History of formation of the decimal number concept

Iakovlieva O. N.
(Odessa)
E-mail: olganik6505@gmail.com

Lipska Zh. M.
(Odessa)
E-mail: zhannka5zhienko@gmail.com

The precursors of decimal numbers were sexadecimal numbers of Babylonians [1, 240]. In their fractions, the number 60 and its natural powers served as the denominator. These fractions were called physical or astronomical because this number system was widely used in astronomy right up to Renaissance.

The decimal number system has already been used in ancient China in the III-rd century BC. Liu Hui, Chinese mathematician of that time, recommended to use fractions with 10, 100, etc. as the denominator while extracting square roots. He meant the following rule:

$$\sqrt{a} = \frac{1}{10^n}\sqrt{a10^{2n}}.$$

The first systematic presentation. The theory of decimal numbers was systematically expounded by Samarkand mathematician Giyas-ad-din Jamshid ibn Mas'ud al-Kashi in his work 'The Key to Arithmetics' in the first half of the XVth century. He gave rules of arithmetics of decimals, the rules for converting sexadecimal numbers to decimal ones. However, his works were unknown in Europe. Al-Kashi separated the integer part of a number from its fractional part by a vertical line, he inscribed its decimal place above each digit and etc.

Decimal numbers in Europe. In Europe the idea of decimal numbers was systematically developed by I. Bonfis from Tarascon (Southern France) in the mid of the XIV-th century. He described the system of fractions in which 1 = 10 primas, 1 prima = 10 seconds, etc., and briefly explained the rules of the basic operations on these fractions in his manuscript [2, 360]. Bonfis's work called 'The Way of Division' was discovered only in the 20-th century. First decimal numbers in Europe were written as integers in a certain agreed scale. For example, the trigonometric tables of Regiomontan (1467) contained values magnified by 100,000 and then rounded up to the nearest integer.

The discovery and promotion of decimals in Europe is a merit of Flemish engineer S. Stevin. He published his brochure 'De Thiende, La Disme' in 1585, where he introduced the decimal system of monetary units, measures, weights as the natural completion of the idea of decimal numbers [1, 243]. Stevin indicated the digit place by an encircled number after each digit (or above it). First using the decimal point for writing decimal numbers occurred in 1592 [3, 56].

J. Wallis continued the work on the theory of decimal numbers. He proved that the fraction with the denominator 2^m5^n can be turned into a finite decimal fraction in his 'Treatise on Algebra' in 1685. In the XVIII century German mathematician J. Lambert proved that a purely periodic decimal fraction can be turned into a usual fraction, i.e. it is a rational number [2, 367]. Deep properties of periodic decimal fractions were described in K. Gauss's 'Arithmetic Studies'. For example, Gauss proved that the largest number of digits in the period for the fraction $\frac{p}{q}$, where q is a prime number, is less or equal $q - 1$ [4, 109].

Justification of the theory of decimal fractions. In the XIX century German mathematician Karl Weierstrass considered decimal numbers as a model of the system of real numbers.

References

[1] И. Я. Депман "История арифметики" Изд. "Просвещение", Москва, 1965.

[2] Вилейтнер Г. История математики от Декарта до середины XIX столетия, Гос. изд. физ.-мат. лит-ры, Москва, 1960 г.

[3] Свечников А. "Путешествие в историю математики или Как люди учились считать: Книга для тех, кто учит и учится." М.: Педагогика-Пресс, 1995 г.

[4] Tent Margaret "The Prince of Mathematics: Carl Friedrich Gauss", 2006.