Notes: Adding and Subtract Rational Expressions

The strategies for adding and subtracting rational expressions are similar to the strategies you learned for adding and subtracting fractions.

Adding and Subtracting Rational Expressions:

1. Write all polynomial denominators in factored form.
2. Determine the least common denominator (LCD).
3. Multiply numerator and denominator of each fraction by any missing factors to get the LCD.
4. *"Across the top you add or subtract, but leave the denominator intact."*
5. Factor the new numerator if possible, and cancel factors if possible.
6. Answers may be left in factored form.

Examples:

A. $\frac{9}{10x}+\frac{4x}{5y}$ LCD = $10xy$

$\frac{9}{10x}\cdot\frac{y}{y}+\frac{4x}{5y}\cdot\frac{2x}{2x}$

$\frac{9y}{10xy}+\frac{8x^2}{10xy}=\frac{9y+8x^2}{10xy}$

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

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

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

C. $\frac{x}{x^2+5x+6}-\frac{2}{x^2+4x+4}$

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

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

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

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

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

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

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

$\frac{x+5}{x-3}$

F. $\frac{\frac{b}{b}\cdot\frac{1}{a}+\frac{1}{b}\cdot\frac{a}{a}}{\frac{b}{b}\cdot\frac{1}{a}-\frac{1}{b}\cdot\frac{a}{a}}=\frac{\frac{1b}{ab}+\frac{1a}{ab}}{\frac{1b}{ab}-\frac{1a}{ab}}$

$\frac{\frac{b+a}{ab}}{\frac{b-a}{ab}}=\frac{b+a}{ab}\cdot\frac{ab}{b-a}$

$\frac{b+a}{b-a}$

Math 3 Adding and Subtracting Rational Expressions Worksheet

Simplify each rational expression.

1. $\frac{5}{x+1}+\frac{x}{x+1}=\frac{5+x}{x+1}$

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

$\frac{8x-3}{4x-3}$

3. $\frac{3}{3}\cdot\frac{5}{x}+\frac{2}{3x}=\frac{15}{3x}+\frac{2}{3x}=\frac{17}{3x}$

4. $\frac{x^2}{x^2}\cdot\frac{1}{2}+\frac{2x}{x\cdot x^2}\cdot\frac{3}{2}\cdot\frac{2}{2}$

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

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

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

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

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

6. $\frac{x}{x^2-x-30}-\frac{1}{x+5}$

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

$\frac{x-x+6}{(x-6)(x+5)}=\frac{6}{(x-6)(x+5)}$

7. $\frac{4-\frac{5}{x+3}}{1}$ $\frac{4(x+3)}{x+3}-\frac{5}{x+3}$

$\frac{4x+12-5}{x+3}=\frac{4x+7}{x+3}$

8. $\frac{4}{a-3}+\frac{9}{a-5}=\frac{4(a-5)+9(a-3)}{(a-5)(a-3)}$

$\frac{4a-20+9a-27}{(a-5)(a-3)}$

$\frac{13a-47}{(a-5)(a-3)}$

9. $\frac{2p-3}{p^2-5p+6}-\frac{5}{p^2-9}$

$\frac{p+3}{p+3}\quad\frac{2p-3}{(p-3)(p-2)}-\frac{5}{(p+3)(p-3)}\quad\frac{p-2}{(p-2)}$

$\frac{(2p-3)(p+3)}{(p+3)(p-3)(p-2)}-\frac{5(p-2)}{(p+3)(p-3)(p-2)}$

$\frac{2p^2+3p-9-5p+10}{(p-2)(p-3)(p+3)}$

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

10. $\frac{\frac{x}{3x}-\frac{4}{x+2}}{\frac{x}{x+2}+\frac{1}{x}}\cdot\frac{3x}{3x}$ $\frac{x^2+2x-12x}{3x(x+2)}$

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

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

$\frac{-11x+2}{3(x^2+x+2)}$