Routines for Reasoning

Supporting Numeracy in Primary

Math is everywhere! And lately the internet has become a place for educators to create and share amazing ways to help our students find and think about math in their everyday lives. We have been using these great resources in our classrooms as routines. When children become familiar with a routine, they learn to navigate their learning because of its predictability. This is important especially for our students who struggle with understanding and following instructions. With a routine, the instructions are similar, or remain the same, and students can focus on the provocation or task – they can focus on their thinking about the math!

These routines can also be used to support math conversations between children and parents at home.

Routines and provocations provide an opportunity:

- to include regular practice of foundational Numeracy concepts
- to build a community and culture of learning
- to focus on noticing and listening, and being responsive to students' understandings and reasoning
- to provide a focus on the curricular competencies

Curricular Competencies
Students are expected to do the following:

Reasoning and analyzing
- Use reasoning to explore and make connections
- Estimate reasonably
- Develop mental math strategies and abilities to make sense of quantities
- Use technology to explore mathematics
- Model mathematics in contextualized experiences

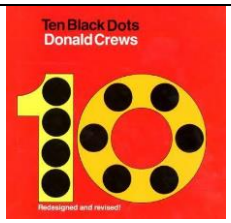
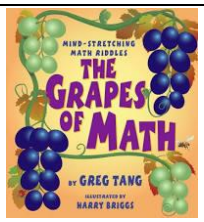
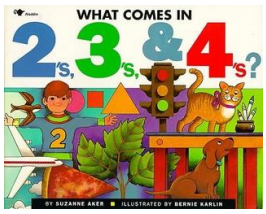
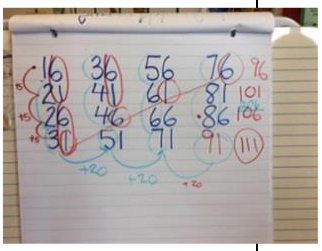
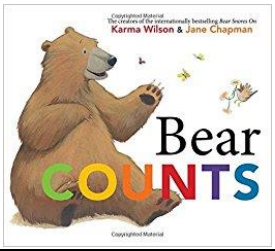
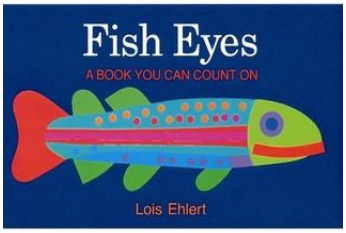
Understanding and solving
- Develop, demonstrate, and apply mathematical understanding through play, inquiry, and problem solving
- Visualize to explore mathematical concepts
- Develop and use multiple strategies to engage in problem solving
- Engage in problem-solving experiences that are connected to place, story, cultural practices, and perspectives relevant to local FP communities, the local community, and other cultures

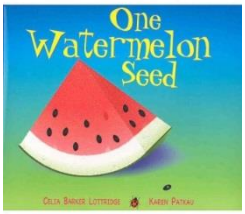
Communicating and representing
- Communicate mathematical thinking in many ways
- Use mathematical vocabulary and language to contribute to mathematical discussions
- Explain and justify mathematical ideas and decisions
- Represent mathematical ideas in concrete, pictorial, and symbolic forms

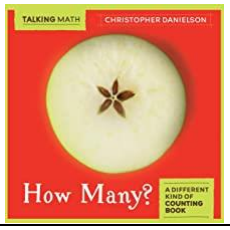
Connecting and reflecting
- Reflect on mathematical thinking
- Connect mathematical concepts to each other and to other areas and personal interests
- Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts

These routines can serve as 5 to 15 minute daily experiences to help students develop a firm Numeracy foundation, including subitizing, counting, decomposing numbers, patterning and spatial reasoning, which can spiral throughout the year in different contexts.

Routine	Activities
What Do You See? Focuses on using 'quick images' to develop perceptual subitzing (recognizing a small amount without counting) and conceptual (recognizing small amounts and combining them to see them as a unit). **Prompting Questions:** How many do you see? How do you see them? Did you need to count? So what did you do? Why are you able to know the amount so quickly?	**Dazzling Dot Cards –** using cards with dots arranged in various groupings. Flash the card for 3 -5 seconds to visualize the amount. See http://bit.ly/2uUCsoI for dot cards **Subitizing Slides and Challenge Patterns:** https://stevewyborney.com/2018/09/100-subitizing-slides-10-challenge-patterns/ **Splat! –**How many dots do you see? How many are covered by the Splat!? https://stevewyborney.com/2017/02/splat/ **Terrific Ten Frames –** using ten frames for 'quick image flash' cards. The difference in using the 5 or 10 frames structures are highlighted by the configuration of the frame. See http://bit.ly/2fdv0yr for Ten Frames. Links to a page with 3 blank ten frames - add your own circle stickers. Video example here: http://bit.ly/1rMwIWj **Ten Wands –** using a combination of 5 of one colour and five of a different colour of connecting cubes to make a wand. Breaks the wand into two parts and asks prompting questions. See video example: http://bit.ly/2hbCWNs **Ways to Make… -** focus on decomposing and recomposing numbers. Ask students to identify ways to make (10). **Photo Search –** present a photograph and ask prompting questions. Images can be found at the following link: http://ntimages.weebly.com/photos.html **Missing Parts –** focus is on visualizing the missing part to make the whole. Using 'part-part whole' cards (see handout) show the students a part of the whole and then ask them to determine the other part. Part-whole cards to 9 http://bit.ly/2wnkGLi Part-whole cards 10 – 20 p 

	Awesome Arrays –using arrays (photographs or real objects). Display the array and ask without counting: *How many are there? Can you see it a different way?* *What number story (equation) would match the way you see it?* You could also show an array with missing parts and ask: *How many would be there if you could see them all?*
Book titles to support Subitizing: Books may be found online or through Epic Books	   Or in any story ask: How many (people, leaves, houses, etc) do you see? Continue with prompting questions for subitizing!
Counting Counting is putting a name to a quantity, understanding the way our number system is orgainzed and using patterns. Counting sequences help students to understand relationships among numbers and further develop their abilities to apply these understandings to a problem-solving situation. **Prompting Questions:** Can you guess how many you think are there? How can you find out for sure? How can we arrange the items so they are easier to count? Is there a way to count more quickly? Rearrange items. How many are there now? How many are there if you start counting from the middle? How many will there be if you group-count (by 2's, 5's)?	**Stop and Start Counting -** Count a number sequence together, with a starting number and a stopping number (e.g. start with 1 and stop at 10). Ask questions to facilitate discussions about counting patterns *(e.g. If we start at 21 and count by 2s, would we be able to stop at the number 32?)* **Backwards Count –** counting backwards by 1s, 2s, 5s, or 10s. Start from a number and count backwards. Record the numbers as they are said to help facilitate questions about counting patterns. **Choral Counting –** in this routine, counts aloud a number sequence altogether and record the numbers. This is a good routine to use if the majority of students are struggling with the counting sequence. To facilitate higher lever thinking and spark discussion about the counting sequence, ask: *What do you notice about the pattern? What patterns do you see?*  **Counting Collections –** count collections of pebbles, shells, socks while folding laundry, lego pieces, cheerios… working on 1:1 correspondence (touching one item and saying the number at the same time). Children often think of counting as 'labelling' (eg. This one is #4) rather than the total counted thus far (Four means that I have counted four so far…). Use the prompting questions to watch counting. Picture books for counting:  





Let's Talk About It
Focuses on discussing and communicating mathematical thinking, learning strategies and ideas from each other to develop number sense.
Number sense is the ability to play with numbers, meaning students can visualize problem solving, perform calculations by breaking numbers apart, and using strategies flexibly.
Prompting Questions:
What do you notice?
What strategies did you use?
Which strategy is most efficient?

Strategies you may see students using:

Using addition to subtract 12 – 5 (think 5 + ? = 12)	**Halving** 48 ÷ 4 (think half of 48 is 24 and half of 24 is 12)
One more, one less 8 + 5 (think 8 + 4 is 12 so one more is 13) 8 + 3 (think 8 + 4 is 12 so one less is 11)	**Using Place Value** 23 + 17 (think 20 + 10 is 30, 7 + 3 is 10 and 30 + 10 = 40) 267 – 135 (think 200 – 100, 60 – 30, 7 – 5 is 132)
Using Doubles (using doubles +1, +2 or −1, −2) 7 + 9 (think 7 + 7 is 14 + 2 = 16) 27 x 4 (think double 27 is 54 and double 54 is 108) 7 x 8 (think 7 x 7 is 49 + 7 = 56)	**Counting On or Counting Back** 3 + 5 (think 5 + 1 + 1 + 1 = 8 or 5, 6, 7, 8) 139 – 4 (think 139, 138, 137, 136) 12.9 + 0.3 (think 12.9, 13.0, 13.1, 13.2)

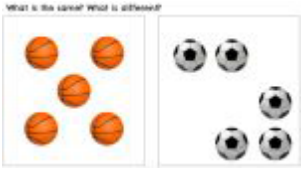
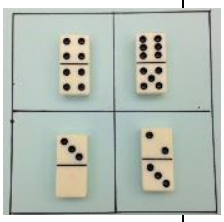
Or, you may see them reasoning in many other ways!

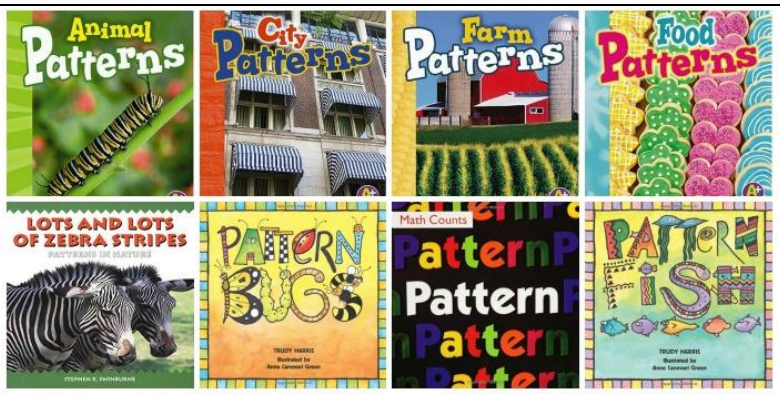
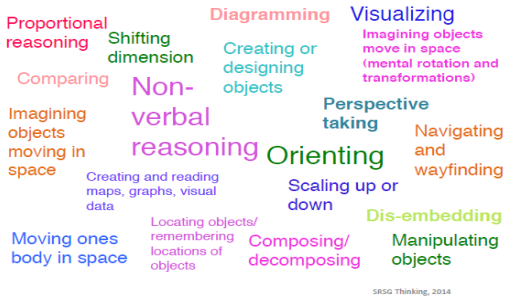
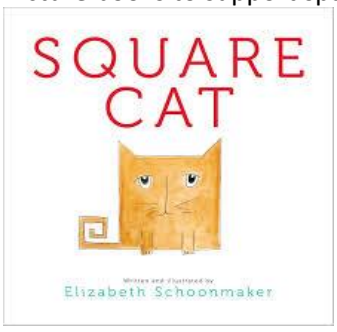
Mystery Number – identify a 'mystery number' using a set of clues. Each clue is given one at a time (e.g. *The number is between 5 and 13. It is a double. It is more than 10? What might the mystery number be?*
Students can also write their own clues about a number.
Tell Me Everything - choose a number and ask the student to tell you
everything they know about the number (e.g. 10…it fills up a ten frame, is 2 more than 8, it has 2 digits, it is the number of fingers I have…). Provides the opportunity to share understandings around a common idea.
https://learn.teachingchannel.com/video/k-math-routine-tell-me
Today's Number –choose a number for a specific reason (e.g. you might choose the number 10 because you want to provide opportunities to use 10 as an anchor). In order to help students understand numbers in various contexts, ask questions: *When is 10 a large number? Why did you think of that as an example of when ten is a large number? When is 10 a small number? Why does 10 mean different things*?

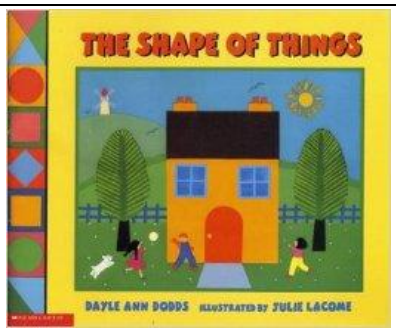
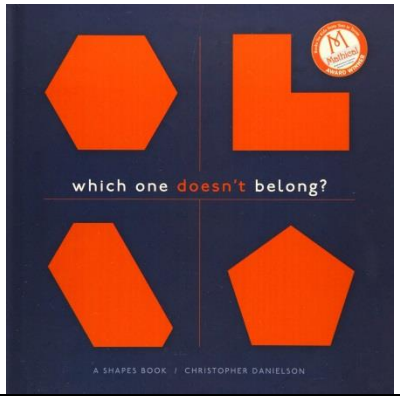
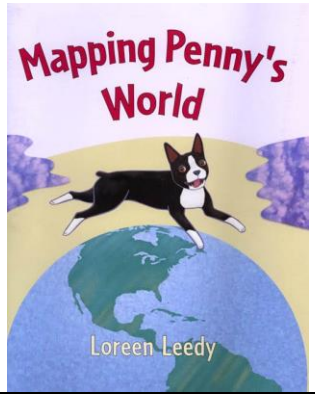
Number Talks – Number Talks are short (5- 15 minutes), frequent opportunities aimed at building number sense. During a number talk, students are thinking, asking their peers questions, and explaining their own thinking all while the teacher records the thinking.
Present an equation or problem and ask students to solve it in their heads (without paper and pencil or manipulatives). The emphasis is on visualizing the then verbalizing the strategies used. To facilitate students verbalizing their mental math ask: *What did your brain do? Why does that work? Who can tell us what …said? What strategy might*
you try next time? See handouts and articles.
https://elementarynumbertalks.wordpress.com/

Reverse Number Talks– instead of giving the students a 'quick image', present a quantity of manipulatives and ask: *How might you arrange (13) dots in interesting ways?* Record the various ways the students create and discuss the commonalities and differences. Have the students represent the structure they see.

Number Ladders – show an equation and ask students to solve. Add a related equation that can build on the first one. Continue

	adding equations that build a ladder of related equations that focus on applying strategies to determine answers. **5 + 5 =** **5 + 6 =** **5 + 7=** **Open Questions** – present a question/problem that is framed in such a way that a variety of responses or strategies are possible. Have students think about the question and share their thinking. Students gain confidence because they have an answer that makes sense to them right from the start. There is not a single right answer. (e.g. What makes 5 a special number?)
Patterning Focus on identifying, describing and creating patterns. Students will need to identify a pattern core, repeat and name it. **Prompting Questions:** What is the unit (core) that repeats over and over again? How might we change the pattern? What other patterns can you create? How would you describe the pattern? How are they the same? Different?	**People Patterns –** create patterns with students by sorting and then creating a pattern and ask prompting questions. **Hear the Pattern** (sound patterns) – Students make sound patterns with musical instruments. Half of the class might have bells and half of the class might have shakers (or some other instrument), and the students play: bells, shakers, bells, shakers… For ABC patterns, the class is divided into three groups with each group playing an instrument in turn. **Colourful Cubes –** ask the student to create a pattern using unifix cubes. Have them show them to someone else and identify the unit that repeats. **Number Patterns -** using numbers create a pattern (e.g. 2,4,6,8…) Ask the prompting questions. **What's the Core? –**create a pattern. Ask students to identify the unit that repeats (the core). Have students create their own patterns and identify the unit that repeats. **Is it a Pattern? –** present a selection of photos and ask the students to give reasoning if it is a pattern or not be a pattern.   **Fix It Patterns –** present a pattern that has a mistake in the pattern. Ask: *What do you notice? How might we fix the pattern?* **Same? Different? -** present students with photos and have them think about ways they are the same and different. Great images can be found at the following link: **https://samedifferentimages.wordpress.com/** **Which One Doesn't Belong? –** present the students With thought-provoking puzzles that have many different and correct ways of choosing 'Which one doesn't belong?' Great images can be found at the following link: http://wodb.ca/ 

Picture books to support patterning:	
Spatial Reasoning Spatial Reasoning is the ability to create and manipulate mental representations of actual and imagined shapes, objects and structures. It involves:  It is linked to abilities to perform basic counting skills, mental arithmetic, algebra, geometry, calculus, word problems, advanced mathematics such as function theory, set theory, mathematical logic (Bruce, Flynn, 2015) as well as literacy skills (Connor, 2014), making it an area of math that is *as important* to develop as number sense. **Prompting Questions:** What do you see? How do you see it? What part did you focus on? Can you see it a different way? What does it remind you of? What might it look like if you flipped it or viewed from a different angle? What words could you use to describe it?	**Cube Conversations:** https://stevewyborney.com/2017/12/cube-conversations/ **Which One Doesn't Belong? –** present the students With thought-provoking puzzles that have many different and correct ways of choosing 'Which one doesn't belong?' Great images can be found at the following link: http://wodb.ca/ **Estimation 180:** http://www.estimation180.com/ **Esti-mysteries:** https://stevewyborney.com/2019/09/51-esti-mysteries/ **Quick Images:** -show pictures displaying groups of objects or symbols, viewing each for only a few seconds. The short period of time encourages children to find efficient strategies to determine how many symbols there are rather than counting one-by-one. https://tedd.org/quick-images-2/ **Cube Conversations: https://stevewyborney.com/2017/12/cube-conversations/** Picture books to support spatial reasoning:  

	   
Composing/Decomposing (or Partitioning) When students have regular and extensive experiences breaking apart numbers, they come to realize that numbers represents quantities that can be grouped and represented in different ways. For instance 9 can be represented as a group of 4 and a group of 5 (4+5) or as 3 groups of 3 (3x3) etc, etc. Once children are familiar and confident with all the parts of all the numbers to 20 – they have a solid foundation for knowing their basic facts. Decomposing larger numbers helps children to see that it is helpful to group by tens and then hundreds (as 'friendly numbers') which supports place value concepts. **Prompting Questions:** How many ways can you represent the number? Can you break apart the number into two groups? Three groups? More? Can you break apart the number into equal groups? Is there another way? How would we represent your groupings in writing? Is there another way to represent this arrangement?	**Splat!** An arrangement of dots are displayed. The question 'How many?' is posed. After students determine how many, Splat! Some of the dots are hidden. How many are hidden? How do you know? https://stevewyborney.com/2017/02/splat/ This routine can be made into a game by cutting out and providing foam 'Splat!s' and counters. Partner A scatters some counters, Partner B determines how many, and Partner A hides some counters asking Partner B How many are covered.