Blaise Pascal

Blaise Pascal was born at Clermont on June 19, 1623, and died at Paris on August 19, 1662. Initially, his education was confined only to the study of languages, and did not include any mathematics. As a twelve-year old, having heard from his tutor that geometry was the science of constructing exact figures and of determining the proportions between their different parts, Pascal was stimulated into giving up his play-time to the study of geometry. He discovered by himself that the sum of the angles of a triangle is equal to two right angles. Soon after, he read and quickly mastered Euclid's Elements. At the age of fourteen he started attending the weekly meetings of French mathematicians like Mersenne, Gassendi, Roberval, Carcavi, Auzout, Mydorge and, Desargues.Pascal wrote an essay on conic sections which was published only much later in 1779.Among these is the famous "Mystic hexagon theorem" asserting that, for any hexagon inscribed in a conic, the points of intersection of the opposite sides are collinear. Pascal's mystic hexagon is invariant under canonical projection; indeed, along with his friend Desargues, he is a pioneer of projective geometry.It should be noted that the curve known as the 'limacon of Pascal' was discovered by the father Etienne Pascal.

In 1641, Pascal invented the first digital calculator to help his father with his work collecting taxes. The French currency at that time had 20 sols in a livre and 12 deniers in a sol. As it was much harder to work with this division of the livre into 240 than he would have had if the division had been 100, there were problems with the design of the calculator. In his correspondence with Fermat around this time, he dealt with analytical geometry and physics. Around this time Pascal began a series of experiments on atmospheric pressure and by 1647 had satisfied himself that a vacuum existed. Descartes visited Pascal and the two argued about the vacuum which Descartes did not believe in. Descartes wrote (rather unkindly) to Huygens that "Pascal has too much vacuum in his head." Pascal repeated Torricelli's experiments for estimating the pressure of the atmosphere and reconfirmed his theory. Pascal also made several experiments on the pressure exerted by gases and liquids and explained what is now known as Pascal's law. In between, for three years he abandoned these pursuits to study religion.

In 1654, he invented the so-called Pascal's triangle which gives the coefficients of the expansion of a binomial which later led Newton to his discovery of the general binomial theorem for fractional and negative powers. At about this time, he is credited with creating probability theory in his correspondence with Fermat. This correspondence consisted of five letters and occurred in the summer of 1654 and arose from a problem proposed by a gamester, the Chevalier de Méré. The problem was the following. Two players of equal skill want to leave the table before finishing their game. Their scores and the number of points which constitute the game being given, it is desired to find in what proportion they should divide the stakes. Pascal and Fermat independently obtained the same answer, but gave different proofs. Actually, Zhu Shijie in his book of 1303 already considered Pascal's triangle but Pascal made use of it in ingenious ways in his work on probability theory. In a lighter vein, one may say that it was not chance but an ability to probe which lead Pascal to probability theory.

Further, the explicit formula $n(n-1) \ldots (n-r+1)/1.2 \ldots r$ for the binomial coefficient 'n choose r' was proved by Pascal and is the first example of the fundamental pattern of reasoning which has come to be known as mathematical induction.

In November 1654, Pascal miraculously survived an accident when he was driving a four-in-hand. His thoughts again turned to religion and relinquishing his scientific pursuits, he moved to Port Royal until his death in 1662. An essay on the cycloid in 1658 was the only mathematical work that he produced after moving to Port Royal. It is said that he was suffering from a toothache when the idea occurred to him and, found to his surprise his teeth immediately ceased to ache. Regarding this as a divine intimation to proceed with the problem, he worked incessantly for eight days at it. He computed the area of any segment of the cycloid and also solved the problems of the volume and surface area of the solid of revolution formed by rotating the cycloid about the x-axis. Pascal also investigated the geometry of the Archimedean spiral. Leibniz was greatly influenced by Pascal's work on integration and his speculations on the infinitesimal. Pascal's work on the cycloid (roulette) – written under the pseudonym of Amas Dettonville – was also an important influence on Leibniz.

Pascal wrote the philosophical work Pensées towards the end of his life. This is a collection of his thoughts on human suffering and faith in God which he began in late 1656 and continued to work on during 1657 and 1658. This work contains 'Pascal's wager' which claims to prove that belief in God is rational with the following argument:

"Let us weigh the gain and the loss in wagering that God is. Let us consider the two possibilities. If you gain, you gain all; if you lose, you lose nothing. Hesitate not, then, to wager that He is."

In the seventh chapter of Pensées, he tries to apply his probability theory to argue that it is worthwhile to be religious. He argues that, as the value of eternal happiness must be infinite, then, even if the probability of a religious life ensuring eternal happiness be very small, still the expectation (which is measured by the product of the two) must be of sufficient magnitude to make it worthwhile to be religious!

Pascal died at the age of 39 in intense pain after a malignant growth in his stomach spread to the brain.

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"Those who are accustomed to judge by feeling do not understand the process of reasoning, because they want to comprehend at a glance and are not used to seeking for first principles. Those, on the other hand, who are accustomed to reason from first principles do not understand matters of feeling at all, because they look for first principles and are unable to comprehend at a glance."

From: *Pensees*