Greek decline

Facts:
- Rome took political power
- 500 AD Rome fell
  → Closed schools in Athens
- Library burned down (200 BC) - Syracus
  - also in Alexandria
- Archimedes killed
- Hipparchus (200 BC)
- Ptolemy (200 AD)

~~→ until 400/500 AD "Mathematics school"

"Explanations":
- horror of the limit
- complicated geometric algebra
- more practical uses (theoretical math not appreciated)
- end of the oral tradition (visual)
- rejection of "irrationals"

Arab connection → (11 AD)
- base 10, 0, position (decimal point) (Bagdhad)
- Hindu Mathematics → number theory
- Al-jahr → algebra
  ↳ manipulating formulas for linear and quadratic equations

$$x^2 + 2bx = c \Rightarrow x = -b + \sqrt{b^2 + c}$$ (rhetorical)

Remark:
- Numbers were written out (Greek)
- Diophantus invented Δ^{γ} Λ^{γ} (3AD) for squares & cubes

- al-jahr — traveled to India and was familiar with Greek school

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History of Calculus homework 5, Question 1, a.b.c.

A) Why did Greek mathematics disappear?

After the golden age in the third and fourth centuries B.C. (after Archimedes) there was a general decline in great new findings, but it wasn't until the collapse of the Western Roman Empire in the fifth century A.D. that Greek mathematics was in danger of being forgotten. At first the Greek legacy was preserved in the Byzantine or Eastern Roman Empire and in 529 A.D. the emperor closed the Greek schools in Athens. In 641 A.D. the main Greek learning place which was at Alexandria was taken by the Moslems who eventually during the ninth and tenth centuries translated from Greek to Arabic the works of Euclid, Archimedes, Apollonius, and Ptolemy.

The biggest problem was that Greek analysis worked mostly with geometrical magnitudes rather than arithmetic. Since Greeks used a strict mathematically logical rigor, they didn't work with things they couldn't completely understand such as limits. This was part of the differences between Archimedes' findings and Calculus, he talked about the Greek "horror of the infinite" which prevented Greeks from working with a "limit", the distinction of what is "different but similar" to what is "similar" meaning "equals", and lastly, Archimedes didn't recognize the inverse relationship between area and tangent which would have revealed that it is a "rate of change".

← good formulate

) all that discovered later, though

B) What crucial new elements were added by Arab mathematicians?

Base ten, decimal notation, and a zero symbol were added in what was called the "Hindu-Arabic numeration", and was widely introduced by Al-Khwarizmi - a Bagdad mathematician and astronomer. He also introduced the term "algebra" in his second book. He included roots, squares and numbers (x, x^2, and constants). In the ninth and tenth centuries when Euclid's "elements" and many of Archimedes' works were translated into Arabic alternative proofs and generalizations were added. By the twelfth century when Arabic science started to decline, the dark ages were ending in Western Europe, so Euclid's "Elements" was translated from Arabic to Latin, and Al-Khwarizmi's "Algebra" was translated in 1145.

C) In which sense are the medieval summation calculations different from the Greek ones?

Medieval scholastic philosophers speculated about "the infinite", the nature of the continuum, and the existence of irrational numbers, but their speculations were mostly philosophical rather than mathematical and offered few scientific conclusions. Even so, they showed an appreciation for the logical difficulties in the nature of these concepts and took down the taboo against these concepts that were held with the Greeks. Since the Greeks didn't use "continuous variation" at all as a concept, studies of change of motion didn't begin until the early fourteenth century. They added "intensities" referring to hotness, or density. They referred to qualities like hotness and density as intensive, and quantities such as heat and weight as extensive quantities. Instantaneous velocity was referred to as a quality. They defined motion to be "uniform" if equal distances are described as equal times, and uniform acceleration was defined as "that for which equal increments of velocity are acquired in equal intervals of time." They came up with the mean speed theorem called the "Merton Rule of uniform acceleration"

In the "Treatise on Configurations" Oresme (a Parisian scholastic who wrote his bit in the 1350's) introduced line segments, a functional relationship between variables, a graphical representation of this functional relationship, and the concept of INTEGRATION!!! YAY omg!!! Also called continuous summation used to calculate the distance as the area under a velocity-time graph.

Later, Descartes and Fermat translated geometrical problems into the language of algebraic equations so that the problems could be simplified. All together Descartes and Fermat covered "means of curves", studied curves as being "defined by" equations, they concentrated on indeterminate equations with "continuous" variables. This concept of the variable was indispensable to the development of calculus!!