GENERAL

adding and subtracting exponents worksheet

Published: September 3, 2026 | Index ID: #-

Adding and Subtracting Exponents: A Complete Worksheet Guide

Mathematics often feels like a puzzle, especially when you encounter exponents. Whether you're a student tackling algebra for the first time or a teacher preparing lessons, mastering the art of adding and subtracting exponents is essential. This article offers a thorough walkthrough of the concepts, step by step instructions, and a ready to use worksheet that will help you practice and master the skill.

Why Exponent Operations Matter

Exponents are more than just a notation; they represent repeated multiplication. When you learn to combine exponents, you unlock a powerful tool for simplifying expressions, solving equations, and understanding the structure of numbers in both pure and applied mathematics. Adding and subtracting exponents is a foundational skill that appears in algebra, calculus, physics, and computer science.

Key Rules for Adding and Subtracting Exponents

Before diving into the worksheet, let's review the core rules that govern exponent operations. These rules are simple to remember once you see them in action.

1. Multiplication Rule: When multiplying like bases, add the exponents.
   am × an = am+n
2. Division Rule: When dividing like bases, subtract the exponents.
   am ÷ an = am" n
3. Exponent of an Exponent: Multiply the exponents.
   (am)n = am×n
4. Negative Exponents: A negative exponent indicates the reciprocal.
   a" n = 1/an
5. Zero Exponent: Any non zero base raised to the zero power equals one.
   a0 = 1

These rules form the backbone of exponent manipulation. When you combine them, you'll be able to solve complex algebraic expressions quickly and confidently.

Step by Step Example: Adding Exponents

Let's walk through an example to illustrate how to add exponents.

1. Expression: 34 × 32
2. Identify the base: Both terms share the base 3.
3. Apply the multiplication rule: Add the exponents:
   4 + 2 = 6
4. Result: 36 = 729.

Notice how the base stays the same while the exponent changes. The multiplication rule turns a product into a single power, simplifying the expression dramatically.

Step by Step Example: Subtracting Exponents

Now let’s see how to subtract exponents using the division rule.

1. Expression: 57 ÷ 53
2. Identify the base: Both terms share the base 5.
3. Apply the division rule: Subtract the exponents:
   7 " 3 = 4
4. Result: 54 = 625.

Subtracting exponents reduces the exponent value, often simplifying the expression to a smaller number or a fraction if the exponent becomes negative.

Common Mistakes to Avoid

When working with exponents, it’s easy to slip into errors. Keep these pitfalls in mind:

- Mixing up bases: The rules only apply when the bases are identical. 23 × 33 cannot be combined.
- Forgetting to subtract when dividing: 45 ÷ 42 equals 43, not 47.
- Ignoring negative exponents: 2" 3 equals 1/8, not 8.
- Applying the wrong rule to addition: You cannot add exponents directly; you can only add them when the bases are the same and you’re multiplying.

Practical Worksheet: Adding and Subtracting Exponents

Below is a comprehensive worksheet that covers a range of difficulty levels. Work through each section, and check your answers at the end. This exercise is ideal for self study, classroom practice, or tutoring sessions.

1. 23 × 24 = ?
2. 56 ÷ 52 = ?
3. 71 × 70 = ?
4. 92 ÷ 93 = ?

1. (32)3 = ?
2. (4" 1)2 = ?
3. 63 × (6" 2) = ?
4. (80)5 = ?

1. 25 × 2" 2 = ?
2. 34 ÷ 31 = ?
3. (52 ÷ 53) × 54 = ?
4. (73 × 71) ÷ 72 = ?

1. 2" 3 × 24 = ?
2. 40 × 45 = ?
3. (3" 2)3 = ?
4. 51 ÷ 5" 2 = ?

1. A computer’s memory grows by a factor of 2 each year. If the memory was 64 GB last year, what will it be after 3 years? Represent the growth using exponents.
2. A bacteria culture doubles every hour. If the initial count is 10,000, what is the count after 5 hours?
3. Calculate the ratio of 93 to 91 using exponent rules.
4. If a population decreases by 1/2 each decade, express the population after 4 decades starting from 1,000,000 using exponents.

Answer Key

Here are the correct answers for each section. Use this key to verify your work.

1. 27 = 128
2. 54 = 625
3. 71 × 70 = 71+0 = 71 = 7
4. 92" 3 = 9" 1 = 1/9

1. (32)3 = 32×3 = 36 = 729
2. (4" 1)2 = 4" 2 = 1/16
3. 63" 2 = 61 = 6
4. (80)5 = 15 = 1

1. 25" 2 = 23 = 8
2. 34" 1 = 33 = 27
3. (52" 3) × 54 = 5" 1 × 54 = 53 = 125
4. (73+1) ÷ 72 = 74" 2 = 72 = 49

1. 2" 3+4 = 21 = 2
2. 40+5 = 45 = 1024
3. (3" 2)3 = 3" 6 = 1/729
4. 51" (" 2) = 53 = 125

1. Memory after 3 years: 64 × 23 = 64 × 8 = 512 /GB.
2. Bacteria after 5 hours: 10,000 × 25 = 10,000 × 32 = 320,000.
3. Ratio 93 ÷ 91 = 92 = 81.
4. Population after 4 decades: 1,000,000 × (1/2)4 = 1,000,000 × 1/16 = 62,500.

Tips for Mastering Exponent Operations

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