are combined, but these elements are usually not numbers, as is now commonly known.

The groups whose elements obey the commutative law when they are combined are known as Abelian groups, and under the entry of "groups" in this encyclopedia it is stated (volume 10, page 914) that a set of independent generators of such a group can be so selected that their orders are powers of distinct prime numbers. This is clearly only possible in the special case when the Abelian group is a cyclic group. Among the other errors which appear under the same entry is the assertion that the group of the cube is the same as the group of the regular tetrahedron, while the latter group contains only one half as many elements as the former, and is a subgroup of the former. The regular solids have received considerable attention in mathematics since the times of the ancient Greeks, and hence it may be assumed that their groups of movements are of general interest.

Under the entry "algebra" in this encyclopedia it is stated that "the earliest known treatise containing problems which would at present be called algebraic is the Ahmes Papyrus (also called, from the name of its former owner, the Rhind Papyrus) now in the British Museum and written 1700–1600 B.C. It is now known that the work along the line of algebra by the ancient Sumerians and the ancient Babylonians is more advanced and probably older than that of the ancient Egyptians. On the following page it is said that the biquadratic equation was solved by Ferrari (1540). As Ferrari was born in 1522 he would have been only about eighteen years old when he first solved this equation. The solution was first published in the *Ars Magna* by H. Cardan in 1545, and there is no evidence to support the statement that Ferrari had obtained it long before the time of its publication and at such an early age as about eighteen years.

Several very elementary errors appear under the entry "arithmetic." On page 356 of volume 2 there appears the following statement: "The fact that twelve is scientifically a more convenient radix than ten (having its half, third and fourth easily expressible), seems to have led to the use of eleven and twelve instead of oneteen and twoteen, after which the denary scale was followed." Since eleven means etymologically one left and twelve means two left, these terms relate to the base ten and have no connection with the base twelve. On the same page it is stated that "the distinction between *abstract numbers,* like 4, and *concrete numbers,* like 4 ft., is an inheritance that serves no important purpose." On the contrary, the concept of abstract mathematics is of fundamental importance and it appears in the earliest extant mathematical developments. The early appearance of abstract mathematics is one of the primary facts of history.

Under the entry "Euler, Leonard" it is said that a complete edition of his works was begun in 1926. As a matter of fact, the first volume of this edition was published in 1911 and edited by H. Weber. As this was an international undertaking which was greatly delayed by the World War, the given date is somewhat striking, especially in view of the publicity given to the vast project of publishing Euler's complete works after several failures along this line. Under the entry "Descartes, René" it is stated in volume 7, page 252, that his lines of reference were preferable at right angles to one another. On the contrary, both he and Fermat commonly used lines of reference which are not at right angles to one another. Unfortunately, it is stated in many other places that the lines of reference used by Descartes were preferably at right angles to each other, and hence this error deserves emphasis. In view of the fact that Descartes's Collected Works are widely available this error can easily be verified.

Under the entry "coordinates" it is stated in volume 6, page 391, that the polar coordinates are attributed to Gregorio Fontana (1725–1803). In fact, these coordinates were used much earlier by Jakob Bernoulli (1694) but were not widely used before the appearance of the *Introductio* by L. Euler. On page 75 of volume 15 there appears the following sentence: "The number of mathematical societies, clubs, and circles organized since the early one at Hamburg in 1690 is exceedingly large, but the number of mathematical periodicals since the seventeenth century is very much larger." Since no one knows the number of mathematical organizations which were formed since 1690 it is misleading to imply the contrary. Many of these organizations lasted only a short time and did not publish any of their discussions. In fact, the number of mathematical periodicals since the seventeenth century is not definitely known.

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A REMARKABLE EXAMPLE OF POLAR MIRAGE

IN midsummer of the present year those on board the schooner *Effie M. Morrissey,* while midway between the tip of South Greenland and Iceland, were favored by a remarkable example of superior or polar mirage. Captain Robert A. Bartlett, master of the *Morrissey,* who has reported the occurrence to me with a view to its publication in SCIENCE, has during an experience of more than forty years in the Arctic seen many polar mirages, but, as he says, none so remarkable as this and certainly none so well checked for position and distance.

On July 17, the schooner was from its noon observation in sunshine found to be in latitude 63° 38′ N and longitude 33° 42′ W. The ship's three chronometers

had been checked daily by the Naval Observatory signal, and the air was calm and the sea smooth. At 4 P.M. with sun in the southwest the remarkable mirage appeared in the direction of southwestern Iceland. The Snaefells Jökull (4,715 feet) and other landmarks well known to the captain and the mate were seen as though at a distance of twenty-five or thirty nautical miles, though the position of the schooner showed that these features were actually at a distance of 335 to 350 statute miles. A checking observation of the sun made at 6 P.M. gave the latitude at that time as 63° 42′ N and longitude 33° 32′ W. It was warm and rainy; the air had throughout been calm and the sea smooth. Captain Bartlett writes: "If I hadn't been sure of my position and had been bound for Rejkjavik, I would have expected to arrive within a few hours. The contours of the land and the snow-covered summit of the Snaefells Jökull showed up almost unbelievably near."

It should be pointed out that superior or polar mirage is always a phenomenon concerned with great distances and, further, is visible for any given features only within a comparatively limited area. This is because the rays from the object must be directed upward into the warmer air layers of an *inversion*, and these inversions are generally at elevations in excess of a thousand meters where the differences in temperature are represented by a few degrees only. The refraction of the rays necessary to bring them down to the surface of the sea where they would be visible thus represents very flat curvatures and correspondingly great distances. The writer has drawn attention to examples where distances of 100 to 300 miles are involved. The example furnished by Captain Bartlett is somewhat in excess of the examples already described.[1]

WILLIAM H. HOBBS

INDEX TO SCHOOLCRAFT'S "INDIAN TRIBES"

THE monumental six-volume work by Henry R. Schoolcraft entitled "Historical and Statistical Information Respecting the History, Condition and Prospects of the Indian Tribes of the United States." which was published in 1851–1857, represents the first systematic attempt on the part of the Federal Government to study the ethnology and archeology of the North American Indians. Because of this fact and because of the early date at which the information was collected, it will always remain a most valuable source of information on American ethnology.

While this report has proved an important reference work on American Indians for nearly ninety years, its usefulness has been greatly hampered because of the fact that heretofore no index has been available. Mrs. F. S. Nichols, of the editor's office of the Bureau of American Ethnology, has now completed an index consisting of about 22,000 entries on cards, which is available in its present form to ethnologists, librarians and other workers who may wish to make use of it.

Those who can not consult it in person may write to the Editor's Office, Bureau of American Ethnology, Smithsonian Institution, and information requested will gladly be furnished by mail.

M. W. STIRLING

BUREAU OF AMERICAN ETHNOLOGY

AVAILABLE LECTURERS IN GEOLOGY AND GEOGRAPHY

SEVERAL months ago a note in SCIENCE announced a tentative plan to furnish university departments with information regarding distinguished foreign geologists and geographers who may be available for lectures. During the summer and early fall, the names of five scholars who wish to make lecture tours were registered with the Division of Geology and Geography. Some of these men have already arranged to give lectures at several universities, and will be glad to make other appointments. Departments that are interested may secure detailed information by writing to the office of the division.

In this connection, attention is called to the Institute of International Education, which acts as a clearing house of information on available lecturers in all fields of learning. This institute publishes a "News Bulletin," issued monthly from October to May, giving specific information about individual lecturers. The bulletin is published at 2 West 45th St., New York.

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SCIENTIFIC BOOKS

DEVELOPMENTS IN PHYSICS

Atomes, radioactivité, transmutations. By MAURICE DE BROGLIE. 269 pp. Bibliothèque de Philosophie scientifique, Flammarion, Paris, 1939. Paper covers, 22 francs.

WITH the distinctive clarity so characteristic of French authors, M. de Broglie gives an account of the developments in physics during the last thirty years culminating in a discussion of the modern concepts of the atomic nuclei and the transmutation of one element into another. Apart from the more profound philosophical aspects of the recent work in this field, and

[1] W. H. Hobbs, *Ann. Assoc. Amer. Geog.*, 27: 229–240, December, 1937.