2.2B Operations with Rational Expressions (Adding and Subtracting)

A concrete example:

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

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

$$= \frac{5}{2}$$

A concrete example:

$$\frac{2}{2} \quad \frac{7}{9} - \frac{5}{6} \quad \frac{3}{3} \qquad \overline{18} \; ?$$

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

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

Ex. 1 Simplify. State restrictions.

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

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

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

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) $\dfrac{^2(5x-1)}{_2(6)} - \dfrac{(7x+2)^3}{(4)^3}$

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

CAREFUL!

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

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

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

c) $\dfrac{5}{x^2-4} - \dfrac{3}{4-x^2}{}^{x-1}_{x-1}$

x² - 4 and 4 - x² are opposites!

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

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

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

Finding the LCD

$$4x^3 = \quad 4\cdot 2 \cdot x \cdot x \cdot x \qquad = 8x^3$$

$$8x = \quad 8 \quad \cdot x \cdot x \cdot x \qquad = 8x^3$$

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

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

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

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

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

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

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

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

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

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

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

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

$(2x \cdot 3)$

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

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

$= \dfrac{2x^2-4x-3x+6 - 3+12x}{(2x-3)(x+1)}$

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

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

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

$\begin{array}{cc} -6 \\ -1 \\ \dfrac{2}{-3} & \dfrac{2}{2} \\ & = -\dfrac{1}{1} \end{array}$

$\begin{array}{cc} M & 6 \\ A & 5^- \\ N & \dfrac{2}{2} \quad \dfrac{2}{3} \\ & \dfrac{1}{1} \end{array}$

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

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

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

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

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

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

HOMEWORK
Page 93 #C3, 7bdfh, 8ad,
9bd, 11c, 19

+ Additional HW Handout Lesson 2.2B