GENERAL

practice 9 5 adding and subtracting rational expressions

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Introduction

Rational expressions—fractions whose numerators and denominators are polynomials—are a staple of algebra, especially in middle and high school curricula. Whether you're a student tackling a 9th grade worksheet or a teacher preparing practice material, mastering the art of adding and subtracting these expressions is essential. This article provides a thorough, step by step guide, complete with clear examples, common pitfalls, and a generous set of practice problems designed specifically for 9th grade students. By the end, you'll feel confident handling any addition or subtraction challenge that comes your way.

Understanding Rational Expressions

What Are Rational Expressions?

A rational expression is any algebraic fraction where both the numerator and the denominator are polynomials. For instance, $(x^2 – 4)/(x + 2)$ is a rational expression because the numerator $x^2 – 4$ and the denominator $x + 2$ are both polynomials.

Why They Matter in Algebra

Rational expressions appear in numerous contexts: simplifying complex fractions, solving equations, modeling real world scenarios, and even in calculus when dealing with limits and integrals. A solid grasp of adding and subtracting them forms the foundation for more advanced topics.

Key Concepts for Adding and Subtracting Rational Expressions

Finding the Least Common Denominator (LCD)

Just as with ordinary fractions, the first step is to identify a common denominator that works for all terms. The **Least Common Denominator (LCD)**is the smallest polynomial that can be evenly divided by each original denominator. Factor each denominator completely, then take the highest power of each distinct factor.

Rewriting with the LCD

Once the LCD is known, rewrite each rational expression so that its denominator matches the LCD. This often involves multiplying the numerator and denominator by the missing factor.

Combining Like Terms

After rewriting, the numerators can be added or subtracted directly, just as you would with simple fractions. Combine like terms within the numerators if necessary.

Simplifying the Result

The final fraction may be reducible. Factor the numerator and denominator, cancel common factors, and simplify any remaining expression.

Step by Step Guide to Adding Rational Expressions

Example 1

Compute $(x + 3)/(x^2 – 1) + (2)/(x + 1)$.

1. Factor denominators: $x^2 – 1 = (x – 1)(x + 1)$.
2. LCD: $(x – 1)(x + 1)$.
3. Rewrite each term:

   The first fraction already has the LCD.
4. The second fraction needs to be multiplied by $(x – 1)/(x – 1)$:
   $(2)(x – 1)/[(x + 1)(x – 1)] = 2(x – 1)/[(x – 1)(x + 1)]$.

Example 2

Compute $(2x)/(x^2 – 4) + (x – 1)/(x^2 – 5x + 6)$.

1. Factor denominators:

   $x^2 – 4 = (x – 2)(x + 2)$.
2. $x^2 – 5x + 6 = (x – 2)(x – 3)$.

- The first fraction: multiply by $(x – 3)/(x – 3)$ to get $2x(x – 3)/[(x – 2)(x + 2)(x – 3)]$.
- The second fraction: multiply by $(x + 2)/(x + 2)$ to get $(x – 1)(x + 2)/[(x – 2)(x + 2)(x – 3)]$.

Step by Step Guide to Subtracting Rational Expressions

Example 1

Compute $(5)/(x – 1) – (x)/(x^2 – 1)$.

1. Factor denominators:

   $x^2 – 1 = (x – 1)(x + 1)$.

- First fraction: multiply by $(x + 1)/(x + 1)$ to get $5(x + 1)/[(x – 1)(x + 1)]$.
- Second fraction already has the LCD.

Example 2

Compute $(x + 2)/(x^2 – 9) – (3)/(x – 3)$.

1. Factor denominators:

   $x^2 – 9 = (x – 3)(x + 3)$.

- First fraction already has the LCD.
- Second fraction: multiply by $(x + 3)/(x + 3)$ to get $3(x + 3)/[(x – 3)(x + 3)]$.

Common Mistakes to Avoid

- Forgetting to factor completely: The LCD depends on fully factored denominators. Leaving a factor un factored can lead to an incorrect LCD.
- Incorrectly applying the LCD: When rewriting, ensure the numerator is multiplied by the same factor that the denominator was multiplied by.
- Skipping simplification: After combining, always check if the fraction can be simplified further.
- Overlooking domain restrictions: Rational expressions are undefined where the denominator equals zero. Always state the restrictions in your final answer.

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