

Operations with Rationals

Math 130 Kovitz 2012

Negative of a Fraction

$$-\frac{a}{b} = \frac{-a}{b} = \frac{a}{-b} \quad \left[-\frac{2}{3} = \frac{-2}{3} = \frac{2}{-3} \right]$$

Reducing Fractions by cancelling

$$\frac{ab}{bc} = \frac{a}{b} \quad \left[\frac{6}{15} = \frac{2 \cdot 3}{5 \cdot 3} = \frac{2}{5} \right]$$

Multiplication of Fractions

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd} \quad \left[\frac{2}{\sqrt{8}} \cdot \frac{6}{\sqrt{2}} = \frac{12}{\sqrt{16}} = \frac{12}{4} = 3 \right]$$

Division of Fractions

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc} \quad \left[\frac{3}{5} \div \frac{2}{3} = \frac{3}{5} \cdot \frac{3}{2} = \frac{3 \cdot 3}{5 \cdot 2} = \frac{9}{10} \right]$$

Addition and Subtraction of Fractions-Same Denominator

$$\frac{a}{d} + \frac{c}{d} = \frac{a+c}{d}$$
$$\frac{a}{d} - \frac{c}{d} = \frac{a-c}{d}$$

Addition and Subtraction of Fractions-Different Denominators

$$\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$$
$$\frac{a}{b} - \frac{c}{d} = \frac{ad-bc}{bd}$$

In the general case or with more than two terms, multiply numerator and denominator of each term by the factors necessary to make all the denominators the same.

Equations with Fractions

Multiply both sides of the equation (each term) by the least common denominator. After this is accomplished there will be no fractions as all the denominators will have been cancelled. Don't forget to multiply the terms that originally had no denominators by the LCD; this step is necessary to keep the resulting equation equivalent to the original equation.

The case where both sides of the equation are simple fractions may be done more simply.

The equation $\frac{a}{b} = \frac{c}{d}$ will be equivalent to the equation $ad = bc$. The latter is often easier to work with. We call that process cross-multiplication.