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Adding and Subtracting Rational Expressions

Unit 11 Lesson 4

Adding and Subtracting Rational Expressions

Students will be able to:

Simplify and perform addition and subtraction of rational expressions

Key Vocabulary:

- Fraction
- Least common denominator
- Similar Fractions
- Dissimilar Fractions
- Addition
- Subtraction

Adding and Subtracting Rational Expressions

Addition of fraction depends on the kinds of denominator the fraction have.

1. To add two fractions with the same denominator, use

$$\frac{a}{c} + \frac{b}{c} = \frac{a+b}{c}$$

2. To add two fraction with different denominators, use

$$\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$$

Least Common Denominator

The **least common denominator**, or simply LCD, of a set fraction is the least common multiple of the denominators of the given fractions.

Adding and Subtracting Rational Expressions

Sample Problem 1: Add or subtract the following rational expressions with the same denominator.

$$1. \frac{2x-1}{x^2} + \frac{4x+1}{x^2}$$

$$2. \frac{5}{24x} - \frac{7}{24x}$$

$$3. \frac{5x+7}{2x+2} - \frac{3x-1}{2x+2}$$

$$4. \frac{3x+17}{x+5} + \frac{x+7}{x+5}$$

Adding and Subtracting Rational Expressions

Sample Problem 1: Add or subtract the following rational expressions with the same denominator.

1. $\frac{2x-1}{x^2} + \frac{4x+1}{x^2}$

Solution:

$$\frac{2x-1}{x^2} + \frac{4x+1}{x^2} = \frac{2x-1+4x+1}{x^2} = \frac{6x}{x^2} = \frac{6}{x}$$

Adding and Subtracting Rational Expressions

Sample Problem 1: Add or subtract the following rational expressions with the same denominator.

$$2. \quad \frac{5}{24x} - \frac{7}{24x}$$

Solution:

$$\frac{5}{24x} - \frac{7}{24x} = \frac{5-7}{24x} = -\frac{2}{24x} = -\frac{1}{12x}$$

Adding and Subtracting Rational Expressions

Sample Problem 1: Add or subtract the following rational expressions with the same denominator.

$$3. \frac{5x+7}{2x+2} - \frac{3x-1}{2x+2}$$

Solution:

$$\begin{aligned} \frac{5x+7}{2x+2} - \frac{3x-1}{2x+2} &= \frac{(5x+7) - (3x-1)}{2x+2} = \frac{5x+7-3x+1}{2x+2} = \frac{2x+8}{2x+2} \\ &= \frac{\cancel{2}(x+4)}{\cancel{2}(x+1)} = \frac{x+4}{x+1} \end{aligned}$$

Adding and Subtracting Rational Expressions

Sample Problem 1: Add or subtract the following rational expressions with the same denominator.

$$4. \quad \frac{3x+17}{x+5} + \frac{x+7}{x+5}$$

Solution:

$$\frac{3x+17}{x+5} + \frac{x+7}{x+5} = \frac{3x+17+x+7}{x+5} = \frac{4x+24}{x+5}$$

Adding and Subtracting Rational Expressions

Sample Problem 2: Add or subtract the rational expressions with different denominator.

$$1. \frac{7}{6xy^2} + \frac{2}{15x^2y}$$

$$2. \frac{5}{v+4} - \frac{4}{v-5}$$

$$3. \frac{3y}{y+1} + \frac{2y}{y-1}$$

$$4. \frac{3x}{x-3} - \frac{x+4}{x+2}$$

Adding and Subtracting Rational Expressions

Sample Problem 2: Add or subtract the rational expressions with different denominator.

$$5. \frac{7}{6xy^2} + \frac{2}{15x^2y}$$

Solution:

$$\text{LCD: } 30x^2y^2$$

$$\frac{7}{6xy^2} + \frac{2}{15x^2y} = \frac{7(5x) + 2(2y)}{30x^2y^2} = \frac{35x + 4y}{30x^2y^2}$$

Adding and Subtracting Rational Expressions

Sample Problem 2: Add or subtract the rational expressions with different denominator.

$$6. \frac{5}{v+4} - \frac{4}{v-5}$$

Solution:

$$\text{LCD: } (v+4)(v-5) = v^2 - v - 20$$

$$\frac{5}{v+4} - \frac{4}{v-5} = \frac{5(v-5) - 4(v+4)}{v^2 - v - 20} = \frac{5v - 25 - 4v - 16}{v^2 - v - 20} = \frac{v - 41}{v^2 - v - 20}$$

Adding and Subtracting Rational Expressions

Sample Problem 2: Add or subtract the rational expressions with different denominator.

$$7. \frac{3y}{y+1} + \frac{2y}{y-1}$$

Solution:

$$\text{LCD: } (y+1)(y-1) = y^2 - 1$$

$$\frac{3y}{y+1} + \frac{2y}{y-1} = \frac{3y(y-1) + 2y(y+1)}{y^2 - 1} = \frac{3y^2 - 3y + 2y^2 + 2y}{y^2 - 1}$$

$$= \frac{5y^2 - y}{y^2 - 1}$$

Adding and Subtracting Rational Expressions

Sample Problem 2: Add or subtract the rational expressions with different denominator.

$$8. \frac{3x}{x-3} - \frac{x+4}{x+2}$$

Solution:

$$\text{LCD: } (x-3)(x+2) = x^2 - x - 6$$

$$\frac{3x}{x-3} - \frac{x+4}{x+2} = \frac{3x(x+2) - (x+4)(x-3)}{x^2 - x - 6} = \frac{3x^2 + 6x - x^2 - x + 12}{x^2 - x - 6}$$

$$= \frac{2x^2 + 5x + 12}{x^2 - x - 6}$$