The Four What's of Mathematics

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1. What is mathematics?
2. What do mathematicians do?
3. What kind of individuals become mathematicians?
4. What is the nature of mathematics?

What is mathematics? This is indeed hard to describe, due to the complex nature of the various disciplines and the role different professionals currently play. It has become a kind of international activity.

Therefore, we first discuss: What do mathematicians do?

Looking at the *American Mathematical Reviews*, a publication of the American Mathematical Society which publishes review articles on numerous papers and books handled by world mathematicians, one notes that there are at least 100 subclassifications of mathematics. To name a few, we have:

history, logic, set theory, combinatorics, graph theory, number theory, algebra, geometry, topology, calculus, probability theory, statistics, numerical analysis, computer science, elasticity, plasticity, fluid mechanics, acoustics, optics, electromagnetic theory, thermodynamics, quantum mechanics, relativity, astronomy, astrophysics, geophysics, operations research, systems, control, information and communication, automata.

The list is almost endless, as this is a vast field which seems to grow and grow!

Mathematical reviews seem to be very useful for gleaning mathematical ideas. They are presently being published in English, French, German and Italian. Reviews are published for papers or books in almost any language in which mathematical ideas are transmitted, and since they contain only a special limited vocabulary, some familiarity with the subject enables mathematicians to read most papers or at least make a good guess at their contents.

International Mathematics Conferences have been very successful due to the fact that mathematicians from all parts of the world can understand each other. These conferences, held every four years, provide willing mathematicians with ample opportunities to make personal contacts and exchange viewpoints. The attendance at such conferences is quite high - usually well over 3,000. Two prizes of great value are awarded at each conference for the best work done by a mathematician under age 40, the award recipient being chosen by a jury of internationally famous mathematicians. The human aspect of such a large gathering of mathematical specialists is one of the great attractions.[1]

What kind of individuals become mathematicians? It is said that people turn to mathematics when they are unable to cope with the problems of the world! This is not always the case. Mathematicians are all sorts of people. There are mathematicians who are genial giants, mathematicians who are rotund Rotarians, mathematicians who adore Bach, mathematicians who play jazz and so on. There are also mathematicians who would never be suspected of being mathematicians!

[1]The next International Mathematics Conference happens to be in North America. It will be held in Berkeley, California, on August 10-16, 1980.

The one faculty common to all mathematicians is a capacity for the *abstract* thought.

Therefore, to answer the question "What is mathematics?", perhaps one can ask, "What is it not?" As for the nature of mathematics, Professor Alfred J. Ayer, in *Language, Truth and Logic*,[2] contends that an infinitely intelligent person would find mathematics dull, since he would be able to see at a glance all the possible consequences of any set of axioms! This is a meaningless statement, since we cannot devise a test to see whether any person is infinitely intelligent. But If we give meaning to the statement, we assume that mathematical development is exclusively occupied with the logical deductions from the given axioms or theorems.

Poincaré writes in his *Science and Method*[3]:

> ... That the mathematical discovery does not consist in making new combinations with entities that are already known. This indeed can be done by anyone in infinitely many ways. Discovery consists not in constructing useless combinations, but constructing those that are useful - which are an infinitely small minority.
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> ... Mathematical facts worthy of being studied are those which, by their analogy with other facts, are capable of leading us to the knowledge of a mathematical law, in the same way as the experimental facts lead us to the knowledge of a physical law.

Mathematics may be summed up as a vast adventure in ideas. It is a collection of thoughts of several generations. It has been influenced by agriculture, commerce, engineering, philosophy and many other disciplines. The mathematics of the present century has so many aspects that it is impossible to do justice with even main trends. We suggest the following books on the history of mathematics to serve as a supplement for further exploration of the subject:

Bell, E.T. *Men of Mathematics*, Second Ed., Pelican Books. New York: Simon & Schuster, 1953.

Jacobs, Harold R. *Mathematics - A Human Endeavor (A Book for Those Who Think They Don't Like the Subject)*. San Francisco: Freeman and Co., 1970.

Kline, M. *Mathematics in Western Culture*. New York: Oxford University Press, 1953.

Kline, Morris. *Mathematics: An Introduction to Its Spirit and Use*. San Francisco: Freeman and Company, 1978.

Miller, G.A. "A First Lesson in the History of Mathematics," "A Second Lesson...," et cetera - a series of 10 articles in *National Mathematics Magazine*, Vols. 13-19 (1935-45).

Sarton, G. *The Study of the History of Mathematics*. London: Cambridge Dover, (reprint) 1957.

Sedgwick, W.T. and H.W. Tyler. *A Short History of Science*, Third Ed. New York: Macmillan Co., 1948.

Smith, D.E. *A Source Book in Mathematics*. London: Cambridge University Press, 1929, and New York: Dover Publications Inc. (reprint), 2 volumes, 1959.

Struick, Dirk J. *A Concise History of Mathematics*, Third Ed. New York: Dover Publications, Inc., 1967.

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[2]Alfred J. Ayer, *Language, Truth and Logic* (New York: Dover Publications, Inc., 1947), p.85.

[3]Poincaré, *Science and Method* (New York: Science Press).