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This book offers a detailed examination of how the human intellect achieved one of its most significant accomplishments: the development of calculus. It explores the intricate history of both integral and differential calculus from their beginnings in ancient times to their eventual transformation into abstract mathematical concepts by the 19th century, defined through formal logic based on the concept of an infinite sequence's limit. While the significance of calculus and mathematical analysis cannot be overstated as they form the core of modern mathematics, this book provides a more profound value beyond its subject matter. It dispels the notion that great mathematical achievements were formulated in their final forms from the start. Instead, it presents a holistic view of mathematics as a way of thinking rather than just a technique and bridges the gap between science and humanities. The book also clearly illustrates how modern understanding of mathematics has evolved from the ancient Greek concept of reality and immanence to the rigorous 19th-century approach, making clear the contributions of numerous mathematicians throughout history and shedding light on both mathematical discovery methods and thought foundations. Mathematics will be presented from its inception to its modern form, giving readers a deeper understanding of the subject as a way of thinking rather than just a technique. This approach aims to bridge the gap between scientific and humanistic disciplines. The book will thoroughly explain how mathematical concepts evolved over time, starting with the Greek view of mathematics as an inherent part of reality, and then transitioning to the modern concept of rigor developed by 19th-century mathematicians. It will highlight the contributions of various thinkers such as Zeno, Plato, Pythagoras, Eudoxus, Arabic and Scholastic mathematicians, Newton, Leibnitz, Taylor, Descartes, Euler, Lagrange, Cantor, Weierstrass, and others in the development from the Greek "method of exhaustion" to the modern concept of a limit independent of sensory experience. The book will provide insight into both mathematical discovery methods and the foundations of mathematical thought. It will also examine how early civilizations like the Greeks, medieval thinkers, and later mathematicians such as Newton and Leibniz contributed to the development of calculus over time, leading up to its final rigorous formulation in modern mathematics. Given article text here Newton and Leibniz independently developed calculus in the early work, but they lacked a formal concept of limits. They used a procedure that involved setting terms of higher order to zero to evaluate derivatives. However, this approach was deemed slippery by Berkeley, who argued that it was not mathematically rigorous. It wasn't until Cauchy and Weierstrass developed their theories that the controversy surrounding calculus was resolved. Boyer discusses the various justifications offered by different parties involved in the debate, but ultimately does not take a stance on the issue. We should question our assumption about applying ordinal concepts to the number line. Is this approach related to spatial experience? If so, wouldn't ordinality be secondary to a more fundamental notion of continuity? This perspective supports using arithmetization guided by spatial intuition instead of purely ordinal methods. Additionally, Boyer's view on what constitutes the modern terminus ad quem is debatable. He emphasizes the importance of medieval computists in laying groundwork for calculus development, which was previously overlooked. Boyer also clarifies that Leibniz and Cauchy differ in their approach to differential and derivative concepts. The book's grasp of abstract or philosophical concepts is impressive – if only every author could convey them with equal clarity and conciseness. However, there are some drawbacks: the content doesn't delve deeply into technical aspects, and scholarly references are absent. The author occasionally mentions philosophical points but never fully explores them; readers can't pinpoint a consistent philosophical stance in the text. The discussion sidesteps Arabic and Hindu mathematics, only briefly mentioning a few minor details. Notably, the omission of Arabic mathematics is puzzling, given its significant contribution to algebraic operations, which were crucial for European mathematicians in the 17th century. This oversight makes the book's narrative less comprehensive, especially considering that Newton himself used algebraic methods in his work. The author's handling of Hindu mathematics also seems dismissive, possibly due to the Indian focus on number theory and discrete structures, which differ from the calculus' emphasis on continuously varying real quantities. The development of calculus would have required a prior understanding of real quantities as their own entity. Hence, Hindu mathematics' strengths weren't suited for contributing to the origins of calculus. Additionally, Boyer's criticism that Hindu mathematics was too computational and didn't prioritize logical derivation might hold some truth. This could explain why the discovery of Taylor series expansions centuries before Europeans got there didn't lead to the full elaboration of logical concepts like limits, derivatives, and antiderivatives. It's intriguing to wonder whether Hindu mathematicians, left to themselves, could have eventually reached modern real numbers and calculus by applying infinitary procedures with rational numbers. Comparing the discovery of Taylor series in the Occident and Orient would be a fascinating intellectual exercise. The chapter 'A century of anticipation' is poorly organized, covering many figures but missing crucial ones like Descartes or Rolle. The chapter on 'A period of indecision' primarily shows discomfort with infinitesimals without exploring why Leibnizian formalism prevailed over Newtonian on the continent and vice versa in England. There's also a lack of discussion on the 18th century's consolidation of calculus methods and applications to remarkable problems in mathematical physics. Closing remarks: Boyer is not overly philosophical or recondite; he remains consistently accessible, sparing his philosophical remarks for their significance in understanding mathematics. His asides help readers grasp the underlying issues and contribute to professional mathematicians' 'culture'. Boyer's study is essentially a summary of various reasonings that eventually condenses into a specific definition. Although Boyer is an accomplished scholar, his work lacks a comprehensive thesis, instead presenting a collection of viewpoints related to other historians' ideas. Reading through it once or twice can give one an idea of the current debates among historians of calculus, but as a scholarly reference, it's somewhat lacking in depth (compare this with Otto Neugebauer and Jeremy Gray). Boyer's work primarily serves as an entry point into more substantial scholarly literature due to its comprehensive bibliography. For those seeking a solid, in-depth reference on the history of mathematics, perhaps Moritz Cantor's four-volume "Vorlesungen über Geschichte der Mathematik" could be considered (though it might require some time). The Greeks' ability to produce and maintain such large numbers of books is puzzling, especially considering their constant petty warfare. Plato noted that before the library, Greece had no culture of science. Socrates was charged with a crime for saying the moon was a clod of earth, highlighting the intolerance towards scientific inquiry. This atmosphere persisted until after Alexander's time, with Aristotle fleeing Athens due to fear of death for studying scientific books. Despite this hostile environment, Greek contributions are often credited with major scientific advancements. In reality, Indian planetary models, which used epicycles and calculus, predated Greek work. Aryabhata developed a numerical technique in the 5th century CE, equivalent to Euler's method. Geometry and calculus were transmitted from India to the Portuguese Romans, who established a library in Kerala, India. The European navigation problem drove their need for precise trigonometric values, which they acquired from Indian contexts using calculus. However, this knowledge was not readily understood by Europeans, as seen in Descartes' quote about the complexity of calculus. Many others reproduced Indian infinite series without acknowledging their pagan sources, a common practice to avoid Church persecution. This phenomenon illustrates a broader pattern: the fabrication of history through claims of "independent rediscovery". Other cases show that major scientific contributions were not actually made independently by Europeans but rather borrowed from other cultures, often without proper credit or recognition. Carl Boyer's book on the history of calculus is an engaging read, making math and history accessible to both experts and laymen. The author skillfully traces the development of calculus from ancient Greek concepts to modern debates about Newtonian and Leibnizian calculus. However, some reviewers found the writing dry and the explanations not always clear, particularly without sufficient visual aids or a strong understanding of contemporary mathematical foundations. Despite this, many found it to be an excellent survey for those well-versed in calculus, although others felt it was more suited as a PhD thesis from 1939 rather than a modern book, making it less engaging and worth the reader's time.

The history of calculus. Who invented calculus and why. The history of the calculus and its conceptual development pdf. The history of the calculus and its conceptual development by carl b boyer.