Abraham de Moivre (1667–1754)

Natali Hritonenko

Mathematics brings beauty and diversity to our lives. It changes our world of thinking and feeling. Therefore, it is not surprising that mathematicians are unique and have incredible lives. Some of them were famous in life; others got recognition only after death. Often, the latter predicted mathematics discoveries before they were observed by the scientists after whom they are named. Sometimes history takes a turn and the truth comes out.

For a long time, the normal distribution was called the Gaussian distribution, after German mathematician Carl Friedrich Gauss (1777–1855). It is true that Gauss discussed this distribution in 1809, but French mathematician Abraham de Moivre first announced it in 1733. To avoid "an international question of priority," Sir Francis Galton suggested the adjective *normal* for the distribution in 1877, and Karl Pearson recommended the routine use of that term, although it has the effect of leading people to believe that all other distributions of frequency are in some way abnormal. The normal distribution was not the only distribution described by De Moivre. In 1718, he exposed a distribution later named the Poisson distribution after French mathematician and physicist Siméon Poisson (1781–1840), who described it only in 1830. Thinking of and talking about these distributions, we usually forget to mention their inventor.

Abraham de Moivre was born in Vitry, near Paris, France, on May 26, 1667. His life was full of adventure, innovation and mystery. After spending five years at a Protestant academy in Sedan, De Moivre studied logic at Saumur and at the Collège de Harcourt in Paris. Then, as a French Protestant, he was compelled to leave France on the revocation of the Edict of Nantes in 1685. At the age of 18, he immigrated to England with great hopes and expectations. As a foreigner, he could not find employment other than being a private tutor of mathematics. However, in 1710 he was appointed to the commission set up by the Royal Society to review the rival claims of Isaac Newton (1642–1727) and Gottfried Wilhelm von Leibniz (1646–1716) to be the discoverer of calculus. Given that De Moivre was friends with Newton, it is clear where the Royal Society's support lay!

De Moivre ranked high as a mathematician. In the later years of his life, Newton responded to mathematical inquiries by saying, "Go to Mr. De Moivre; he knows these things better than I do."

De Moivre's power as a mathematician lies in his analytic rather than geometric investigation. He pioneered the development of analytic geometry and the theory of probability. In 1718, he published *The Doctrine of Chance*. The definition of *statistical independence* appears in this book together with many problems with dice and other games. He also investigated mortality statistics and the foundation of the theory of annuities.

In *Miscellanea Analytica* (1730), De Moivre presented the first version of a famous formula later called Stirling's formula:

$$N! \sim [2\pi/(N+1)]^{1/2} E^{-(N+1)} (N+1)^{(N+1)}$$

that produces better approximations for $N!$ as N gets bigger. This formula was wrongly attributed to James Stirling (1692–1770), although De Moivre used it in 1733 to derive the normal distribution as an approximation of the binomial one. Stirling only pointed out some errors in the primary formula suggested by De Moivre. Even Stirling related the episode in a letter to Gabriel Cramer (1704–1752) in September 1730. In the second edition of *Miscellanea Analytica* in 1738, De Moivre gave credit to Stirling for improving the formula. But we still name this famous formula after Stirling.

De Moivre is remembered for the formula named after him,

$$(\cos x + i \sin x)^n = \cos nx + i \sin nx,$$

which changed the mathematical world, took trigonometry into analysis and is still used in different applications.

Despite De Moivre's scientific eminence, his main income came from tutoring mathematics. He spent much of his free time answering questions about games of chance for rich patrons at a tavern on St. Martin's Lane in London. He died in poverty.

Such an extraordinary person could not simply pass away. Shortly before his death, De Moivre made his last, most prominent prediction. He declared that it would become necessary for him to sleep 15 minutes longer each subsequent night and that he would die on the day, calculated from the arithmetic progression, that he slept for 24 hours. He was right! The day after he had slept almost 24 hours, he slept exactly 24 hours and then passed away in his sleep.

Each side of a square is 60 cm long. If a rectangle has a width of 30 cm and the same area as the square, what is its perimeter?