探究

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Why Do We Do Mathematics?

In this article, I would like to introduce an excerpt from Paul Lockhart's *Measurement* and reflect with you on what it means to study mathematics. This book is one of my personal favorites; not only does it feature a beautiful cover and a friendly, engaging narrative tone, but the hand-drawn diagrams scattered throughout provide a sense of happiness—a truly wonderful reading experience.

Let's begin by reading an excerpt from pages 49–50 of the first part of the book, "SIZE AND SHAPE," in its original English:

.... I want to address a serious question. Why are we doing this? What is the point of making up these imaginary shapes and then trying to measure them?

It's certainly not for any practical purpose. In fact, these imaginary shapes are actually harder to measure than real ones. Measuring the diagonal of a rectangle requires insight and ingenuity; measuring the diagonal of a piece of paper is easy—just get out a ruler. There are no truths, no surprises, no philosophical problems at all. No, the issues we're going to be dealing with have nothing to do with the real world in any way. For one thing, the patterns we will choose to measure will be chosen because they are beautiful and curious not because they are useful. **People don't do mathematics because it's useful. They do it because it's *interesting*.**

But what's so interesting about a bunch of measurements? Who cares what the length of some diagonal happens to be, or how much space some imaginary shape takes up? Those numbers are what they are. Does it really matter what?

Actually, I don't think it does. The point of a measurement problem is not what the measurement is; it's how to figure out what it is. The answer to the question about the diagonal of a square is not $\sqrt{2}$; it's the mosaic design. (At least that's one possible answer!)

The solution to a math problem is not a number; it's an argument, a proof. We're trying to create these little poems of pure reason. Of course, like any other form of poetry, we want our work to be beautiful as well as meaningful. Mathematics is the art of explanation, and consequently, it is difficult, frustrating, and deeply satisfying.

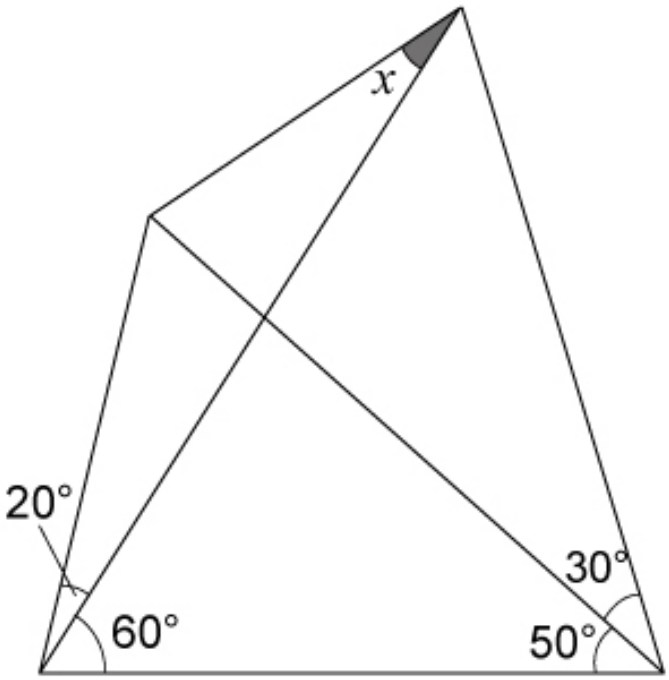
It's also a great philosophical exercise. We are capable of creating in our minds perfect imaginary objects, which then have perfect imaginary measurements. But can we get at them? There are truths out there. Do we have access to them? It's really a question about the limits of the human mind. *What can we know?* This is the real question at the heart of every mathematics problem.

So the point of making these measurements is to see if we can. We do it because it's a challenge and an adventure and because it's fun. We do it because we're curious, and we want to understand mathematical reality and the minds that can conceive it.

First, Lockhart states that we do math because it is interesting, not because being useful is the ultimate goal. Of course, mathematics *is* useful, but for us as individuals, the act of "doing math" possesses an inherent artistic and philosophical joy and significance.

As an instructor, when I ask middle and high school students about their favorite or least favorite subjects, I often hear expressions like: "I like math because there is only one right answer and it feels clear, but I'm not a fan of Japanese (literature) because the essay answers are vague and hard to grasp." Certainly, the refreshing feeling of marking a correct answer with a red pen after completing a complex calculation is irreplaceable. However, the author argues that the "solution" in mathematics is not the answer itself, but rather how one arrived there.

Take, for example, the famous challenge in elementary geometry known as **"Langley's Adventitious Angles."** The value of the answer itself isn't where the great significance lies; rather, the wonder and beauty reside in the method used to derive it. It is interesting to observe that when you show this problem to elementary students, they frantically guess "15 degrees!" or "20 degrees!" just to get it right. In contrast, high school students, after agonizing over it for a while, will ask, "How do you solve this?"



Lockhart goes on to say, **"We're trying to create these little poems of pure reason."** This kind of expression is exactly why I am such a big fan of his. The Pythagorean theorem (the sum of the squares of the two sides enclosing the right angle is equal to the square of the hypotenuse) is interesting in its own right, but the true essence lies in *how* it is proved. I always feel that this artistic side of mathematics shares a common thread with painting. When technique, imagination, and creativity converge, they form an artistic activity that truly delights the brain.

Furthermore, as the quote progresses, he explains that mathematics is a philosophical endeavor. The question "What can we know?" is the heart of math. we create a mathematical world in our minds and explore just how much we can understand about the numbers and shapes that inhabit it.

- "I don't know why I'm studying math."
- "Exam prep is so hard that I've forgotten what's supposed to be fun about it."
- "I want to try math again as an adult, but I'm worried if it's worth it."

If you feel this way, I highly recommend this book. With its beautiful illustrations, you can read along smoothly and might find yourself happily "falling down the rabbit hole" of mathematics before you know it. If you find the English text difficult, I can work with you as a learning coach to read it closely and support your journey. Please feel free to reach out via the Tankyu website.

Wishing you a wonderful mathematical journey!

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