Isaac Newton: The Calculus

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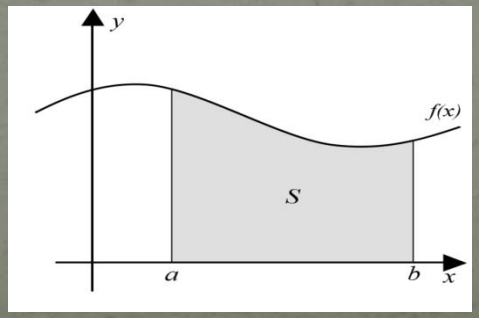
Pre-Calculus

- 1615-Johannes Kepler uses infinitesimals to calculate volumes of revolution in New Measurement of the Volume of Wine Casks.
- 1635-Bonaventura Cavalieri calculates volumes using infinitely small sections.
- 655-John Wallis studies infinite series in Arithmetic of Infinitesimals
- 1658-Blaise Pascal, working on the sine function, “almost” discovers calculus.

Early Calculus

- 1665-Isaac Newton retires to the country to escape the Great Plague in London; there he invents the first form of calculus.
- Newton had the essence of the methods of fluxions by 1666
- The first to become known, privately, to other mathematicians, in 1668, was Newton's method of integration by infinite series



Early Calculus (Continued)

- 1668-James Gregory includes a geometrical version of the fundamental theorem of calculus in Geometrical Exercises and the Universal Part of Geometry.
- 1669-Newton includes his method for finding areas under curves in his On the Analysis of Equations Unlimited in the Number of Their Terms, circulated privately.
- 1670-Isaac Barrow uses methods similar to calculus to draw tangents to curves, find the lengths of curves, and the areas bounded by curves.
- 1675-In Paris in 1675 Gottfried Wilhelm Leibniz independently evolved the first ideas of his differential calculus

Early Calculus (Continued)

- 1676-Newton writes two letters to Leibniz, hinting at his work with infinite series and fluxions (his form of calculus); also this year, Leibniz discovers how to differentiate any fractional power of x.
- 1677-Leibniz finds the quotient rule for differentiation.

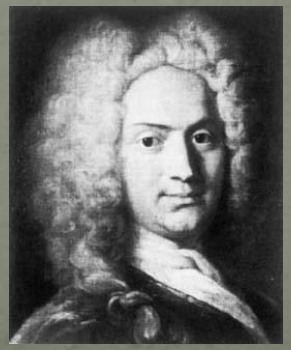
Developmental Calculus

- 1684-Leibniz publishes “A new method for maxima and minima as well as tangents, which is impeded neither by fractional nor by irrational quantities, and a remarkable type of calculus for this”; although only six pages long, few can understand it.
- 1686-Leibniz publishes his method of integral calculus in an issue of Acta Eruditorum.
- 1693-John Wallis publishes Newton's method of fluxions in volume two of his Mathematical Works.

Developmental Calculus (Continued)

- 1694-Jean Bernoulli discovers the method known as l'Hospital's Rule; it is known by that name because Marquis Antoine de l'Hospital bought it from Bernoulli and introduced it in his influential 1696 textbook Analysis of Infinitesimals.
- 1715-Brooke Taylor introduces his famous series in Methodus Incrementorum Directa et Inversa, in which he develops the calculus of finite differences



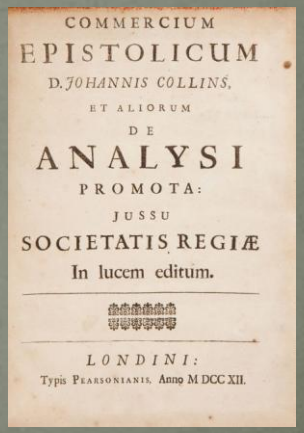


Newton the Inventor

- Student of Trinity College (Transition from student to professor is when the plague hit)
- He was a professor in Mathematics at Trinity College - (Certainly qualified)
  - Newton had ample time to work on his theories due to the closing of his university at the onset of the plague.
- He first developed his theory of "fluxions" in 1665 and was very tight lipped about his breakthroughs (after having studied the work of other mathematicians such as Barrow and Wallis)
  - Newton was the first to establish such principles based on the work of others
- Newton was the first to state the fundamental theorem of calculus and was also the first to explore applications of both integration and differentiation in a single work

Newton the Inventor (Continued)

- By the middle of 1665, Newton was able to set down the standard differential algorithms
- Newton's notebooks made reference to calculus as far back as 1666
- Newton had already begun work on the calculus by the time Leibniz started in October of 1675
- When Newton was 22 he finished his "De Analysi" in 1671, but left it unpublished because:
  - He typically preferred to not publish his works
  - Newton didn't publish right away because no publisher in England would publish mathematical books. (One publisher went bankrupt for publishing Barrow's geometry compilation)


COMMERCIUM
EPISTOLICUM
D. JOHANNIS COLLINS,
ET ALIORUM
DE
ANALYSI
PROMOTA:
JUSSU
SOCIETATIS REGIÆ
In lucem editum.

LONDINI:
Typis Pearsonianis, Anno M DCC XII.

Newton the Inventor (Continued)

- Leibniz took notes on Newton's book called *On Analysis,* a compilation of Newton's work on the Calculus
- In two letters to one another in 1676, Newton informs Leibniz that he possessed the fluxional calculus
- He finally published his book (*De Analysi*) in 1704 after all aspects were perfected
- In 1715, the Royal Society ruled that

Newton was the true inventor of calculus.

Leibniz's Late Approach

- Not the first to establish the ideas of calculus (Began work in 1675, four years after Newton finished his first compilation of principles in *De Analysi.*)
  - Newton started working on Calculus first in 1665 in comparison to Leibniz's beginning in 1675
- It is believed that Leibniz had access to Newton's information
  - He wrote letters back and forth with Newton so he knew what Newton was working on
- He used different sets of symbols, but he performed the same work (no original principles)
- Leibniz visited England in 1673 and 1676 and was shown Newton's work

Leibniz's Late Approach (Continued)

- Questionable qualifications- (Went to school and received a BA/MD in Philosophy rather than Mathematics. Begs the question, did his theories come from his knowledge or that of Newton who was skilled in such fields?)
- Newton went further into the explanation of calculus and its practical application
- Only one supporter of his work who later denied supporting him (Bernoulli)

Leibniz's Late Approach (Continued)

- Leibniz hurried to publish in 1684 almost 20 years after Newton's initial idea.
- Leibniz admitted before his death that he was shown some of Newton's papers in 1676 before his work in calculus was complete. In fact, Newton first described his methods, formulas, concepts, binomial theorem, and fluxions in the letters to Leibniz.
- Accused of plagiarism, stole and copied Barrow's and Newton's work
- Archimedes discovered the basics first (especially limits). Newton and Leibniz further developed calculus, but Newton pioneered the primary foundations/concepts before Leibniz's contributions/epiphanies

Newton's Contributions to Modern Day Calculus

- He applied his theories to physics, experiments, and results-(Applied calculus to business, economics and the sciences)
- He developed limits and concrete reality-(a different spectrum of calculus than Leibniz)
- Expanded infinite series
- Worked on tangents to form derivatives
- **Newton invented fluxional calculus, which shows primitive functions (indefinite integrals) and finding the area under a curve (definite integrals).**

Works Cited

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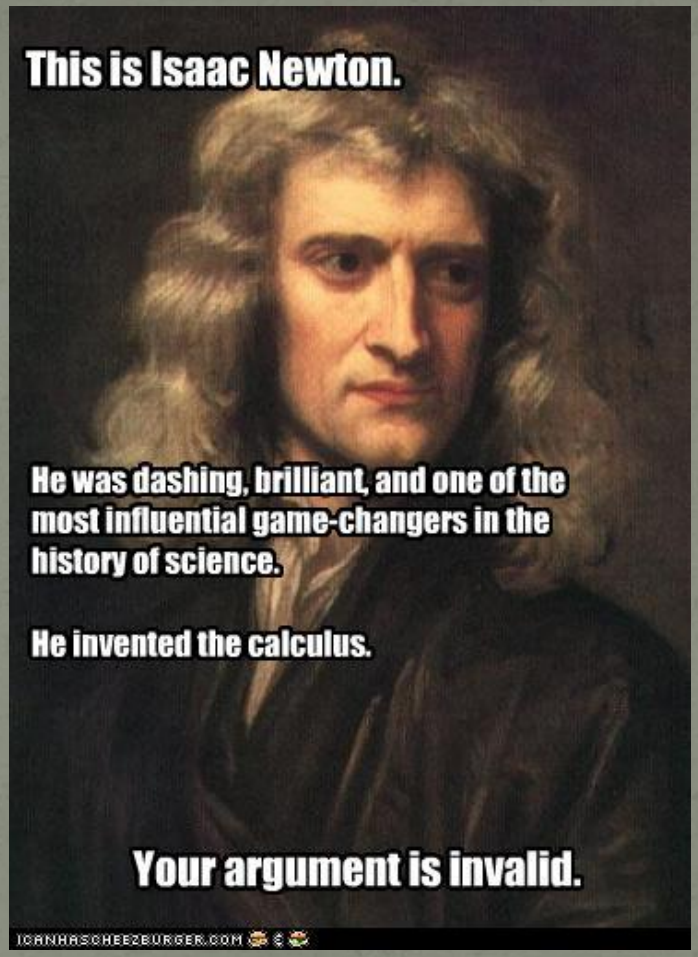
- scienceworld.wolfram.com/biography/Newton.html
  - Newton Background/Reasons
- http://www.gap-system.org/~history/HistTopics/The_rise_of_calculus.html
  - Timeline Information
- http://www-groups.dcs.st-and.ac.uk/~history/Biographies/Newton.html
  - Newton Contributions/Reasons
- http://www.enotes.com/history-fact-finder/science-invention/who-invented-calculus
  - Calculus is the means of explaining physics - and Newton was a ***physicist***
- http://en.wikipedia.org/wiki/Leibniz_and_Newton_calculus_controversy
  - Leibniz visited England in 1673 and '76 and was shown Newton's work
- http://en.wikipedia.org/wiki/History_of_calculus
  - Finished Fluxionary calculus in 1666
  - Newton created Binomial Theorem (fractions & exponents)
  - Inversion and area under a curve
  - Newton created "*f*" - function of a formula f(x) - a derivative
  - Newton completed his work 8 years before Leibniz
  - Newton studied math and physics rigorously
- http://www.mscs.dal.ca/~kgardner/History.html
  - Closing of university / Plague
  - Newton didn't usually publish his work
  - Newton discovered Gravity
  - Newton made the three laws of motion
- Article: When Lions Battler
  - Letters Between Newton and Leibniz
  - Newton/Leibniz Reasons


This is Isaac Newton.
He was dashing, brilliant, and one of the most influential game-changers in the history of science.
He invented the calculus.
Your argument is invalid.
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