did not advance further for about 3 weeks although it continued to be active over the peninsula. It started advancing again on 11 July and reached Delhi and neighbouring areas on 16 July. By 19 July, the monsoon covered the entire country. (See figure for the week-by-week rainfall so far.)

As on 31 July, out of the 35 meteorological subdivisions, 21 have received normal or excess rainfall. On a districtwise count, 54% of the districts have received normal to excess rainfall. All through the season so far, the meteorological subdivisions comprising the Indian peninsula and the Lakshadweep islands have received normal or excess rainfall. Rayalaseema, Telangana, Madhya Maharashtra, Marathwada and Vidarbha, which are rain-fed and traditionally deficient, have received copious rainfall. Same is the case with Tamil Nadu, which is generally a rain-shadow area during the southwest monsoon. West Bengal has been in the 'normal' category all along. The map depicts the position as on 31 July.

The delay in advance of monsoon over northwest India was mainly due to the prevalence of unfavourable pressure patterns. From the second week of July onwards, three low-pressure areas and one depression developed over north Bay of Bengal and moved over land, increasing the rainfall activity over Orissa and then over central and west India. This provided much-needed rainfall to Orissa, MP and Gujarat, all of which are now in 'normal' category. The position in Rajasthan and in Saurashtra and Kutch has also improved to a large extent. Bihar, UP, HP, Delhi, Haryana and adjoining parts of Rajasthan did not benefit much from the passage of these systems, although these regions also received rainfall.

To summarize: Rainfall has been very good over the peninsula, and good over northeast India, West Bengal, Orissa, MP, Gujarat and the island territories. Rainfall has also been by and large satisfactory in Punjab and East Rajasthan. Rainfall activity has been subdued over Bihar, Haryana, HP, Delhi, UP and adjoining parts of Rajasthan; the deficiency in rainfall is more marked in these areas. However, some rainfall activity has restarted over Bihar, UP, HP, and parts of Haryana and adjoining areas of Rajasthan during the last few days.

In the long-range forecast issued in May, IMD had indicated that the behaviour of certain parameters, particularly El Niño, had been somewhat erratic, and the developments were being watched carefully. El Niño has continued to be erratic and IMD is monitoring the situation. However, at this point in time, IMD does not anticipate any further exceptionally adverse impact of El Niño on the performance of the monsoon in the remaining half of the season.

With the total rainfall for the country as a whole for the first half of the current monsoon season being 93% of the long-period average value, the overall performance of the monsoon so far has been within the range of the long-range forecast issued by IMD in May 1991. Half of the season is still available and it is anticipated that the total seasonal performance of the monsoon for the country as a whole will be on the lower side of the normal range, as forecast by IMD.

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Encyclopaedia of Mathematical Sciences, or mathematics with a human face

More than a hundred volumes of a new *Encyclopaedia of Mathematical Sciences* have been written by Soviet mathematicians in the last few years. About one half of these have appeared at present in Russian, and about twenty volumes have been translated into English by Springer-Verlag. About ten volumes are at present available in the English edition.

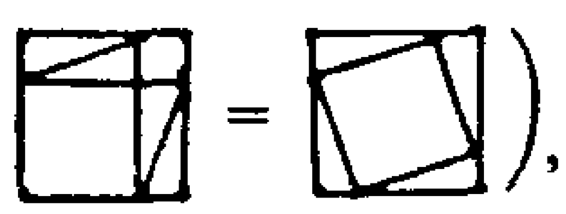
The idea of the project was to present a crucial, united treatment of the whole of mathematics, including the applications, from a modern point of view. The development of mathematics in the last century has produced a large amount of important new theories and a new insight into many classical domains. But the style of mathematical writing has become mostly incomprehensible to the potential users of these results (physicists, engineers, etc.), to students, and even to experts in neighbouring domains.

The lucid style of F. Klein's 'History of the development of mathematics in the XIX century', so different from Bourbaki's incomprehensible 'Eléments des Mathématiques', was the inspiring example for the authors of the *Encyclopaedia*, among whom are most of the leading Soviet mathematicians (several articles have been written by Western authors).

The aim of the *Encyclopaedia* is to provide an easy way to the mathematical results and ideas for the potential user, who is interested in the mathematical tools for his problems rather than in the details of the complicated proofs of difficult theorems and in the study of the independence of the axioms and other problems of foundations.

One of the main obstacles to the understanding of modern mathematics by the scientist is its deductive-axiomatical style. According to Bertrand Russell, the axiomatic method has a lot of advantages, similar to the advantages of stealing compared to honest work. The main idea of this method is to replace the *theorems* by *definitions*. The Pythagoras theorem, one of the most important achievements of ancient mathematics, is reduced in the modern axiomatic treatment of geometry to an innocent-looking definition: a Euclidean space is a vector space equipped with a bilinear symmetric positive definite form.

Both presentations the original one, where the Pythagoras theorem is a statement to be proven, and the axiomatic one, where there is nothing to prove—are in fact mathematically equivalent (while this is in no way evident a priori) However, the two presentations are completely different from the point of view of a beginner, who is able to understand the statement of the Pythagoras theorem, to be astonished by this statement, to check the particular cases, and finally to prove the theorem (or to understand some of the proofs, like the 'Indian' proof.



but who is not able to understand why one has to introduce the strange bilinear form of the axiomatic theory—the so-called inner product.

The abundance of unmotivated definitions is a very characteristic feature of the axiomatic method. Of course, it is impossible to *understand* an unmotivated definition (like the above definition of the inner product) unless you understand the underlying results (in the above example, unless you know the Pythagoras theorem). To use these definitions without real understanding may be the shortest way to apply the theory, but it is so unsatisfactory conceptually and pedagogically that most scientists are automatically stopped by the first unmotivated definition they meet in their attempt to understand modern mathematics.

A simple but typical example of this difficulty is the definition of a group. In abstract mathematics a group is usually defined as a set with one operation verifying a list of axioms (which a normal person is unable to remember).

Historically the notion of the group, which is one of the most important in mathematics, has emerged, of course, in a different way.

Let us consider a set (say a triangle). A *transformation* is a mapping of this set to itself, which is one-to-one and hence has an inverse map (say the reflection of the equilateral triangle in its median). A set of transformations forms a *group of transformations* if, for any transformation, it contains the inverse one, and for two transformations it contains their product.

The definition is complete—no further axioms are needed. The facts that are usually mentioned as the list of the axioms of an abstract group (say $(a\cdot b)\cdot c = a\cdot(b\cdot c)$) are easy *properties* of the groups of transformations. These properties are in fact *theorems* and not axioms; they may be proved.

The abstract-group notion has been invented as a generalization of the elementary and 'naive' notion of the transformation groups. It is very natural for mathematicians to study the possibility of such generalizations since they can use the intuition acquired while studying the elementary and 'naive' objects for the study of the generalized ones, whose study may be much more difficult. The final result of the attempts of the mathematician to find a natural generalization of the notion of the group of transformations was the following theorem due to A. Cayley: Any abstract group may be represented by a group of transformations.

Thus the generalization provides no new objects: *there exist no abstract groups different from the naive groups of transformations*!

Most abstract and difficult mathematical notions have the same origin: they are the by-product of the unsuccessful attempts of mathematicians to generalize simple and natural notions.

Thus the abstract 'manifolds' coincide with the 'naive' curves, surfaces and higher-dimensional surfaces in Euclidean spaces, the abstract 'algorithms' coincide with the 'naive' Turing-machine programs, and so on.

Mathematicians are of course aware of these facts, but they prefer to hide them from the scientific and other users for the sake of the authority of their hermetic science. The 'naive' facts that form the essence of the sophisticated mathematical theories and the motivation of the axioms on which the deductions are based are usually explained only privately, to the disciples (as parables).

The *Encyclopaedia of Mathematical Sciences* is intended to overcome the difficulties users have in penetrating into the hermetical domains of modern mathematics—the examples, motivations of definitions, and the secrets of the mathematical art are explained here in a mathematical way. At the same time long lists of further results, tables and annotated bibliography provide the possibility of finding easily the present state of the art in any domain of mathematics and of its applications.

The *Encyclopaedia* is organized unlike most encyclopaedias are—it rather follows the pattern of Klein's *Encyclopaedia der Mathematische Wissenschaften*. Each subject is covered by several articles (sometimes several volumes) describing it from different points of view and at different levels.

The volumes are numbered more or less chronologically, in the order in which they have appeared in print. They are organized into series (algebra, geometry, topology, analysis, dynamical systems, etc.). Thus volume 39 is *Dynamical Systems* and is devoted to the applications of singularity theory.

I may say, even being one of the authors of the *Encyclopaedia*, that at least some of the volumes are real mathematical gems. I may mention, for instance, the volume *Topology-1*, which contains an introduction to topology, algebraic topology and differential topology (by S. P. Novikov and D. B. Fuchs); several volumes on algebraic geometry; those on discrete groups; and so on. The *Encyclopaedia* provides beginners with a royal way to penetrate the otherwise hermetic ideas and methods of modern mathematics, while the experts will find there a concise description of the latest developments both in their area and in neighbouring domains.

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