2.2B Operations with Rational Expressions (Adding and Subtracting)

A concrete example:

$$\frac{3}{4}+\frac{7}{4}$$

$$= \frac{10}{4}$$

A concrete example:

$$\frac{2}{2}\cdot\frac{7}{9}-\frac{5}{6}\cdot\frac{3}{3}$$

$$= \frac{14}{18} - \frac{15}{18}$$

$$= -\frac{1}{18}$$

Ex. 1 Simplify. State restrictions.

a) $\frac{3}{y^2}-\frac{2}{y^2}+\frac{6}{y^2}$

$$= \frac{3-2+6}{y^2}$$

$$= \frac{7}{y^2}, y\neq 0$$

PROCESS
1. Find the lowest common denominator and create equivalent rational expressions.
2. Add or subtract the numerators but do not change the denominators.
3. Reduce by any common factors.
4. State the restrictions.

b) $\frac{2}{2}\cdot\frac{(5x-1)}{6}-\frac{(7x+2)}{4}\cdot\frac{3}{3}$

$$= \frac{10x-2}{12} - \frac{(21x+6)}{12}$$ (careful!)

$$= \frac{10x-2-21x-6}{12}$$

$$= \frac{-11x-8}{12}$$

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

$x^2 - 4$ and $4 - x^2$ are opposites!

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

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

$$= \frac{8}{x^2-4}$$

$$= \frac{8}{(x+2)(x-2)}, x\neq \pm 2$$

Finding the LCD

$4x^3 =$ 4 $x \cdot x \cdot x$

$8x =$ 8 x

} $8x^3$

THINK Factors must divide evenly into multiples.

PROCESS
1. Find the lowest common denominator and create equivalent rational expressions.
2. Add or subtract the numerators but do not change the denominators.
3. Reduce by any common factors.
4. State the restrictions.

Ex. 2 Simplify and state the restrictions.

a) $\frac{2(4x-1)}{2(4x^3)} - \frac{(1+3x)x^2}{(8x)x^2}$

$= \frac{8x-2}{8x^3} - \frac{x^2+3x^3}{8x^3}$

$= \frac{8x-2-x^2-3x^3}{8x^3}, \quad x \neq 0$

b) $\frac{4x+4}{5x^2+15x+10} + \frac{1}{x+3}$

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

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

$= \frac{4}{5(x+2)} + \frac{1}{x+3}$ (multiply by $\frac{(x+3)}{(x+3)}$ and $\frac{5(x+2)}{5(x+2)}$)

$= \frac{4x+12}{5(x+2)(x+3)} + \frac{5x+10}{5(x+2)(x+3)}$

$= \frac{9x+22}{5(x+2)(x+3)}, \quad x \neq -2, -1, -3$

$\frac{4}{5a} + \frac{1}{b}$

$= \frac{\quad}{5ab} + \frac{\quad}{5ab}$

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

M −6
A −1
N $-\frac{3}{2}$ $\frac{2}{2}$
$\frac{1}{1}$

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

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

$= \dfrac{2x^2-7x+6 - (3-12x)}{(x+1)(2x-3)}$

$= \dfrac{2x^2+5x+3}{(x+1)(2x-3)}$

M 6
A 5
N $\frac{2}{2}$ $\frac{3}{2}$
$\frac{1}{1}$

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

$= \dfrac{2x+3}{2x-3}$, $x \neq \frac{3}{2}, -1$

d) $\dfrac{7}{6x-6} + \dfrac{2x^2}{(x-1)^2} \div \dfrac{4x}{x^2-1}$

- Factor Factor Factor!
- multiply by reciprocal (flip & times instead of divide)
- Remember to multiply first! Because BEDMAS

$= \dfrac{7}{6(x-1)} + \dfrac{2x^2}{(x-1)(x-1)} \div \dfrac{4x}{(x+1)(x-1)}$

$= \dfrac{7}{6(x-1)} + \dfrac{\overset{1}{\cancel{2}}x^2}{(x-1)\cancel{(x-1)}} \cdot \dfrac{(x+1)\cancel{(x-1)}}{\underset{2}{\cancel{4x}}}$

$= \dfrac{7}{6(x-1)} + \dfrac{x(x+1)}{2(x-1)}\dfrac{3}{3}$

$= \dfrac{7}{6(x-1)} + \dfrac{3x(x+1)}{6(x-1)}$

$= \dfrac{7+3x^2+3x}{6(x-1)}$

$= \dfrac{3x^2+3x+7}{6(x-1)}$, $x \neq 0, \pm 1$

HOMEWORK

Pg. 128 # 1ac, 3, 5a, 6ad, 7c, 8b, 10c
Additional HW Handout Lesson 2.2B