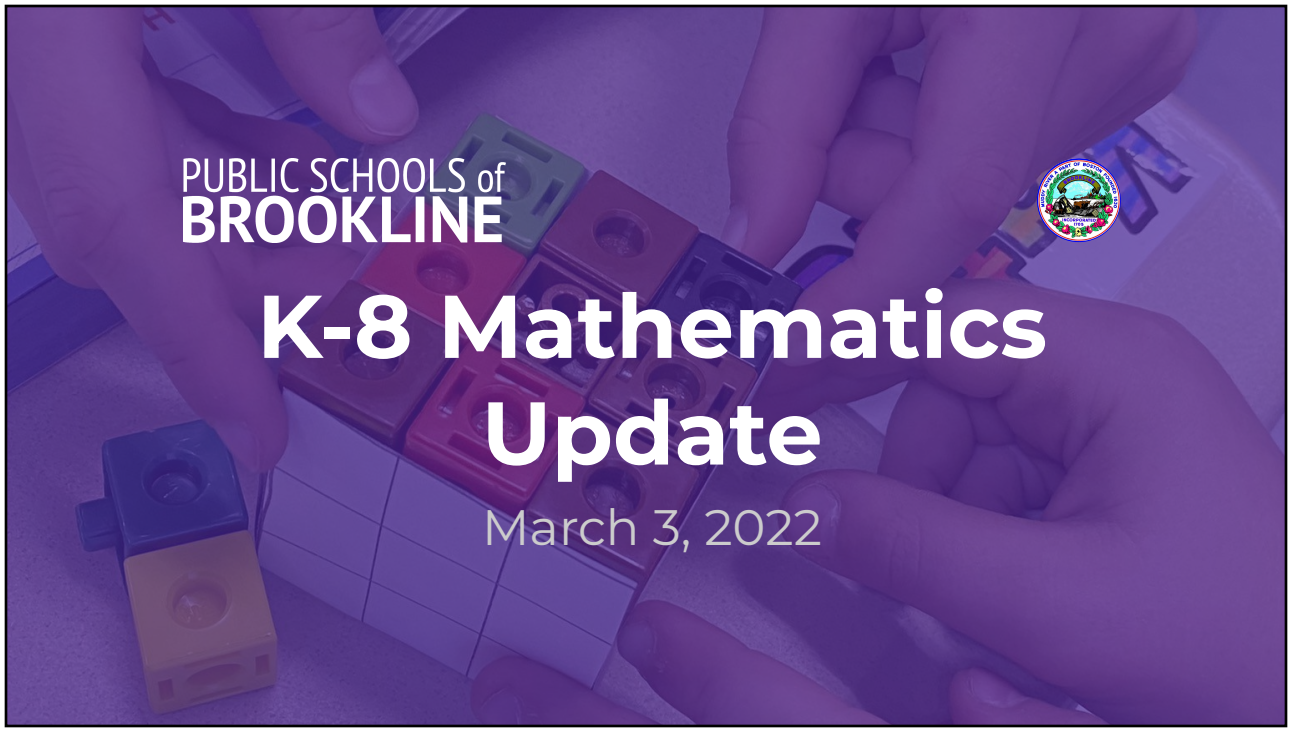


K-8 Mathematics Update

March 3, 2022

Objectives

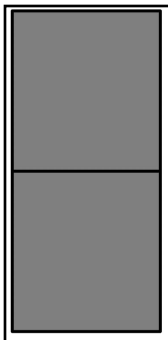
PUBLIC SCHOOLS of BROOKLINE

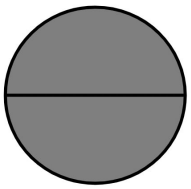
- Provide an update on the mathematics program K-8 based on recommendations from Program Review
- Highlight work from students, teachers, and math specialists in program implementation
- Connect what is taking place in and out of classrooms to broader district themes (equity, inclusion, SEL, PD)
- Provide a pathway for future growth and development

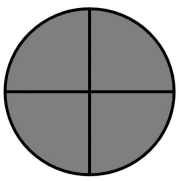
Grade 2 - Quick Images Routine

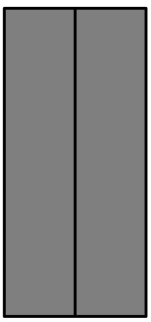
"The three pillars of Investigations are the routines, the classroom discourse, and the games. If you are not doing these three things, you are not doing Investigations."

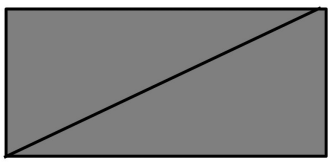
Dr. Susan Jo Russell
Principal Author of Investigations

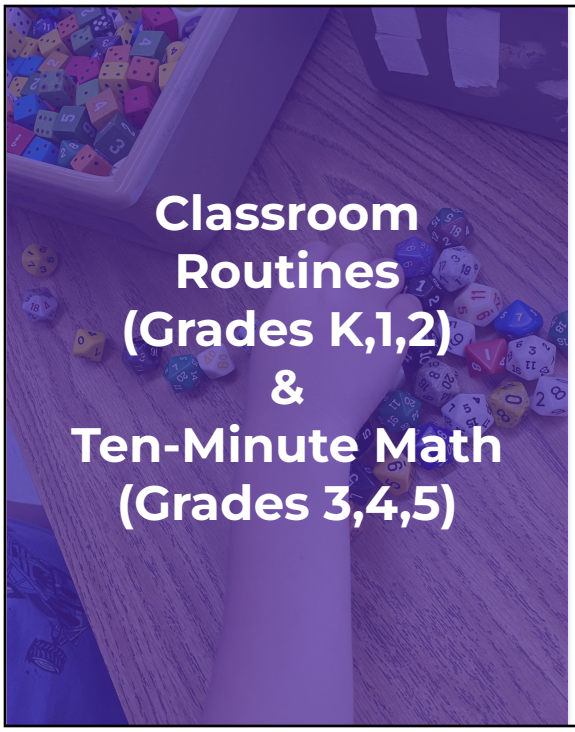












Classroom Routines (Grades K,1,2) & Ten-Minute Math (Grades 3,4,5)

- Ideally used outside of math time or as a pre-lesson warm-up
- Offers ongoing skill-building, practice, review
- Reinforces previous concepts
- Helps students increase repertoire of strategies for mental computation and problem solving

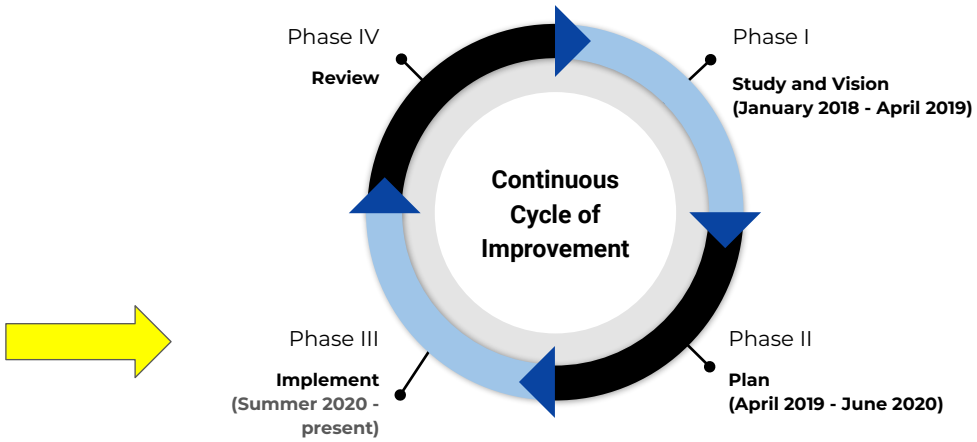
What has led up to this...

Shifts in Mathematics Teaching and Learning

Stating a standard	Communicating expectations for learning
Routine tasks	Reasoning tasks
Teaching about representations	Teaching through representations
Show-and-tell	Share-and-compare
Questions that seek expected answers	Questions that illuminate & deepen understanding
Teaching so that students replicate procedures	Teaching so that students select strategies
Mathematics-made-easy	Mathematics takes time
Looking at correct answers	Looking for students' thinking

McGatha, M., Bay-Williams, J., Kobett, B., & Wray, J. (2018). *Everything you need for mathematics coaching: Tools, plans, and a process that works: Grades K-12.* Corwin.

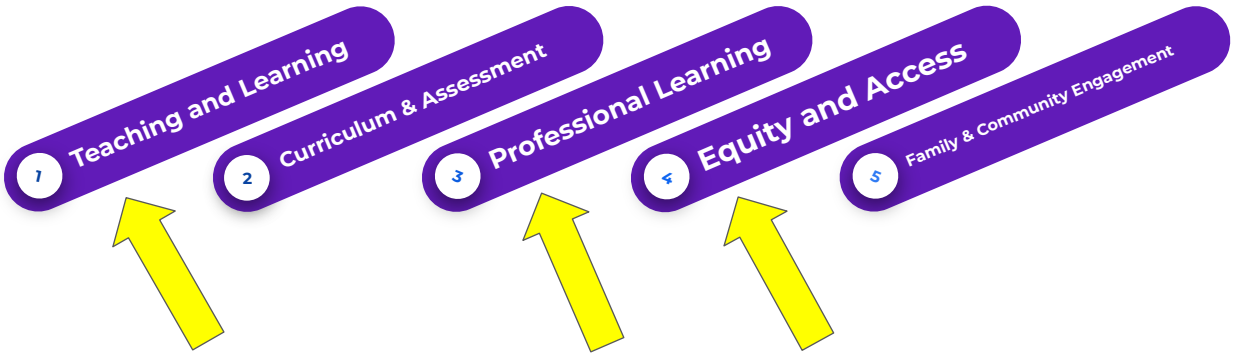
Math Program Review Process



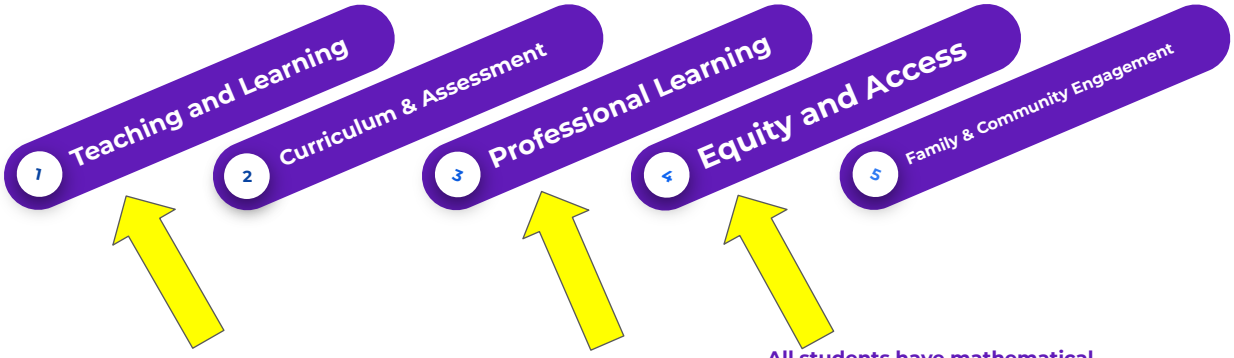
PSB PK-8 Mathematics Vision Statement

The vision for PK-8 mathematics education in the Public Schools of Brookline is to nurture a comprehensive mathematical identity in all of our students, helping them to see themselves as capable mathematicians. Students learn challenging and relevant mathematics through the development of conceptual understanding, procedural fluency, and application. Our heterogeneously grouped classrooms are set up as creative, collaborative, joyful, student-centered learning spaces. Students are active team members who engage in mathematical discussions, solve real life and theoretical problems, and use mathematics effectively in a diverse and evolving global society.

PSB K-8 Math Department Strategic Priorities



PSB K-8 Math Department
Strategic Priorities + Investigations Guiding Principles

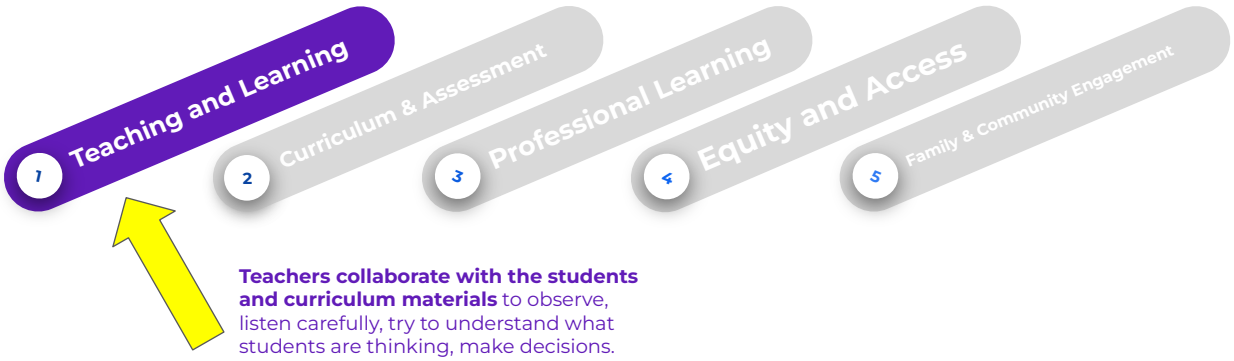


Teachers collaborate with the students and curriculum materials to observe, listen carefully, try to understand what students are thinking, make decisions.

Teachers are engaged in ongoing learning about mathematics content, pedagogy, and student learning.

All students have mathematical ideas. If the environment stresses making sense of mathematics, students build on the ideas they already have and learn about new math they have never encountered.

PSB K-8 Math Department
Strategic Priorities



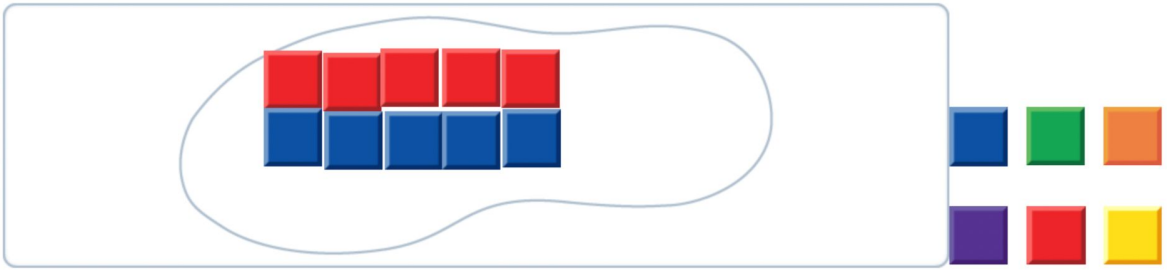
Teachers collaborate with the students and curriculum materials to observe, listen carefully, try to understand what students are thinking, make decisions.

Grade 1

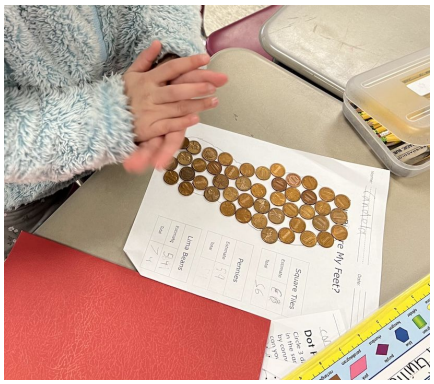
INVESTIGATIONS 3
IN NUMBER, DATA, AND SPACE®

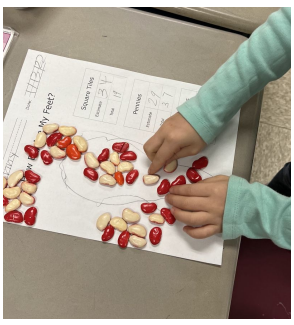
Directions

Drag square tiles to the footprint to find how big it is.



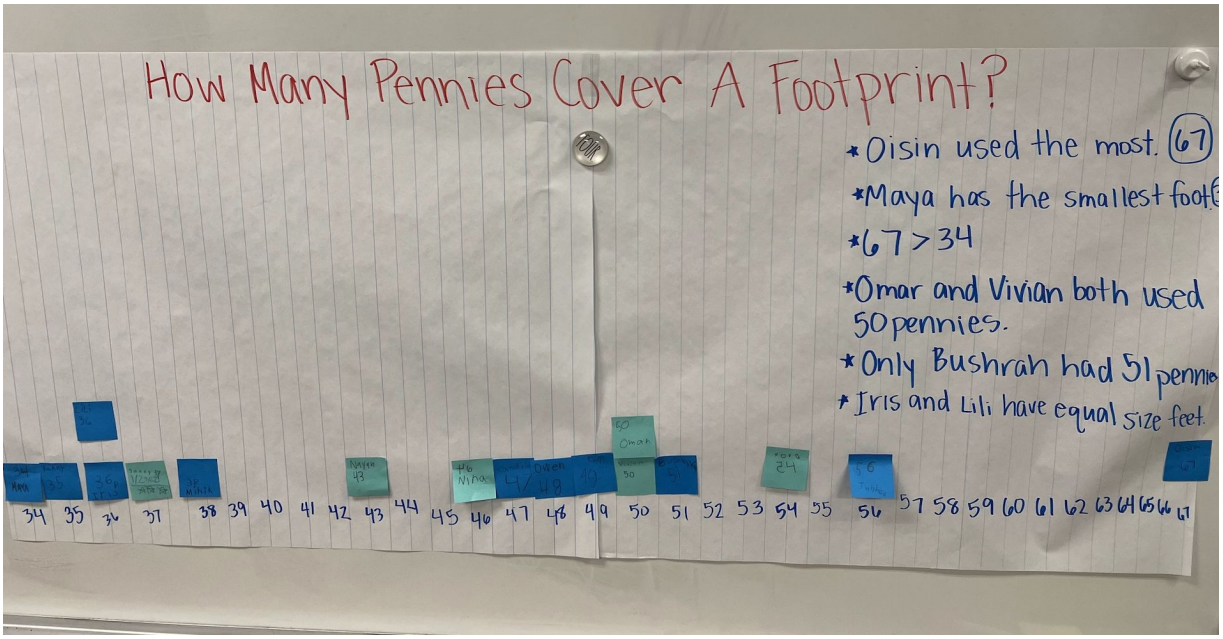
Start Over



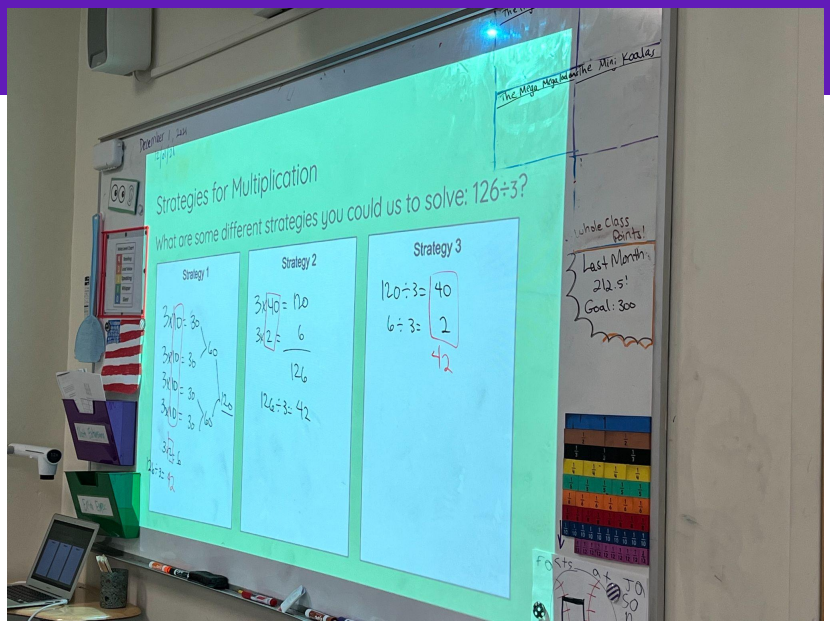


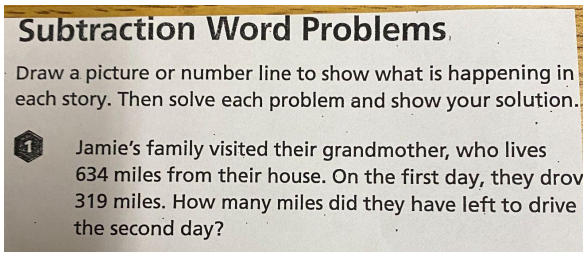
Extension
Describe a relationship

Can you use Problem 1 to solve/help with Problem 2? How are the problems related?


How Many Pennies Cover A Footprint?
*Oisin used the most. (67)
*Maya has the smallest foot
*67 > 34
*Omar and Vivian both used 50 pennies.
*Only Bushrah had 51 pennie
*Iris and Lili have equal size feet.
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67

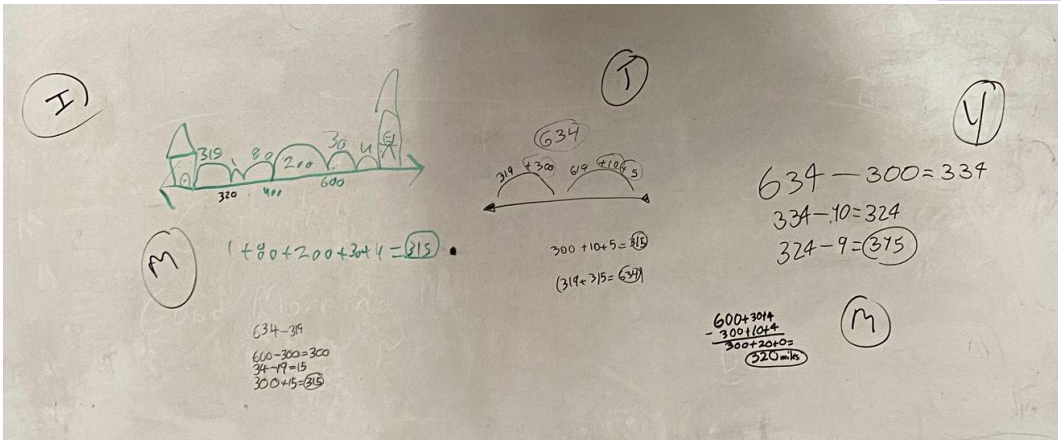
Grade 4

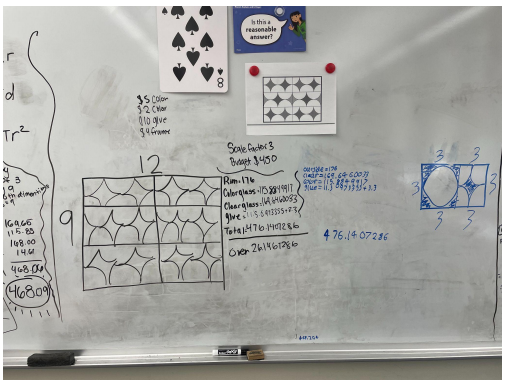

Strategies for Multiplication
What are some different strategies you could us to solve: 126÷3?
Strategy 1
Strategy 2
Strategy 3
120÷3= 40
6÷3= 2
42
126÷3= 42
Whole Class Points!
Last Month: 212.5!
Goal: 300



Extension
Generalize

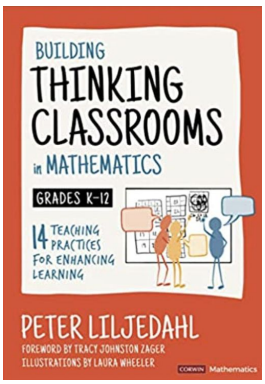
Do you think this will work for all numbers?

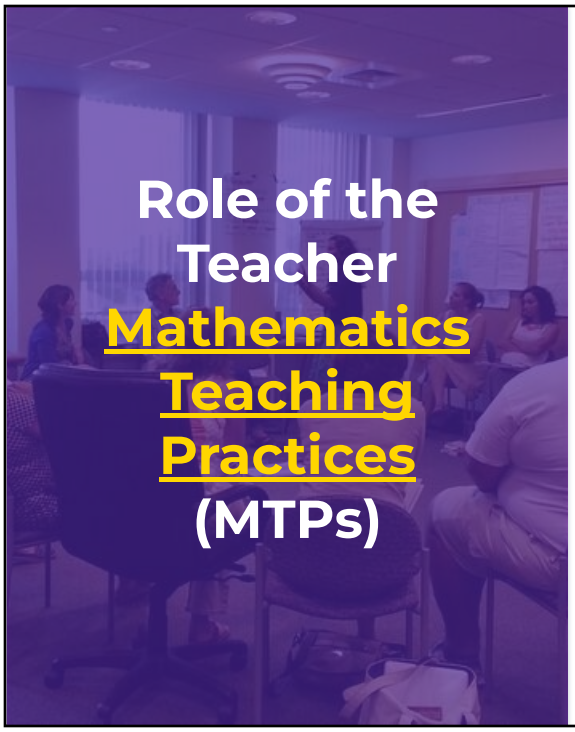




Grade 8

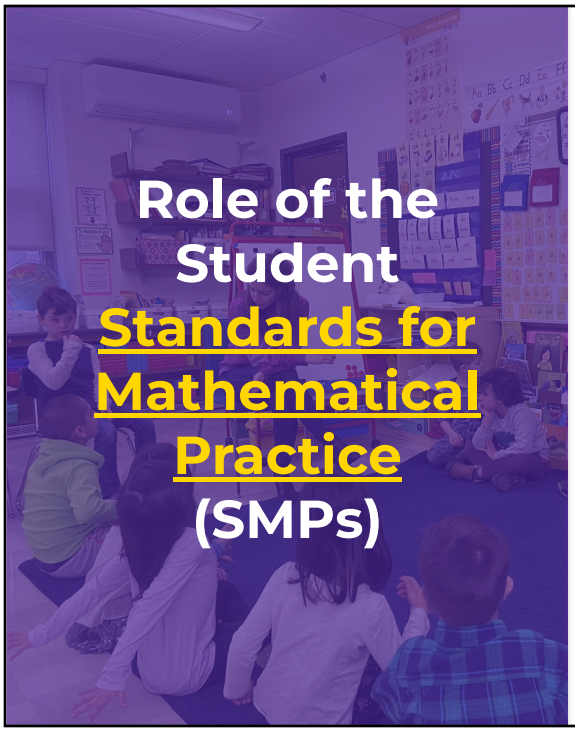
Desmos Grades 6-8





Role of the Teacher Mathematics Teaching Practices (MTPs)

- Establish mathematics goals to focus learning
- Implement tasks that promote reasoning and problem solving
- Use and connect mathematical representations
- Facilitate meaningful mathematical discourse
- Pose purposeful questions
  Build procedural fluency from conceptual understanding
- Support productive struggle in learning mathematics
- Elicit and use evidence of student thinking



Role of the Student Standards for Mathematical Practice (SMPs)

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

Measures of Effectiveness

Priority 1 - Teaching and Learning

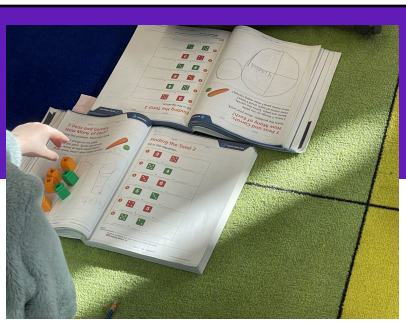
- All K-8 classrooms use a common math curriculum as the foundation for instruction
- Effective Math Teaching Practices are observed across all K-8 classrooms
- Students regularly engage with content through the Standards of Mathematical Practice

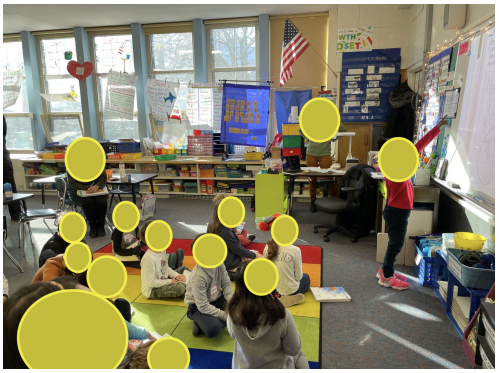
PSB K-8 Math Department Strategic Priorities

1. Teaching and Learning
2. Curriculum & Assessment
3. **Professional Learning**
4. Equity and Access
5. Family & Community Engagement

Teachers are engaged in ongoing learning about mathematics content, pedagogy, and student learning.

Lesson Study





A major goal for K-5 math specialists is to support the effective implementation of the Investigations curriculum and instructional routines that are embedded in the program.

As a department we are providing a variety of different approaches to strengthen student learning.

The support from math specialists could include:

- Co-planning or co-teaching lessons
- Modeling lessons to highlight equitable teaching practices
- Working in the classroom with small groups of students or stations
- Providing curriculum-related resources
- Supporting assessment and analysis of student learning
- Supporting the planning and implementation of differentiated instruction
- Facilitating professional development experiences
- Providing direct support to students

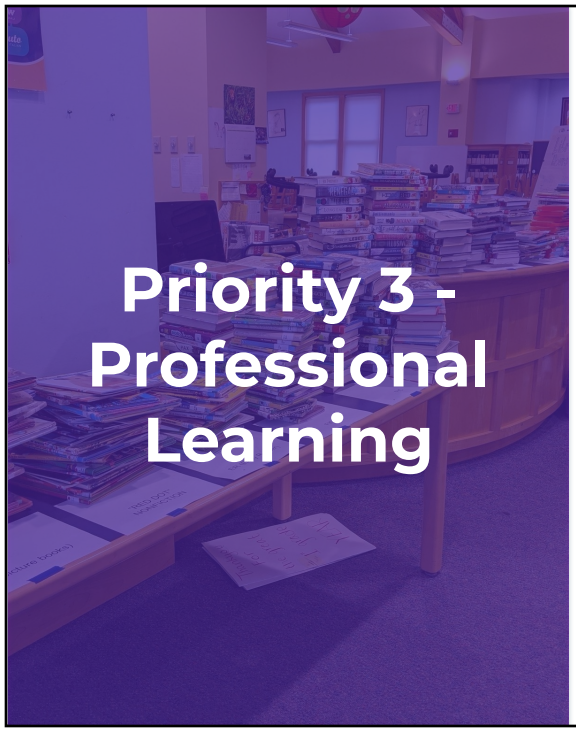
Investigations...from teachers' perspectives...

"...encourages students to visualize...with more ways for students to express their understanding..."

"...provides examples of student work, includes interactive technology tools, and incorporates fluency..."

"...brings forward such rich conversions...allows for and embraces all types of thinking about math, which cultivates curiosity..."

Measures of Effectiveness



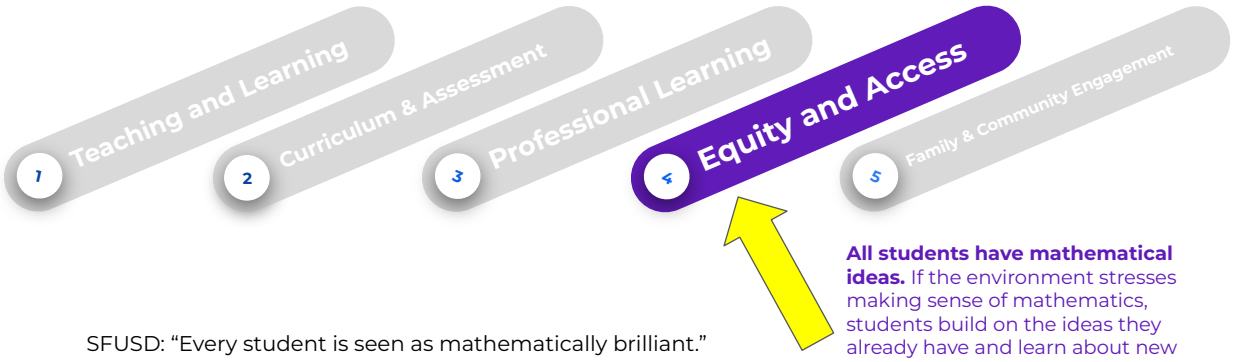
Priority 3 - Professional Learning

- Access to relevant professional learning opportunities in content, pedagogy, curriculum implementation, and meeting diverse student needs
- Formalized opportunities for math specialists, teachers, and special educators to learn together and collaborate
- Culture of and commitment to ongoing job-embedded professional growth through coaching, collaboration, and shared practice

Challenges

- Scarcity of substitutes to cover for teachers
- Limited time for professional development
- Pandemic
- Contract

PSB K-8 Math Department Strategic Priorities



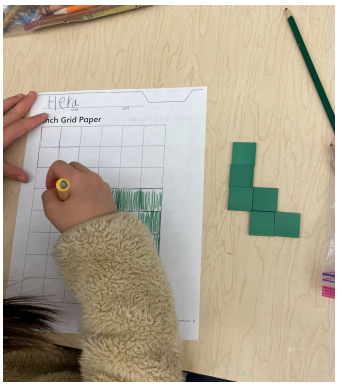
SFUSD: “Every student is seen as mathematically brilliant.”

All students have mathematical ideas. If the environment stresses making sense of mathematics, students build on the ideas they already have and learn about new math they have never encountered.

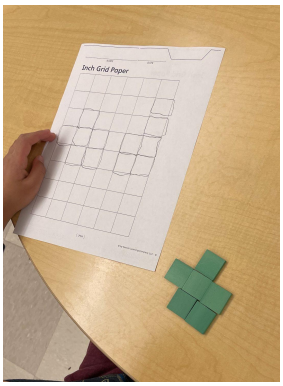
Kindergarten - Arrangements of 6

Extension

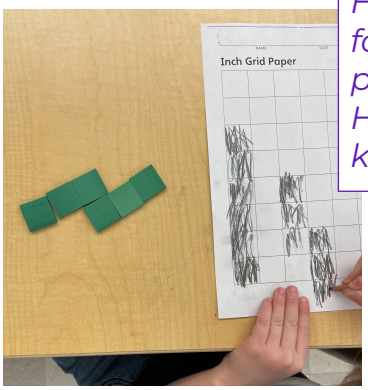
Have you found all the possibilities? How do you know?



1 + 1 + 2 + 2 = 6

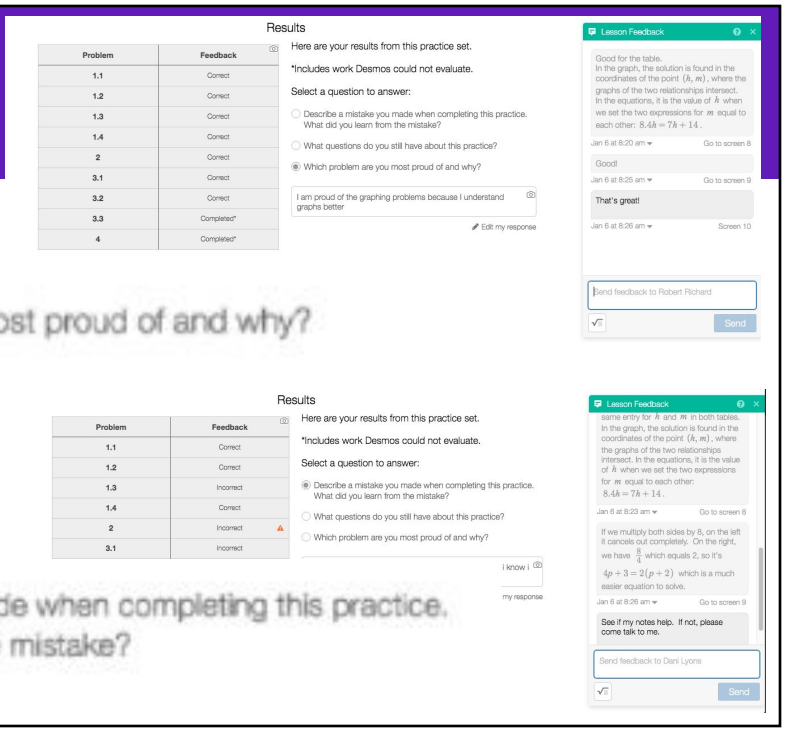


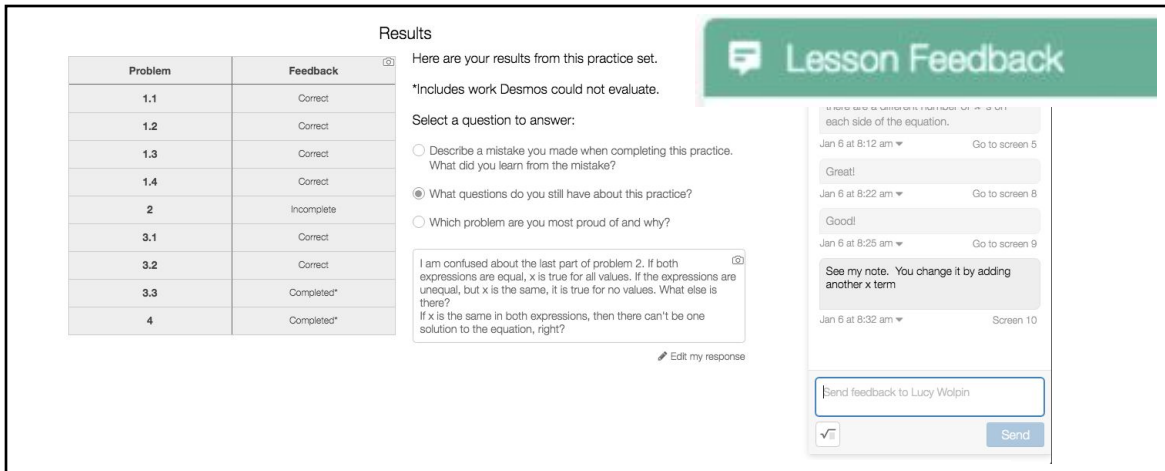
1 + 3 + 2 = 6



3 + 3 = 6

Grade 8





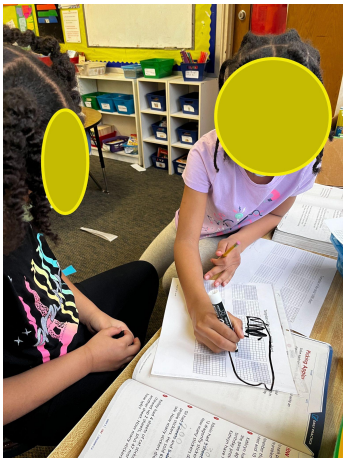
What questions do you still have about this practice?

Extension
Are you ready for more?

- Gives students an opportunity to develop and practice concepts and skills
- Helps students develop independence and learn to take responsibility for their own learning as they choose activities, keep track of their work, use and take care of classroom materials, and work with others
- Provides time for the teacher to work with individuals/small groups and to assess students' learning and understanding

In order for differentiation to impact student learning, we need to first make sure that our classrooms are places where making sense of mathematics is at the center of the work for both students and teachers, and that we believe that all students are capable of doing important mathematics. This is where differentiation begins.

Grade 3



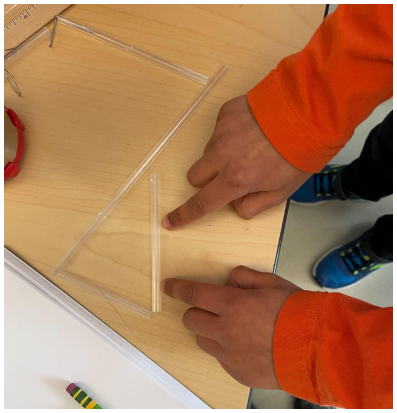
Extension
Support and justify one's thinking

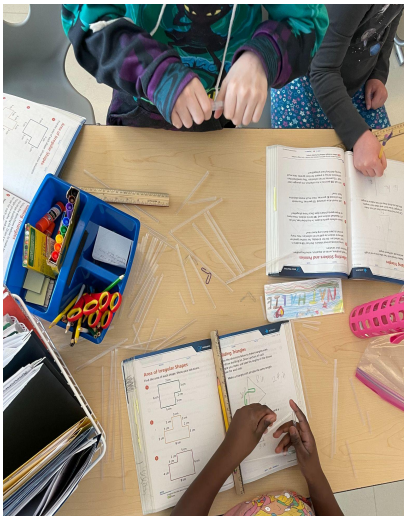
Are you sure? How would you convince someone else?

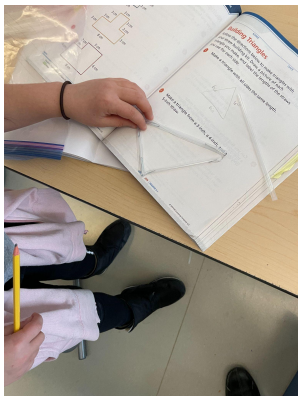
Extension
Conjecture

What happens when (you add two odd numbers)?

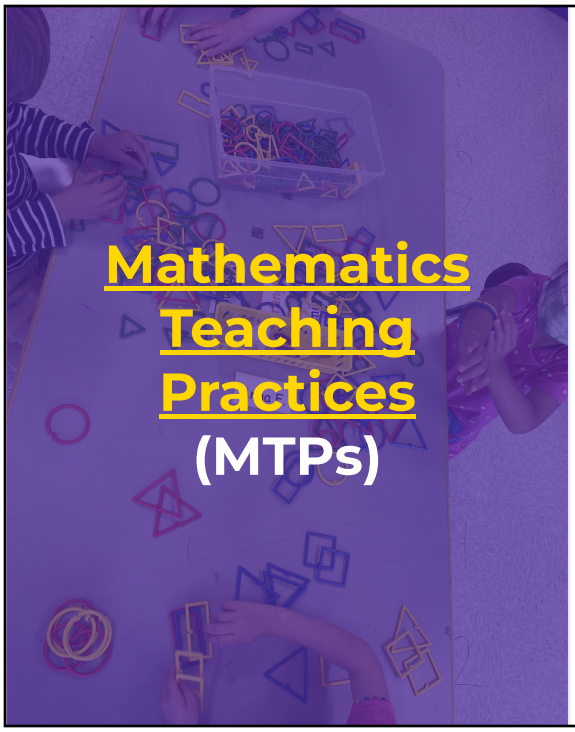
Grade 3







"I work better with my classmates. Not only can I give my ideas, but I can see another person's ideas, which might be more effective, and then I learn more." - FK



Mathematics Teaching Practices (MTPs)

- **Use and connect mathematical representations**
  - Promote the creation and discussion of unique ideas to position students as mathematically competent.

- **Facilitate meaningful mathematical discourse**
  - Create space for students to interact with peers to value multiple contributions and diminish hierarchical status among students (perceptions of differences in smartness and ability to participate).

- **Elicit and use evidence of student thinking**
  - Make student thinking public. Choose to elevate a student to a more prominent position by identifying his or her idea as worth exploring. Promote a culture in which mistakes/errors are viewed as important reasoning opportunities.

Measures of Effectiveness

Priority 4 - Equity and Access

- Consistent access to effective teaching practices and differentiated learning opportunities across all pK-8 schools
- Regular personalized feedback and reflection
- Increased student responsibility, independence, and confidence

Summary

Key Actions	2020-2021	2021-2022	2022-2023
Build an understanding of Effective Mathematical Teaching Practices for teachers and administrators	Ongoing through new curriculum and specialists		
Implement new 6-8 curriculum with ongoing PD (summer, job-embedded, department meetings)	All teachers 7-8	All teachers 6-8	
Implement new K-5 curriculum with ongoing PD (summer, job-embedded, workshops)	All teachers 3-5; New teachers and opt-in K-2	All teachers K-5	
Engage in Lesson Study PD for K-5 teachers			
Utilize key embedded assessments and gather data on student performance K-5; provide updated guidelines for assessment and intervention PRIORITY 2			
Provide parent information sessions and workshops PRIORITY 5		PTO coffees	School-based or district-wide parent series connected with K-5 curriculum