Chapter 6 section 3

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Complex Rational Expressions

- Complex Fractions
- Fractions that have rational expressions in the numerator and/or denominator
- Example:

$$\frac{\dfrac{x+1}{x}}{\dfrac{x+2}{x}}$$

Two ways to Simplify

First way:

- Find the common denominator of all denominators and multiply each expression by the common denominator.

Way 1

$$\frac{\dfrac{4}{x+4}}{\dfrac{1}{x+4}-\dfrac{1}{x}}$$

- Denominators are (x + 4) and x
- Common denominator is: x(x + 4)
- Multiply each expression with the common denominator

Multiply

- $$\frac{\dfrac{4}{x+4}\left(\dfrac{x(x+4)}{1}\right)}{\dfrac{1}{x+4}\left(\dfrac{x(x+4)}{1}\right)-\dfrac{1}{x}\left(\dfrac{x(x+4)}{1}\right)}$$

- Reduce: $\dfrac{4x}{x-(x+4)}$

Simplify

- $$\dfrac{4x}{x-\left(x+4\right)}$$

- $$\dfrac{4x}{x-x-4}$$

- Answer: $-x$

Way 2

- Add or subtract to get a single expression in the numerator and denominator

- Rewrite the fraction as division

- Simplify

Way 2

- $$\dfrac{\dfrac{4}{x+4}}{\dfrac{1}{x+4} - \dfrac{1}{x}}$$

- Simplify the denominator: $\dfrac{\dfrac{4}{x+4}}{\dfrac{-4}{x(x+4)}}$

- Rewrite as division: $\dfrac{4}{x+4} \div \dfrac{-4}{x(x+4)}$

Simplify

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

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

- - X

Which way is easier?

- Usually the multiply by the LCD has less steps.

Try these

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

2) $$\dfrac{5a^{-1}-2c^{-1}}{25a^{-2}-4c^{-2}}$$ What does the -1 mean?

3) $$\dfrac{\dfrac{7x}{2x-2}+\dfrac{x}{x^2-1}}{\dfrac{4}{x+1}-\dfrac{1}{3x+3}}$$

Summary

- Define complex rational expressions
- Simplify – two different ways.
  - Find common denominator and multiply each fraction by the common denominator.
  - Simplify the numerator and denominator then divide.

Find the common denominator

e) $\dfrac{3y+2}{y-5} + \dfrac{4}{3y+4}$

f) $\dfrac{3}{y^2-y-20} - \dfrac{y}{2y^2+7y-4}$

Rewrite each fraction with the common denominator

g) Common denominator: (x + 7)(x − 2)

$$\frac{x-2}{x+7} \qquad \frac{x+7}{x-2}$$