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Mathematics Through Time and Cultures

Professor Little

Understanding the Benefits of Geometry

Geometry, to some, is simply a class required for graduation - not to be taken too seriously, because any higher applications will soon be forgotten. But why take it? Why require it? Naturally, in the past, I have questioned the reasons why I was required to attend Mr. Warren’s geometry class sophomore year, even though I retained little other than “The Vertical Angle Theorem”… or was it a postulate? Nevertheless, as I have continued through math classes throughout the years, especially into higher math courses, I have come to understand geometry is not required in schools just to memorize postulates, learn theorems, and compute for busywork. Math is done for the sake of it – to compute for the purpose of computing, to learn for the reason of learning. Geometry rarely comes up in our daily lives in the form of a written problem; we usually see it as a real life problem that needs solving, or to be understood. However, we must study geometry in school in order to recognize the applications of it outside of the classroom. The benefits of studying all mathematics does not come in the form of a letter grade on a report card; studying math results in an understanding of the world around us and a better perception of ourselves.

Euclid, a Greek mathematician living in Alexandria in about 300 BCE, compiled a revolutionary geometrical textbook, referred to today as “Euclid’s Elements.” Euclid managed to break down the fundamentals of mathematics into postulates, common notes, definitions and propositions. Together, Euclid managed to explain, by proofs, various mathematical concepts- concepts we now take for granted. He worked so in depth with geometrical mathematics that poet Edna St. Vincent Millay stated, “Euclid alone has looked on Beauty bare”, using Beauty as a symbol for extensive, but simplistic mathematics. As in depth as Euclid studied geometry, he always started his proofs under the assumption of having the worst circumstances as possible. He would never measure lines for their quantitative value; he would just speak in theory, allowing one proof to help prove the next. Line segment AB did not have a value besides AB, and if that segment was a side of a square, Euclid considered the area solely to be AB2. When someone takes the time to fully understand math to the extent that Euclid did, Edna St. Vincent Millay considers that person to have seen true, bare Beauty. I can only assume she calls this “Beauty bare” due to all the applications of it.

Euclid’s Proposition 28, stating line segment AB parallel to line segment CD cut by the line EF makes the exterior angle equal to the interior and opposite angle on the same side, can clearly be used outside the classroom. We could use it to study angles of planes, stability of bridges, or angles of things that exist naturally. Geometry, especially as Euclid presented it, can be used in a myriad of ways to understand the simplest things in our world to some of the most complex.

Euclid’s Propositions have already been utilized to geometrically determine important quantities, especially his Proposition 28. Between 276-194 BCE in Alexandria, the same city Euclid was from, mathematician Eratosthenes was able to use Euclid’s Proposition to determine the circumference of the Earth. By calculating the distance between two places, and the degrees at which the sunlight hit and object, Eratosthenes determined the circumference to within one percent accuracy! Take notice of the time in which he solved this, more than 1800 years ago. If one mathematician was able to infer so much about the Earth centauries ago, one could only imagine how beneficial Euclid’s Elements have been in the modern world. In fact, most geometry textbooks are based off the Elements. The applications of geometry over the years, from Eratosthenes time until today, have been immense and innumerable. Due to Euclid and his promotion of geometry, man has flown, gone to the moon, built grand, stable structures and much more.

Though mathematics helps us to understand our surroundings, it also helps us in understanding our ability to learn. The Greek mathematician and philosopher Proclus once said, “Mathematical science must be considered desirable in itself, though not with reference to the needs of daily life.” That is, math should be studied simply because math is an interesting thing to study, not just because it encourages knowledge of our world. Proclus also says, if there is a benefit to study math besides its innate fascination, “we must connect that benefit with intellectual knowledge.” Euclid did not write his textbook because he found math interesting; Euclid wanted to help educate himself as well as others. So, when one of his student’s was practicing geometry with him and asked, “’What shall I get by learning these things?’” Euclid replied “’Give this man three obols, since he must profit from what he learns.’” The obol, a small unit of money during Euclid’s time, was not to be given to the boy as a reward or as a “profit”, but instead to mock him. Since the student felt he was not gaining anything, as implied by his question, Euclid realized studying geometry was not showing the student his own capacity to learn. Mathematics clearly gives to those who study it a feeling of introspection in regards to their intelligence. To put the time and effort into solving some math equations, or figuring out difficult proofs, not only demonstrates patience, creativity, determination and thoughtfulness, but also shows other major characteristics that contribute to intelligence.

Albert Einstein once said, “Pure mathematics is, in its way, the poetry of logical ideas.” He means, I assume, that the fundamentals of life are constructed through math, though not necessarily explicitly. All branches of mathematics help explain even our most basic realities, realities of our world and of ourselves. Not only can we use math and the applications that come from it to help comprehend real life problems, such as angle measurements and parallel lines, but studying mathematics additionally helps us to understand our own intelligence. We must learn math not just in order to understand problems or algorithms, but also to help understand life and our connection to it.