A Brief History of Algebra

"Algebra" comes from the Arabic word "al-jabr," which has been translated to be "reunion" or "restoration."

Algebra began with computations similar to that of basic arithmetic, but with letters standing in for numbers. Algebra as a proper field of mathematics can be traced to the end of the 16^{th} century, but the true theory of algebra started much earlier.

$\sim$2000-1600 BCE: Babylonians developed advanced arithmetical systems allowing them to do calculations via algorithms. Their methods for solving linear equations, quadratic equations, and indeterminant linear equations are all still in use today! Compare this to the premier works of the Egyptians (*Mathematical Papyrus*), the Greeks (Euclid's *Elements*), and the Chinese (*Nine Chapters in Mathematical Art*) which all used geometric methods to solve similar problems.

$\sim$780-850 CE: Persian mathematician al-Khwarizmi (earlier transliterated as Algoritmi—and from where we get "algorithm"!) was directly influenced by more ancient Greek and Indian mathematicians and published his work *The Compendious Book on Calculation by Completion and Balancing.* This helped established algebra as a field separate from arithmetic and geometry. His work was done without the use of negatives or zero. His work was eventually translated in the 12^{th} century and brought to Europe, introducing Europe to Arabic numerals, which we still use today.

$\sim$628 CE: Indian mathematician Brahmagupta's work gave the first complete arithmetical solution to the quadratic equation, including zero and negatives, and gave a generalized solution to linear equations.

$\sim$1070 CE: Omar Khayyám's influential *Treatise on Demonstration of Problems of Algebra* derived general methods of solutions to cubics (and some higher order) and discussed the triangular array of binomial coefficients, what we know as Pascal's triangle. This became part of the body of Persian mathematics and would eventually be translated to Europe.

The algebra we will be doing is known as "elementary algebra" and is not the algebra studied by mathematicians now. Abstract, or modern, algebra is a field of mathematics concerned with the properties of algebraic structures—sets (not necessarily of numbers) which have some kind of behavior under an operation, usually denoted as $+$.

One useful example is the area of group theory. Groups can be thought of

as symmetry operations. Different shapes have different amounts of symmetry (consider the square versus the hexagon). Group theory is actually used in physical chemistry to reduce unnecessary computations and to predict behavior or existence of molecules.

This is a **very very** brief outline of just one area of mathematics—there's much much more! If you're interested in learning more about the history of mathematics, you can check out the (brief) reading list and view them on Amazon by clicking. Further, the S&T call number is listed and will link to the book's page on the library website. While there's only three books listed, I am confident these three alone will give a great view of the history of mathematics. Keep in mind, however, that mathematics is constantly developing so that any published book will be out of date for the most recent advancements!

Finally, there is (sometimes) a history of mathematics course offered in the spring here at S&T.

Further Reading:

1. *Mathematical Thought from Ancient to Modern Times*, Morris Kline. (QA21.K53 1972)

2. *Mathematics and Its History*, John Stillwell (QA21.S84 2002)

3. *Journey Through Genius*, William Dunham (QA21.D78 1990)