

# THE PHILOSOPHY OF MATHEMATICS

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What is the number 4?

What exactly is a real number?

???

What are natural numbers?

# First and Foremost...

## Why this topic?

### What We Taught



Amerindians

Bacon

Machines Who Think



Mesopotamia

Ancient Israel

The Maya



Egypt

Greeks

Ancient Muslims

China



Scientific Change

India

# 19<sup>th</sup> Century

- Birth of the 'modern' style of thought
- Gradual increase in abstraction
- Modern Algebraic concepts
- Number theory, geometry, theory of equations
- Geometry

**What's the point?**

# The Aim or What is it?

- To Provide an account of the nature and methodology of math and to understand the place of math in peoples' lives
- Different interpretations of math produce different metaphysical views about the nature of reality

# Mathematical Developments

- Stability in math, controversy & debate
- Basically two central questions:
  1. What are objects?
  2. How do we (or can we) have knowledge of them?

# An Example of Tension

## Plato

- Abstract math objects are forms
- Before we were born, direct interactions

## Aristotle

- Abstractions from our experiences with various roughly spherical objects, we develop a perfect sphere

# Tension Example #2

**Rene Descartes**  
**Rationalists**

- Paradigm of knowledge because its truths can be obtained by a clear mind reflecting on ideas

**John Locke**  
**Empiricists**

- Certain knowledge of ideas, although ideas ultimately spring from experience

# The Beliefs

## □ Anti-Realist

No such thing as 'numbers'

## □ Platonism

Numbers as abstract  
(nonphysical, nonmental)

Abstract Exist, not in space  
or time at all

## □ Realist

Numbers & Objects

Different views of what a  
number is

1. Mental Objects
2. Outside of heads



# Platonism

- Def: There exists abstract objects that are wholly non-spatiotemporal, nonphysical, and non-mental
  - There are true math sentences
- Ex: Mental idea of #4 → Not just a mental thought
- Math is the study of the nature of various math structures, which are abstract in nature

# Some More Plat

- Math entities are

**Unchanging  
Abstract  
Eternal**

- Problem: Precisely where and how do the math entities exist and how do we know about them?

\*Most commonly supported belief

# Anti-Platonism

- Many philosophers cannot bring themselves to believe in abstract objects
- Numbers and sets exists
- Theorems as true descriptions

# Other Views

- Realism: Math entities exist independently of the human mind. Humans do not invent math, they discover it

Ex: Triangles

- Empiricism: We discover math facts by empirical research, just like other sciences

# One More View

- Logicism: Logic as the proper foundation of math.  
All math statements are logical truths
- Knowledge of math is a part of our...
  1. The **concepts** of math can be derived from logical concepts through explicit definitions
  2. The **theorems** of math can be derived from logical axioms through purely logical deduction

# Continued!

- Problem: if math is a part of logic, then questions about math objects reduce to questions of logical objects
  
- Philosophical theorizing

# P of M Today

- Irrealist accounts of math objects which aim to explain references to abstract objects via various reinterpretations of math language
- Naturalism: Once 1 accepts math as a **whole**, it is useful to the **sciences**.

# Impact on Education

- Research shows...

The approaches of  
teaching and  
development

- Learning Theories:  
Teachers apply in  
teaching math

- 1. Skills → Procedural
- 2. Conceptual →  
Meaningful, facts,  
formulas
- 3. Prob. Solving →  
Development of thinking
- 4. Investigative → All  
above and thinking  
beyond

# 😊 A Wrap Up 😊

- P of M: theorizing about the nature of **thought, language,** and that the world must come **together**

Reflection