Mathematics for Every Teacher

with Jake Tawney

Lecture 2: What is Mathematics

Outline:

What is Mathematics?

- Why is it that we have trouble describing the life of a mathematician?
    - People struggle to answer this because they haven't been engaged in the actual act of mathematics.

The Liberal Arts

- The infinity of the arts of language extends in two directions.
    - Horizontally: The arts of language are employed in all the disciplines (including mathematics).
    - Vertical: The use of language and argumentation does not change throughout history.
- Quadrivium: Mathematics is the study of the unchangeable.
    - **Quantity** (The Discrete)
        - **Alone** (The Absolute): Arithmetic
        - **In Relation** (The Relative): Music
    - **Magnitude** (The Continuous)
        - **At Rest** (The Stable): Geometry
        - **In Motion** (The Moving): Astronomy

What does it mean to do mathematics?

- Most of us are not going to use the content that we learned in math class.
- What is needed is to present mathematics in all of its purity and beauty.
- Math is not about simple utility.
- What is mathematics?
    - The process of doing mathematics is about:
        - **Patterns**
        - **Problems**
        - **Proofs**

Patterns, Problems, Proofs, Properties, & Play

- Mathematicians are concerned with play.
- They look at structures and they look for patterns. These patterns lead to questions about the properties of the structures, which allows them to pose problems and then engage in mathematical rhetoric, which is proof.

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- This is why we have students show their work. We have students show their work because they have discovered something true, and they are bound to communicate the truth with others in a way that is convincing.
- **The mathematician is a professional proof writer.**
    - Mathematics is a human endeavor embarked upon by real men and women.

The Quest for a Better Math Curriculum

- Redefine success.
- Reduce the amount of content…really.
- Give proof (and play) pride of place…at all ages.
    - (To do this you will have to reduce the content.)
- Reduce the amount of algebra and include more geometry and number theory.
- Integrate original sources.
- Establish a canon of theorem, proofs, and unsolved problems.

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