

Caen Science Festival 09.

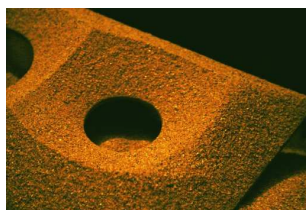
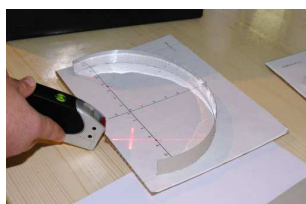
Eric Reyssat



Here is a brief abstract of activities presented to visitors in Caen for the national science fest in november 2009. These activities were organized by the maths department of the university together with highschool teachers involved in research about mathematical education (IREM).

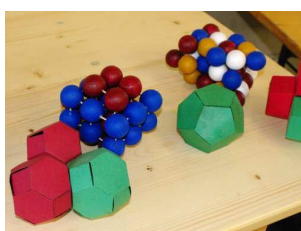
This document is organized by mathematical theme, as were the workshops during the festival. The order of paragraphs as well as items in tables has no meaning. Just lazyness from myself.

§ 1 Conics



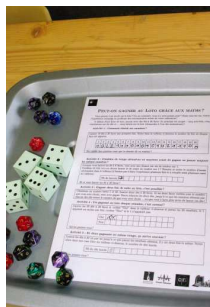
Material	Pedagogical goals
Plane sections of polystyrene cylinders, cones, hyperboloids	Visualizing conics as plane sections of cones and other quadrics
Elliptic billiard	Visualizing properties of the foci in an ellipse
Elliptic and parabolic mirrors + laser pointer	Comparing properties of the foci in ellipses and parabolas
Sand heaps and various shapes of wood to put the sand on.	See how to make different kinds of conics using dry sand heaps to intersect cones and planes
Hyperboloid made of strings.	Seeing how straight lines may generate hyperbolas

§ 2 Polyhedra



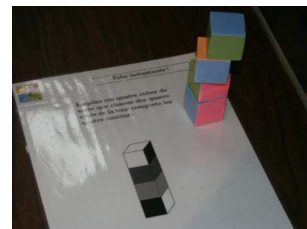
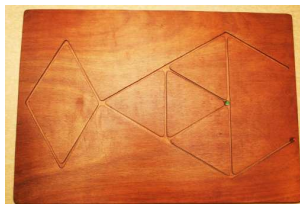
Material	Pedagogical goals
Wooden sticks (1m long) and cords to build edges and diagonals of polyhedra	Visualizing symmetry properties of regular polyhedra and notions of orthogonality of planes or lines
Toothpicks and adhesive paste.	Constructing simple models, verifying Euler's formula.
Different unusual polyhedra	Discussing the variety of polyhedra, making conjectures
Polyhedral calendar.	Concrete application of geometry and graphs.
Football ball and golf ball. Polyhedral dices.	Understanding the structure of regular and semi-regular polyhedra.
Electric knife and foam from mattresses	Helping to visualize the links between different polyhedra.
Different cardboard nets of polyhedra	Constructing 3D shapes, and understanding the links between polyhedra and their nets
Already mounted cardboard polyhedra	Comparing different kinds of polyhedra, studying their tiling properties and discussing regularity properties.
Plastic polygons (polydrons TM) and magnetic bars (geomag TM) to build polyhedra	Investigating the notion of regular polyhedra, combinatorial properties of polyhedra

§ 3 Probability



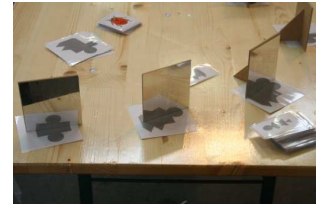
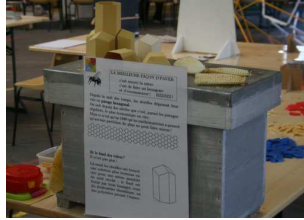
Material	Pedagogical goals
Galton board	Studying the binomial law and its convergence to a normal distribution
Different kinds of dices	Modelling some gambling games and understanding some probability paradoxes
Monty Hall box	Introducing to some paradoxes in probability

§ 4 Graphs



Material	Pedagogical goals
Set of colored cubes	Understand the use of graphs when dealing with complicated problems
Train maneuver board	Ability to model concrete situations with graphs
Blind barman game, water bucket and recipients.	Building a strategy using graphs to solve a problem.
Paths drawn on nailed boards, Hamilton game.	Study of eulerian and hamiltonian graphs.

§ 5 Symmetry and tilings



Material	Pedagogical goals
Color paper for constructing a large tiling, questions about this tiling	Finding the different symmetries of a tiling, discovering hidden geometrical shapes, some links with number theory
Different kinds of plane mirrors	Investigating the notion of mirror symmetry and their compositions.
Hive and honey combs, cardboard comb structure	Studying the best tilings of the plane and the 3D-space. Linking to recently proved conjecture.
Sets of polygonal plastic pieces (Attrimaths™)	Constructing tilings and compare different kinds of symmetries.
Symmetry games	Understanding symmetry, for children.
Tetrahedral puzzles with balls.	Mentioning sphere packing problems and conjectures.

§ 6 Games, logic, puzzles



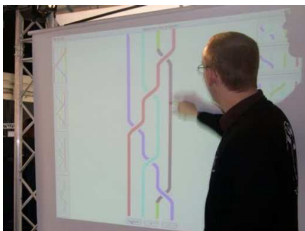
Material	Pedagogical goals
Hanoi towers	Studying strategy, logic and complexity theory.
Dissection puzzles	Proofs without words of some geometric theorems.
Roberval balance and set of weights	Solving logical puzzles
Tangram sets and example sheets.	Visualize planar decompositions.
Enigmae panel	Testing logical skills

§ 7 Moebius band (schools only)



Material	Pedagogical goals
Paper and tissue strips, glue sticks, scissors, markers, ...	Guessing and verifying some strange topological properties of the Moebius band.
Zippers.	Understanding the decomposition of a Moebius band cut in halves.

§ 8 Braids and knots



Material	Pedagogical goals
Boromean rings	Visualizing some interesting knots
Electric wire braids, computer software for handle reduction.	Visualizing how to simplify braids.
Elastic string knots	Understanding some properties of knots.

§ 9 Perspective and anamorphoses



Material	Pedagogical goals
Camera, computer and printer.	Constructing conical anamorphoses.
Cube.	Studying the projections of an object.
impossible 3D-cube, pictures of impossible objects and perspective illusions, objects with reversed convexity.	Understanding the loss of information in the process of projection
Examples of anamorphic photographs	Introducing projective geometry
Conical and cylindrical mirrors, grids, and anamorphoses.	Seeing how images are twisted by non linear transformations. Understanding the notions of left and right sides in a mirror.
Spherical mirror	Looking at transformations of distances and angles.
Plane mirrors	Understanding the simplest transformations of the space
Every day anamorphoses (geographical, roads, etc.)	Seeing applications of different geometric transformations.