Terminology

The top part of a fraction, written above the line, is called the numerator. The bottom part, written below the line, is called the denominator.

There are a few ways to read a fraction. Usually it is read as "numerator" over "denominator". It can also be read as "numerator" out of "denominator", and sometimes fractions have specific names. This is the list of some of the names you need to know:

$\dfrac{1}{2}$	One half
$\dfrac{1}{3}$	One third
$\dfrac{1}{4}$	One quarter
$\dfrac{1}{5}$	One fifth

As the denominator increases past 4, we read this as 'one xth', for example, one sixth, one seventh, one eighth etc. We can also increase the numerator, which changes how we read the fraction. For example, $\dfrac{2}{3}$ is read as "two thirds".

Simplifying fractions

For a fraction $\frac{a}{b}$ we simplify by doing the following:

1. Check to see if a and b have a common factor. This is any number that you can divide both a and b by to give a whole number (eg. 1,2,3 and 6 are all factors of 6, and also of 18).
2. If no common factor exists (other than 1), the fraction is in its simplest form.
3. If a common factor does exist, divide the numerator and the denominator by it.
4. Repeat this process until there are no more common factors (other than 1).

Examples

1. $\frac{6}{18}$. 2 is a common factor of 6 and 18, so we divide the numerator and the denominator by 2, to get $\frac{3}{9}$. 3 is a common factor of 3 and 9, so we divide the numerator and denominator by 3, to get $\frac{1}{3}$. Since there are no more common factors other than 1, this fraction is in its simplest form.

2. $\frac{12}{30}$. 6 is a common factor of 12 and 30, so we divide the numerator and the denominator by 6, to get $\frac{2}{5}$. 2 and 5 have no common factors other than 1, so the fraction is in its simplest form.

Note: it is usually quickest to divide by the highest common factor first.

Operations on fractions

Adding fractions:

$$\frac{a}{b} + \frac{c}{d} = \frac{a{\times}d + c{\times}b}{b{\times}d}$$

Subtracting fractions:

$$\frac{a}{b} - \frac{c}{d} = \frac{a{\times}d - c{\times}b}{b{\times}d}$$

Multiplying fractions:

$$\frac{a}{b} \times \frac{c}{d} = \frac{a{\times}c}{b{\times}d}$$

Dividing fractions:

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{a{\times}d}{b{\times}c}$$

Fractions to a power:

$$\left(\frac{a}{b}\right)^{y} = \frac{a^{y}}{b^{y}}$$

Comparing fraction size

Sometimes you will be asked to compare the size of two fractions to find the larger (or smaller) one. In order to do this, you must have them written over the same denominator, so we do the following calculation:

'Is $\frac{a}{b}$ larger than $\frac{c}{d}$?'

So, we calculate:

$$\frac{a}{b} \times \frac{d}{d} = \frac{ad}{bd}$$

and

$$\frac{c}{d} \times \frac{b}{b} = \frac{bc}{bd}$$

Therefore, both fractions are written over a common denominator bd. So, in order to compare their size, we simply decide if ad is larger or smaller than bc. The larger fraction is the one with the larger numerator.

If we increase the numerator, whilst keeping the denominator the same, we increase the value of the fraction.

If we increase the denominator, whilst keeping the numerator the same, we decrease the value of the fraction.

Example

Is $\frac{3}{4}$ larger or smaller than $\frac{2}{3}$?

Answer

We calculate $\frac{2}{3} \times \frac{4}{4} = \frac{8}{12}$, and $\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$.

$\frac{9}{12}$ is larger than $\frac{8}{12}$, so $\frac{3}{4}$ is larger than $\frac{2}{3}$.

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Improper Fractions

If the numerator is larger than the denominator, we call this an improper fraction. These are also sometimes called top heavy fractions. Sometimes it is okay to leave these in improper form, and sometimes you will be asked to change it into mixed fraction form.

To do this, we follow these steps:

1. For a fraction $\frac{a}{b}$ with a larger than b, we calculate $a \div b = c$.

   c should be greater than 1 if the fraction is improper.

2. If c has values after the decimal point, disregard them. For example, if c = 5.457, we would write c' = 5.

3. Calculate $\frac{a}{b} - \frac{c' \times b}{b} = \frac{d}{b}$.

4. We therefore write $\frac{a}{b}$ as the mixed fraction: $c'\frac{d}{b}$.

In order to turn a mixed fraction into an improper fraction, we do the following:

1. For a mixed fraction $x\frac{y}{z}$, we calculate $(x \times z) + y = w$.

2. We then write the improper fraction as $\frac{w}{z}$.

Example

Write $\frac{12}{5}$ as a mixed fraction.

Answer

1. $12 \div 5 = 2.4$

2. We write this answer as 2, as we disregard the decimal part.

3. $\frac{12}{5} - \frac{2 \times 5}{5} = \frac{12 - 10}{5} = \frac{2}{5}$.

4. We write $\frac{12}{5}$ as $2\frac{2}{5}$.

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