Activities and Syllabus for Math 1300
Mathematical Explorations
Cornell University

This course is taught in an "inquiry-based learning" format, in which students explore mathematics through a series of activities in small groups.

All the activities listed below are detailed in the freely available workbooks (downloadable PDF files) at "Discovering the Art of Mathematics,"
http://www.artofmathematics.org/books

LIST OF ACTIVITIES:

Straight-cut origami – folding and cutting out shapes with a single straight cut. Lines of symmetry, angle bisectors, perpendiculars.
Reference: http://www.artofmathematics.org/books/art-and-sculpture

Symmetry in dance moves: following someone using reflection or rotation. Which poses don't change when you switch from one symmetry to the other?
http://www.artofmathematics.org/books/dance

Symmetry in frieze patterns in architecture: translations, glide reflections. Line dancing. Following one symmetry by another using groups of three students
http://www.artofmathematics.org/books/dance

Pennies and paperclips game. Analysis of which moves win for pennies, which win for clips. Proofs of those claims. Hamiltonian circuit.
http://www.artofmathematics.org/blogs/jfleron/pennies-paperclip-proofs

Doubt: Puzzles with missing leprechauns, optical illusions. Discussions: Myths that were once widely believed, now debunked. Politics. Ideas in math that you don't necessarily believe.
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Certainty: Euclid and the axiomatic method. Echoes of Euclid in Declaration of Independence. What do you know about pi?
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Why A = πr^2 for circle. Cutting and reassembling a circle into a rectangle. Taxicab geometry and a new version of pi.
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Inductive reasoning. Looking for patterns and rules. "What's my world?" Patterns in death dates of presidents.

http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Deductive reasoning. Knights and knaves. Sudoku. Three and four point geometries.
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Cheez-It math. Finding and proving patterns about sums like 1+2+3+4+3+2+1, and 1+3+5+7, by representing them with cheez-its
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Five ways to prove the sum of the angles in a triangle equals 180°; tearing, folding, squinting, walking, and tiling
http://www.artofmathematics.org/books/truth-reasoning-certainty-and-proof

Fibonacci numbers. Pinecones, sunflowers, rabbit problem.
http://www.artofmathematics.org/books/number-theory

Golden ratio: measuring bellybutton heights. Analyzing $\sqrt{1+\sqrt{1+\sqrt{1+...}}}$
http://www.artofmathematics.org/books/number-theory

Golden Ratio. Faces of celebrities. Read from The DaVinci code. Honeybee math.
http://www.artofmathematics.org/books/number-theory

Area. Why is xy the area of a rectangle? Area of a fractal snowflake curve.
http://www.artofmathematics.org/books/calculus

Class discussion of Lockhart's "A Mathematician's Lament" and math education
https://www.maa.org/external_archive/devlin/LockhartsLament.pdf

Which whole numbers can be written as 3a+5b? Conjectures and proofs.
http://artofmathematics.org/blogs/jfleron/3a5b-proofs

Big numbers in everyday life. What can you buy will a million dollars? How long is a million vs a billion seconds?
http://www.artofmathematics.org/books/the-infinite

Games with one and two piles of M&M's and Skittles. Finding and proving winning strategies.
 http://www.artofmathematics.org/books/games-and-puzzles

Human knot game. Trefoils, figure-8 knot. Deforming string knots string to their mirror images.
http://www.artofmathematics.org/books/knot-theory