PROBLEM SOLVING WITH NUMBER SENSE & GEOMETRY FOR TEACHERS

MTCH 8030

Course Description:

Rigorous mathematical thought in games and puzzles, advanced number sense, the notion of infinity, and novel interpretations and geometric properties. **3 credits**

Prerequisites:

Admission to the Graduate Program.

Overview of Content and Purpose of the Course:

The purpose of this course is to present unique problem solving strategies in a variety of mathematical settings, including number sense and geometry. Students will be working in an inquiry-based manner and will present problems and solutions from advanced number sense and geometry. Many classic problems will be presented and students will develop rigorous proofs of those problems, including those encountered in "fun and games." Problems focusing on shapes and measurements, both 2- and 3-dimensional will be considered, including, but not limited to discoveries of symmetry and interconnections between shapes. Students will be exploring both Euclidean and non-Euclidean geometry.

Anticipated Audience/Demand:

Students enrolled in the Master of Arts for Teachers of Mathematics program, and other graduate students interested in mathematics education. This course responds to the needs addressed in the "Mathematical Education of Teachers" document prepared by the Mathematical Association of America.

Major Topics:

Fun and Games: *An introduction to rigorous thought*

- Conundrums evoking techniques of effective thinking
- Leading questions and hints for resolving the stories
- Discovering strategies of thought for life

Number Contemplation

- Counting Principles
- Numerical Patterns in Nature
- Prime Cuts of Numbers
- Secret Codes
- Irrational and Rational Numbers

Infinity

- Beyond Numbers: *What does infinity mean?*
- Comparing the Infinite: *Pairing up collections via a one-to-one correspondence*
- Travels Toward the Stratosphere of Infinities: *The power set and the question of an infinite galaxy of infinities*
- Straightening Up the Circle: *Exploring the infinite within geometrical objects*

Geometric Topics

- Pythagoras and his Hypotenuse: *How a puzzle leads to the proof of one of the gems of mathematics*
- Using computational geometry to place security cameras in museums
- Finding aesthetics in life, art, and math through the Golden Rectangle
- Symmetry
- Platonic Solids: *Discovering the symmetry and interconnections among the Solids*
- The Shape of Reality?: *How straight lines can bend in non-Euclidean geometries*
- The Fourth Dimension: *Can you see it?*

Methods:

Inquiry-based learning will be utilized. Students will be working in groups and doing full-class presentations. Activities will be integrated into classroom discussions.

Student Role:

Students will engage daily in classroom discussions and activities.

Students will do individual and group presentations to the class.

Textbook:

Burger, E. B. and Michael Starbird. *The Heart of Mathematics*. Hoboken, NJ: John Wiley & Sons Inc., 2009.

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