Aim: How do we simplify complex fractions?

Do Now: 1. Add: $1 + \dfrac{1}{x}$

2. Subtract: $1 - \dfrac{1}{x}$

3. Simplify: $\dfrac{1 + \dfrac{1}{x}}{1 - \dfrac{1}{x}}$

HW: Worksheet

There are 2 methods to simplify complex fractions

We first need to simplified the numerator and denominator for both methods then do either one

Method 1:

$$\frac{\dfrac{a}{b}}{\dfrac{c}{d}} = \frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$$

Method 2:

$$\frac{\dfrac{a}{b}}{\dfrac{c}{d}} = \frac{ad}{bc}$$

Method 1

$$\frac{1 + \dfrac{1}{x}}{1 - \dfrac{1}{x}} = \frac{\dfrac{x+1}{x}}{\dfrac{x-1}{x}} = \frac{x+1}{x} \div \frac{x-1}{x}$$

$$= \frac{x+1}{\cancel{x}} \cdot \frac{\cancel{x}}{x-1} = \frac{x+1}{x-1}$$

Method 2

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

1 to simplify complex fraction.

$$\frac{2 - \dfrac{5}{x}}{3 + \dfrac{1}{x}} \quad = \quad \frac{\dfrac{2x}{x} - \dfrac{5}{x}}{\dfrac{3x}{x} + \dfrac{1}{x}} \quad = \quad \frac{\dfrac{2x - 5}{x}}{\dfrac{3x + 1}{x}}$$

Simplify the numerator and denominator. (Step 1)

$$= \quad \frac{2x - 5}{x} \div \frac{3x + 1}{x}$$

Write as a division problem.

$$= \quad \frac{2x - 5}{\cancel{x}} \cdot \frac{\cancel{x}}{3x + 1}$$

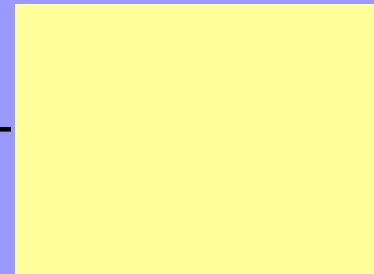Multiply by the reciprocal of $\dfrac{3x + 1}{x}$. (Step 2)

$$= \quad \frac{2x - 5}{3x + 1}$$

Multiply and simplify. (Step 3)

Example: simplify the expression

$$\cfrac{\dfrac{x^2 + 5x + 6}{3xy}}{\dfrac{x^2 - 9}{6xy}} = \dfrac{x^2 + 5x + 6}{3xy} \div \dfrac{x^2 - 9}{6xy} =$$

$$\dfrac{x^2 + 5x + 6}{3xy} \cdot \dfrac{6xy}{x^2 - 9} =$$

$$\dfrac{(x + 2)(x + 3)}{3xy} \cdot \dfrac{6xy}{(x + 3)(x - 3)} =$$

simplify complex fraction.

$$\dfrac{\dfrac{3}{x-1}}{\dfrac{4}{x^2-1}}$$

Method 1

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

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

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

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

Method 2

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

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

Practice

Simplify.

1) $$\dfrac{\dfrac{x}{2}+\dfrac{x}{3}}{\dfrac{1}{2}}$$

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

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