CTTI-Geometry Workshop-Fall 2012-11-10

Notes

Logistics

Description of upcoming Logic class

Focus on G-SRT-4 :Prove theorems involving similarity

-Difficult standard because it does not include a discussion of the basis for proof.

-Revisit argument for "5-section" of segment

-"Mathematics is not something that can be done in 5 minutes"
-Build up knowledge over time so that at the END the proof can be done right.

Napoleon's Theorem Activity

-sugesstions/conjectures: Parallelogram?
-Area of inner quad is ½ area of outer quad?
-What if you have a square? Inner quad is rhombus
-If you have rectangle, what is inner quad?
-Strategy: Draw all the lines that "might possibly be reasonable".

-use similar triangles & diagonals to get parallel sides through transitivity

-How to generate idea for proof? comment about playing around and just seeing what happens as consistent with history of science/mathdiscoveries;

-Multiple solutions? Andreas's proof w/o invoking proportionality

Activity: Conditions for a parallelogram
-opposite sides congruent, then draw diagonal and apply SSS

Area of Triangle Activity:
-Should be in every HS geometry class
-Why? Changing which side represents the triangle "base" (altitude fall outside triangle base)
-Take Pythagorean theorem(i.e., rote calculation) out of the picture.
-Also, can introduce topics of limits (e.g., angle goes to zero, but area remains constant!)

Scissors Congruence Activity

Euclid I.35 Activity

Lunch announcement: Bonnie's course proposal for advanced discrete math
-cf. programming & cryptography; graph theory; binary numbers
-two levels: lower, non-precalc course; upper, proof-oriented

-The course is new; due to funding issues, could it be a "workshop"?
-Too much CPS commitment if a course?
-Lack of grad credit as workshop not really a big deal for some, but yes for others

Area Axioms
-Where does area (de-)composition come in the curriculum? 6th grade
-Do high school students understand this? (*chirp,chirp*)

-changing the variable in perimeter and area is trouble for students

Distance
-What is the distance between and point and a line?
-Need to define it.
-Precise and consistent language is necessary so as not to confuse students with a proliferation of incommensurable terms.

-Are there better definitions than the given formulation? How would you prove it?
-"Two lines m and l are parallel iff they are always the same distance apart". What does "always" mean?

-Use of quantifiers from the Logic course!

-The word "always" is actually disguising the use of universal and existential quantifiers.

Lecture portion on Terminology
-Equality vs. Congruence
-the status quo is based on real numbers, but students don't have a sound understanding of real numbers (cf. misconceptions about irrational numbers)
-History of rise of set theory as a corrective to fundamental problems with concept of continuity
-Synthetic-Euclidean vs. Analytic-Coordinate (Cartesian)
-Building geometry from arithmetic or vice versa
-Systms of Synthetic Geo: Euclid, Hilbert, Tarski, Birkhoff

Function Activity

-Answers to “what is a function”?
-relationship between two sets (of numbers), every number in the one set is associated with exactly one number in the other
-Importance of the words “exactly one”

-Functions do not need to come from formulas (although these are the only types of functions students encounter)

-Given a finite table for function inputs/outputs, there are many, MANY rules.

Equivalence Relations
-Explanation and examples
-e.g., congruence (geometrical and algebraic), geometrical similarity, same area, same perimeter, etc.
-What is a natural example of eqRel on a function?
Things that map to the same object.

Overview of our axiom system
-function from all congruent segments into one representative segment on a fixed line with a fixed point of reference.

-historical shift from dealing with line segments to dealing with numerical representations of their endpoints.

Adding segments Activity Sheet
-showing that the geometrical definition works like algebra
-define addition
-show commutativity and associativity.