

INTRODUCTION TO GRAPHIC COMMUNICATIONS Section No. 209
NUMBER DEVELOPMENT

Numbers are a human invention brought about by the need to measure and count things. Early peoples had only a primitive concept of number, so the development of an abstract number sequence was a major

advance. Mathematical growth has led to ever-broadening ideas of what numbers are.

Counting began with 1, 2, many; it slowly evolved until the numbers consisted of 1, 2, 3, 4, . . . , or what we call the counting

numbers or positive integers. Such numbers describe how many elements there are in a collection of objects and are called cardinal numbers. A related sequence of numbers describes how elements in a collection are ordered, or positioned; such numbers are called ordinal numbers—for example, first (1st), second (2nd), third (3rd), fourth (4th), fifth (5th), etc.

As civilizations became more advanced, it became necessary to measure parts of things. Initially the concept of a fraction was avoided by subdividing existing units into smaller ones, like the division of an hour into 60 minutes. By 1500 BC, however, the Egyptians had developed the use of fractions, or positive rational numbers.

Mathematics progressed, and a systematic study of geometry was undertaken. Having precise mathematical theorems for measuring abstract geometric objects proved extremely useful in construction and in various arts.

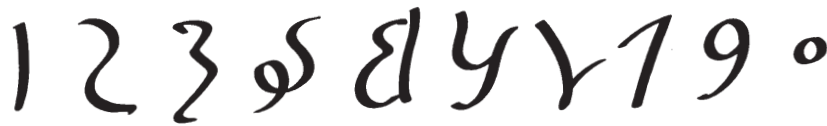
In particular, the Greeks discovered—by means of the theorem of Pythagoras—that in a square with sides of length one, the length of its diagonal d is a number whose square is two ($dd = 2$).

At first, they attempted to find a rational number whose square was 2, but finally they proved (about 460 BC) that $d =$ (the square root of 2) was not

**Major Phases in
 Number Development**



ONE VARIETY OF EARLY INDIAN NUMBERS.



EASTERN ARABIC NUMBERS.



WESTERN ARABIC NUMBERS (GHOBAR).



GENERAL STYLE OF 11TH CENTURY NUMBERS IN EUROPE.



LATER VARIETY OF EUROPEAN NUMBERS.



OLDSTYLE NUMBERS OF CLAUDE GARAMONT — 1545.

rational. The concept of a number, therefore, had to be expanded to include these irrational numbers, or surds.

Another mysterious number arose naturally: namely the ratio of the circumference of a circle to its diameter (π , p). The Greeks were unable to decide if π was rational or not, but by the 18th century it was shown that π was irrational.

Meanwhile, the idea of a negative number began to emerge (around 200 BC in China and later in the West), but the concept of a number was not actually broadened to include negative numbers until about the 16th century.

The concept of zero made its appearance in about the 9th century in middle east (and independently in the Mayan culture). It was initially used as a place holder in numerical notation and was basic to the development of the system of Hindu-Arabic numerals, which are still in use today.