Properties of Integer Exponents

Repair and Recover Exponents

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Match the rule to the operation. Multiply equal-base powers by adding exponents; raise a power to a power by multiplying exponents. Addition has no matching exponent rule: $3^2 + 3^2 = 18$, not 3^4. A negative exponent indicates a reciprocal. Reverse problems compare exponents only after writing both sides with the same suitable base, such as $2^{k+1} = 2^5$.

Worked example

Find k if $(4^k)^2 = 4^{-4}$.

1. The outer square multiplies exponents: $(4^k)^2 = 4^{2k}$. Equal powers of base 4 require $2k = -4$.

2. Solve $k = -2$. Substitution gives $(4^{-2})^2 = (\frac{1}{16})^2 = \frac{1}{256} = 4^{-4}$, verifying the negative integer exponent.

Answer: $k = -2$.

Practice Problems

Show your thinking.

1. Correct $2^3 \cdot 2^4 = 2^{12}$. Give the correct power and value.

2. Correct $(5^2)^3 = 5^5$. Give the correct power and value.

3. Find integer k if $3^k \cdot 3^4 = 3^1$.

4. Find integer n if $\frac{7^8}{7^n} = 7^3$.

5. A student writes $6^{-2} = -36$. Correct the value and explain its sign.

6. Find the missing integer m: $(2^m)^3 = 2^{-6}$.

7. Is $2^3 + 2^3 = 2^6$? Find the correct single power of 2.

8. Which is larger: 2^{-3} or 2^{-5}? Give exact fractions.

9. Assume $a \neq 0$. A student simplifies $\frac{a^2}{a^5}$ to a^3. Correct the expression.

10. Find positive integer base b if $b^{-2} = \frac{1}{49}$.

Answer Key

1. $2^7 = 128$.
2. $5^6 = 15625$.
3. $k = -3$.
4. $n = 5$.
5. $\frac{1}{36} > 0$.
6. $m = -2$.
7. No; $2^4 = 16$.
8. $2^{-3} = \frac{1}{8} > \frac{1}{32} = 2^{-5}$.
9. $\frac{1}{a^3}$.
10. $b = 7$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. These are two powers multiplied, not a power raised to a power. The factor counts add: $3 + 4 = 7$.

2. Thus $2^3 \cdot 2^4 = 2^7 = 128$. Checking $8 \cdot 16 = 128$ confirms the correction; multiplying the exponents would incorrectly give 4096.

Problem 2

1. Expand the outer cube: $(5^2)^3 = 5^2 \cdot 5^2 \cdot 5^2$. There are $2 + 2 + 2 = 6$ factors of 5.

2. The correct power is $5^{2 \cdot 3} = 5^6 = 15625$. Adding $2 + 3$ would describe a different operation, not this power of a power.

Problem 3

1. Combine powers with common base: $3^k \cdot 3^4 = 3^{k+4}$. Equal powers of base 3 require $k + 4 = 1$.

2. Subtract 4 to obtain $k = -3$. Checking $3^{-3} \cdot 3^4 = 3^1 = 3$ confirms the missing integer exponent.

Problem 4

1. The nonzero common base permits exponent subtraction: $\frac{7^8}{7^n} = 7^{8-n}$. Therefore the exponents must satisfy $8 - n = 3$.

2. Solve to get $n = 5$. Substitute back: $\frac{7^8}{7^5} = 7^{8-5} = 7^3$, exactly the required quotient.

Problem 5

1. The minus sign belongs to the exponent, not the base or result. By the reciprocal rule, $6^{-2} = \frac{1}{6^2}$.

2. Since $6^2 = 36$, the value is $\frac{1}{36}$, which is positive. A negative exponent changes the scale by reciprocation; it does not negate the power.

Problem 6

1. Apply the power-of-a-power identity: $(2^m)^3 = 2^{3m}$. Because the bases agree, solve the exponent equation $3m = -6$.

2. Dividing by 3 gives $m = -2$. Check $(2^{-2})^3 = (\frac{1}{4})^3 = \frac{1}{64} = 2^{-6}$, so the negative exponent is consistent.

Problem 7

1. Evaluate the sum directly: $2^3 + 2^3 = 8 + 8 = 16$. The product rule cannot be applied to a sum of powers.

2. Factor instead: $2^3 + 2^3 = 2(2^3) = 2^1 \cdot 2^3 = 2^4$. Since $2^6 = 64$, the proposed equality is false.

Problem 8

1. Rewrite the negative powers as reciprocals: $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$ and $2^{-5} = \frac{1}{2^5} = \frac{1}{32}$.

2. With equal positive numerators, the smaller positive denominator gives the larger fraction. Since $8 < 32$, $\frac{1}{8} > \frac{1}{32}$, so 2^{-3} is larger.

Problem 9

1. Subtract the denominator exponent from the numerator exponent: $\frac{a^2}{a^5} = a^{2-5} = a^{-3}$. The subtraction order matters.

2. Use the reciprocal identity to write $a^{-3} = \frac{1}{a^3}$. Cancellation leaves three factors in the denominator, not in the numerator, because $5 > 2$.

Problem 10

1. The reciprocal rule gives $\frac{1}{b^2} = \frac{1}{49}$. Since both denominators are positive and nonzero, $b^2 = 49$.

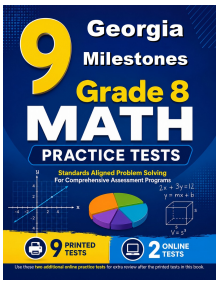
2. The positive integer solution is $b = 7$ because $7^2 = 49$. The negative value -7 would square correctly but is excluded by the requested positive base.

TESTINAR

Keep Building Grade 8 Math Skills

Choose the practice book matched to your state assessment and turn worksheet practice into a complete test-prep plan.

All Grade 8 books



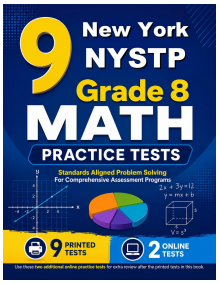
GEORGIA MILESTONES

9 Full-Length Math Practice Tests

Build Grade 8 accuracy, confidence, and test stamina with 9 printable practice tests.

Printable eBook • Instant PDF access

View eBook



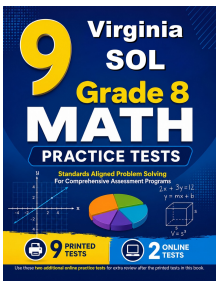
NEW YORK NYSTP

9 Full-Length Math Practice Tests

Build Grade 8 accuracy, confidence, and test stamina with 9 printable practice tests.

Printable eBook • Instant PDF access

View eBook



VIRGINIA SOL

9 Full-Length Math Practice Tests

Build Grade 8 accuracy, confidence, and test stamina with 9 printable practice tests.

Printable eBook • Instant PDF access

View eBook

Need a different state?
Testinar has Grade 8 math practice books for state assessments across the country.

TESTINAR.COM/GRADES/8