Adding and Subtracting Rational Expressions

© **Content Standard**
A.APR.7 ... Add, subtract, multiply, and divide rational expressions.

Objective To add and subtract rational expressions

To add or subtract fractions, the fractions MUST have a _____common denominator_____.

Examples. Add or subtract and simplify.

1. $\dfrac{3}{12}+\dfrac{5}{12}=\dfrac{8}{12}=\dfrac{2}{3}$

2. $\dfrac{3}{x^2}+\dfrac{5}{x^2}$ $\dfrac{8}{x^2}$

3. $\dfrac{x^2}{x-3}-\dfrac{9}{x-3}$ $\dfrac{x^2-9}{x-3}$ $\dfrac{(x+3)(x-3)}{x-3}$ $\dfrac{}{x-3}$

© **Problem 2** Adding Rational Expressions

What is the sum of the two rational expressions in simplest form? State any restrictions on the variable. $\dfrac{x}{x-1}+\dfrac{2x-1}{x^2-3x+2}$

Plan

How does the LCD help you simplify this sum?
The LCD is $(x-1)(x-2)$. Multiply the first expression by $\frac{x-2}{x-2}$ to get a common denominator.

$\dfrac{x}{x-1}+\dfrac{2x-1}{x^2-3x+2}=\dfrac{x}{(x-1)}+\dfrac{2x-1}{(x-1)(x-2)}$ Factor the denominators.

$=\dfrac{x}{(x-1)}\cdot\dfrac{(x-2)}{(x-2)}+\dfrac{2x-1}{(x-1)(x-2)}$ Rewrite each expression with the LCD.

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

$=\dfrac{x^2-2x+2x-1}{(x-1)(x-2)}$ Add the numerators. Combine like terms.

$=\dfrac{x^2-1}{(x-1)(x-2)}$

$=\dfrac{(x-1)(x+1)}{(x-1)(x-2)}$ Factor the numerator and divide out the common factors.

$=\dfrac{x+1}{x-2}, x\neq 1$

The sum of the expressions is $\frac{x+1}{x-2}$ for $x\neq 1$ and $x\neq 2$.

Write each expression as a single rational expression in simplest form.

4. $\dfrac{7}{3x^2}+\dfrac{1}{9x}$

$\dfrac{21}{9x^2}+\dfrac{x}{9x^2}$

$\boxed{\dfrac{21+x}{9x^2}}$

$x\neq 0$

5. $\dfrac{x+9}{4}-\dfrac{x-3}{3}$

$\dfrac{3(x+9)}{12}-\dfrac{4(x-3)}{12}$

$\dfrac{3x+27}{12}-\dfrac{4x-12}{12}$

$\dfrac{(3x+27)-(4x-12)}{12}$

$\dfrac{3x+27-4x+12}{12}$

6. $\dfrac{x+2}{x^2-2x}-\dfrac{x+2}{2x-4}$

$\times(x-2) \quad 2(x-2)$

$\dfrac{2(x+2)}{2x(x-2)}-\dfrac{x(x+2)}{2x(x-2)}$

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

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

$\dfrac{4-x^2}{2x(x-2)}$

7. $\dfrac{6}{x^2+2x-3}-\dfrac{x}{x^2+x-2}$

$(x+3)(x-1) \quad (x+2)(x-1)$

$\dfrac{6(x+2)}{(x+3)(x+2)(x-1)}-\dfrac{x(x+3)}{(x+3)(x+2)(x-1)}$

$\dfrac{6x+12-x^2-3x}{(x+3)(x+2)(x-1)}$

$\dfrac{-x^2+3x+12}{(x+3)(x+2)(x-1)} \quad x\neq -3,-2,1$

$\boxed{\dfrac{-1(x^2-3x-12)}{(x+3)(x+2)(x-1)}}$

Homework

11. $\frac{1}{2x} + \frac{1}{2x}$

13. $\frac{-2}{x} - \frac{1}{x}$

15. $\frac{5y + 2}{xy^2} + \frac{2x - 4}{4xy}$

17. $\frac{y}{2y + 4} - \frac{3}{y + 2}$

19. $\frac{-3x}{x^2 - 9} + \frac{4}{2x - 6}$

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

31. $\frac{3}{4x} - \frac{2}{x^2}$

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

35. $3x + \frac{x^2 + 5x}{x^2 - 2}$