

Varied Topics for MATH 100

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June 17, 2009

1 How to Study Mathematics

1.1 The Work of Uri Treisman

Here we will discuss how key is to foster class discussion and group work to succeed in Mathematics.

Assign Uri Treisman's Dolciani Lecture: <http://tinyurl.com/c8rgvf>

2 Pattern Blocks

<http://math.rice.edu/~lanius/Patterns/>

<http://tinyurl.com/d2uqlh> (Virtual Pattern Blocks)

3 Cuisenaire Rods (Integer Rods or Integer Bars)

<http://www.etacuisenaire.com/cuisenairerods/cuisenairerods.jsp>

http://en.wikipedia.org/wiki/Cuisenaire_rods

<http://arcytech.org/java/integers/index.html> (Lesson Plans)

<http://tinyurl.com/238zsg> (Virtual Rods)

<http://www.elasticmind.com/labababado/rods.html> (Virtual Rods)

<http://tinyurl.com/ddrku6> (Virtual Rod Trains)

<http://tinyurl.com/c8m47o> (Fractions)

4 Ethnomathematics

4.1 Native Hawaiian Mathematics

Among the topics to be covered are:

- Konane.
http://www.k12.hi.us/~gkaapuni/how_to_play_konane.htm
<http://tinyurl.com/c6gxay>
- Nets and Netting
<http://www.ethnomath.org/resources/stokes1906.pdf>
- Astronomy
<http://www.ethnomath.org/resources/makemson1938.pdf>

4.2 The Mayas.

<http://tinyurl.com/dx6te8>

- Zero.
<http://mathforum.org/k12/mayan.math/>
- How to count in Maya (using Cuisenaire Rods).
- The Maya Calendar. The Long Count.

4.3 Africa

<http://www.amazon.com/gp/product/0883857154>

<http://tinyurl.com/db088d>

Among the topics to be covered are:

- Sand Drawings
<http://tinyurl.com/cvk4gq>
- The Ishango Bone.
http://en.wikipedia.org/wiki/Ishango_bone
http://www.simonsingh.net/The_Ishango_Bone.html

4.4 The Story of 1

We will watch the film: The Story of 1 (60 Minutes).

5 Topics in the History of Mathematics

5.1 Women in Mathematics

The students will be assigned, to read and answer questions on the biographies, which can be found here <http://tinyurl.com/clan2p>, of the following female mathematicians:

- Hypatia of Alexandria.
- Marie-Sophie Germain.
- Sofia Vasilyevna Kovalevskaya.
- Florence Nightingale.
- Augusta Ada King, countess of Lovelace.
- Christine Ladd-Franklin.
- Emmy Amalie Noether.
- Julia Hall Bowman Robinson.

5.2 Flatland: A Romance of Many Dimensions

<http://www.ibiblio.org/eldritch/eaa/FL.HTM> (Full Text)

<http://en.wikipedia.org/wiki/Flatland>

We will watch the film Flatland by Ladd Ehlinger (duration 98 minutes). Followed by a brief discussion on the Geometrical ideas in Flatland.

6 Topics in Geometry

6.1 The Pythagorean Theorem

<http://mathworld.wolfram.com/PythagoreanTheorem.html>

- Basic Properties of Triangles.
- Did the Egyptians know it?
- Proofs without Algebra.
- Which U.S. President proved it?
- Albert Einstein.

6.2 The Möbius Strip

http://en.wikipedia.org/wiki/Möbius_strip

6.3 The Platonic Solids. Polyhedra

http://en.wikipedia.org/wiki/Platonic_solid

- What are they and how to construct them.
- Why are there only 5.
- Euler and his formula.
http://en.wikipedia.org/wiki/Euler_characteristic

6.4 The Archimedes Palimpsest

<http://www.npr.org/templates/story/story.php?storyId=5583668>

7 Numbers

7.1 Prime Numbers.

- What are they. An explanation without arithmetic, using Cuisenaire Rods.
- The sieve of Eratosthenes.
http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes
- How prime numbers make e-commerce possible.
<http://crypto.stanford.edu/~dabo/papers/RSA-survey.pdf>

- Cicadas, Prime Numbers and Least Common Multiples
http://www.maa.org/mathland/mathtrek_06_23_03.html
<http://tinyurl.com/cg4u96>

7.2 Cuisenaire Rods

We will revisit Cuisenaire Rods and how to use them to compute Least Common Multiple and Greatest Common Divisors. <http://tinyurl.com/dy4eyc>.

8 Puzzles

8.1 How to cut a cake. How to use mathematics to fairly apportion.

<http://tinyurl.com/cu3k84>
<http://mathworld.wolfram.com/CakeCutting.html>
<http://tinyurl.com/c2y6qu>

8.2 The Towers of Hanoi and Inductive Thinking

http://en.wikipedia.org/wiki/Tower_of_Hanoi

8.3 Brain Teasers

- You do your laundry every 7 days and mow the lawn every 5 days. Your neighbor does laundry every 8 days and mows the lawn every 6 days. In what way do you have a better schedule according to the least common multiples?
- A bear travels 10 miles due south, 10 miles due west and 10 miles due north. If the bear ends where it started, what color is the bear?

8.4 How to add the numbers 1 through 100. Gauss: The Prince of Mathematicians.

In this section we will learn about geometric progressions, and the legend of how Karl Friederich Gauß discovered them for himself as a child:

<http://tinyurl.com/cbbnlv>

8.5 Magic Squares

http://en.wikipedia.org/wiki/Magic_square

- The Lo Shu
http://en.wikipedia.org/wiki/Lo_Shu_Square
- Benjamin Franklin

9 Graph Theory

9.1 What is a graph

9.2 The First Theorem of Graph Theory

9.3 Ramsey Theory

9.4 The King Chicken Theorem

<http://tinyurl.com/dxpt73>

9.5 How to Color a Map - The Four Color Theorem.

<http://mathworld.wolfram.com/Four-ColorTheorem.html>

9.6 The Seven Bridges of Königsberg

http://en.wikipedia.org/wiki/Seven_Bridges_of_Konigsberg

9.7 Irregular Graphs.

Time permitting we will watch the film: N is a number (duration 1 hour) (<http://www.zalafilms.com/films/nisanumber.html>).

10 Mathematics and Art

We will start class by watching the film: The Fantastic World of M.C. Escher (duration 50 minutes).

10.1 Tesselations (Tilings of the Plane)

- The Art of M.C. Escher.
<http://www.mcescher.com/>
<http://www-history.mcs.st-and.ac.uk/Biographies/Escher.html>
- Tilings in Islamic Art. The Alhambra.
<http://en.wikipedia.org/wiki/Alhambra>
- Non-periodic Tilings - Quasi Crystals in Medieval Mosques.
<http://tinyurl.com/29pvv6> (NPR)
- Penrose Tilings
http://en.wikipedia.org/wiki/Penrose_tiling

10.2 The Golden Ratio

<http://mathworld.wolfram.com/GoldenRatio.html>

- How to build a Golden rectangle.
<http://mathworld.wolfram.com/GoldenRectangle.html>
- The Fibonacci Sequence.
<http://mathworld.wolfram.com/FibonacciNumber.html>
- Phyllotaxis
<http://mathworld.wolfram.com/Phyllotaxis.html>
- The Nautilus Shell

10.3 Capturing the Unicorn

http://www.newyorker.com/archive/2005/04/11/050411fa_fact

- The Brothers Chudnovsky
<http://tinyurl.com/15266> (video)

10.4 Mathematics and Music

<http://tinyurl.com/o9sue> (BBC podcast)