

8.2 Adding and Subtracting Rational Expressions

Honors Algebra 2

$$\begin{aligned} \text{Add } \frac{4}{9} + \frac{5}{6} &= \frac{4}{3 \cdot 3} + \frac{5}{2 \cdot 3} \\ &= \frac{2}{2} \cdot \frac{4}{3 \cdot 3} + \frac{5}{2 \cdot 3} \cdot \frac{3}{3} \end{aligned} \quad \begin{aligned} &= \frac{8}{2 \cdot 3 \cdot 3} + \frac{15}{2 \cdot 3 \cdot 3} \\ &= \frac{8+15}{2 \cdot 3 \cdot 3} = \frac{23}{18} \end{aligned}$$

1. Add the following:

a. $\frac{3y}{2x^3} + \frac{5z}{8xy^2}$

$$\frac{4y^2}{4y^2} \cdot \frac{3y}{2x^3} + \frac{5z}{8xy^2} \cdot \frac{x^2}{x^2}$$

$$\frac{12y^3}{8x^3y^2} + \frac{5zx^2}{8x^3y^2}$$

$$\frac{12y^3 + 5zx^2}{8x^3y^2}$$

b. $\frac{4}{5a^3b^2} + \frac{9c}{10ab}$

$$\frac{2}{2} \cdot \frac{4}{5a^3b^2} + \frac{9c}{10ab} \cdot \frac{a^2b}{a^2b}$$

$$\frac{8}{10a^3b^2} + \frac{9ca^2b}{10a^3b^2}$$

$$\frac{8 + 9ca^2b}{10a^3b^2}$$

c. $\frac{3a^2}{16b^2} - \frac{8x}{5a^3b}$

$$\frac{5a^3}{5a^3} \cdot \frac{3a^2}{16b^2} - \frac{8x}{5a^3b} \cdot \frac{16b}{16b}$$

$$\frac{15a^5}{80a^3b^2} - \frac{128xb}{80a^3b^2}$$

$$\frac{15a^5 - 128xb}{80a^3b^2}$$

d. $\frac{7b}{12a} - \frac{1}{18ab^3}$

$$\frac{3b^3}{3b^3} \cdot \frac{7b}{12a} - \frac{1}{18ab^3} \cdot \frac{2}{2}$$

$$\frac{21b^4}{36ab^3} - \frac{2}{36ab^3}$$

$$\frac{21b^4 - 2}{36ab^3}$$

* factor!

8.2 Adding and Subtracting Rational Expressions

Honors Algebra 2

2. Add the following:

<p>a. $\frac{5}{6x-18} + \frac{x-1}{4x^2-14x+6} \rightarrow 2(2x^2-7x+3)$</p> $= \frac{5}{6(x-3)} + \frac{x-1}{2(2x-1)(x-3)}$ $= \frac{(2x-1)}{(2x-1)} \frac{5}{6(x-3)} + \frac{(x-1)}{2(2x-1)(x-3)} \cdot \frac{3}{3}$ $= \frac{5(2x-1)}{6(x-3)(2x-1)} + \frac{3(x-1)}{6(2x-1)(x-3)}$ $= \frac{5(2x-1) + 3(x-1)}{6(x-3)(2x-1)}$ $= \frac{13x-8}{6(x-3)(2x-1)}$	<p>b. $\frac{x-1}{x^2-x-6} - \frac{4}{5x+10}$</p> $\frac{5}{5} \frac{x-1}{(x-3)(x+2)} - \frac{4}{5(x+2)} \frac{(x-3)}{(x-3)}$ $= \frac{5(x-1)}{5(x-3)(x+2)} - \frac{4(x-3)}{5(x+2)(x-3)}$ $= \frac{5x-5 - (4x-12)}{5(x-3)(x+2)}$ $= \frac{5x-5-4x+12}{5(x-3)(x+2)}$ $= \frac{x+7}{5(x-3)(x+2)}$
<p>c. $\frac{x-8}{4x^2+21x+5} + \frac{6}{12x+3}$</p> <p>could have canceled 3 in 1st step OA</p> $\frac{3}{3} \frac{x-8}{(4x+1)(x+5)} + \frac{6}{3(4x+1)} \frac{(x+5)}{(x+5)}$ $\frac{3(x-8)}{3(4x+1)(x+5)} + \frac{6(x+5)}{3(4x+1)(x+5)}$ $\frac{3x-24+6x+30}{3(4x+1)(x+5)}$ $\frac{9x+6}{3(4x+1)(x+5)}$ $\frac{3x+2}{(4x+1)(x+5)}$ <p>in last step</p>	<p>d. $\frac{4x}{x^2+9x+18} + \frac{5}{x+6}$</p> $\frac{4x}{(x+3)(x+6)} + \frac{5}{x+6} \frac{(x+3)}{(x+3)}$ $\frac{4x}{(x+3)(x+6)} + \frac{5(x+3)}{(x+6)(x+3)}$ $\frac{4x+5x+15}{(x+3)(x+6)}$ $\frac{9x+15}{(x+3)(x+6)}$

8.2 Adding and Subtracting Rational Expressions
Honors Algebra 2

e. $\frac{8}{y-3} + \frac{2y-5}{y^2-12y+27}$

$y-9$
 $y-9$

$$\frac{8}{y-3} + \frac{(2y-5)}{(y-9)(y-3)}$$

$$= \frac{8(y-9)}{(y-3)(y-9)} + \frac{2y-5}{(y-9)(y-3)}$$

$$= \frac{8y-72+2y-5}{(y-3)(y-9)}$$

$$= \frac{10y-77}{(y-3)(y-9)}$$

f. $\frac{4}{3x+6} - \frac{x+1}{x^2-4}$

$x-2$
 $x-2$

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

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

$$= \frac{4x-8-(3x+3)}{3(x-2)(x+2)}$$

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

3. Simplify the following:

a. $\frac{1+\frac{1}{x}}{1-\frac{1}{y}}$

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

$$= \frac{\frac{x}{x} + \frac{1}{x}}{\frac{y}{y} - \frac{1}{y}}$$

$$= \frac{\frac{x+1}{x}}{\frac{y-x}{y}}$$

$$= \frac{x+1}{x} \cdot \frac{y}{y-x} = \frac{y(x+1)}{x(y-x)}$$

b. $\frac{1-\frac{y}{x}}{\frac{y}{y+x}}$

$$= \frac{\frac{x}{x} - \frac{y}{x}}{\frac{y}{y+x}}$$

$$= \frac{\frac{x-y}{x}}{\frac{y}{y+x}}$$

$$= \frac{x-y}{x} \cdot \frac{y+x}{y}$$

$$= \frac{y(x-y)}{x+y}$$

* one frac in both num & denom

8.2 Adding and Subtracting Rational Expressions

Honors Algebra 2

c. $\frac{c-d}{c+2}$

$$= \frac{\frac{c}{c} \cdot \frac{c}{d} - \frac{d}{c} \cdot \frac{d}{d}}{\frac{d}{c} + \frac{2}{1} \frac{c}{c}}$$

$$= \frac{\frac{c^2}{cd} - \frac{d^2}{cd}}{d/c + 2c/c}$$

$$= \frac{\frac{c^2 - d^2}{cd}}{\frac{d + 2c}{c}}$$

$$= \frac{c^2 - d^2}{\cancel{cd}} \cdot \frac{\cancel{c}}{d + 2c}$$

$$= \frac{c^2 - d^2}{d(d + 2c)}$$

d. $\frac{b+1}{1-\frac{b}{a}}$

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

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

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

$$= \frac{a(a+b)}{b(a-b)}$$