Complex Fractions and Complex Rational Expressions ~ 5.6

A complex fraction is a fraction that contains other fractions.

They might resemble any of the following:

$$\frac{\frac{5}{6}}{\frac{2}{3}} \quad \text{or} \quad \frac{2\frac{1}{2}}{5} \quad \text{or} \quad \frac{x-\frac{1}{x}}{x+1} \quad \text{or even} \quad \frac{x+2}{1+\frac{5}{x}+\frac{6}{x^2}}$$

The procedure for simplifying complex rational expressions is basically the same. Two methods are commonly used.

Method 1: Think of the complex fraction as a division problem ~ don't divide, but multiply by the reciprocal.

Method 2: Multiply the entire complex fraction by the LCD of ALL the denominators.

Simplify each complex fraction:

a) $\dfrac{\frac{5}{6}}{\frac{2}{3}}$ $\quad \frac{5}{2\cancel{6}} \cdot \frac{\cancel{3}}{2} = \frac{5}{4}$

b) $\dfrac{2\frac{1}{2}}{\frac{5}{1}}$ $\quad \frac{\cancel{5}}{\cancel{2}} \cdot \frac{1}{\cancel{5}} = \frac{1}{2}$

c) $\dfrac{4}{1\frac{1}{3}}$ $\quad \frac{\cancel{4}}{1} \cdot \frac{3}{\cancel{4}}$

Express each rational expression in simplest form:

a) $\dfrac{\frac{2}{3x}}{\frac{1}{x}}$ $\quad \dfrac{2}{3x} \cdot \dfrac{x}{1} = \dfrac{2x}{3x} = \boxed{\dfrac{1}{x}}$

b) $\dfrac{x - \frac{1}{x}}{x+1}$ $\quad \left(\dfrac{x}{x}\right)$ $\dfrac{x^2-1}{x} \cdot \dfrac{1}{x+1} = \dfrac{(x+1)(x-1)}{x(x+1)} = \boxed{\dfrac{(x-1)}{x}}$

c) $\dfrac{x+2}{1+\frac{5}{x}+\frac{6}{x^2}}$ $\quad \left(\dfrac{x^2}{x^2}\right)$ $= \dfrac{x+2}{\frac{6x+6}{x^2}} = \dfrac{x+2}{1} \cdot \dfrac{x^2}{6x+6}$

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

nothing to reduce.

Lastly, how about trying this on for size?

Try method II: Multiply all terms by the LCD.

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

LCD = x

And this?

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

LCD = x^2y^2

Homework:

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9) $\dfrac{\frac{1}{x}+\frac{1}{y}}{\frac{1}{x}-\frac{1}{y}} =$

11) $\dfrac{\frac{2}{a}+\frac{4}{b}}{\frac{4a}{b}-\frac{b}{a}} =$

12) $\dfrac{1-\dfrac{3}{y}}{\dfrac{9}{y^2}-1} =$

14) $\dfrac{1-\dfrac{2}{x}-\dfrac{24}{x^2}}{1-\dfrac{6}{x}} =$

19) In electronics, when two resistors, R_1 and R_2, are connected in parallel, their combined resistance is given by the formula $\frac{1}{\frac{1}{R_1}+\frac{1}{R_2}}$. When simplified, this complex rational expression is equivalent to

1) $R_1 + R_2$ 2) $R_1 R_2$ 3) $\frac{R_1 + R_2}{R_1 R_2}$ 4) $\frac{R_1 R_2}{R_1 + R_2}$