# Twitter Thread by Jose Jorge



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## Today I want to start a potentially little series of threads about one of my biggest passions■...

## Gödel's theorems■

## One of the biggest discoveries of all time that I'm sure will blow your mind!!!

## I'll structure the series as follows ■

Today: The history that preceded the theorems

Then: The theorems. Explanation and some common misconceptions

And finally: Shallow overview of the demonstration

So let's start with the history that preceded Gödel's results

It is pretty much the history of math so let's see if we can comprise it in a thread

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The study of math as a science started in ancient Greece ■

Although math was applied earlier in other ancient civilizations, philosophers like Tales were the first that studied mathematical abstractions like shapes without asking for the practical purpose of that study.

Math started to have its very own questions that only could be answered inside math itself.

Math became a science ■

Pythagoreans were a philosophy group that defended that the essence of the universe was numbers ■

■ But their theory was based on the hypothesis that all numbers could be expressed as a fraction of two integer numbers

It seemed an acceptable supposition until...

A member of the Pythagorean school discovered some numbers that cannot be expressed that way■

For example sqrt(2) and sqrt(5). Those are presumably the first known irrational numbers

So all the Pythagorean theory was reduced to ashes. That was the first big crisis of math

What was wrong with the Pythagorean theory■

They assumed as true a proposition that is false *inside that theory*

■ You can prove some numbers cannot be expressed as a fraction using just the theorems, elements, and operations of the theory

Greeks realized they needed to change the way math was developed so far■

And then Euclid ■ wrote one of the most important books of the history of science... "The Elements"

Almost all the geometry we learned until high school was written by Euclid 2500 years earlier.

But the best part was the method Euclid used to formulate his geometry

"The Elements" showed the first example of an axiomatic theory■

An axiomatic theory is built on top of very simple propositions that are assumed as true (axioms)

Every other proposition needs to be demonstrated from the axioms by following a set of rules that state how can we go from proposition A to proposition B

- The process of going from the set of axioms to some proposition A is called demonstration.

- When we demonstrate proposition A we say that A is a theorem in our theory

Let's see how history continues

Euclid built his geometry on top of five axioms.

The first four of them seemed pretty simple but the fifth was trickier

It's well known that Euclid himself tried to demonstrate the fifth axiom from the other four...

More than 2000 years after the first publication of "The Elements", mathematicians were still figuring out how to remove the fifth axiom by demonstrating it.

The result of those studies unveiled an astonishing fact:

Euclid just defined one of the many possible geometries■

If you change the fifth axiom a little bit, you can end up with a perfectly defined (although very crazy) geometry

■ as a side note, the General Theory of Relativity demonstrated that the geometry of our universe is non-Euclidean (it's one of the new crazy ones)

■But this was a big problem!!!

Mathematicians though the fifth axiom could be demonstrated someday and they built the entire Math building on top of the robust and unique Euclidian geometry

This meant the second deep crisis of Math

We need to rebuild the whole thing again!!!

■But what do we mean by building the entire Math on top of something?

■ It is defining some axioms in a way that any mathematical proposition can be either proved or refuted by a demonstration process

Many of the greatest mathematicians of all time worked hard on that problem

And then, in 1931, a 25 yo man destroyed that intention.

Kurt Gödel proved that such a system was impossible to build

He proved that there are true propositions that cannot be proved in some theories■

He proved some things cannot be proved!!! ■■■

But that's the topic for the next week's thread■

This was a very shallow overview of the history that preceded Gödel's amazing discovery

Feel free to reply, retweet, @-me, if you want to talk about this thread or other CS-related problem. Hope you enjoyed it.