

On the first day of class I asked the question: “What is Mathematics?” Many students submitted responses (some of them anonymous). I will attempt to summarize them here. I found the variety of answers interesting. No single answer was dominant.

After reading this, how would you answer the question differently?

Universal Language (8 matches)

Several students used variants of the term “universal language.” This could mean a few things: First, it could mean a language that is (or can be) universally understood by humans of different cultures and circumstances. [This is rather close to the answer I gave in class: that math allows humans to **agree** on things.] Second, it could mean a language that is “universally applicable,” i.e. can be used to solve many different kinds of problems. Third, some students suggested that mathematics is literally the “language of the universe.” For more on that perspective, see **Physics** below.

Art and Aesthetics (5 matches)

Several students mentioned artistic and aesthetic aspects of mathematics. Some said that math is both a science and an art, and maybe is unique in that respect. One student emphasized the satisfaction of doing mathematics: that after a long chain of reasoning, we sometimes arrive at a simple and elegant answer. Finally, someone said math is an (maybe the) art form that uses logic for its material (instead of, say, paint or words). [Interestingly, no one **identified** math with logic. For a brief time around 1900, the “logician” philosophy of mathematics was quite popular.]

Science and Physics (7 matches)

Galileo said (and I’m paraphrasing) that the Book of Nature is written in the language of mathematics. Many of the students agree. I received various forms of the answer: Mathematics allows us to understand (or unlock) the laws (or mechanics) of the universe (or the world around us). Historically, mathematics has been more closely associated with physics than any other science. One student suggested that math in general is the soul that allows science to operate. [I’ll ignore the question: What is science?]

Social and Human Aspects (9 matches)

Some students emphasized social aspects of mathematics. [This is related to math as a **Universal Language**; see above.] For example, the study of math allows humans to develop logical thinking and reasoning skills. This is thought of as a social good, which allows modern society to function

properly. (Recall that Abraham Lincoln studied the first six books of Euclid's Elements. His goal was primarily social.) Modern society also requires mathematics to the extent that it depends on technology; see **Computation** below.

Numbers (5 matches)

What is the explicit subject of mathematics? Many students mentioned that math works with “numbers,” which is true. But it is a misconception that numbers are the main focus. Actually mathematics deals with a variety of fundamental concepts, including “measurement,” “shape,” “movement” and “change” (which are aspects of “space” and “time”). More recently (since approximately 1900), mathematics is concerned with “symmetry” and “relationships between things,” as opposed to the “things in themselves.”

Computation (10 matches)

Almost every answer regarded math as useful. The words “tool” and “method” showed up frequently. Some people said that math allows us to take possibly complex situations and simplify them, to make them “concrete” and “decidable.” Once a problem has been simplified in this way, the remaining steps are labeled “computation.” It is a misconception to identify mathematics with computation. In a sense, computation is just the final step of applied mathematics, in which the solution is packaged in such a way that it can be used easily by non-mathematicians. We couldn't build bridges or run airports without it. [Unfortunately, the way we teach math seems to perpetuate the mistake that math is nothing **but** computation.]

Philosophy (9 matches)

Many students suggested a link between mathematics and philosophy. They said that math helps us to uncover the “truth” (whether this truth is physical or not; see **Science** above). Some even suggested that mathematics has the best claim to truth. [This was certainly the belief of the Pythagoreans, and it was the origin of mathematics as we know it.] Other students made the related observation that math helps us to “understand” and to “make sense” of things. That's what I like about mathematics: it makes sense. (If it doesn't make sense, you're not doing it right.)

Hard to Define

Finally, one student suggested that mathematics is really essential and simple, but really hard to define. I agree.