Chapter 6 section 3
Complex Rational Expressions

Complex Rational Expressions – Complex Fractions have numerators or denominators containing one or more rational expressions.

Fractions in numerator and/or denominator

Example:

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

Simplifying Complex Rational Expressions
2 ways

1) Multiply both the numerator and denominator by the LCD of all rational expressions

Example:

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

Solution:

a) Find the LCD of all the denominators

x, x^2, y, y^2

LCD is x^2y^2

b) Multiply both the numerators and denominators by the LCD, x^2y^2

$$\frac{\frac{1}{x}\left(\frac{x^2y^2}{1}\right)+\frac{y}{x^2}\left(\frac{x^2y^2}{1}\right)}{\frac{1}{y}\left(\frac{x^2y^2}{1}\right)+\frac{x}{y^2}\left(\frac{x^2y^2}{1}\right)}$$

c) When you multiply, reduce

$$\frac{xy^2+y^3}{x^2y+x^3}$$

d) Factor and simplify

$$\frac{y^2(x+y)}{x^2(x+y)}$$

e) Write answer

$$\frac{y^2}{x^2}$$

Try:

a)

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

b)

$$\frac{8x^{-2}-2x^{-1}}{10x^{-1}-6x^{-2}}$$

2) Division

Simplify the numerator and denominator so that there is a single rational expression in the numerator and denominator.

Add or subtract the numerator and/or denominators so that there is a single fraction in the numerator and denominator.

Write the expression as a division.

Example:

$$\frac{1-\frac{1}{x^2}}{1-\frac{4}{x}+\frac{3}{x^2}}$$

$$\frac{\frac{x^2-1}{x^2}}{\frac{x^2-4x+3}{x^2}}$$

The major fraction bar means divide so:

$$\frac{x^2-1}{x^2} \div \frac{x^2-4x+3}{x^2}$$

Change to a multiplication problem, by taking the reciprocal of the second fraction.

$$\frac{x^2-1}{x^2} \bullet \frac{x^2}{x^2-4x+3}$$

Multiply, factor, reduce and write the answer.

$$\frac{x+1}{x-3}$$

Try this one:

c)

$$\frac{\frac{2}{x+3}+\frac{5x}{x^2-9}}{\frac{4}{x+3}+\frac{2}{x-3}}$$

d)

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