

## Fractions

In order to manipulate fractions involving variables later in the semester, it is imperative that you be able to work with numerical fractions without a calculator.

### Definitions

The numerator of the fraction is the portion above the fraction bar.

The denominator of the fraction is the portion below the fraction bar.

A reduced fraction is a fraction in which the numerator and the denominator have no common factors

The following definitions strictly apply to numerical fractions.

An improper fraction is a fraction in which the absolute value of the numerator is at least as large as the absolute value of the denominator.

A mixed number is a number that consists of both an integer and a fraction such that the fraction part is not an improper fraction.

### Converting Between Mixed Numbers and Improper Fractions

To convert from a mixed number to an improper fraction, multiply the integer by the denominator. If the result is positive, add the numerator of the fraction of the mixed number. Otherwise, subtract the numerator of the fraction of the mixed number. This result is the numerator of the improper fraction. The denominator of the improper fraction is the same as the denominator of the mixed number.

To convert from an improper fraction to a mixed number, divide the numerator by the denominator. The quotient is the integer part. The absolute value of the remainder is the numerator of the fraction part. The denominators of the improper fraction and the mixed number match.

### Adding and Subtracting Fractions

1. Obtain a common denominator. This stays constant throughout the problem until step 3.
2. Perform the indicated operation on the numerators. (It may be convenient to work with mixed numerals in order to avoid carrying or borrowing.)
3. Reduce the fraction.

## Multiplying Fractions

1. If applicable, convert mixed numbers to improper fractions.
2. Reduce the fractions. (This is not totally necessary, but it makes step 3 easier.)
3. Multiply the numerators to obtain the new numerator, and multiply the denominators to obtain the new denominator.
4. Reduce the fraction.

## Dividing Fractions

Note that, for dividing fractions, the division problem always becomes a multiplication problem.

1. If applicable, convert mixed numbers to improper fractions.
2. Perform KFC: Keep the first fraction the same, flip the second fraction, and change the problem to a multiplication problem.
3. Complete the indicated multiplication problem according to the above rules.

I insist that answers to problems involving fractions be either mixed numbers or improper fractions and that all answers be reduced.

Please be sure that you can do such problems without the use of a calculator.