

Building a Mathematical Learning Community

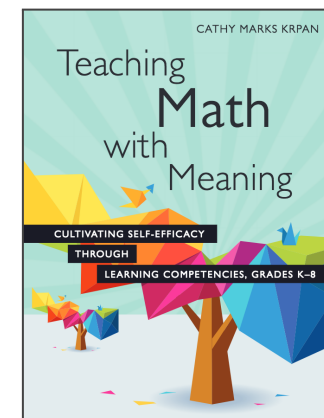
Grade 4 - Possible Tasks Organized by Teaching Points

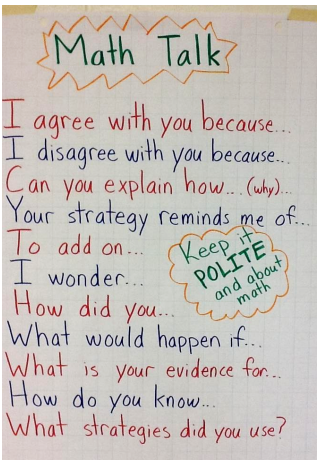
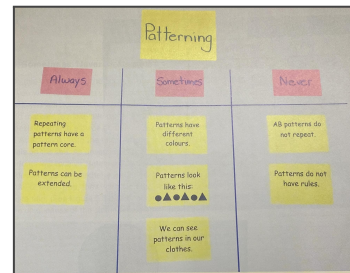
Introduction

In planning for the first few weeks of mathematics instruction, teachers are encouraged to consider how they will cultivate a learning community focused on **math talk**, **student thinking**, and **collaborative relationships**.

To support developing this community, learning experiences have been selected that are engaging and open. The learning contexts described below will allow teachers to collect some initial **observational data** on the students' mathematical learning identity and their use of the mathematical processes. (e.g. observation logs for [Social-Emotional Learning](#))

One type of learning experience that cultivates a learning community is a thinking routine. By introducing thinking routines in the first weeks of school, educators establish clear expectations for the mathematics classroom. These routines are flexible and can continue to be used across the year in different learning contexts and topics. In helping to establish these routines, example tasks have been selected from the text “Teaching Math with Meaning” by Cathy Marks Krpan. (Note, this text has been provided to all Elementary schools for their professional libraries.)



Mathematical Thinking Routine	Example Routines	
Math Talk - sharing our mathematical ideas - reflecting on and explaining one's thinking to others - understanding and using math vocabulary - listening thoughtfully to others and building on or challenging the ideas of others - representing mathematical ideas in a variety of ways	Structured Math Prompts Introducing students to mathematical discussions via Math Prompts (Pg. 73, 82-83) Routine Overview - provide students with a problem to think about independently - then invite students to discuss the problem with a partner - choose a few math talk prompts (p 73) that will help focus the conversation - bring the students together to sharing their thinking - discuss how the math talk prompts helped in their discussion - add helpful prompts to a class anchor chart 	Always, Sometimes, Never Developing mathematical argumentation and reasoning skills (Pg. 86-92) Routine Overview - display a three column chart with the headings <i>Always</i>, <i>Sometimes</i>, and <i>Never</i> - share cards with mathematical statements (e.g “triangles have 3 vertices,” “triangles have sides that are the same length,” or “triangles can have parallel sides”) - students work with a partner or small group to discuss which column their statement(s) fits under, then present their thinking to the class - as groups share, invite the class to discuss and provide feedback - ensuring all students understand the reasons for each placement 

Student Thinking

- making connections to prior learning
- creating by considering a problem in new or novel ways
- using reasoning and logic
- supporting answers with evidence
- teaching and using self-talk strategies to support metacognition, self-efficacy, and self-regulation

Mathematical Think-Alouds

Making thinking visible through teacher modeling using [Self-Talk Strategies](#) (Pg. 145-155)

Routine Overview

- choose a rich mathematical task and **one or two thinking or self-regulation strategies** from the above list
- use visuals or concrete materials to provide a focus for the problem-solving think aloud and prepare a simple script of what you intend to model
- explain to students that you are going to “think aloud to show you how I think through this problem” -- remember, what you are modeling is the thinking process, not a procedure
- after the modeled think-aloud, discuss what the students observed (see the text references above for examples of think-aloud problems)

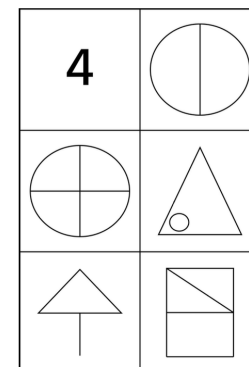


Making Connections

Promoting creative thinking and valuing diverse perspectives via the use of [Connection Cards](#) (Pg. 156-160)

Routine Overview

- prepare the connection cards linked above or make your own (i.e. cards with diverse mathematical images for students to compare and make connections between)
- provide each pair of students with a set of cards and time to talk about the connections they see between the images (you may decide to model this activity with the whole class first)
- invite students to share their observations with the class - encourage others to build on the thinking by sharing their own connections



Collaborative Relationships

- contributing to the group
- self-regulating to productively engage
- advocating for one's ideas
- valuing diverse perspectives
- resolving problems or differences that arise within the group - understanding the effects of your words and actions on others

Concept Circle Collaborations

Collaboratively use concrete materials to represent and discuss mathematical relationships using [Concept Circles](#) (Pg. 205-213)

Routine Overview

- select a representation of a concept for the center of the concept circle
- students can:
 - show different representations of the same concept (e.g. the number 6 in the center, students show different representations of 6 around the circle)
 - **or**, the teacher could provide labels for the outside section for the students to think about (e.g. 1 whole shown in the middle with different fraction amounts for students to represent around the circle)
- as students work collaboratively, the teacher circulates to gather assessment information (what do students understand?, what language do they use?)
- see this [video explanation](#) for more information

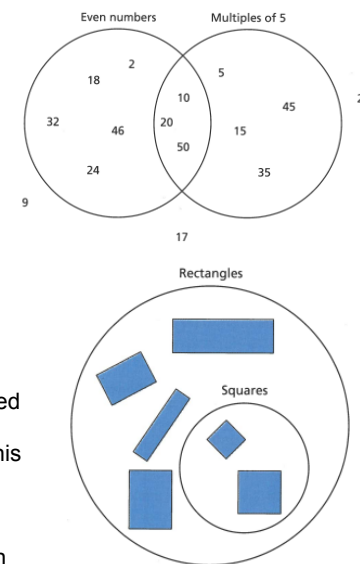


Set Diagram Collaborations

Using, classifying, and choosing set diagrams to compare and discuss mathematical ideas (Pg. 96-106)

Routine Overview

- display a completed Venn or Euler diagram
- invite students to share their observations and questions
- encourage discussion
 - Why do you think ____ was placed in this section?
 - What do the objects / items in this section have in common?
 - What could you add to this diagram?
 - Where would you place ____ on the diagram? Why?
 - Why do you think this title was chosen for this section of the diagram?
 - What do you notice about the objects in the area where the circles overlap?
- See pages 96-106 for extensions to this task



The table below lists possible learning tasks organized by **teaching points**. These teaching points are intended to support the teacher as they work with students to uncover the important components of a **learning community focused on collaborative mathematical learning**.

A Menu of Additional Problems and Explorations:

Learning Tasks	Possible Teaching Points					Possible Consolidation Questions
	Math-Talk - norms and routines	Collaborative Learning Skills	Representing our Thinking Visually	Honouring Math Thinking / Valuing Mistakes	Developing Perseverance	
Estimation Clipboard - SteveWyborney - student explore strategies for estimating quantities	✓	✓				- How did having others to talk to about the problem help you? - How did a teammate's ideas change your original thinking? - Did everyone always agree? What did you do when/if they didn't? - What strategies did your team use to share ideas? - How did your group use each other's ideas to make decisions? - What does productive math talk sounds like, look like, and feel like? - What did you do to support others on your team?
Video: The Exceptional Life of Benjamin Banneker	✓					
Video: Joe Boaler's Brains Grow and Change	✓					
Esti-Mysteries - SteveWyborney - students use clues to support estimating quantities from visual prompts	✓	✓				
Wild Tic-Tac-Toe - students explore the strategies needed to play a modified version of tic-tac-toe		✓		✓		
Math Talk: Dot Card Activity - YouCubed.org	✓					
The Checker/Chess Board Problem - students look for patterns and relationships to help them determine the number of squares in a chess board			✓		✓	- How did a "visual" help you solve the problem? - How did your visuals remind you of or connect to numbers? - Why is it important to represent a problem visually or with manipulatives? - Knowing what you know about the brain, what is a strategy you will add to your "toolbox" for solving problems? - What was challenging about this problem? - What did you decide to do first? - How did you organize your thinking? - How did you decide on using the tool you did? - How do manipulatives and tools help us when we are solving problems?
Leaves on a Tree - students collaboratively explore a Fermi question to practise estimation, numerical reasoning, communication in mathematics.		✓	✓		✓	
Video: Jo Boaler's Brain Crossing video			✓			
Two Clocks Problem - students explore telling time on analogue clocks by solving riddles.		✓	✓			
Heads and Feet - students explore multiplicative relationships as they solve a barnyard puzzle.		✓	✓		✓	
Video: Jo Boaler's Strategies for Learning Math			✓			
Math Talk: Cube Conversation - SteveWyborney			✓			
Skyscraper Challenges - build cube towers of different heights so no row or column has towers of the same height.				✓	✓	- What happened to your thinking when you saw someone else try a move that didn't work? - How has your thinking changed about mistakes? - How did it feel when it took multiple attempts to solve? - What helped you persevere through the problem? - How did you feel when you had a breakthrough no matter how small? - What strategies can you use when you're having difficulty sticking with a problem and want to quit?
Math Talk: How Many Eggs? - Number Talk Images				✓		
Math Talk: How Many Squares - Number Talk Images				✓		
Video: Jo Boaler's Mistakes video				✓		
Karate Bricks Problem - students use dominoes to solve a spatial reasoning puzzle.		✓	✓		✓	
Video: Jo Boaler's Speed is Not Important					✓	

Video						
Video: Jo Boaler's Believe In Yourself Video					✓	
Video: Dorothy Vaughan Story					✓	