8/26/09

- warm-up
- Lecture 7.6

↳ Complex Rational Expressions

Prep for Monday

- Read 7.7 – 7.8
- Practice solving linear & quadratic equations

7 from somewhere!

$$\frac{a^2+2ab+b^2}{3a+3b}\cdot\frac{a-b}{a^2-b^2}$$

$$=\frac{(a+b)^2}{3(a+b)}\cdot\frac{\cancel{(a-b)}^{1}}{\cancel{(a-b)}_{1}(a+b)}$$

$$=\frac{\cancel{(a+b)^2}^{1}}{3\cancel{(a+b)^2}_{1}} = \boxed{\frac{1}{3}}$$

When you are done with your 7.6 homework you should be able to…

- π Simplify a Complex Rational Expression by Simplifying the Numerator and Denominator Separately.
- π Simplify a Complex Rational Expression Using the LCD.

WARM-UP:

1. Factor.

$$8x^2 - 14x - 15$$

-120

$-20 \quad +6$

-14

$$\underbrace{8x^2 - 20x}\underbrace{+6x - 15}$$

$$4x(2x-5) + 3(2x-5)$$

$$\boxed{(2x-5)(4x+3)}$$

2. Find the quotient:

$$\frac{\left(\frac{x^2+x}{3x+3}\right)}{\left(\frac{x}{x^2-1}\right)} = \frac{x\cancel{(x+1)}}{3\cancel{(x+1)}} \div \frac{x}{(x+1)(x-1)}$$

$$= \frac{\cancel{x}}{3} \cdot \frac{(x+1)(x-1)}{\cancel{x}} = \boxed{\frac{(x+1)(x-1)}{3}}$$

Definition

A **complex rational expression** is a fraction in which the numerator and/or the denominator contains the sum or difference of rational expressions.

Steps to Simplify a Complex Rational Expression by Simplifying the Numerator and Denominator Separately (Method 1)

Step 1: Write the numerator of the complex rational expression as a single rational expression.

Step 2: Write the denominator of the complex rational expression as a single rational expression.

Step 3: Rewrite the complex rational expression using the rational expressions determined in step steps 1 and 2.

Step 4: Simplify the rational expression using the techniques for dividing rational expressions.

3. Simplify the complex rational expressions using method 1.

a. $\dfrac{\frac{1}{x}-\frac{1}{y}}{\frac{2}{xy}} = \dfrac{y-x}{xy} \div \dfrac{2}{xy} = \dfrac{y-x}{\cancel{xy}} \cdot \dfrac{\cancel{xy}}{2} = \boxed{\dfrac{y-x}{2}}$

$\dfrac{y}{y}\cdot\dfrac{1}{x} - \dfrac{1}{y}\cdot\dfrac{x}{x} = \dfrac{y-x}{xy}$

prep work

b. $\dfrac{\frac{x+1}{6}}{\frac{x^2+3x+2}{3}} = \dfrac{x+1}{6} \div \dfrac{(x+2)(x+1)}{3}$

$= \dfrac{\cancel{(x+1)}}{\cancel{6}_{2}} \cdot \dfrac{\cancel{3}}{(x+2)\cancel{(x+1)}}$

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

c) $$\frac{\frac{n}{m+n} - \frac{m}{m-n}}{\frac{1}{m} + \frac{1}{n}}$$

zero out

$$\frac{(n)}{(m+n)} \cdot \frac{(m-n)}{(m-n)} - \frac{(m)}{(m-n)} \cdot \frac{(m+n)}{(m+n)} = \frac{\cancel{nm} - n^2 - m^2 - \cancel{mn}}{(m+n)(m-n)}$$

$$\frac{1}{m} \cdot \frac{n}{n} + \frac{1}{n} \cdot \frac{m}{m} = \frac{n+m}{mn}$$

$$= \frac{-n^2 - m^2}{(m+n)(m-n)} \cdot \frac{mn}{n+m}$$

$$= \boxed{\frac{-mn(n^2+m^2)}{(m+n)^2(m-n)}}$$

Steps to Simplify Complex Rational Expressions Using the LCD (Method 2)

Step 1: Find the least common denominator among each denominator in the complex rational expression.

Step 2: Multiply both the numerator and the denominator of the complex rational expression by the LCD found in step 1.

Step 3: Simplify the rational expression, if possible.

4. Simplify the complex rational expressions using method 2.

a. $$\frac{\left(\frac{x}{\cancel{(x+1)}}\right)\left[\frac{\cancel{(x+1)}(x-1)}{1}\right]}{\left(\frac{1}{1}+\frac{1}{x-1}\right)\left[\frac{(x+1)(x-1)}{1}\right]} = \frac{x(x-1)}{(x+1)(x-1)+(x+1)} = \frac{x(x-1)}{(x+1)[(x-1)+1]} = \frac{\cancel{x}^{1}(x-1)}{(x+1)(\cancel{x})_{1}} = \boxed{\frac{x-1}{x+1}}$$

b. $$\frac{\frac{-6}{y^2+5y+6}}{\frac{2}{y+3}-\frac{3}{y+2}}$$

5. Simplify the complex rational expressions using either method.

a. $1-\dfrac{1}{1-\dfrac{1}{x-2}}$

b. $1+\dfrac{2}{1+\dfrac{2}{x+\dfrac{2}{x}}}$

6. **Applications**

In a rectangle, the length can be found by dividing the area by the width. If the area of a rectangle is $\frac{x-4}{x^3}-\frac{2}{x^2}$ and the width is $\frac{x-4}{x^3}-\frac{2}{x^2}$, write a complex rational expression to find the length and then simplify the complex rational expression.