From the Annals of the World History

Maria Gaetana Agnesi

May 16, 1718 - January 9, 1799

Maria Gaetana Agnesi was an Italian mathematician and philosopher. She is credited with writing the first book discussing both differential and integral calculus and was an honorary member of the faculty at the University of Bologna.

She devoted the last four decades of her life to studying theology (especially patristic) and to serving the poor.

Maria Gaetana Agnesi was born in Milan on May 16, 1718, to a wealthy and literate family. Her father wanted to elevate his family into the Milanese nobility. In order to achieve his goal, he had married in 1717 Anna Fortunata Brivio. Her mother's death provided her the excuse to retire from public life. She took over management of the household.

Having been born in Milan, Maria was recognized as a child prodigy very early; she could speak both Italian and French at five years of age. By her thirteenth birthday she had acquired Greek, Hebrew, Spanish, German, Latin, and was referred to as the "Walking Polyglot". She even educated her younger brothers. When she was 9 years old, she composed and delivered an hour-long speech in Latin to some of the most distinguished intellectuals of the day. The subject was women's right to be educated. When she was fifteen, her father began to regularly gather in his house a circle of the most learned men in Bologna, before whom she read and maintained a series of theses on the most abstruse philosophical questions. Records of these meetings are given in Charles de Brosses' Lettres sur l'Italie and in the Propositiones Philosophicae, which her father had published in 1738.

Maria was very shy in nature and did not like these meetings. Although her father refused to grant this wish of joining a convent, he agreed to let her live from that time on in an almost conventional semi-retirement, avoiding all interactions with society and devoting herself entirely to the study of mathematics. During that time, Maria studied both differential and integral calculus. Her father, Pietro Agnesi, also married twice more after Maria's mother died, so that Maria Agnesi ended up the oldest of 21 children. In addition to her performances and lessons, her responsibility was to teach her siblings. This task kept her from her own goal of entering a convent. Fellow philosophers thought she was extremely beautiful and her family was recognized as one of the wealthiest in Milan. Maria became a professor at the University of Bologna.

Contributions to Mathematics

The most valuable result of her labour was the Instituzioni analitiche ad uso della gioventù italiana, a work of great merit, which was published at Milan in 1748 and "was regarded as the best introduction extant to the works of Euler." The first volume treats of the analysis of finite quantities and the second of the analysis of infinitesimals.

Witch of Agnesi

The Instituzioni analitiche..., among other things, discussed a curve earlier studied and constructed by Pierre de Fermat and Guido Grandi. Grandi called the curve versoria in Latin and suggested the term versiera for Italian, possibly as a pun: 'versoria' is a nautical term, "sheet", while versiera/aversiera is "she-devil", "witch", from Latin Adversarius, an alias for "devil" (Adversary of God). For whatever reasons, after translations and publications of the Instituzioni analitiche... the curve has become known as the "Witch of Agnesi".

In mathematics, the witch of Agnesi, sometimes called the witch of Maria Agnesi is the curve defined as follows.

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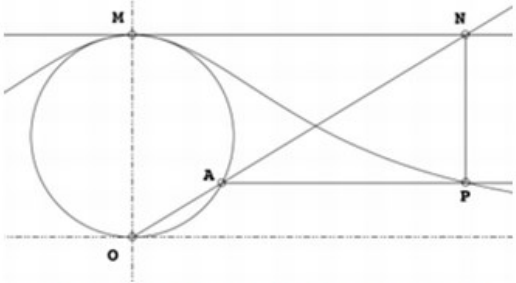

The Witch of Agnesi with labeled points

Starting with a fixed circle, a point O on the circle is chosen. For any other point A on the circle, the secant line OA is drawn. The point M is diametrically opposite to O. The line OA intersects the tangent of M at the point N. The line parallel to OM through N, and the line perpendicular to OM through A intersect at P. As the point A is varied, the path of P is the witch. The curve is asymptotic to the line tangent to the fixed circle through the point O.

Suppose the point O is the origin, and that M is on the positive y-axis. Suppose the radius of the circle is a.

Then the curve has Cartesian equation

$$y = \frac{8a^3}{x^2 + 4a^2}.$$

The curve has applications to real-life phenomena, which have only come during the 20th and 21st centuries. The Cartesian equation (above) has appeared in the modeling of some physical phenomena mathematical models: the equation approximates the spectral line distribution of optical lines and x-rays as well as the amount of power dissipated in resonant circuits. Formally, the curve is equivalent to the probability density function of the Cauchy distribution. The cross-section of a smooth hill also has a similar shape. It has been used as the generic topographic obstacle in a flow in mathematical modeling.

Later life

In 1750, on the illness of her father, she was appointed by Pope Benedict XIV to the chair of mathematics and natural philosophy and physics at Bologna. She was the first woman to be appointed professor at a university. After the death of her father in 1752 she carried out a long-cherished purpose by giving herself to the study of theology, and especially of the Fathers and devoted herself to the poor, homeless, and sick. After holding for some years the office of director of the Hospice Trivulzio for Blue Nuns at Milan, she herself joined the sisterhood, and in this austere order ended her days, though the terms of her death are unknown.

The Witch of Agnesi, a curve, A crater on Venus and Asteroid 16765 Agnesi (1996) are in her honour.