PROMOTING MATHEMATICS IN COMPLICATED TIMES

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It is very difficult to define mathematics, and even so, it is a subject in schools where students can leave even without knowing how to define it. Mathematics matters, is necessary, and useful, but the application appears with a theoretical background behind it, and it is also necessary to make this theoretical background known in order to progress. Seeking application to everything is sometimes absurd, and devoting oneself to pure mathematics is perfectly normal. I am a popularizer of mathematics, and I find myself in situations that frustrate me a lot. Classmates who learn derivatives in high school without knowing what they mean, people who ask you to find a sum, as if more than math you were good at mental calculation, and then hearing my brothers complain about math and say that they are useless… The pandemic affects many people, and it has to go down. Many things still keep happening and just increases this hate towards mathematics.

In my work to spread mathematics, I have asked politicians who are in charge of education and youth to ask teachers to promote a critical spirit in mathematics. Mathematics is not to believe, but to make things clear. Some listen and agree that there is a problem, but no one seems to want to fix it. Because solving it is another problem, and they don't know which one is worse. Some want to see math disappear, and that's frustrating.

Mathematics education fails, and when students learn something that is not mathematics, calling it mathematics in fact it is a problem, because they learn to hate real mathematics and underestimate the value of this science, and in fact they are not learning but simple math. In the 1970s, a brief and dramatic change in the way mathematics was taught took place, and it failed because of complexity. Definitely what is most important is to show “real” mathematics, those who are adequate to the times, and try to make each student understand what is going on in mathematics. What is worse is that many students think they are

not good at mathematics. If we want to stop this, we must ensure that students do not learn math as if history would be. A math proof can not be memorized by hand, and so that is something we can do to achieve this. If we show various math things, and why they matter, and not just a few tricks and how to do them, we will get students more motivated than if they learn things by memorization. Math Olympiad is the best example: you can learn many things, but the problems are random. There are many approaches to the problem, but sometimes the idea is just to think creatively. You can just do many problems to prepare, and having an interest in it in order to prepare the maximum (as sportsmen do) is the best way to get the maximum points.

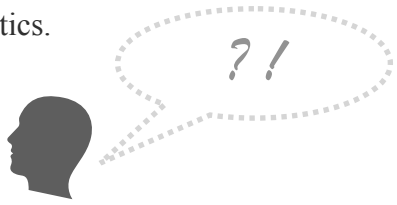
Fortunately, there are and have been many popularizers of mathematics and the number is increasing more and more. This is increasing the interest of people towards mathematics, but the problem is always the same: math popularizers always reach the same people, those who are already interested in mathematics, and not those who are not.

I try to reach those who are not interested in mathematics, those who hate math. Unfortunately, there are many, but some things are common among them. One thing they all have in common is that they see mathematics as something hard, simple, without any interest at all. Mathematicians see them as numberists. And it is more than that.

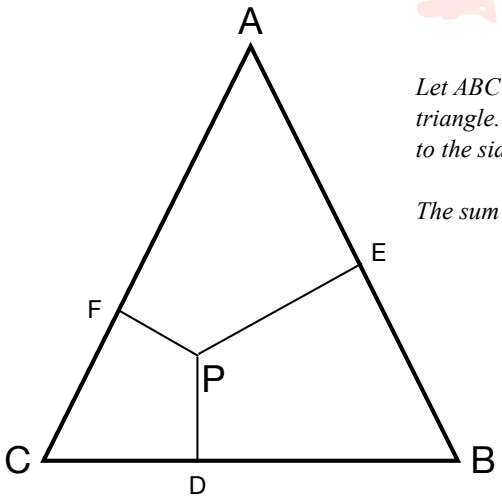
I used to show the beauty of mathematics through games, such as Rubik's cubes. I explained that there are more states in the Rubik's cube than atoms in a bottle of water, or humans in the world. One day one teenager asked me why this matters, and I told him that a Rubik's cube is an example to understand the general idea of combinatorics. In a business, if there are 12 people for an election to the president, vice president and worker, then there are 1320 ways to choose them. More than what anyone may expect.

When I am asked to explain what I do, I say to raise awareness about the importance of math. When I started writing this, I thought about how important football is, but how much less important the Abel Prize winner is, or Conway's game of life as entertainment is. In my free time, I spend creating and solving math problems, and my wish is that people get less afraid of them, and get encouraged to play them at an early age.

Mathematics does not depend on the weather, the place, or the context, and learning mathematics indirectly helps you make decisions, such as to understand which object is bigger, how to compare two situations, and to find solutions to immediate questions. Popularizing mathematics is important, not only for people to learn, but also so people do not make mistakes in the interpretation of data, or in serious debates such as counting. We, those interested in mathematics, must get this message across, because maybe someone near you forgot mathematics because of a lack of interest, and small things such as Viviani's theorem may bring back the interest it may have once had in mathematics.

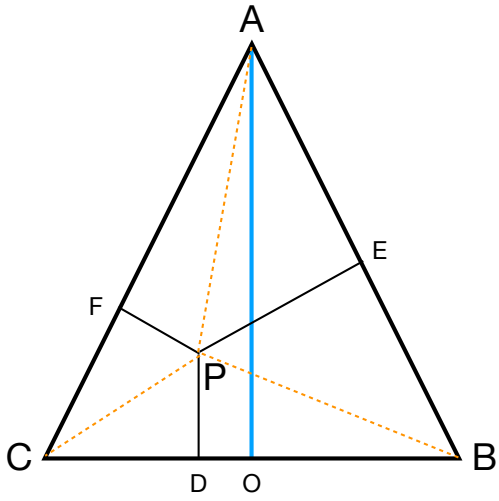


VIVIANI'S THEOREM



Let ABC be an equilateral triangle and P an arbitrary point inside the triangle. The segments PD, PE and PF are, respectively, perpendicular to the sides BC, AC and AB.

The sum PD+PE+PF is equal to the height of the equilateral triangle.



Proof:

$\text{Area(APB)} = \frac{1}{2}\,\text{Area(rectangle AB} \times \text{PE)}$ **(prove this!)**

$\text{Area(BPC)} = \frac{1}{2}\,\text{Area(rectangle BC} \times \text{PD)}$

$\text{Area(APC)} = \frac{1}{2}\,\text{Area(rectangle CA} \times \text{PF)}$

The sum of the l.h.s. is Area(ABC), which is equal to half of the area of the rectangle with sides BC and (PE+PD+PF). But this is also equal to the area of a rectangle with sides BC and AO. Hence

AO=PE+PD+PF, which we wanted to prove.

Exercise: construct at least two other proofs of Viviani's theorem.