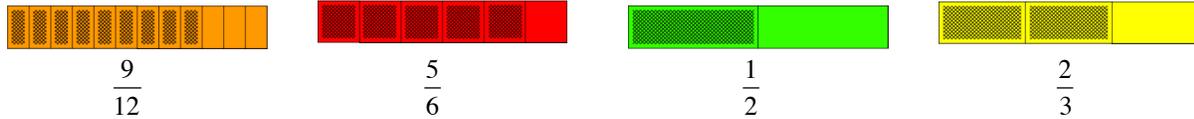


# Mathematical Operations with Fraction Bars

## Part-to-Whole Concept of Fractions

In these examples, the fraction indicates the shaded amount of the bar.



Whenever you see a fraction, it should make sense. You should think about what the fraction means. In the fraction  $\frac{5}{6}$ , the "6" means divide something into 6 equal parts, and the "5" indicates 5 of these parts. The fraction  $\frac{5}{6}$  represents almost the whole of something because it represents 5 out of 6 equal parts.

## Equality of Fractions

Fraction Bars can be used in two ways to illustrate equality of fractions. To first introduce equality, two bars with the same shaded amount represent two equal fractions, as shown in these examples.

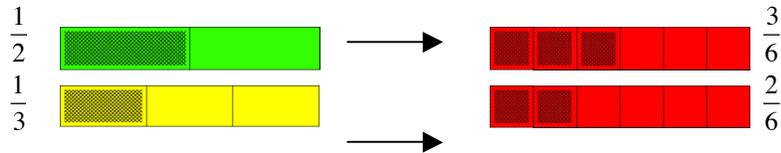


A second method for illustrating equality involves splitting or dividing each part of a bar. Each of the following yellow bars have 2 out of 3 parts shaded and represents the fraction  $\frac{2}{3}$ . After splitting each part of the first bar into 2 equal parts, both the total number of parts and also the number of shaded parts are doubled. So the bar now has 6 parts and 4 shaded parts, and it represents the fraction  $\frac{4}{6}$ . Similarly, each part of the second  $\frac{2}{3}$  bar can be split into 4 equal parts to show that  $\frac{2}{3}$  is equal to  $\frac{8}{12}$ . These are special cases of multiplying the numerator and denominator of a fraction by the same number of obtain an equal fraction.



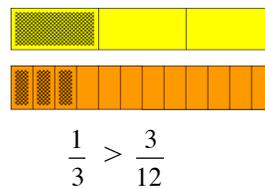
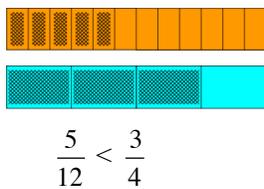
## Common Denominators

If two Fraction Bars have different numbers of parts, their fractions have different denominators. By replacing the bars for  $\frac{1}{2}$  and  $\frac{1}{3}$  by bars having the same number (or common number) of parts, namely a  $\frac{3}{6}$  bar and a  $\frac{2}{6}$  bar, the new denominator of 6 is a common denominator for  $\frac{1}{2}$  and  $\frac{1}{3}$ .



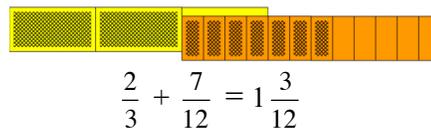
## Inequality of Fractions

If two Fraction Bars have different shaded amounts, the bar with the greater amount of shading is the greater fraction, as shown in these two examples.

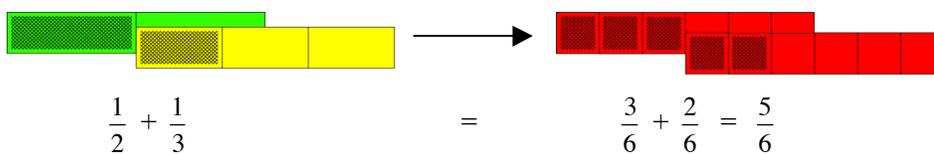


## Addition of Fractions

Addition can be illustrated by "putting-to-gather" or "combining" two amounts. In the following two examples, the shaded amounts of Fraction Bars are placed end-to-end. The first example shows that  $\frac{2}{3} + \frac{7}{12}$  is one whole bar and 3 parts out of 12.

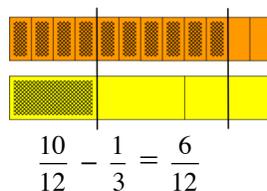


The second example illustrates getting common denominators for the fractions before adding.

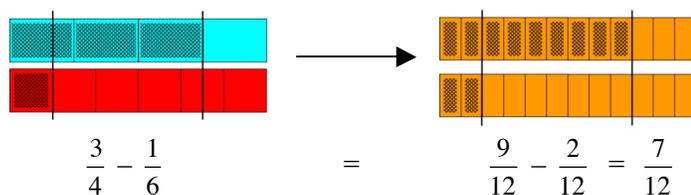


## Subtraction of Fractions

Subtraction can be illustrated by "talking one amount away from another" or by "comparing two amounts to determine their difference", as shown here. The vertical lines show that  $\frac{10}{12} - \frac{1}{3} = \frac{6}{12}$ .

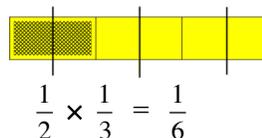
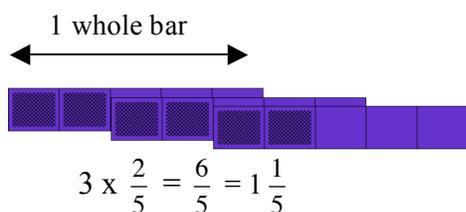


The second example of subtraction illustrates getting a common denominator before subtracting.



## Multiplication with Fractions

Multiplication of a whole number times a fraction can be illustrated by repeated addition as shown in the first example. That is, the total shaded amount of the three  $\frac{2}{5}$  bars is 1 whole bar and  $\frac{1}{5}$  of a bar. In the second example,  $\frac{1}{2} \times \frac{1}{3}$  is illustrated by taking  $\frac{1}{2}$  of the shaded amount of the  $\frac{1}{3}$  bar, and the diagram shows this is  $\frac{1}{6}$ .



## Division with Fractions

Division of one fraction by another can be illustrated by determining "how many times greater" one amount is than the other, or determining how many times one amount "fits into" the other, as shown in this example. The lines on this diagram show that  $\frac{1}{6}$  "fits into"  $\frac{2}{3}$  four times.

