4.4 Adding/subtracting Rat. Exp.

1st Review fractions:

Add: $\frac{1}{2} + \frac{1}{3}$

Get LCD $\Rightarrow$ 6

$\frac{1}{2}\cdot\frac{3}{3} + \frac{1}{3}\cdot\frac{2}{2}$

$\frac{3}{6} + \frac{2}{6}$

$\frac{3+2}{6} = \frac{5}{6}$

$\frac{1}{6} + \frac{1}{9}$

$\frac{1}{2\cdot 3} + \frac{1}{3\cdot 3}$

$\frac{1}{2\cdot 3}\frac{3}{3} + \frac{1}{3\cdot 3}\frac{2}{2}$

$\frac{3}{18} + \frac{2}{18}$

$\frac{3+2}{18} = \frac{5}{18}$

Now for Rat. Exp.

Add: $\frac{1}{x} + \frac{1}{y}$ (LCD: xy)

$\frac{1}{x}\cdot\frac{y}{y} + \frac{x}{x}\frac{1}{y}$

$\frac{y}{xy} + \frac{x}{xy}$

$\frac{y+x}{xy} = \boxed{\frac{x+y}{xy}}$

Ex② Add $\frac{1}{x} + \frac{1}{x^2}$

$\frac{1}{x} + \frac{1}{x\cdot x}$

$\frac{1}{x}\cdot\frac{x}{x} + \frac{1}{x\cdot x}$

$\frac{x}{x^2} + \frac{1}{x^2}$

$\frac{x+1}{x^2}$

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Ex 3 $\frac{1}{x^2-x} + \frac{1}{x}$ factor denom.

$\frac{1}{x(x-1)} + \frac{1}{x}\frac{(x-1)}{(x-1)}$ multiply by factor needed to get LCD

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

$\frac{1+1(x-1)}{x(x-1)}$ Put num. together over LCD

$\frac{\cancel{1}+x-\cancel{1}}{x(x-1)}$ multiply in num. to get rid of brackets

$\frac{\cancel{x}\cdot 1}{\cancel{x}(x-1)}$ "cancel" common factors from num. and den.

$= \frac{1}{(x-1)}$

Ex ④ Subtract and Simplify:

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

LCD $(x-3)(x+1)$

$x \neq 3, -1$

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

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

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

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

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

$$\frac{11x-1}{(x-3)(x+1)}$$

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Ex: $\dfrac{1}{x^2+x} + \dfrac{2}{1-x^2}$

factor factor

$= \dfrac{1}{x(x+1)} + \dfrac{2}{(1-x)(1+x)}$ $\quad x \neq 0, \pm 1$

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

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

$= \dfrac{1-x+2x}{x(x+1)(1-x)}$ combine like terms

$= \dfrac{\cancel{(1+x)}\cdot 1}{x\cancel{(x+1)}(1-x)} = \dfrac{1}{x(1-x)}$

Ex: $\dfrac{1}{3x^2-12x} - \dfrac{1}{x^2-16}$ $\quad x \neq 0, \pm 4$

LCD $3x(x+4)(x-4)$

$\dfrac{1}{3x(x-4)} - \dfrac{1}{(x+4)(x-4)}$

$= \dfrac{1}{3x(x-4)}\dfrac{(x+4)}{(x+4)} - \dfrac{1}{(x-4)(x+4)}\dfrac{3x}{3x}$

$= \dfrac{1(x+4) - 1(3x)}{3x(x-4)(x+4)}$

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

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

Ex: $\dfrac{6x+5}{1-4x^2} - \dfrac{15}{2+4x}$ $\quad x \neq \pm\frac{1}{2}$

$$\frac{2}{2}\frac{(6x+5)}{(1+2x)(1-2x)} - \frac{15}{2(1+2x)}\frac{(1-2x)}{(1-2x)}$$

$$\frac{2(6x+5) - 15(1-2x)}{2(1+2x)(1-2x)}$$

$$\frac{12x+10-15+30x}{2(1+2x)(1-2x)}$$

$$\frac{42x-5}{2(1+2x)(1-2x)}$$

Ex: $\dfrac{3x}{4x^2-10x} - \dfrac{x}{35-14x}$

$$\frac{3x}{2x(2x-5)} - \frac{x}{7(5-2x)} \qquad \frac{2x+21}{14(2x-5)}$$

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

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

become +

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

$$\frac{(7)(3x) + x(2x)}{14x(2x-5)}$$

$$\frac{21x + 2x^2}{14x(2x-5)}$$

$$\frac{\cancel{x}(21+2x)}{14\cancel{x}(2x-5)}$$

$$= \frac{21+2x}{14(2x-5)}$$

Ex:

$$\frac{1}{2x-6} - \frac{x}{x^2-9}$$

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

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

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

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

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

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

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

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