Learning Mathematics with Teachers

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Observations

- The Math Wars were a major obstacle to achieving success in addressing issues of math education.
- The central activity in the classroom is learning, not teaching.
- Mathematical Knowledge for Teaching is a genuine mathematical discipline.

In Utah

2006: Committee to create new state standards for Mathematics

2007: Provost insistence on CoEd and CoS cooperation

2009: First cohort for MS degree for teachers

2010: Math for America site in Utah

Who

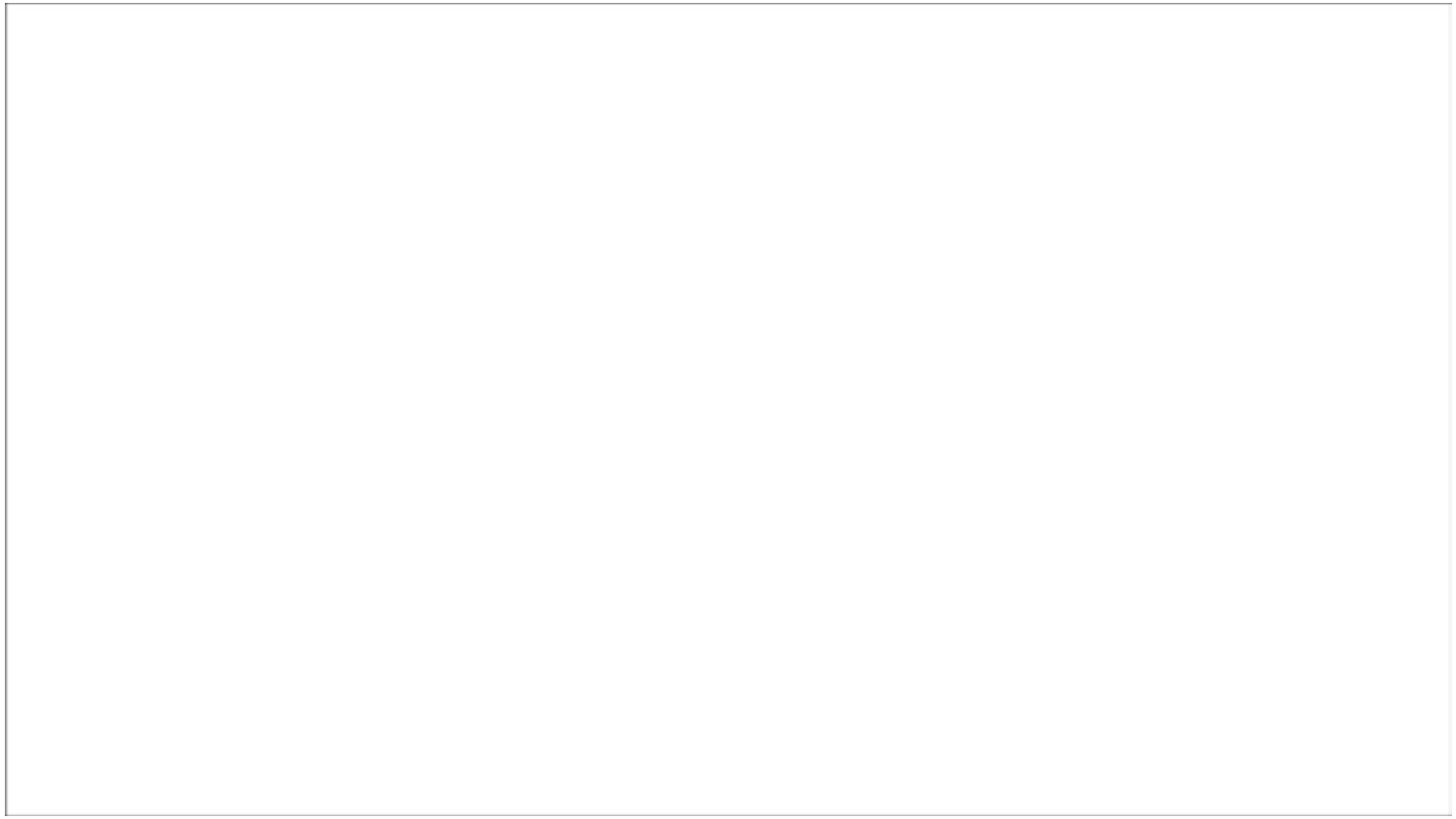
- Development of Authentic Collaboration of Mathematicians, Teachers, and Math Educators

- Involvement of the Utah State Office of Education

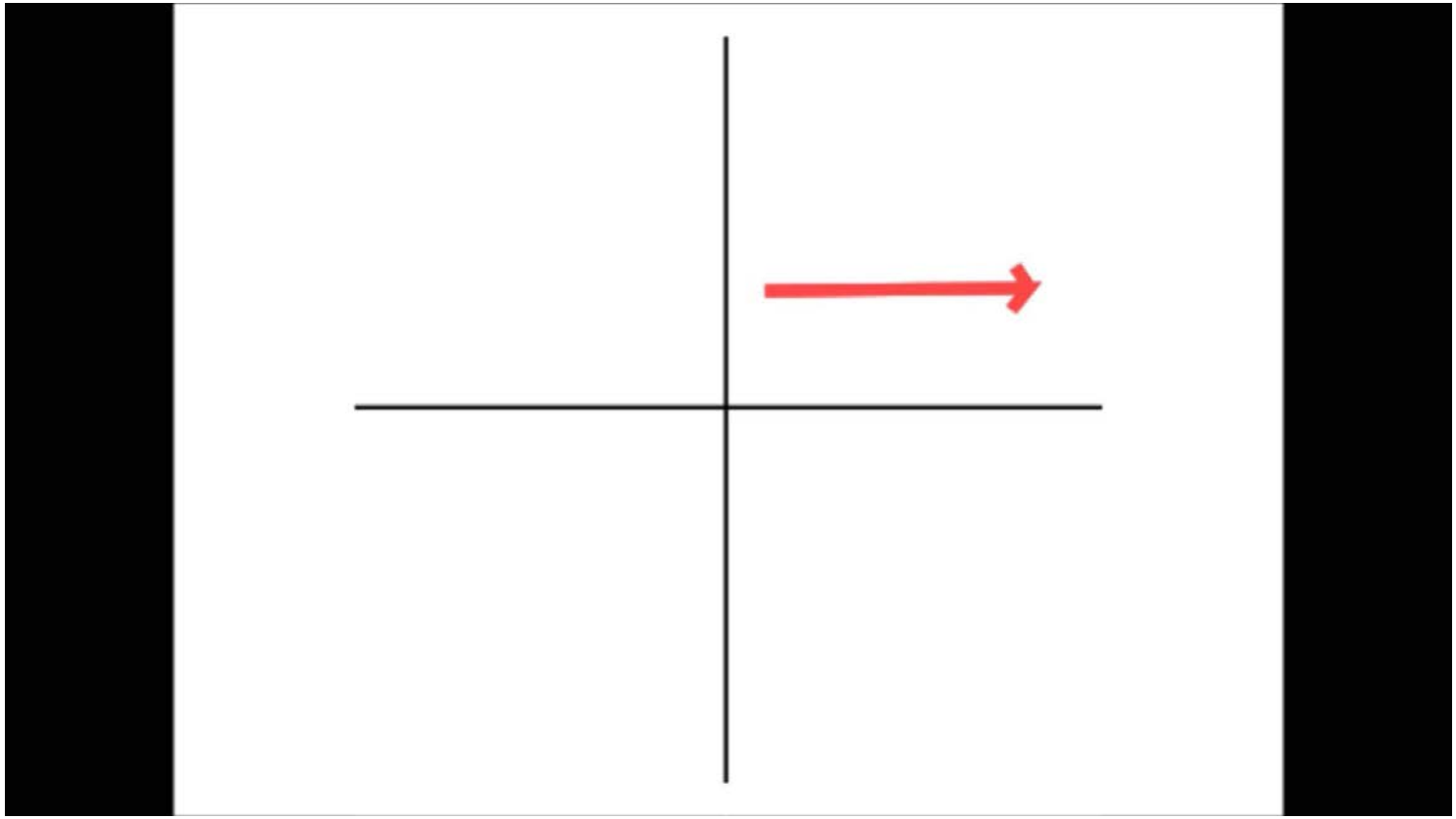
Collaboration of Teachers, Educators, and Mathematicians produces opportunity for deep penetration into Mathematical Knowledge for Educators that otherwise would not be possible

ILLUSTRATIONS

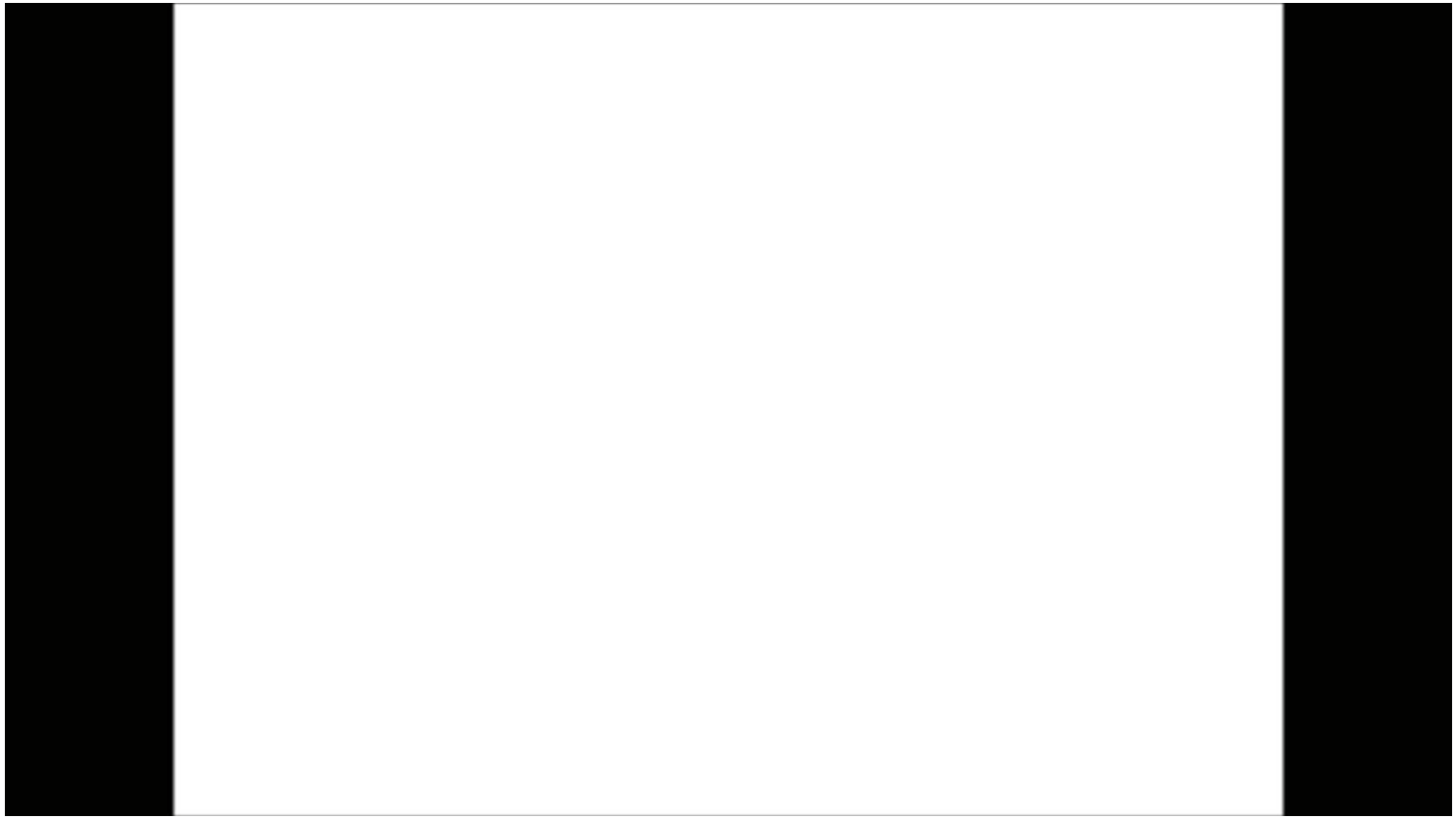
Slope



Orientation



Pythagorean Theorem



Emina Alibegovic

UNDERGRADUATE AND GRADUATE PROGRAMS

Programs

Undergraduate

- Elementary
- Secondary

Graduate

- MS Mathematics (Teaching)
- Master of Science for Secondary School Teachers
- Professional development

Elementary

Mathematics

- Number and operations (4 cr)
- Geometry and statistics (4 cr)
- Algebra (4 cr)

Education

- Methods (3 cr)

MET II recommendation : Elementary

- Programs designed to prepare elementary teachers should include 12 semester hours focused on a careful study of mathematics associated with the CCSS (K–5 and related aspects of 6–8 domains) from a teacher's perspective.

Secondary

Mathematics

- Mathematics major
  - Calculus sequence
  - Linear algebra
  - Differential equations
  - History of mathematics
  - Foundations of analysis
  - Statistics
  - Number theory
- Teaching major
  - Foundations of algebra
  - Foundations of geometry
  - Capstone

Education

- Methods for teaching secondary school mathematics
- Practicum

MET II recommendation: Secondary

- include at least:
  - a three-course calculus sequence,
  - an introductory statistics course,
  - an introductory linear algebra course,
  - 18 additional semester-hours of advanced mathematics (9 focused on high school mathematics from an advanced standpoint.)
- methods courses required for certification focus on instructional strategies for high school mathematics rather than generic instructional methods.

Professional development

- MfA Utah Mathematics Teachers' Circle
  - Year long program
  - Summer workshop
- USOE organized professional development
- C&I Practicum: lesson study
- MS programs

MS

Mathematics Teaching

- Population:
  - Pre-service (MfA)
  - In-service, early career
- Core coursework:
  - Advanced topics in history
  - Topics in contemporary mathematics
  - Curriculum and instruction
  - Practicum
- Elective coursework

MSSST

- Population
  - In-service (at least 3 years)
  - Cohort model
- Fixed coursework

Challenges: Elementary

- ... blend the study of content and methods.
  - Faculty
  - Politics
- … will need additional coursework in mathematics.
  - Differentiation

Challenges: Secondary

- The courses are there, but is the content?
  - Learning mathematical reasoning is more important than covering every possible topic.
- How do they get to know the mathematics?
  - … instructors pay careful attention to building and guiding mathematical reasoning
  - … learners are active participants in developing the mathematics and are constantly required to reflect on their reasoning.
  - View of mathematics
- Middle school teachers

MS challenges

- Differentiation
- Limited number of mathematics faculty involved
  - Problematic?
  - Advantageous?

Challenges for all programs

- Systematic course development
  - Common Core?
  - Common Curriculum?
- Collaborations
  - Building on the expertise of others
  - MTE-P

I asked my students what they learned

- This was my first encounter with a number of concepts since I had misunderstood or incompletely understood them in my high school and undergraduate education.
- I learned you can be a badass mathematician while caring so much about your students and society. Which makes you even more badass.

Maggie Cummings

PROFESSIONAL DEVELOPMENT

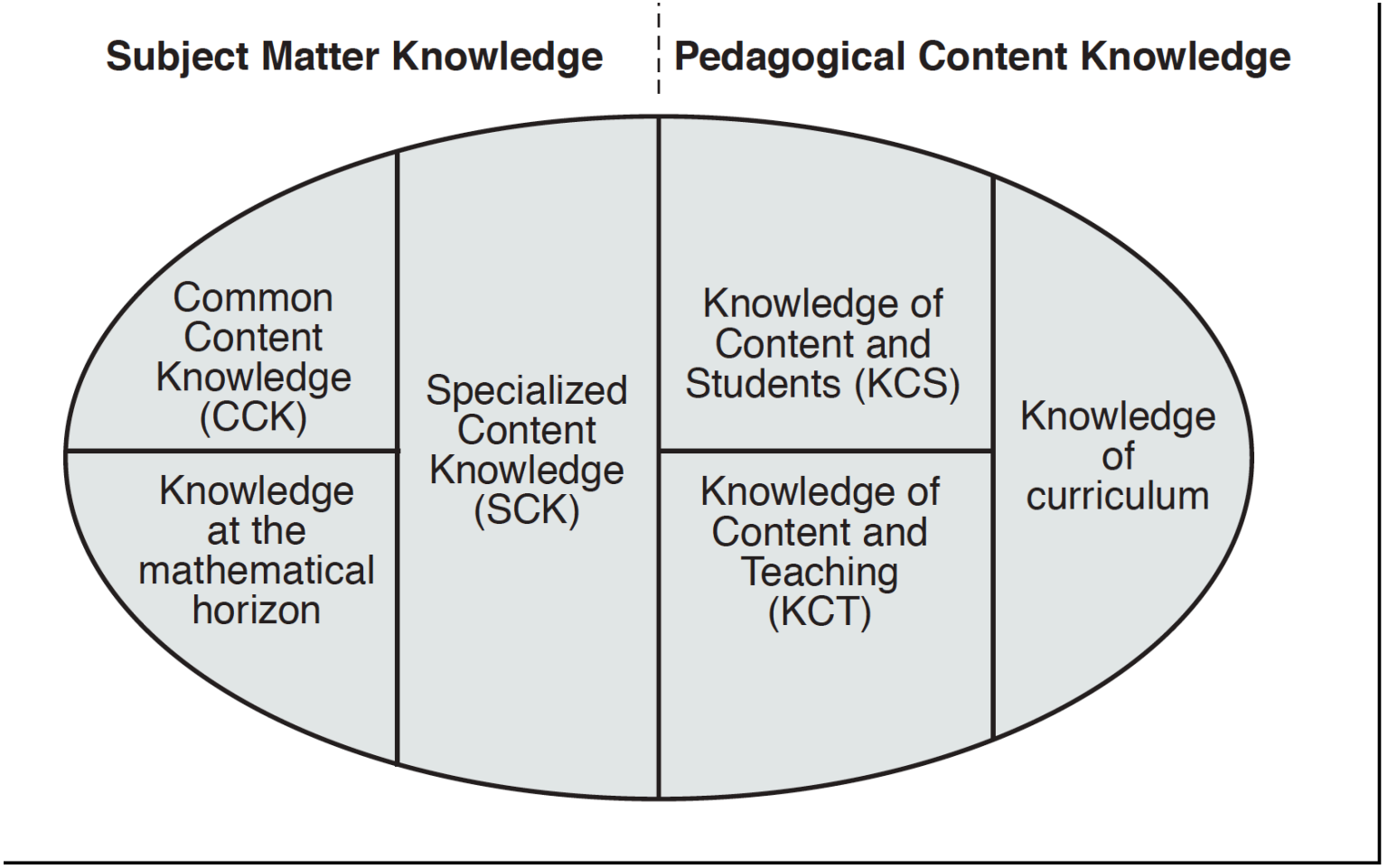
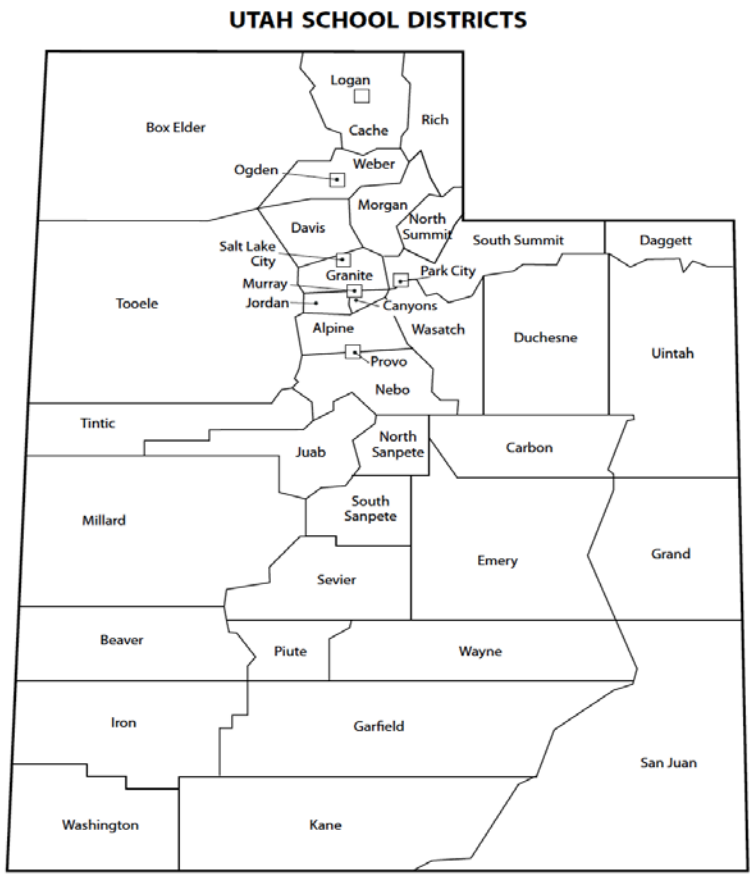


Figure 1. Domain map for mathematical knowledge for teaching.

Transition to CCSS

- Bringing teachers, schools, districts and the U together

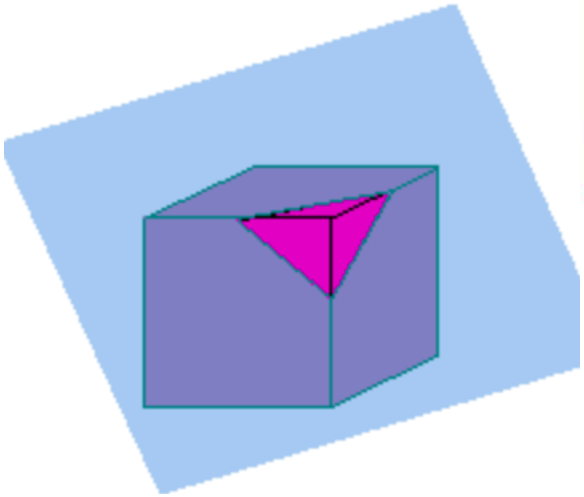


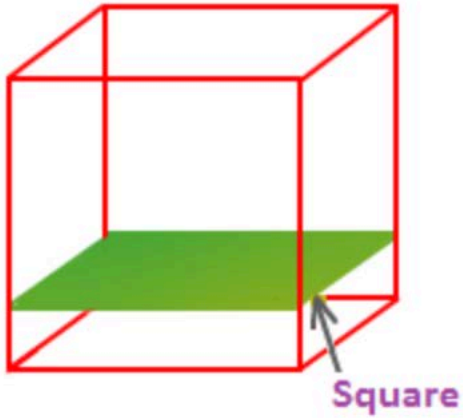

ALEKS

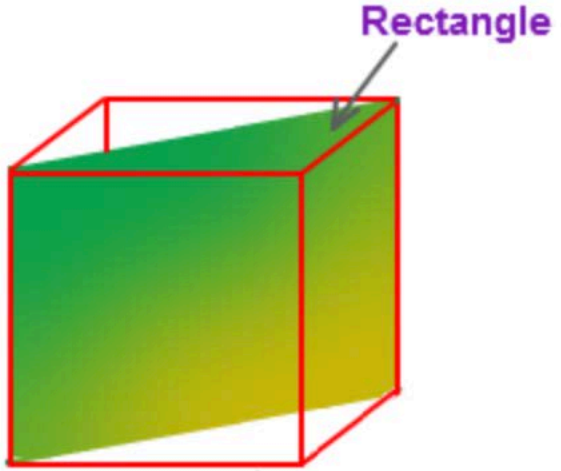

DELL
Clorox
Wipes
DELL

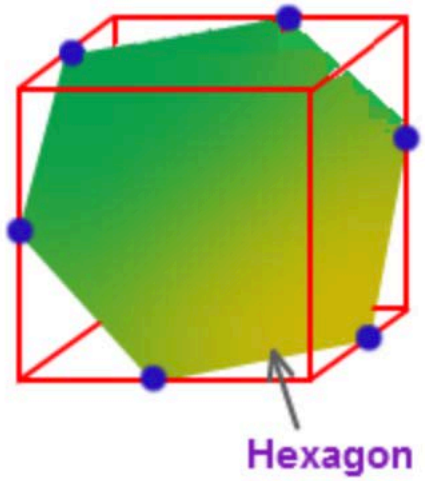
What two dimensional figures result from slicing a cube with a plane?

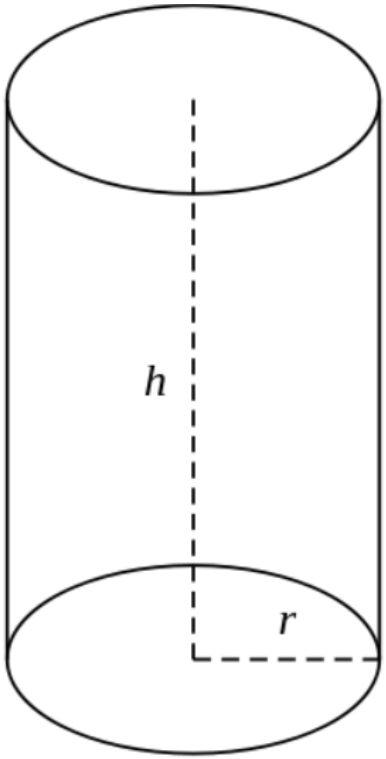
7G3: Describe the two-dimensional figures that result from slicing three dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

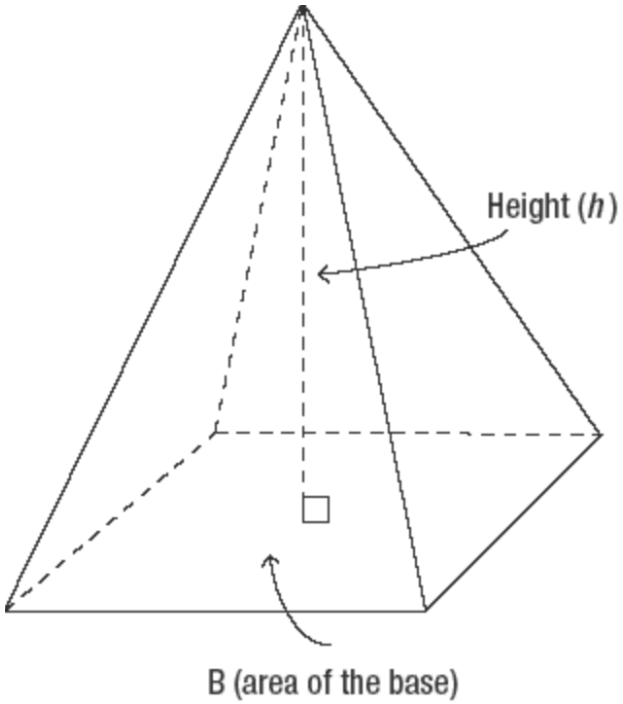


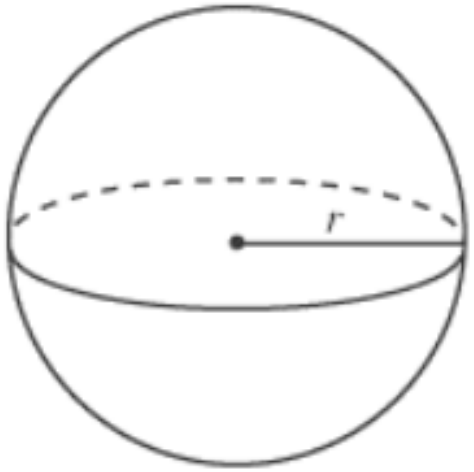

Square


Rectangle


Hexagon

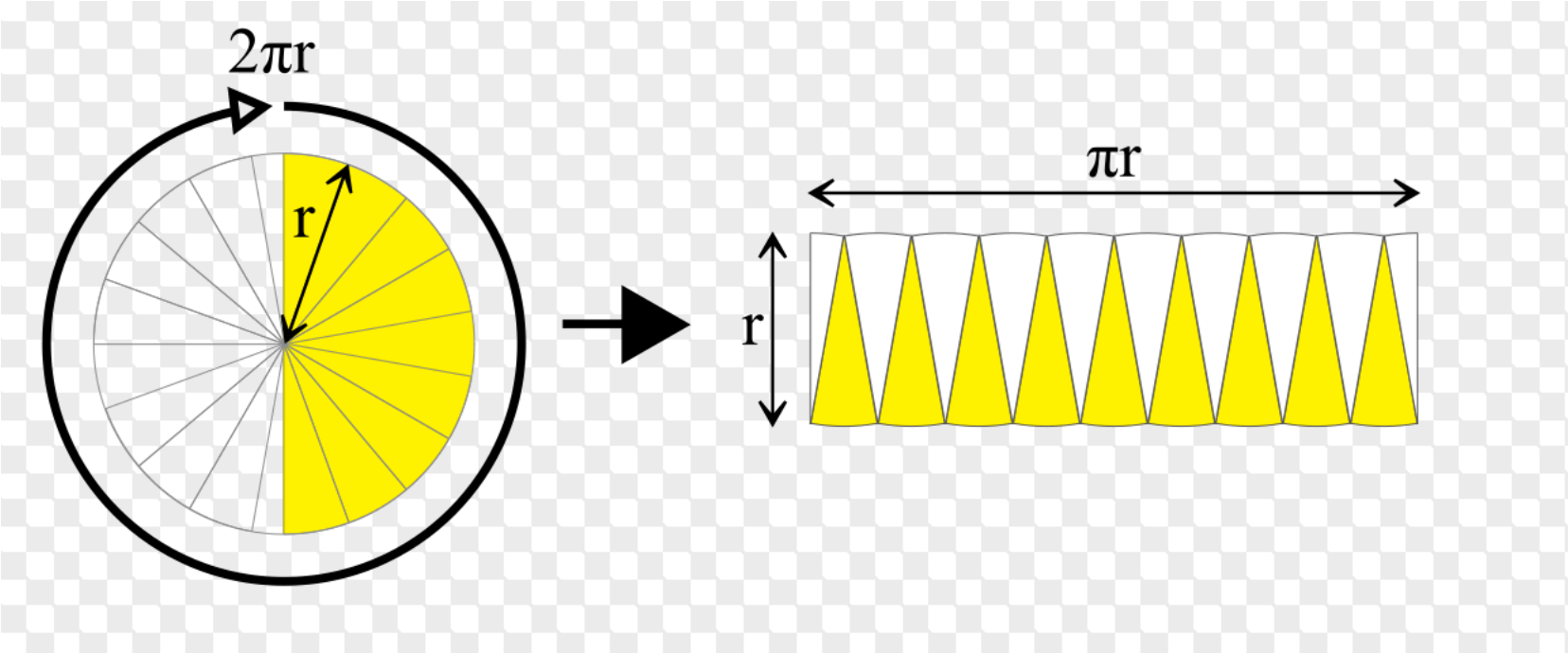

h
r

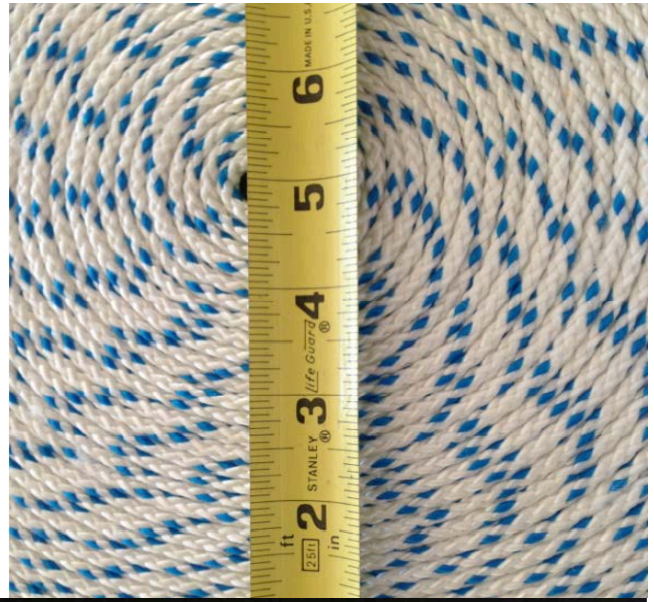

Height (h)
B (area of the base)

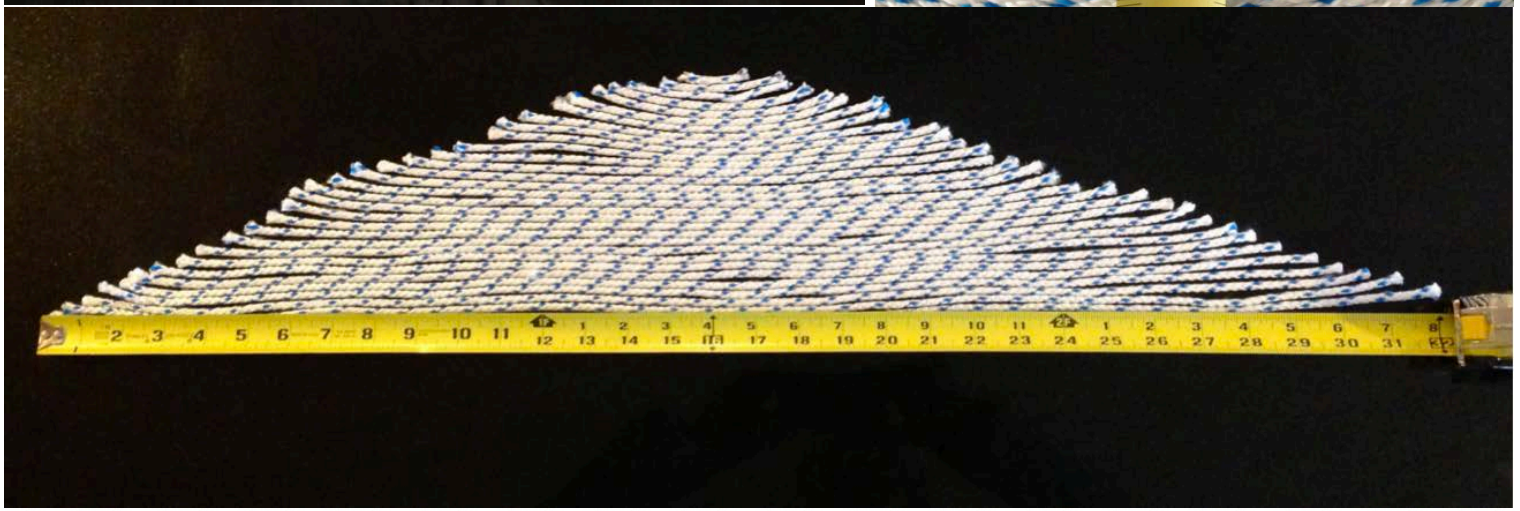

r

What is the relationship between circumference and area of a circle? OR Explain why πr^2 gives the area of a circle.

7G4: Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.


2πr
r
πr
r


STANLEY
life Guard

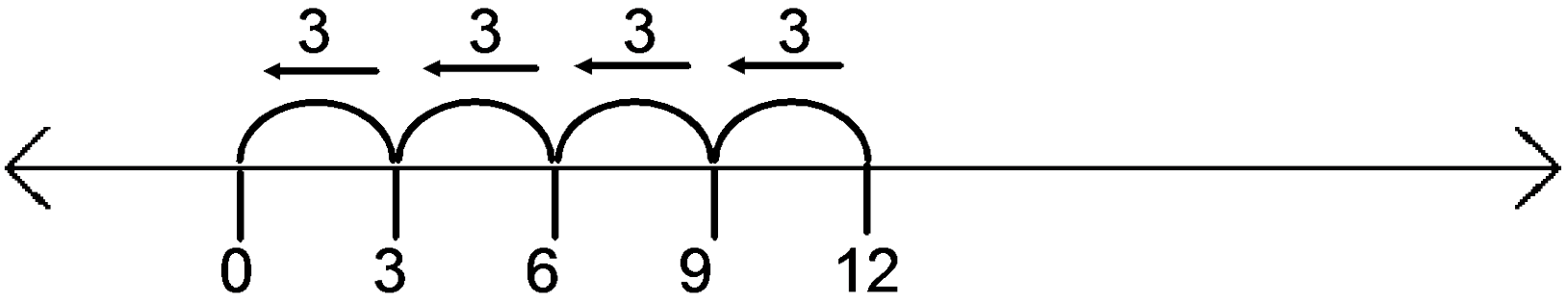


Tse’bii’nidzisgai Elementary and Monument Valley High School

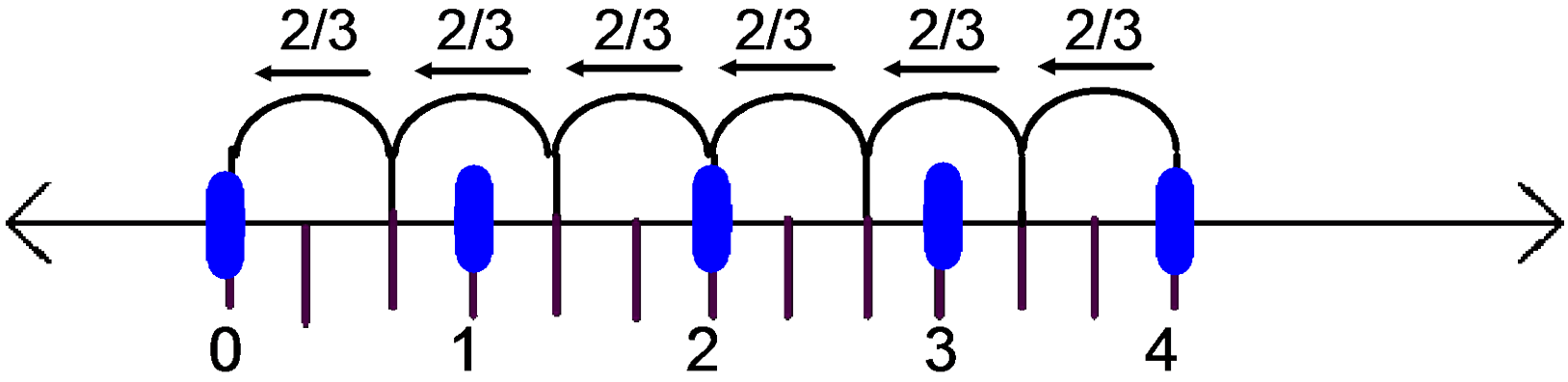
5th Grade

Apply and extend previous understandings of multiplication and division to multiply and divide fractions

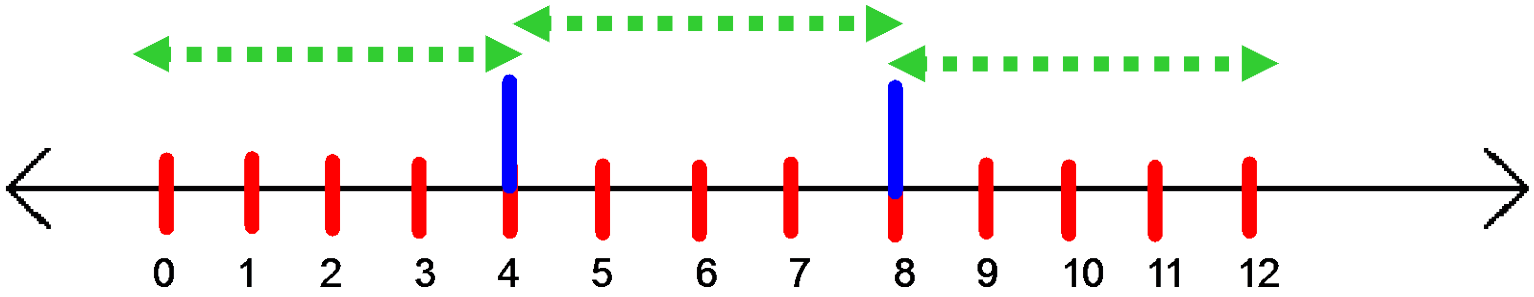
$12 \div 3 = 4$



$4 \div 2/3 = 6$



$12 \div 3 = 4$



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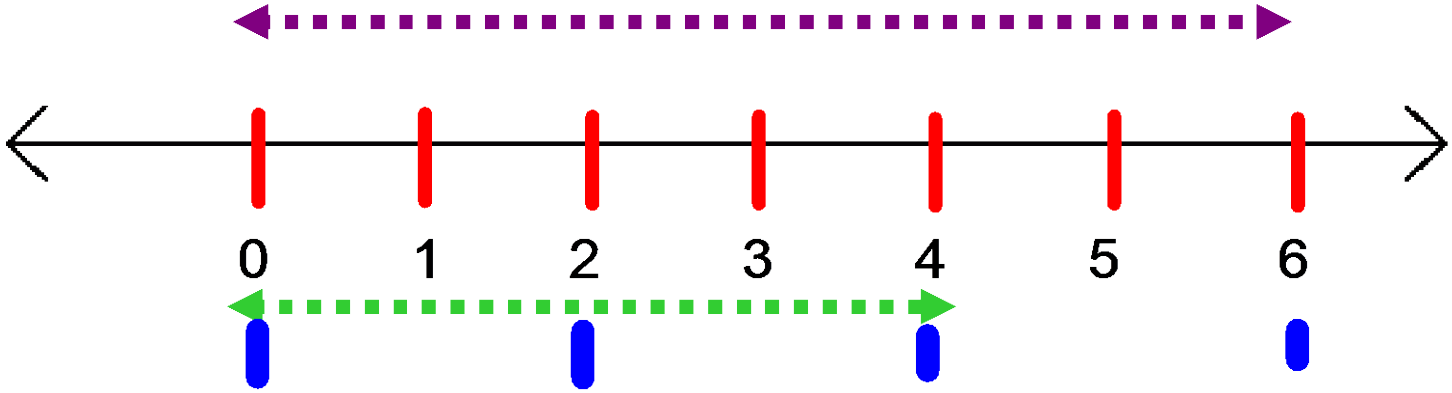

Math Circle and CCSS PD: Henry Fowler (Dine College), Tatiana Shubin (SJSU), Blake Thornton (WU in St. Louis), teachers from Navajo schools

Directions: Determine whether the triangles pictured below are **congruent** to ΔDEF, **similar** to ΔDEF, or neither congruent nor similar to ΔDEF. Describe a sequence of transformations that support your claims.