

Knowledge and Mathematics

AoK 1

2021-2022

Thinking about math

Describe the most significant experience, good, bad or otherwise you have had regarding mathematics?

Why, more than any other area of knowledge, does math seem to divide people who like it or hate it and who are good at it v. those who believe they are not good at it?

What, if anything, is beyond the scope of mathematics? Explain your answer? Another way to think about this is, is there anything that we will never be able to describe or explain mathematically?

Is mathematical description more accurate, are mathematical explanations more true, and are mathematical predictions more certain than those of other AOK?

Is Math a language?

Characteristics of language according to Anne Marie Helmstine:

There must be a **vocabulary** of words or symbols.

Meaning must be attached to the words or symbols.

A language employs **grammar**, which is a set of rules that outline how vocabulary is used

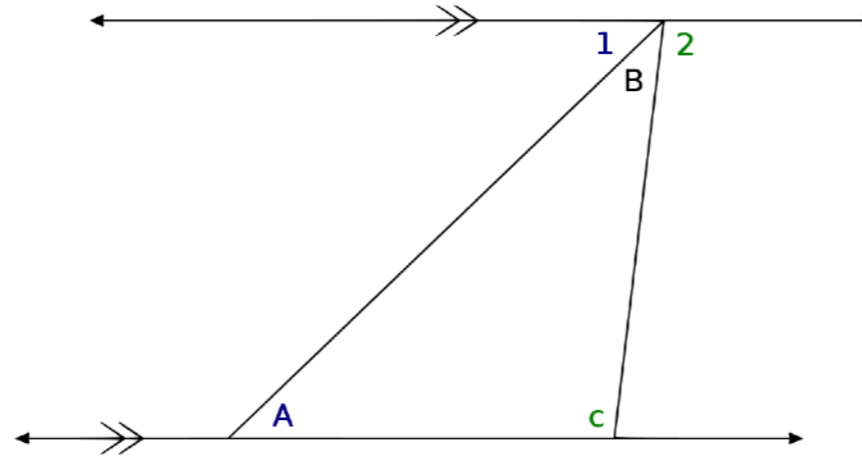
A **syntax** organizes symbols into linear structures or propositions (by linear structure we mean the order by which a sentence properly conveys meaning)

A **narrative** or discourse consists of strings of syntactic propositions.

There must be (or have been) a group of **people who use and understand the symbols**.

In your groups, explain, using the mathematical proof on the next slide, how math meets all of the above requirements. Be prepared to explain your analysis to the class at the front board, labeling the each of the elements Helmstine sees as necessary for something to be a language

Variation of Euclid's proof that the angles of a triangle sum to 180 degrees



The two lines marked with >> are parallel.

- $\angle 1 = \angle A$. Euclid has a proposition about lines crossing parallel lines - that they cross at the same angle, and this is a consequence of that.
- $\angle 2 = \angle C$. This is also true for the same reason.

On the top line we have

$$\angle 1 + \angle B + \angle 2 = 180^\circ$$

But since $\angle 1 = \angle A$ and because $\angle 2 = \angle C$ this is the same as the statement:

$$\angle A + \angle B + \angle C = 180^\circ$$

Which is what we wanted to show.

Necessary and sufficient conditions

“A necessary condition is a condition that must be present for an event to occur.

A sufficient condition is a condition or set of conditions that will produce the event.

A necessary condition must be there, but it alone does not provide sufficient cause for the occurrence of the event.

Only the sufficient grounds can do this. In other words, all of the necessary elements must be there.”

Helmstine’s list contains conditions necessary for something to be a language. Are the items on this list sufficient for something to be called a language? Can you think of any conditions that she may not have included?

The Brain and Language

Listen to the following story from Indiana Public Media. Does this argument disprove the idea that math is a language?

$$\frac{\partial}{\partial a} \ln f_{a, \sigma^2}(\xi_1) = \frac{(\xi_1 - a)}{\sigma^2} f_{a, \sigma^2}(\xi_1) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left\{-\frac{(\xi_1 - a)^2}{2\sigma^2}\right\}$$
$$\int_{\mathcal{R}_n} T(x) \cdot \frac{\partial}{\partial \theta} f(x, \theta) dx = M\left(T(\xi) \cdot \frac{\partial}{\partial \theta} \ln L(\xi, \theta)\right) = \int_{\mathcal{R}_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx$$
$$\int_{\mathcal{R}_n} T(x) \cdot \left(\frac{\partial}{\partial \theta} \ln L(x, \theta)\right) \cdot f(x, \theta) dx = \int_{\mathcal{R}_n} T(x) \cdot \left(\frac{\partial}{\partial \theta} \frac{f(x, \theta)}{f(x, \theta)}\right) \cdot f(x, \theta) dx$$
$$\frac{\partial}{\partial \theta} \int_{\mathcal{R}_n} T(x) f(x, \theta) dx = \int_{\mathcal{R}_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx$$

Your assignment for Wednesday...

Dudes, gents and others in da class - Hear Be the critical do do for Wotan's day.

REEd Why do humans have numbers.

Tern, tern tern it in on pathetic microsooft platform we use.

No be late, No f'n credit be given for slacksters!

Kapiche?

What am I asking you to do and how does this relate to today's discussion?

One more necessary condition for something to be a language . . .

Flexibility

Does math meet this criteria?

Overall, can math be considered a language?