

Many cultures have developed fractions (and decimals) independently.

(All dates in this paper are rough estimates, since they are relying on written records that have been found. BCE stands for "Before Common Era." CE stands for "Common Era.")

The **Babylonians** (who lived where Iraq is today) had one of the oldest written records of fractions and decimals, dating from around 2000 BCE. While our current number system uses base 10 (that is, there are 10 digits that make up all our numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9), the Babylonian's number system was in base 60.

So, when looking at place value,

we have the tens, ones, and one tenths place:

$$\overline{10s} \quad \overline{1s} \quad \cdot \quad \overline{\frac{1}{10}s}$$

So if we were to write the fraction $1\frac{1}{4}$ using decimals we would get:



$$1\frac{1}{4} = 1\frac{25}{100} \rightarrow \overline{10s} \quad \overline{1s} \quad \cdot \quad \overline{\frac{2}{10}s} \quad \overline{\frac{5}{100}s}$$

Babylonians had the sixties, ones, and one sixtieth place:

$$\overline{60s} \quad \overline{1s} \quad \overline{\frac{1}{60}s}$$

$1\frac{1}{4}$ in the Babylonian number system would look like:

$$1\frac{1}{4} = 1\frac{15}{60} \rightarrow \overline{60s} \quad \overline{1s} \quad \overline{\frac{1}{60}s}$$

since they used a  for the number 1 and a  for the number 10.

One of the problems with their number system is that they did not have a symbol to separate the whole numbers from the fraction part.



So,  

could mean $\overline{60s} \quad \overline{1s} \quad \overline{\frac{1}{60}s} = 1\frac{15}{60}$

or $\overline{60s} \quad \overline{1s} \quad \overline{\frac{1}{60}s} = 75$

This could make reading the numbers very confusing, and they had to rely on context to understand what the number actually represented.

The **Egyptians** also developed fractions (around 1800 BCE) and while they worked in base 10 they only had unit fractions (which means that the numerator is a one). They used a

 to mean part of, and would have written $\frac{1}{4}$ as .

So, how would they write a fraction like $\frac{3}{4}$? Well, they wrote all fractions that were not unit fractions as a sum of two or more unit fractions. The only problem was that these sums were not allowed to repeat any unit fraction.

So, while $\frac{3}{4}$ could be written as $\frac{1}{2} + \frac{1}{4}$ or  ,

it could not be written as ~~$\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$~~ .

In this system it is very hard to do calculations.

Around 300 BCE the **Greeks** were writing fractions using their alphabet to represent the numbers. The number 2 was written as β and the number 5 was written as ε .

In the Greek system the denominator was written with two ticks (") written after it. For non-unit fractions the numerator was written with one tick (') after it and the denominator was written twice.

So the unit fraction $\frac{1}{5}$ was written as $5''$ or ε''

and the fraction $\frac{2}{5}$ was written as $2'5''5''$ or $\beta'\varepsilon''\varepsilon''$.

Ancient Romans also developed fractions, but they only used written words to represent them. Most of the fractions were based on the Roman weight system called the "as."

Some examples are: 1 as = 12 uncia

$\frac{1}{12}$ → uncia

$\frac{4}{12}$ → quadrans

$\frac{6}{12}$ → semis

It is hard to know when the **Chinese** started working with fractions, but around 30 BCE they were adding, subtracting, and multiplying them. They worked in base 10 and placed the numerator above the denominator, but did not separate them with a line. In their number system one was represented by **I** and seven was represented by **II**.

The fraction $\frac{1}{7}$ would be written as $\frac{\text{I}}{\text{II}}$.

Around 500 CE we know the **Hindu** culture was using fractions very much like we do today. The number system they used developed into the one we use today, including a zero. Like the Chinese, the numerator was placed over the denominator and there was no line to separate them.

For example $\frac{1}{9}$ was written as $\frac{\text{I}}{\text{9}}$.

The **Arab** culture traded with India, and they adopted this number system. Around 1200 CE they added the line that separates the numerator from the denominator.

So, when did Europe start using fractions? It appears that fractions were introduced into Europe at least twice. In 1202 CE Fibonacci introduced Italy to fractions and the Hindu-Arabic number system in his book *The Book of Calculation*, based in part on his studies with Arabs in Northern Africa. The Hindu-Arabic number system then spread to other European countries. Simon Stevin is also credited with bring fractions and decimals to Europe in his 1585 booklet called *The Art of Tenths*.

The word fraction comes from the Latin "frāctiō" which means *to break*.



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