

NOTES: ADD/SUBTR RATIONAL EXPRESSIONS

DAY 2

Textbook Chapter 8.5

OBJECTIVE: Today you will learn how to add and subtract rational expressions!

ADDING AND SUBTRACTING WITH LIKE DENOMINATORS

$$\frac{1}{7} + \frac{13}{7} = \frac{14}{7} = 2$$

$$\frac{2}{5} - \frac{8}{5} = \frac{-6}{5}$$

$$\frac{12}{5x} - \frac{2}{5x} = \frac{12-2}{5x} = \frac{10}{5x} = \frac{2}{x}$$

$$\frac{3x}{2x+5} + \frac{1}{2x+5} = \frac{3x+1}{2x+5}$$

$$\frac{2x^2}{x^2+1} + \frac{2}{x^2+1} = \frac{2x^2+2}{x^2+1} = \frac{2(x^2+1)}{(x^2+1)} = 2$$

$$\frac{4x}{x+3} - \frac{2x+7}{x+3} = \frac{4x - (2x+7)}{x+3} = \frac{4x - 2x - 7}{x+3} = \frac{2x-7}{x+3}$$

Find the Lowest Common Multiple (LCM)

Find the LCM by writing each factor to the **highest power** it occurs in **either** polynomial.

	Expression	Expression	LCM
1	2	10	10
2	$2x^3$	$6x^{10}$	$6x^{10}$
3	$(x+3)^5$	$(x+3)^2$	$(x+3)^5$
4	$2x(3x+2)$	$4x^5$	$4x^5(3x+2)$
5	$x^4(x-1)^3$	$x(x-1)(x+1)$	$x^4(x-1)^3(x+1)$
6	$9x^4(x-1)^3$	$18x(x-1)^4$	$18x^4(x-1)^4$

ADDING AND SUBTRACTING

Addition and subtraction of rational expressions is the same procedure as with fractions.

1. Find the LCD
2. Multiply to create an LCD
3. Add or Subtract numerators
4. Simplify if possible. (Factor and Cancel)

Properties

$$\text{Addition: } \frac{a}{c} + \frac{b}{d} = \frac{ad}{cd} + \frac{bc}{dc} = \frac{ad+bc}{cd}$$

$$\text{Subtraction: } \frac{a}{c} - \frac{b}{d} = \frac{ad}{cd} - \frac{bc}{dc} = \frac{ad-bc}{cd}$$

$$\frac{3}{4x} - \frac{1}{7} \quad \begin{array}{l} \cdot 7 \cdot \frac{3}{4x} - \frac{1 \cdot 4x}{7 \cdot 4x} \\ \frac{21}{28x} - \frac{4x}{28x} \end{array}$$

$$\frac{21-4x}{28x}$$

$$\text{LCD} = 28x$$

$$\frac{x}{x^2-x-12} + \frac{5}{12x-48} \quad \text{LCD} = 12(x-4)(x+3)$$

$$12 \cdot \frac{x}{(x-4)(x+3)} + \frac{5}{12(x-4) \cdot (x+3)}$$

$$\frac{12x}{12(x-4)(x+3)} + \frac{5(x+3)}{12(x-4)(x+3)}$$

$$\frac{12x+5x+15}{12(x-4)(x+3)} = \frac{17x+15}{12(x-4)(x+3)}$$

$$\text{b) } \frac{7}{9x^2} + \frac{x}{3x^2+3x} \quad \text{LCD} = 9x^2(x+1)$$

$$\frac{7(x+1)}{9x^2(x+1)} + \frac{x \cdot 3x}{3x(x+1) \cdot 3x}$$

$$\frac{7(x+1) + 3x^2}{9x^2(x+1)} = \frac{3x^2+7x+7}{9x^2(x+1)}$$

$$\frac{x+2}{2x-2} - \frac{-2x-1}{x^2-4x+3} \quad \text{LCD} = 2(x-3)(x-1)^2$$

$$\frac{(x-3)(x+2) - 2(-2x-1)}{2(x-3)(x-1)}$$

$$\frac{x^2+x-6+4x+2}{2(x-3)(x-1)} = \frac{x^2+5x-4}{2(x-3)(x-1)}$$

$$\frac{x^2+5x-4}{2(x-3)(x-1)}$$

Simplifying Complex Fractions

A complex fraction is a fraction that contains a fraction in its numerator or denominator.

To simplify a complex fraction: Multiply each fraction in the numerator and denominator by the LCD of every fraction.

Example 1:
$$\frac{\frac{6}{x-5} + \frac{1}{x}}{\frac{3}{x} - \frac{2}{x-5}} = \frac{\frac{6x+x-5}{x(x-5)}}{\frac{x-15}{x(x-5)}} = \frac{7x-5}{x(x-5)} \cdot \frac{x(x-5)}{x-15}$$

<u>Numerator</u>	<u>Denominator</u>
$\frac{6}{x(x-5)} + \frac{1}{x(x-5)}$	$\frac{3}{(x-5)x} - \frac{2}{(x-5)x}$
$\frac{6x+x-5}{x(x-5)}$	$\frac{3x-15-2x}{x(x-5)}$

$$= \frac{7x-5}{x-15}$$

PRACTICE: ADD/SUBTR RATIONAL EXPRESSIONS DAY 18

1. $\frac{8 \cdot 2}{8 \cdot 3} + \frac{5 \cdot 3}{8 \cdot 3} =$

LCD = 24

$$\frac{16}{24} + \frac{15}{24}$$

$$\frac{31}{24}$$

2. $\frac{(x-3)(x+2)}{(x-3)(x+3)} + \frac{(5)(x+3)}{(x-3)(x+3)} =$ LCD = (x+3)(x-3)

$$\frac{x^2 - x - 6}{(x-3)(x+3)} + \frac{5x + 15}{(x-3)(x+3)}$$

$$\frac{x^2 - x - 6 + 5x + 15}{(x+3)(x-3)}$$

$$\frac{x^2 + 4x + 9}{(x+3)(x-3)}$$

3. $\frac{4x}{x+3} - \frac{2x+7}{x^2-9} =$

LCD = (x+3)(x-3)

$$\frac{(x-3)4x}{(x+3)(x-3)} - \frac{(2x+7)}{(x+3)(x-3)}$$

$$\frac{(4x^2 - 12x)}{(x+3)(x-3)} - \frac{(2x+7)}{(x+3)(x-3)}$$

$$\frac{4x^2 - 12x - 2x - 7}{(x+3)(x-3)}$$

$$\frac{4x^2 - 14x - 7}{(x+3)(x-3)}$$

4. $\frac{5}{x^2} + \frac{7}{x^2-3x} =$

LCD = $x^2(x-3)$

$$\frac{(x-3)5}{(x-3)x^2} + \frac{7}{x(x-3)} \cdot x$$

$$\frac{5x-15}{x^2(x-3)} + \frac{7x}{x^2(x-3)}$$

$$\frac{5x-15+7x}{x^2(x-3)}$$

$$\frac{12x-15}{x^2(x-3)}$$

$$\text{LCD} = 3(x^2 + 1)$$

$$\text{LCD} = 3(x-5)(x+1)$$

5. $\frac{2x^2}{x^2+1} + \frac{2}{3x^2+3} =$

$$3 \cdot \frac{2x^2}{(x^2+1)} + \frac{3}{3(x^2+1)}$$

$$\frac{6x^2}{3(x^2+1)} + \frac{3}{3(x^2+1)}$$

$$\frac{6x^2 + 3}{3(x^2+1)}$$

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

6. $\frac{x}{3x-15} - \frac{-2x-1}{x^2-4x-5} =$

$$\frac{x}{3(x-5)} - \frac{-(2x+1)}{(x-5)(x+1)} \cdot 3$$

$$\frac{x^2+x}{3(x-5)(x+1)} + \frac{6x+3}{3(x-5)(x+1)}$$

$$\frac{x^2+x+6x+3}{3(x-5)(x+1)}$$

$$\frac{x^2+7x+3}{3(x-5)(x+1)}$$

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

$$\frac{(x-2)(x+1)}{(x+2)(x+2)} - \frac{2}{(x+2)(x-2)}$$

$$\frac{(x-2)(x-1)}{(x+2)^2(x-2)} - \frac{2(x+2)}{(x+2)^2(x-2)}$$

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

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

$$\frac{x^2-5x-2}{(x+2)^2(x-2)}$$

8. $\frac{2}{x} - \frac{4}{1} + \frac{3}{1}$

Numerator	Denominator
$\frac{2}{x} - \frac{4 \cdot x}{1 \cdot x}$	$\frac{2}{x} + \frac{3 \cdot x}{1 \cdot x}$
$\frac{2}{x} - \frac{4x}{x}$	$\frac{2}{x} + \frac{3x}{x}$
$\frac{2-4x}{x}$	$\frac{2+3x}{x}$

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

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

$$\frac{2-4x}{2+3x} \text{ OR } \frac{2(1-2x)}{2+3x}$$

$$\text{LCD} = (x+2)(x+2)(x-2)$$