Laws of Exponents

Spot mistakes, reason, and work backward

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

QUICK REVIEW

For a nonzero base, $a^m a^n = a^{m+n}$, $a^m/a^n = a^{m-n}$, $(a^m)^n = a^{mn}$, and $a^0 = 1$. Examples: $6^4/6^2 = 6^2 = 36$ and $(5^2)^3 = 5^6$. These laws combine equal bases, not 2^m with 3^n.

Worked example

Use an exponent law to simplify $8^1 \cdot 8^2$ as one power, then evaluate.

1. The base stays 8; the exponent calculation is $1 + 2 = 3$.
2. The single power is $8^3 = 512$.
3. Numerical base powers: $8^1 = 8$ and $8^2 = 64$.
Answer: $8^3 = 512$.

Practice Problems

Show your thinking.

1. A student writes $2^4 \cdot 2^2 = 2^7$. Correct the exponent and check numerically. State the number of equal factors in the combined power.

2. A student writes $3^4 \div 3^2 = 3^3$. Correct the exponent and check numerically. Recover q in 3^q for this quotient.

3. A student writes $(2^2)^3 = 2^7$. Correct the exponent and check numerically. Explain why multiplying exponents, rather than adding them, counts the factors here.

4. A student writes $5^0 = 5^1$. Correct the exponent and check numerically.

5. A student writes $10^3 \div 10^1 = 10^3$. Correct the exponent and check numerically. Write the result in ordinary place value.

6. A student writes $3^2 \cdot 3^3 = 3^6$. Correct the exponent and check numerically. Compare the result with 3^2 by giving the exact multiplicative factor.

7. A student writes $2^5 \cdot 2^3 = 2^9$. Correct the exponent and check numerically.

8. A student writes $5^4 \div 5^2 = 5^3$. Correct the exponent and check numerically.

9. A student writes $(3^2)^2 = 3^5$. Correct the exponent and check numerically.

10. A student writes $7^0 = 7^1$. Correct the exponent and check numerically.

Answer Key

1. $2^6 = 64$. There are 6 factors of 2.
2. $3^2 = 9$. $q = 2$.
3. $2^6 = 64$. Three groups of two factors give six factors.
4. $5^0 = 1$.
5. $10^2 = 100$. 100.
6. $3^5 = 243$. Factor 27.
7. $2^8 = 256$.
8. $5^2 = 25$.
9. $3^4 = 81$.
10. $7^0 = 1$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The base stays 2; the exponent calculation is $4 + 2 = 6$.
2. The single power is $2^6 = 64$.
3. Check with numbers: $16 \times 4 = 64$. The claimed 2^7 gives 128 instead.
4. Exponent $4 + 2 = 6$ counts those factors.

Problem 2

1. The base stays 3; the exponent calculation is $4 - 2 = 2$.
2. The single power is $3^2 = 9$.
3. Check with numbers: $81 \div 9 = 9$. The claimed 3^3 gives 27 instead.
4. $q = 4 - 2 = 2$.

Problem 3

1. The outer 3 repeats the whole 2^2 factor three times: $(2^2)(2^2)(2^2)$. Each group contains two factors of 2.
2. The base stays 2; the exponent calculation is $2 \times 3 = 6$.
3. The single power is $2^6 = 64$.
4. Check with numbers: $4 \times 4 \times 4 = 64$. The claimed 2^7 gives 128 instead.

Problem 4

1. The base 5 is not zero, so $5^1/5^1 = 5/5 = 1$.
2. The same-base quotient law also writes it as $5^{1-1} = 5^0$.
3. Check with numbers: $5 \div 5 = 1$. The claimed 5^1 gives 5 instead.

Problem 5

1. The base stays 10; the exponent calculation is $3 - 1 = 2$.
2. The single power is $10^2 = 100$.
3. Check with numbers: $1000 \div 10 = 100$. The claimed 10^3 gives 1000 instead.
4. $10^2 = 10(10) = 100$.

Problem 6

1. The base stays 3; the exponent calculation is $2 + 3 = 5$.
2. The single power is $3^5 = 243$.
3. Check with numbers: $9 \times 27 = 243$. The claimed 3^6 gives 729 instead.
4. $3^5/3^2 = 3^3 = 27$.

Problem 7

1. The base stays 2; the exponent calculation is $5 + 3 = 8$.
2. The single power is $2^8 = 256$.
3. Check with numbers: $32 \times 8 = 256$. The claimed 2^9 gives 512 instead.

Problem 8

1. The base stays 5; the exponent calculation is $4 - 2 = 2$.
2. The single power is $5^2 = 25$.
3. Check with numbers: $625 \div 25 = 25$. The claimed 5^3 gives 125 instead.

Problem 9

1. The base stays 3; the exponent calculation is $2 \times 2 = 4$.
2. The single power is $3^4 = 81$.
3. Check with numbers: $9 \times 9 = 81$. The claimed 3^5 gives 243 instead.

Problem 10

1. The base 7 is not zero, so $7^1/7^1 = 7/7 = 1$.
2. The same-base quotient law also writes it as $7^{1-1} = 7^0$.
3. Check with numbers: $7 \div 7 = 1$. The claimed 7^1 gives 7 instead.

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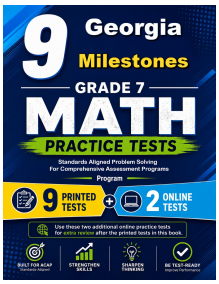

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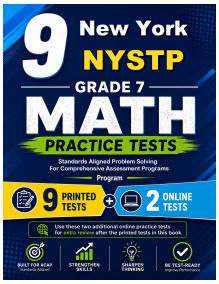

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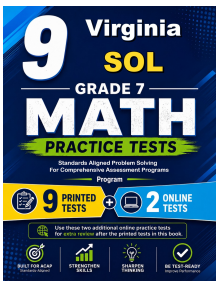

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