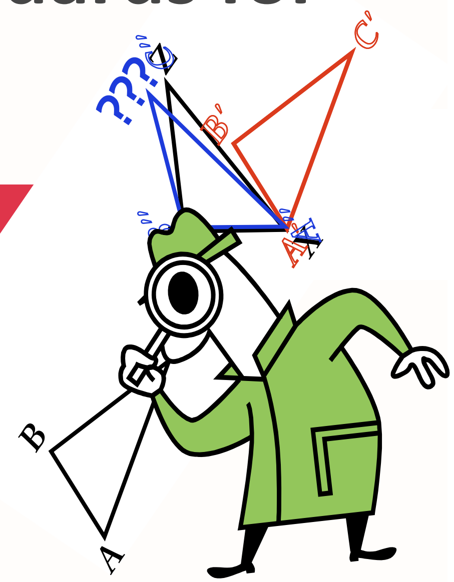
Clear instruction of mathematical practice:

Preparing teachers to use rich and ordinary problems to teach Common Core standards for mathematical practice



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AMS Special Session on the Changing Education of Pre-Service Teachers

Joint Mathematics Meetings • 15 Jan 2014 • Baltimore, MD

Improving teachers' ability to teach practice through content

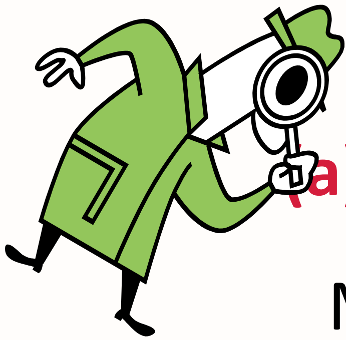
As teacher educators, we must be able to:

- Provide teachers with experiences in mathematical practice
- Identify aspects of mathematical practice that can arise in "rich" and "ordinary" problems alike
- Guide teachers to see mathematical practice as permeating all problems and bear out this appreciation in their teaching

A familiar question in teacher education

- **What mathematics problems can we use** in mathematics courses for teachers, and
- **How can we teach** teachers using these problems to help improve teachers' ability to teach mathematical practice through content?

“Ordinary” Problem: Finding intercepts



Find the x-intercept of the line:

(a) $5y + 10x = 81$ (b) $y = 6x + 7$ (c) ...

Making mathematical practice visible:

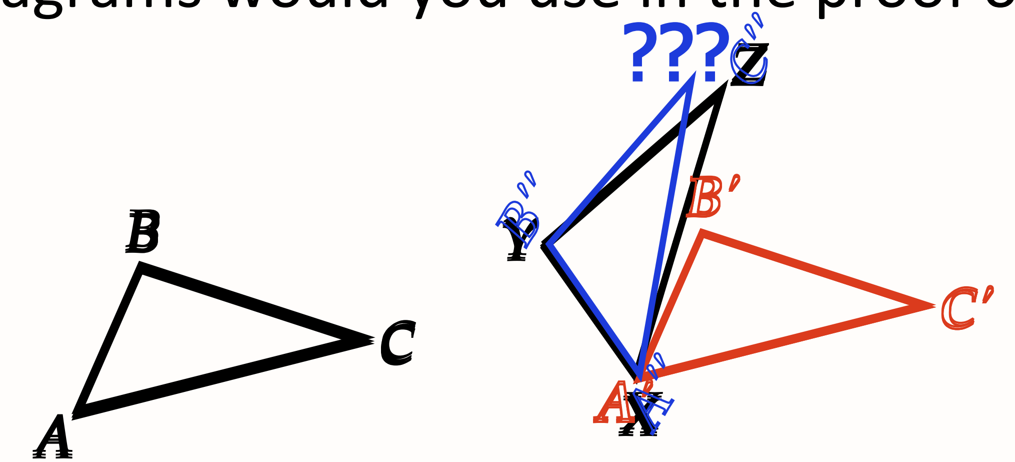
- Why does “putting in zero” for y work? What does this have to do with the intercept? **[6]**
- Does this method work in general for finding the x-intercept? Why? **[8]**

"Ordinary" Problem: SAS Triangle Congruence

State the SAS triangle congruence criterion.

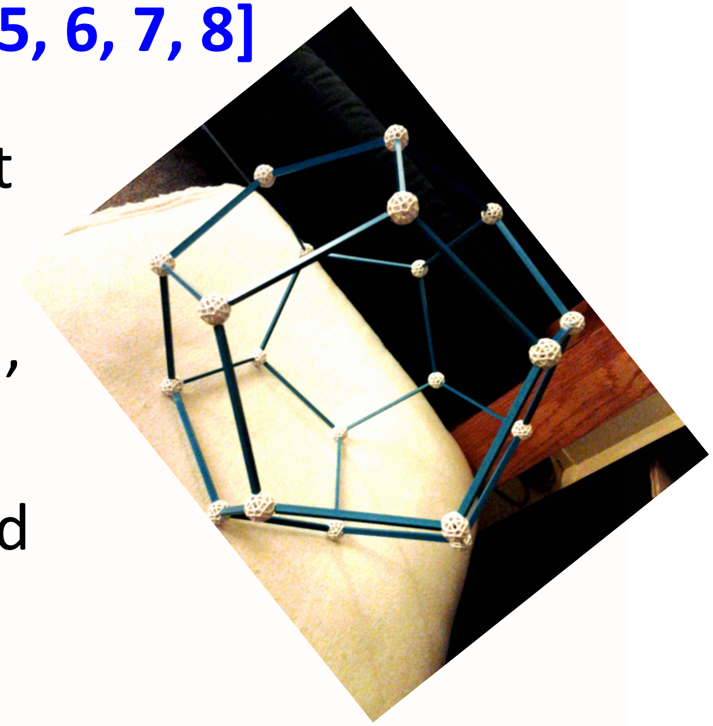
Making mathematical practice visible:

- What diagrams would you use to motivate that there is something to prove? **[1]**
- What diagrams would you use in the proof of SAS? **[5, 6]**



"Rich" problem example: Symmetries of a dodecahedron

What are the reflections and rotations that preserve the dodecahedron? What vertices, edges, and faces are preserved by symmetries? [1, 2, 3, 4?, 5, 6, 7, 8]



Making connection to "ordinary" content visible:

- How do you define reflection, rotation, and symmetry?
- How do these definitions compare and contrast with the definition of these transformations in the plane?

Setting up a conjecture: Clear instruction of mathematical practice

Instruction that

- **explicitly highlights** mathematical practice underlying problems
- **directly connects** the practice to curricular content.
- **sets up teachers to talk to each other** about practice and content

Working conjecture

Clear instruction of mathematical practice:

- Makes "rich" problems and mathematical practices relevant to daily work of teaching
- Makes "ordinary" problems relevant by using them as an anchor for mathematical practice and mathematical theory – and as the seeds for rich problems
- Provides common ground for collaboration between methods and content

Next steps for exploring clear instruction of mathematical practice

- Identify "ordinary" problems tied to specific content that could illustrate mathematical practice
- Develop techniques for finding succinct, direct connections between "rich" problems and curricular content
- Collaboration between methods and content to connect mathematical practice/content to pedagogy

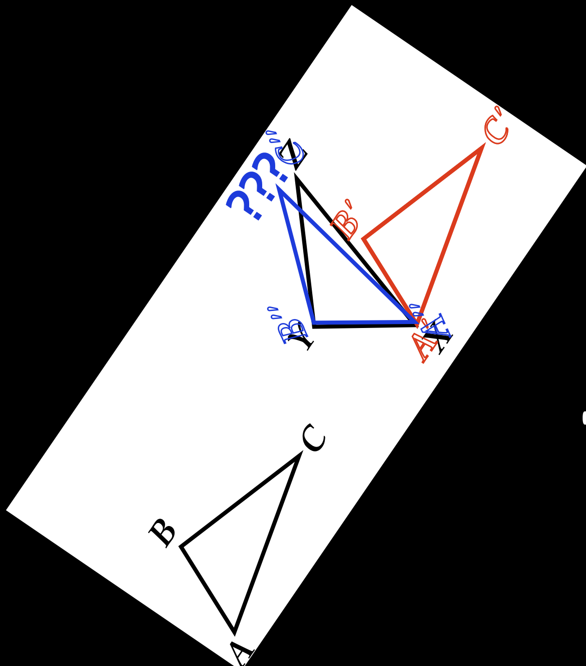
MIME 2014

Mathematicians in Math Education

(organizers 2014: Bill McCallum (chair), Deborah Ball, Hyman Bass, Roger Howe, Yvonne Lai, Yeping Li)

- Texas A&M, College Station, TX
- March 16-18, 2014
- Funding for travel available

Save the date!



Thank you!

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