Q8. $1{,}000 = 10^3$

Part B: Practice Zone (Medium)

Q9. $(3^4 \times 3^5) \div 3^6 = 3^{4+5} \div 3^6 = 3^9 \div 3^6 = 3^{9-6} = 3^3 = 27$

Q10. $0.000025 = 2.5 \times 10^{-5}$

Q11. $(-2)^4 = (-2) \times (-2) \times (-2) \times (-2) = 16$ *(Even power makes it positive)*

Q12. (i) → (b), (ii) → (a), (iii) → (a), (iv) → (c)

Q13. 2.5 million = $2{,}500{,}000 = 2.5 \times 10^6$

Q14. $5^{-2} \times 5^5 = 5^{-2+5} = 5^3 = 125$

Q15. $2^x = 128 = 2^7$, therefore $x = 7$

Q16. After 4 hours: $2^3 \times 2^4 = 2^7 = 128$ bacteria

Q17. $(4^2)^3 \times 4^{-5} = 4^6 \times 4^{-5} = 4^{6-5} = 4^1 = 4$

Q18. 5,970,000,000,000,000,000,000,000 kg = 5.97×10^{24} kg

Part C: Challenge Questions (Hard)

Q19. $[(2^3)^2 \times 2^5] \div [(2^4)^3]$
$= [2^6 \times 2^5] \div 2^{12}$
$= 2^{11} \div 2^{12} = 2^{11-12} = 2^{-1} = 1/2$

Q20. $3^{x+2} = 243 = 3^5$
Therefore, $x + 2 = 5$, so $x = 3$

Q21. $(2^{-1} + 3^{-1})^{-1} = (1/2 + 1/3)^{-1} = (3/6 + 2/6)^{-1} = (5/6)^{-1} = 6/5$

Q22. Time = Distance ÷ Speed = $(1.5 \times 10^{11}) \div (3 \times 10^8)$
$= (1.5 \div 3) \times 10^{11-8} = 0.5 \times 10^3 = 5 \times 10^2$ seconds = 500 seconds

Q23. $(a^m)^n \div (a^n)^m = a^{mn} \div a^{nm} = a^{mn} \div a^{mn} = a^{mn-mn} = a^0 = 1$
Hence proved.

Q24. Let $2^x = 3^y = 6^{-z} = k$
Then: $2 = k^{1/x}$, $3 = k^{1/y}$, $6 = k^{-1/z}$
Since $6 = 2 \times 3$: $k^{-1/z} = k^{1/x} \times k^{1/y} = k^{1/x + 1/y}$
Comparing powers: $-1/z = 1/x + 1/y$
Therefore: $1/x + 1/y + 1/z = 0$ **Proved**

📊 Scoring Guide

Total Questions: 24 | Total Marks: 24

Score Range	Performance Level	What to Do Next
20-24	⭐⭐⭐ Excellent!	Outstanding! You've mastered exponents and powers. Move on to advanced topics like exponential equations, logarithms, and exponential growth/decay problems.
15-19	⭐⭐ Very Good!	Great work! Practice more problems with negative exponents and standard form. Focus on complex expressions with multiple operations.
10-14	⭐ Good Effort!	Keep practicing! Memorize all seven laws of exponents on flashcards. Practice 15 problems daily focusing on one law at a time.
0-9	Keep Trying!	Review the concept section carefully. Start with basic evaluation (2^3, 5^2), then learn one law at a time. Practice identifying which law to apply before solving.

📝 Tips for Improvement:

- **Create a law chart:** Write all 7 laws with examples on a single reference sheet
- **BODMAS matters:** In complex expressions, solve brackets first, then powers, then multiplication/division
- **Negative exponents:** Remember a^{-n} means "flip and make positive" = $1/a^n$
- **Standard form trick:** Count decimal moves - right moves give negative powers, left moves give positive powers
- **Same base rule:** You can only add/subtract exponents when bases are identical
- **Practice conversions:** Convert between exponential and standard form daily
- **Verify answers:** For small numbers, calculate the actual value to check your work

🎯 Common Mistakes to Avoid:

- ❌ Confusing 2^3 with 2×3 ($2^3 = 8$, not 6!)
- ❌ Adding exponents when multiplying different bases ($2^3 \times 3^2 \neq 6^5$)
- ❌ Thinking $(a + b)^2 = a^2 + b^2$ (this is wrong! Exponents don't distribute over addition)
- ❌ Forgetting that $(-2)^4 = 16$ but $-2^4 = -16$ (brackets matter!)
- ❌ Confusing power of a power with product of powers: $(a^m)^n = a^{m \times n}$ but $a^m \times a^n = a^{m+n}$
- ❌ Writing $0^0 = 1$ (this is undefined, not 1)
- ❌ In standard form, using values less than 1 or ≥ 10 for the coefficient (must be $1 \leq a < 10$)

- ❌ Forgetting to change the sign when converting negative exponents: $3^{-2} = 1/3^2 = 1/9$, not -1/9

✨ **Great Job Completing This Worksheet!** ✨

Keep practicing exponents and you'll master it in no time!

🔥 Download more worksheets like this
🌐 Visit: https://thinkingjuggernaut.in/

Thinking Juggernaut

NEP-aligned, hands-on experiential kits

NEP-2020 aligned hands-on kits and workbooks that help kids think independently, solve problems, and explore experiential learning.

Explore Kits

Founded by NIT & IIT Alumni

Thinking Juggernaut

NEP-aligned, hands-on experiential kits

Applied Maths Kit (Age 7+)

Applied Maths Kit (Age 10+)

Interdisciplinary STEM Kit (Age 7+)

Interdisciplinary STEM Kit (Age 10+)

Entrepreneurship Kit

Finance Literacy Kit

Chess Starter Kit

Explore Sanskrit Kit

Founded by IIT & NIT Alumni, Thinking Juggernaut is a NEP-2020 aligned experiential learning platform that builds 21st-century skills, connects subjects, and links classroom concepts to real-life challenges.

View All Kits Online →