MARIA GAËTANA AGNESI (May 16, 1718 – January 9, 1799)

by HEINZ KLAUS STRICK, Germany

MARIA GAËTANA AGNESI is one of the few women whose name is mentioned in the history of mathematics. It is sometimes claimed that she was the first woman to hold a professorship in mathematics.

This is only partially true, because although she was appointed to a chair in mathematics at the University of Bologna, she never took up the post.

There is no theorem in mathematics named after her, but there is a special curve that PIERRE DE FERMAT, GUIDO GRANDI and ISAAC NEWTON had already dealt with before. Unfortunately this curve was given an unpleasant name due to an incorrect translation: "Witch of Agnesi".

MARIA GAËTANA was born in Milan to the rich silk merchant PIETRO AGNESI and his wife ANNA FORTUNATO BRIVIO. (Some sources state that her father was a mathematics professor, but this is definitely not true - one of the first biographers gave this incorrect information, and numerous authors repeated it.)

PIETRO AGNESI was extremely successful as a businessman, but found that this did not gain him recognition from the influential nobles of the city. So he tried to attract attention by giving spectacular receptions at his house. As was usual in aristocratic houses, concert performances and philosophical discussions took place at such events. This was fortunate since it meant that MARIA GAËTANA and her sister MARIA TERESA gained reputations as prodigies.

Because of his wealth, PIETRO AGNESI could afford the best private tutors, and the two girls also had exceptional talents. MARIA GAËTANA spoke "wonderful" French at the age of five (and even published a sonnet). At the age of nine, she is said to have given a lecture at the AGNESI house in the best of classical Latin on the subject that girls should also have access to higher education. (We now know that one of her teachers wrote the text of the lecture in Italian, but she translated it and learned it by heart.)

MARIA GAËTANA became known as *oracolo settelingue* (miracle in seven languages), since she also learnt Greek, German, Spanish and Hebrew and after her lectures on various topics from philosophy and science she could answer questions in these languages. Her sister MARIA TERESA entertained visitors to the events as a harpsichord player and composer.

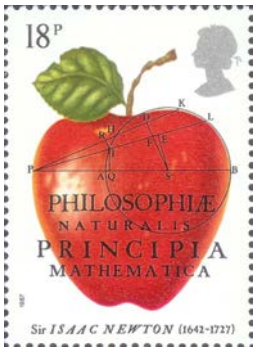
Whenever representatives of the European aristocracy come to Milan, AGNESI hosted a reception with such spectacular presentations, so the AGNESIS became known very widely.

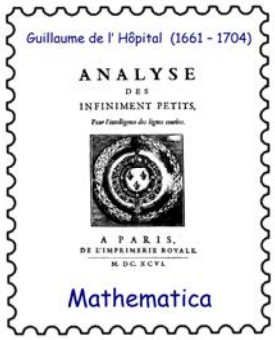
The book *Propositiones Philosophicae* appears in 1738 - it contained 190 lectures that MARIA GAËTANA had given earlier on topics such as the connection between body and soul, or the movement of the tides.

In 1740 PIETRO AGNESI finally achieved his ambition and was able to buy a noble title. In the same year, MARIA GAËTANA, who had become increasingly unhappy with the performances staged by her father, expressed her wish to be allowed to enter a monastery.

For fear of losing his dearest daughter, he agreed to cancel the performances. The versatile young woman could now devote herself to the topics that really interested her.

She read theological works and engaged in mathematics. Above all, she was fascinated by ISAAC NEWTON's new methods. During her studies she was helped by RAMIRO RAMPINELLI, a monk who had previously taught as a professor of mathematics in Rome and Bologna, and later also by JACOPO RICCATI and his sons.





She wrote a commentary on GUILLAUME DE L'HÔPITAL's posthumously published work *Traité analytique des sections coniques* (Analytical treatment of conic sections) though it was never published.

In 1748 the time was ripe for a book summarising the calculus. Since the publication of *Analyse des infiniment petits pour l'intelligence des lignes courbes* by L'HÔPITAL in 1696, no work had been published to provide an overview of the development of analysis. In this respect, her two-volume work *Instituzioni analitiche ad Uso della Gioventù Italiana* (Textbook of analysis for Italian youth), comprising over 1000 pages, came at the right time.

The work, privately printed and subsidised by her father's fortune, was dedicated to the Empress MARIA THERESIA (Milan was part of the Habsburg Empire at the time), who gave her a precious ring as a token of her gratitude.

A complimentary commentary (*Foeminam doctissimam, quae ... sui sexus est unica*) appeared in the journal *Acta Eruditorum*, which was published in Leipzig, as well as in the reports of the Parisian *Académie des sciences*. They were, however, written by little-known authors.

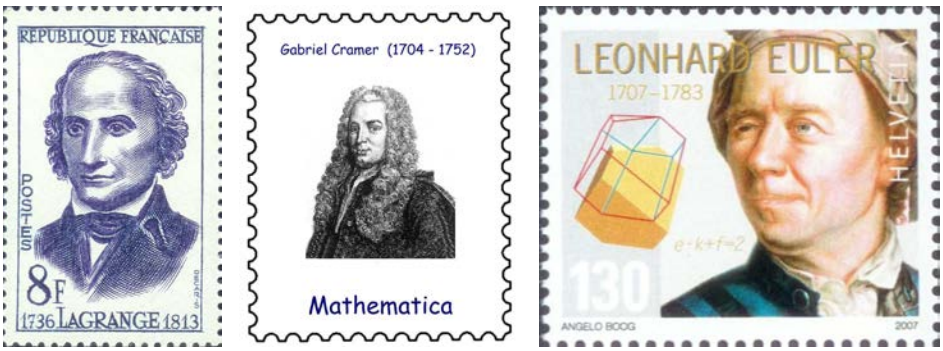
MARIA GAËTANA AGNESI was elected as a member of the Bologna Academy and was appointed *lectrix honoraria* (honorary lecturer) by Pope BENEDIKT XIV and then appointed to the Chair of Mathematics (Bologna was part of the Papal States at the time). As mentioned above, she did not not take up the chair.

Her life changed when her father died in 1752. Of his total of 21 children (from three marriages), 13 were still at home. She dedicated herself to bringing up these underage children.

Her interest in mathematics ended abruptly and she was no longer willing to answer questions about mathematics; among other things, she received an inquiry from the University of Turin for her opinion on the papers submitted by a certain GIUSEPPE LODOVICO LAGRANGIA (later known under the French name JOSEPH-LOUIS LAGRANGE).

Her extensive specialist library was dispersed. Instead, she only read books dealing with religious topics and wrote her own texts. She also looked after the poor and the sick, initially setting up a hospice for women in the family home, and later in her own home. She donated her inherited fortune to charity.

In 1799 she herself died in complete poverty and was buried anonymously in a mass grave that was later destroyed during the NAPOLEONic occupation.

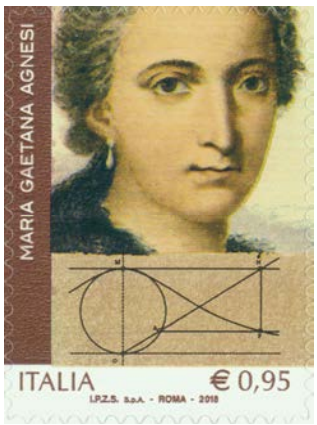


Although AGNESI's volumes were translated into French and English, they did not acquire the same significance as LEONARD EULER's work of the same year, *Introductio in analysin infinitorum*, or GABRIEL CRAMER's *Introduction à l'analyse des lignes courbes algébriques* of 1750.

As the title of her two volumes indicates, AGNESI wrote a work with which young people could learn new mathematics - it was therefore more of a textbook than a work with innovative aspirations. The four chapters of the work were formulated in an understandable language and clearly structured. Numerous examples of problems dealt with topics from elementary algebra, differential and integral calculus and even simple differential equations.

When translating the *Instituzioni analitiche* into English it was the Lucasian Professor of Mathematics at Cambridge, JOHN COLSON, who made the error in naming the curve for which AGNESI is known.

GUIDO GRANDI (1671-1742) had described the curve in Latin as *versoria* (from the Latin *versare* = turn) and in Italian as *la versiera*. Colson confused this with *l'avversiera*, which means something like female devil or witch (in Latin *adversarius* is the enemy, here: the enemy of God), and so he gave the locus the name "Witch of AGNESI".



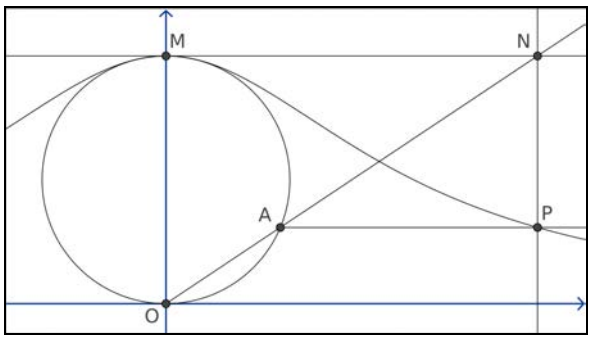
The so-called Witch of AGNESI is defined as follows:

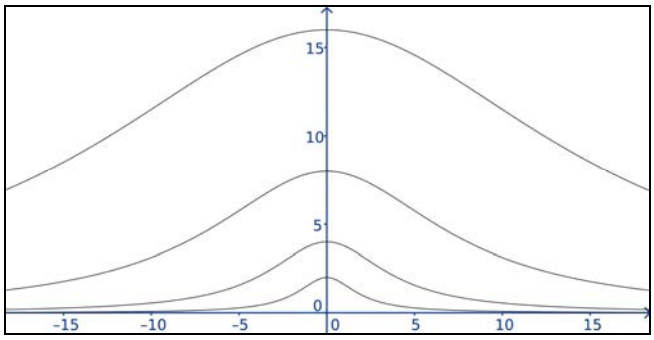
Starting from a circle with a fixed radius *r*, on the diameter of which are the points $O(0;0)$ and $M(0;2r)$, we draw from O a straight line through any point A of the circle. This intersects the straight line with $y = 2r$ at a point $N(n;2r)$, a parallel line through A intersects the straight line with $x = n$ at the point P.

If you move A on the circular line, the locus of P is the curve you are looking for.

It satisfies the function equation $y = \frac{8r^3}{x^2 + 4r^2}$ or $\frac{y}{2r} = \frac{1}{(\frac{x}{2r})^2 + 1}$.

The following diagram shows the *Agnesi curves* for $r = 1, 2, 4, 8$ (source: Morn, CCO, *Wikipedia*).





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Translated by John O'Connor, University of St Andrews

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