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Math Across Time

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It's Hip to be Square: Why we study Geometry

For what reason do we study geometry? This question has been on the minds of philosophers and mathematicians since the formation of the earliest geometric concepts. Stobaeus, an author from Rome around the 5th century C.E., immortalized such questioning in the form of Euclid's student, who openly wonders the merit of such ponderings in front of Euclid himself. Mathematician and philosopher Proclus viewed such ponderings as important in the acquiring of knowledge, viewing it as "a propaedeutic, clearing the eye of the soul and taking away the impediments which the senses place in the way of the knowledge of universals." These sources view the knowledge gained from geometry as fundamental to better understanding the world around us.

It's interesting to see the variety of ways through which the importance of geometry can be measured. Stobaeus reveals why we study geometry not through any mathematical equation or proof, but through a famous story about Euclid passed down through generations before finally being recorded by Stobaeus himself. The story goes: "Someone who had begun to read geometry with Euclid, when he had learnt the first theorem, asked Euclid, 'what shall I get by learning these things?' Euclid called his slave and said, 'Give this man three obols, since he must profit from what he learns.'" While Euclid's response to the student's question

might seem to be a bit pretentious, he makes a very valuable point. Learning geometry shouldn't require any sort of monetary compensation; the reward is in having a greater understanding of the world around you than you previously had. The point Euclid gets at through his gesture is that there is no greater reward from studying than the knowledge obtained from it.

Why Euclid does answer the question of "why we study geometry?" the answer isn't always that clear to some people. In fact, Euclid's response of, "Give this man three obols, since he must profit from what he learns" isn't exactly the most practical answer to give a student. It's possible that, in the eyes of the student, Euclid's cryptic response to such an innocent question might be taken as an insult to the man's intelligence. Typically, all students really want from a teacher is a straightforward answer, something that satisfies they're questioning; however, for some answers to be understood, one must find how to get those conclusions on their own. While the student might interpret Euclid's response as being vague or rude, it may be Euclid's attempt to encourage the student to find the answer for himself. By forcing his student to seek out his own answers, Euclid hopes to convey to the student that the acquiring of new knowledge is a far greater reward than any amount of monetary compensation could.

Stobaeus's retelling of Euclid's story shows the importance of studying geometry as a means of gaining more knowledge; yet he doesn't provide any sort of reaction as to why knowledge is a worthy reward. Proclus, who was both a philosopher and a mathematician, provides for us a response to not only why we study geometry, but also how to acquire its knowledge. According to Proclus:

“Mathematical science must be considered desirable in itself, though not with reference to the needs of daily life.” If one is to gain the greatest amount of mathematical knowledge, one must dedicate themselves fully to the study of math regardless of whether the discoveries help to improve daily life or not. Proclus believes that, by studying hard and, “clearing the eye of the soul,” we are able to clear our minds of distractions and ultimately arrive at the “knowledge of universals.”

In many ways, our study of Book I of *The Elements of Euclid* has cleared the “eye of my soul” in understanding geometry. After laying down a foundation by learning the postulates and theorems of Book I, all Euclid’s propositions are simply additional layers placed on that same foundation. From Proposition 2 onward, every preceding proposition is used in the steps proving that the preceding proposition is true. Such connections help to overcome the impediments that are placed in the way of knowledge by the senses. These barriers caused by the senses usually come in variety of forms, such as seeing the problem as being something different than it is or trying to make a definition fit into a proof despite the fact that there might be a simpler way of solving it. Although difficult to overcome at first, these barriers can be removed through working with the proofs and an increased understanding, making the way to “knowledge of universals” clearer than before.

The “knowledge of universals” that Proclus makes mention to is having an understanding of not just geometry, but knowing how to connect it with different subjects and relate it to real world issues. Though Proclus claims that mathematics should be, “desirable in itself...not with reference to the needs of daily life,” the truth

is that, once one obtains full knowledge of a subject matter, it's only natural to begin to connect it back to other areas of study and even find ways to apply it to subject where mathematics might not normally be found. For example, artists use different geometric principles and measurements in order to give their artwork depth and improve the spatial relations of the subjects present in the work itself. The idea of connecting geometry back to other fields of study alone is enough of a reason to devote precious amounts of time and effort to learn the subject matter, master its concepts, and find how things connect in ways that would have otherwise remained overlooked.

In studying the lessons of Euclid, both Stobaeus and Proclus provide sufficient evidence that it's important to study geometry. In learning the many different geometric theorems and propositions, we not only learn how each of these individual pieces interconnect with each other, but also how this knowledge leads to a greater understanding of the world around us.