

# Boutroux, Pierre Léon | Encyclopedia.com

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(b. Paris, France, 6 December 1880; d. France, August 1922)

*mathematics history, philosophy of science.*

Pierre Boutroux came from a distinguished family. The only son of the celebrated French philosopher Émile Boutroux and Aline Catherine Eugénie Boutroux, he was also the nephew of the statesman Raymond Poincaré and the physicist Lucien Poincaré and a cousin of the noted mathematician Henri Poincaré.

Boutroux's serious academic life began with his studies at the École Normale Supérieure in Paris. In 1900, when he was but nineteen, the University of Paris published his thesis of *licence*, *L'imagination et les mathématiques selon Descartes*. After lecturing in mathematics at the University of Montpellier, Boutroux served as professor of [integral calculus](#) at the University of Poitiers from 1908 until 1920. During this period he traveled widely. In 1909 he was a visiting professor at the University of Nancy. Shortly thereafter he lectured at the Collège de France on mathematical fonctions defined by firstorder differential equations. Then he departed for the [United States](#) and [Princeton University](#), where he occupied the chair of higher mathematics from 1913 through 1914. At Princeton he also assumed the chairmanship of the graduate department of mathematics.

With the advent of [World War I](#), Boutroux took a leave of absence from Princeton in order to join the French army. After serving with distinction, he remained in France. In 1920 he returned to the Collège de France, where he accepted the professorial chair of the general history of science, which [Auguste Comte](#) had first sought to have created in 1832. Although it was finally established in 1892, Boutroux was the first historian of science to occupy it. Had it not been for his untimely death at the age of forty-one, Boutroux, with his extensive erudition, might have made famous the chair of Comte. After his death in 1922, the chair was discontinued.

The writings of Boutroux reflect a wide-ranging scientific interest. In the area of pure mathematics, his chief contribution was his study of multiform fonctions and the singularities of differential equations.

In the nineteenth century, Augustin Cauchy, Karl Weierstrass, and Henri Poincaré had made significant advances in the theory of differential equations in the complex domain. Late in the century the French mathematician Paul Painlevé undertook the study of the singularities of analytic fonctions. After 1887, in a series of brilliant articles, he established a firm foundation for the analytic theory of differential equations and specifically introduced new equations not integrable in terms of elliptic fonctions or any of their degenerate cases. These equations defined new transcendents. Early in the twentieth century Boutroux not only continued Painlevé's work on these new transcendents, but also helped develop Henri Poincaré's and Charles Picard's study in the complex field, around a zero point, of the differential system

where the  $X$ 's are all zero in  $o$  and holomorphic in its neighborhood.

Boutroux's principal pure mathematical publication is *Leçons sur les fonctions définies par les équations différentielles du premier ordre*. After reading this text and several of his articles, one can see that his main contributions to mathematics arose from the extension and clarification of extant ideas rather than from his formulation of new ones.

Boutroux's contributions to the history and philosophy of science are, however, more original and more extensive. The two-volume *Les principes de l'analyse mathématique* is a transitional work encompassing both pure mathematics and the history and philosophy of mathematics. These volumes contain a comprehensive view of the whole field of mathematics in the second decade of the twentieth century, both as a body of knowledge and as a mode of thought. Boutroux's topics range from rational numbers to an analysis of the notion of function. In light of the historical method used by the author, he might better have entitled this book "An Analysis of the Progress of Mathematical Thought." Some of his historical sections are open to criticism. In one instance, for example, his underrating of the accomplishments of [Isaac Barrow](#) and Gottfried Leibniz detract from his analysis of the development of the infinitesimal calculus.

Boutroux clearly presented his view of the nature of mathematical analysis in *Les Principes*. He saw analysis as the combination or reconciliation of two often opposing approaches to explaining the world's phenomena: empiricism and rationalism. His summary of historical developments strikingly shows that modern analysis now envelops these two approaches.

*Les principes* is a substantial contribution to mathematical literature. Its lucid presentation of some of the most important topics in the field has proved to be a valuable guide for graduate students and teachers of mathematics. In addition, this book is a useful source of information for historians of mathematics.

Probably Boutroux's foremost work is *L'idéal scientifique des mathématiciens dans l'antiquité et dans les temps modernes*. In this volume he asserts that the synthetic conception of Cartesian algebra represents a median period in the evolution of mathematics between the aesthetic, contemplative Greek attitude and the apparently groping and incoherent researches of contemporary mathematicians. Throughout these three different ages runs the unity of a search for progress, the attainment of a higher reality. This progress depends neither solely upon mathematicians nor upon the abstract systems of rational or conventional construction. Progress involves many varied rational and practical advances.

The main purpose of Boutroux in writing this book, however, was not to investigate the constituent elements of progress. He had two didactic goals in mind. After showing that the different sciences do not progress independently, he first asserted that the history of science should be a study of the continuous interactions between the various sciences. He opposed the view of the history of science as consisting only of narrow, technical studies. Second, he told teachers and researchers that no one type of solution exists for all problems. He felt that the nature of the problem best dictated the methods needed for its solution.

Boutroux's contributions to the literature of the history of science extend beyond the general surveys mentioned above. His edition of the works of [Blaise Pascal](#) provided the source material needed for the study of seventeenth-century mathematics. He also improved upon some of Pierre Duhem's studies of mechanics and carefully analyzed the writings of the French historian Paul Tannery. Judging from his writings, Boutroux fits into the group of historical thinkers consisting of [Auguste Comte](#), Paul Tannery, Pierre Duhem, and [George Sarton](#).

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