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Using picture books to enhance connections

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Today's session

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- Discuss the benefits of using picture books to inspire mathematicians.
- Explore some tasks that can be differentiated and connect to the proficiencies.
- investigate how the pictures, words and concepts introduced in quality picture books can ignite curiosity in students.
- Look at how picture books and activities can be used by families and at home to create authentic links between home and school.

Warm up

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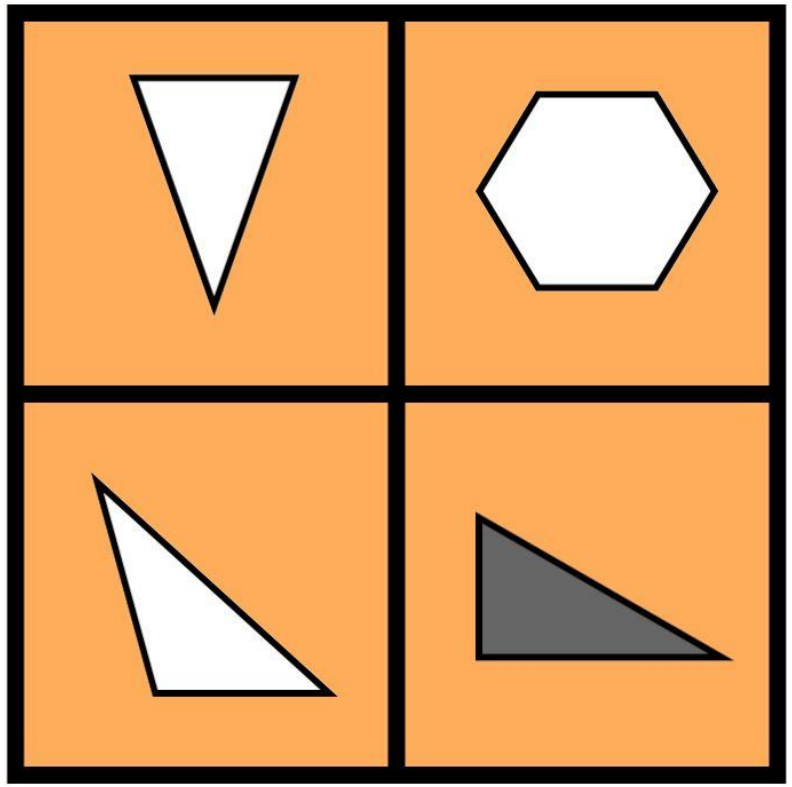
- Which one doesn't belong? Find a reason why each one does not belong.



http://wodb.ca/shapes.html

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- All answers are right
- Justifications and arguments based on the shapes' geometric properties
- Facilitate rich discussion and a deep learning of shapes

What's the story?

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- A picture book is defined as a book suitable for very young children, containing multiple visual images. It is often a simple narrative or descriptive text that is intended to be read aloud and shared between an adult and child or group of children (Muir, 1982)

Types of Picture Books

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- Marston (2010) identifies three different types of mathematical picture books:
- Explicit: books purposefully written for teaching and learning in the mathematics classroom, e.g. Counting on Frank (Clements, 1990) or How Big is a Foot? (Myller, 1962);
- Perceived: books with incidental mathematical concepts as perceived by the teacher e.g. Goldilocks and the Three Bears; and
- Embedded: books that have embedded mathematical ideas but written to entertain rather than specifically for teaching and learning e.g. Uno's Garden (Base, 2013) Catherine Attard (Engaging Maths, 2016)

Linking mathematics to children's literature

- The main benefits for integrating children's literature into mathematics lessons are:
- to help children learn mathematical concepts and skills
- to provide children with a meaningful context for learning mathematics
- to facilitate children's development and use of mathematical language and communication
- to provide children with a richer view of the nature of mathematics
- to provide children with improved attitudes towards mathematics.
- Schiro (1997)
- Using literature as an engaging hook for open-ended investigation can provide each student in the class an opportunity to achieve success, regardless of mathematical ability.
- They also lend themselves to the working mathematically processes that are the core of our mathematics curriculum – problem solving, reasoning, communicating, understanding and fluency.

Starting the Mathematical Investigation

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- First, read the book.
- Next, brainstorm possible mathematical questions that could be explored.
- Once students have had a chance to share their ideas, it is up to the teacher to facilitate how the investigation should progress. Students can form groups and select an area to investigate, or they can conduct an individual investigation that could be teacher guided.
- A good book to use as a stimulus for mathematical investigations is one that builds excitement in the mathematics classroom.

The Art of Clean Up Life Made Neat & Tidy

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- Reimagines the world and its everyday objects as neat, colour-coded rows of their component parts.

What did the kids say?

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- Thinking like a mathematician, If you look at your washing line what questions might you ask?

- Can you order the washing biggest to smallest?
- How many pieces of washing could you fit on the line?
- Can you sort the clothes into colour groups?
- Guess how many clothes there are altogether, show how you worked it out
- What is the least amount of pegs you could use for 20 pieces of washing?
- The shadows on the ground have changed, how long did it take for your washing to dry?

Explore

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- There are 5 clothes hanging on the clothesline, how many pegs could you use? Show 3 different ways to hang them, record how many pegs you use each time.

Differentiation

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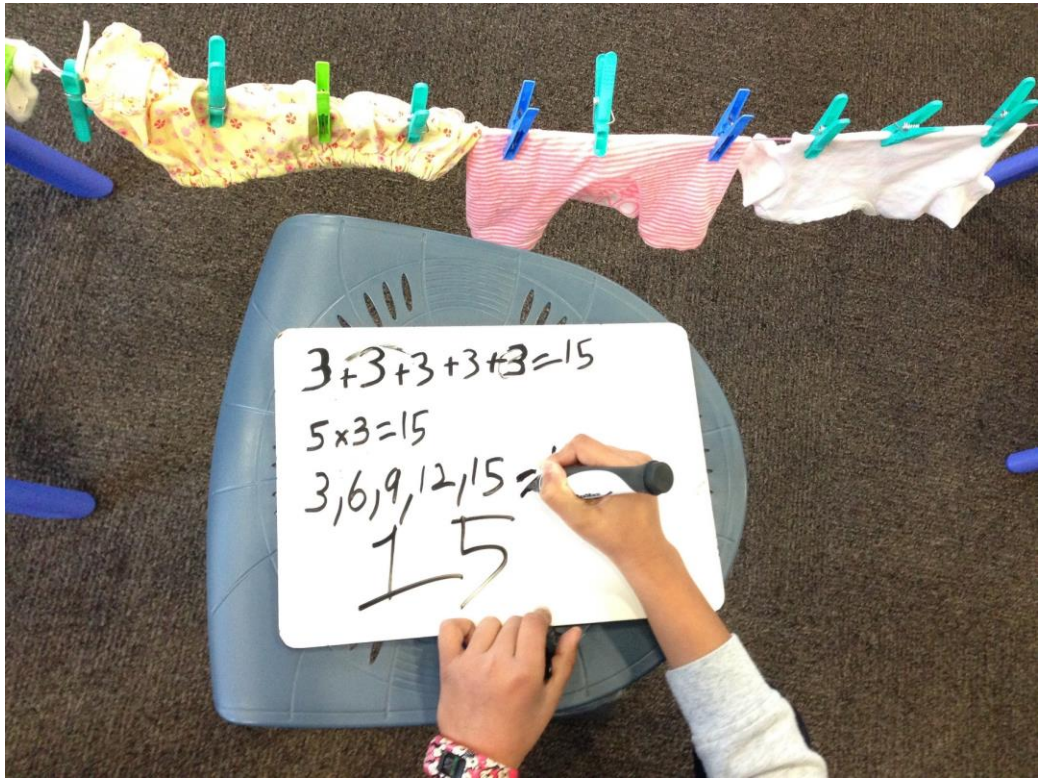
- **Enabling prompt:** There are 3 clothes hanging on the clothesline, how many pegs could you use?
- You have 10 pegs, how many clothes could you hang on the clothesline?

- **Extending prompt:** There are 9 clothes hanging on the clothesline, how many pegs could you use?
- There are 12 pieces of clothing hanging on the clothesline and an odd number of pegs, how many pegs are there?



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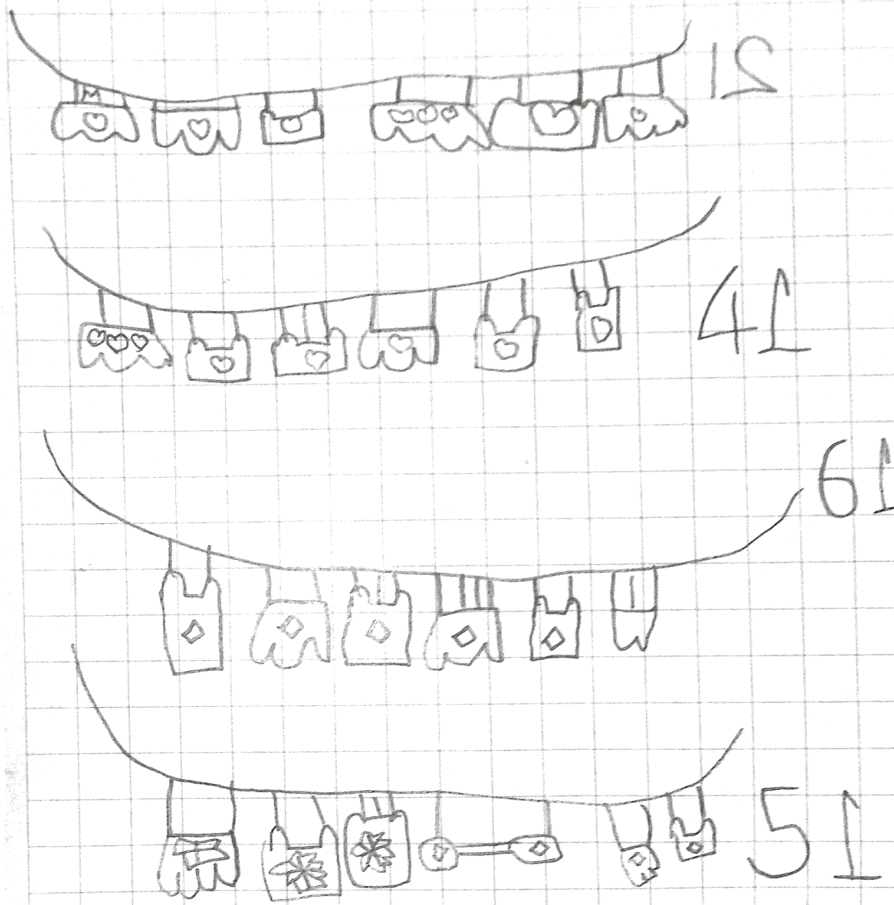

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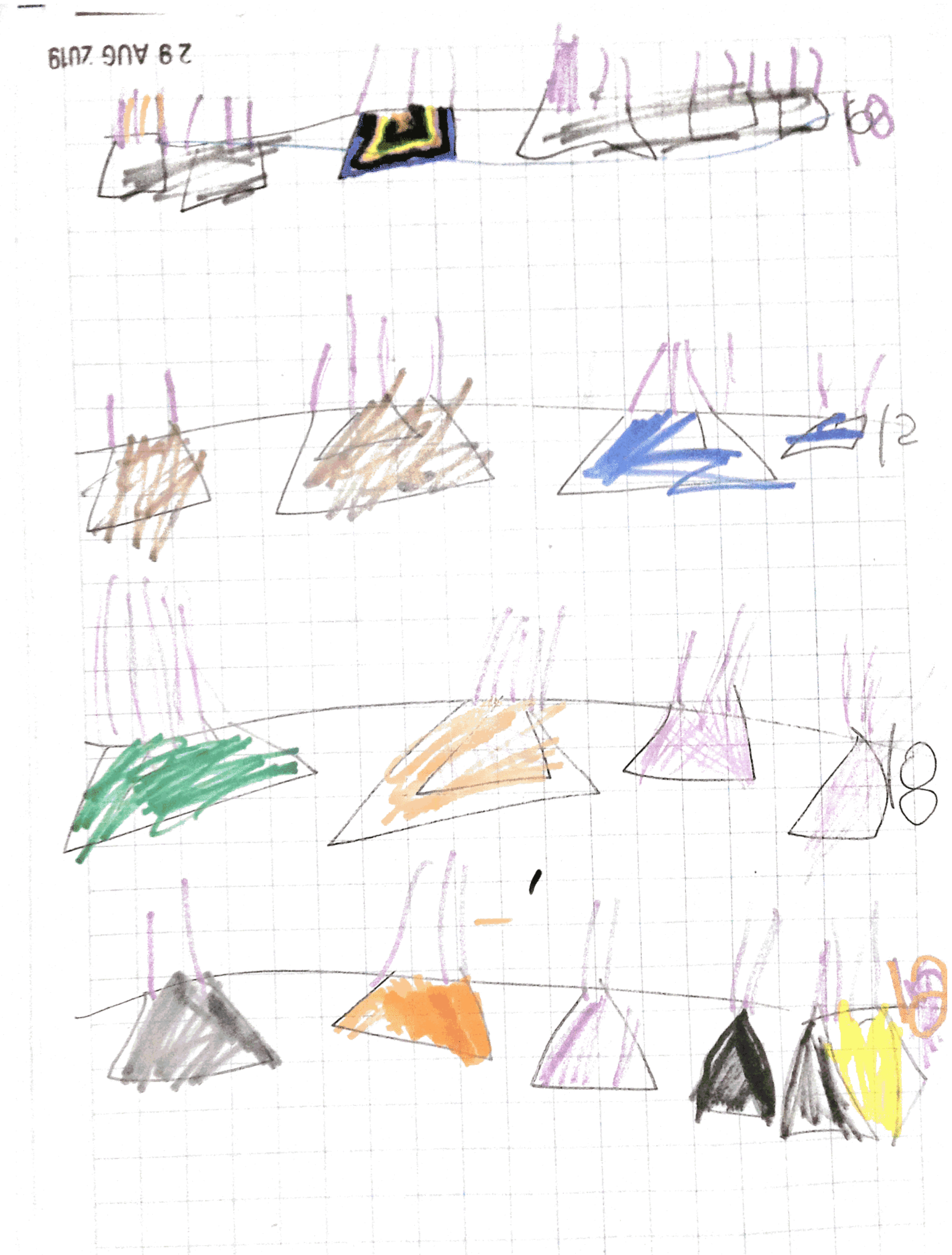
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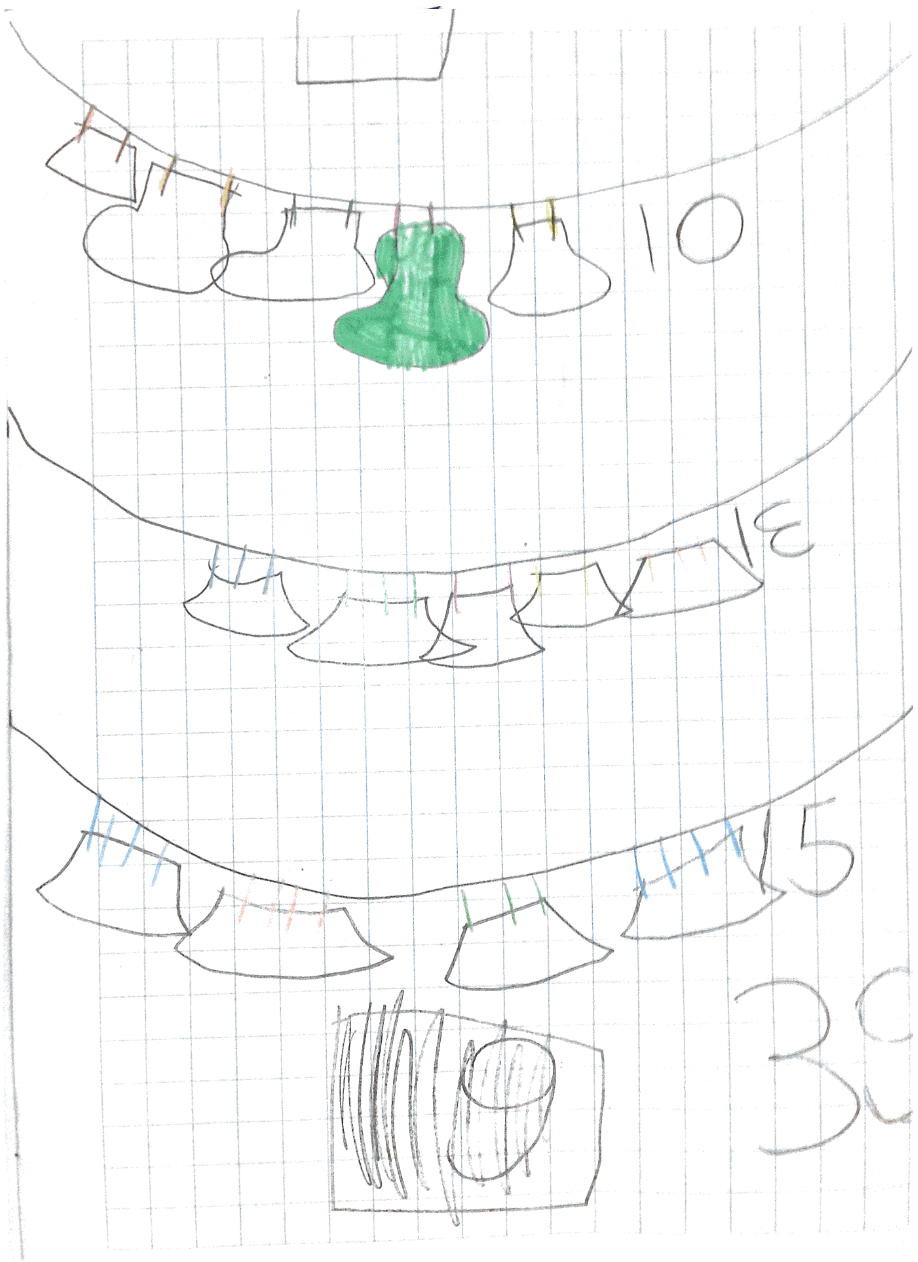
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In the Victorian and Australian curriculum

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- Understanding
  - (connecting ideas, representing concepts, identifying commonalities and differences, describe their thinking, interpret information, sorting, …)
- Fluency
  - (calculating, recognising, choosing, manipulating, recalling factual knowledge …)
- Problem solving
  - (applying, designing, interpret, formulate, planning, model, checking, imagining, …)
- Reasoning
  - (explaining, justifying, comparing and contrasting, analysing, inferring, evaluate, proving, …)

Thoughts..

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- In what ways are we supporting, planning, teaching the four proficiencies to develop your students' numeracy?
- How did the pictures, words and concepts ignite your curiosity?

	Sharing/Division You are going to deep fry chips for your group of friends. How many will you need to cook and how many will each person get? Make them using playdough. How much tomato sauce will you need in total?	Counting 10s and 20s How many different fruits are in the book and how many pieces are they cut in to? How did you count them? Can you count another way? Which' way did you prefer to count?
Estimation Can you estimate how many pieces of fruit there are in your classes lunch boxes today? Estimate how many there are in the year level.	Sort and classify Use your basket of groceries from the supermarket and sort them in to groups. How many different ways can you sort them? Are there items that can fit into more than one group?	Fractions Using the apple, kiwi, mandarin, banana and blueberries, how many different ways can you represent ¼?
Part-Whole Concept How many children are on the asphalt? How many boys? How many girls? There are 10 possible combinations of boys and girls, can you find them all?	Estimation/Capacity Estimate how many colourful balls are in the ball pit. How many balls do you think you would need to fill your bath tub or kitchen sink at home? Show your working out.	Multiplication Design a car park that will allow 20 cars to park. How many cars will be able to park in each row and how will the rows be arranged?

PART-WHOLE CONCEPT

How many babies are in the book altogether? How many boys? How many girls? Is your answer the same as all the other students in your class? Why do you think this is? There are 10 possible combinations of boys and girls. Can you identify all the combinations? You might draw some pictures, or create a table, to help you. *(Years F - 3)*

COUNTING 2's AND 4's

How many babies are in the book altogether? How many little hands are in the book altogether? How many little feet? How many little hands and feet? How did you count them? Can you count them a different way? Which way did you find easiest? Why? *(Years F - 3)*

ROUNDING AND ESTIMATING

255 new babies are born around the world every minute! Can you use rounding to estimate how many are born in an hour? What about each day? In Australia a baby is born on average every 103 seconds. Can you use rounding to estimate how many babies are born here each day? *(Years 4 - 6)*

COUNTING 10's AND 20's

How many little fingers are counted in the book altogether? How many little toes? How many fingers and toes? How did you count them? Can you count them a different way? Which way did you find easiest? Why? *(Years 1 - 4)*

ESTIMATION AND MULTIPLICITATIVE THINKING

Can you estimate how many fingers and toes are in your classroom? What about in your entire school? If the thumb didn't count as a finger, how would your estimates change? *(Years 1 - 6)*

CONDITIONAL PROBABILITY

Imagine that are were 9 different babies born at the same time to 9 different mothers. The babies are all taken to the hospital nursery after birth, but without name tags! Isla and Jasmyn, two of the mothers, come to the nursery to collect their babies. What is the probability they are both given the right babies? *(Years 5-7)*

ELAPSED TIME

There was one little baby who was born far away, so far away that he had to travel over rivers, mountains and deserts for days and nights to meet his new baby friends. If he left home on Wednesday and didn't arrive until the following Sunday, how long was his trip? The baby who was born far away arrived on Sunday 22 March. He spent three days with his baby friends before heading back home. What date did he arrive home? *(Years 2 - 4)*

PROBLEM SOLVING

The poor little baby who suffered from sneezes and chills needed a good dose of medicine to feel better. Each day for one week she had 4 mls of medicine three times a day, and happily, by the end of the week she was in perfect health. How many doses of medicine did she have over the week? How many mls of medicine was this? If each medicine bottle had a capacity of 50mls, how many bottles of medicine would her parents need to purchase? *(Years 3 - 5)*

Process

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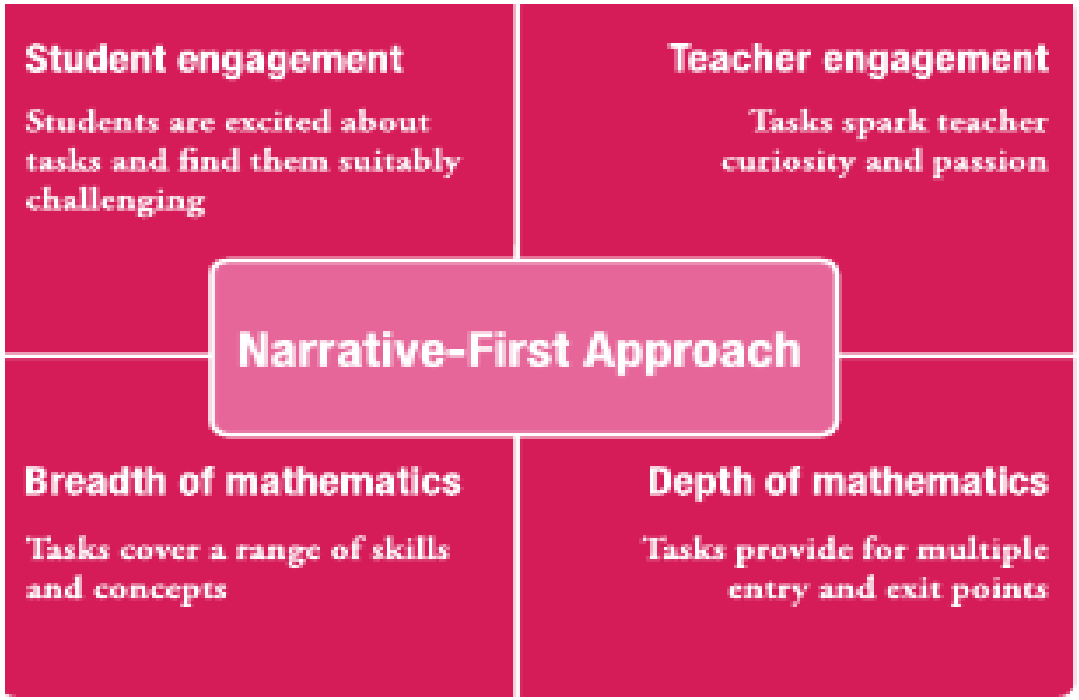
- 1.Choose an engaging picture story book
- 2.Create/find an open-ended/rich task and unpack within your team planning
- 3.Connect task/activity to relevant content descriptions
- 4.Keep a record of the content descriptions covered
- 5.Reflection: Student engagement; was it high and why?



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The Narrative-First Approach is a four-step process for integrating mathematics with children's literature.

Step One involves the educator **identifying rich narratives**, specifically picture-story books or novels that they enjoy, are inspired by and believe their students will find engaging.

Step Two requires the educator to **identify key components of the story**, such as the central complication (or its solution), a key theme or an aspect of characterisation.

Step Three invites educators to **develop rich problem solving tasks**, through making connections between potential mathematical ideas and the key components of the story.

Step Four asks educators to make **curriculum links** retrospectively; that is, make links from the problem solving task back to the curriculum. Our suggestion is that the Victorian (Australian) Curriculum is flexible, covering a range of interconnected skills and content knowledge, thereby allowing for this creativity.

Peter Sullivan

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STRATEGY 1 (THIS IS THE MOST POWERFUL): MAKING TASKS OPEN BY WORKING FROM THE ANSWER

Steps:

- Write down a question and work out the answer.
- Make up a new question that includes the answer as part of the question.

Examples:

- What is there in this room that there is exactly 4 of?
- In a photo of a farmyard, you can see 10 legs. Draw what the animals might be.
- Five students have 21 counters between them. All have different numbers of counters. How many counters might the students each have?

STRATEGY 2: MAKING TASKS OPEN BY CREATING BLANKS

Steps:

- Write down a complete question including the answer.
- Remove some of the question parts.

Examples:

- What might be the missing numbers in this equation?
  $15 + ? = 20 + ?$
- I did an addition question correctly for homework, but my printer ran out of ink. I remember it looked like __ 4 + __ = __ 0. What might be the digits that did not print?
- I did a subtraction question correctly for homework, but my printer ran out of ink. I remember it looked like 3 __ – 2 __ = __ 2. What might be the digits that did not print?

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STRATEGY 3: OPENNESS THROUGH PERSONALISING

Steps:

- This can be either about students themselves, or they can create their own unique solution. In either case, it makes it obvious to the students that they have to engage their own minds in solving the task.

Examples:

- Write your name using 50 matchsticks
- Draw a graph to show how hungry you are over the day?
- How much do you think your family would need to budget over Christmas time?

STRATEGY 4: 'FORCING CONNECTIONS'

Steps:

- One approach is to address two or more concepts and build connections between them. Another approach is to represent solution methods in two ways

Examples:

- Can you work out the answer to $3 + 5 + 35 + 37$? Now do it another way. Which way do you think was easier? Why?
- A square with sides of 4cm has the same perimeter (16cm) and area (16cm^2). Can you find another sized rectangle that has the same perimeter and area?
- Estimate which is the larger number: The number of seconds that have passed since the Big Bang, or the number of grains of sand on earth?

100 Hungry Ants

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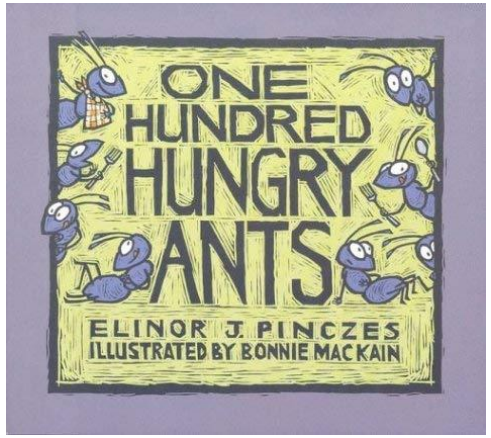
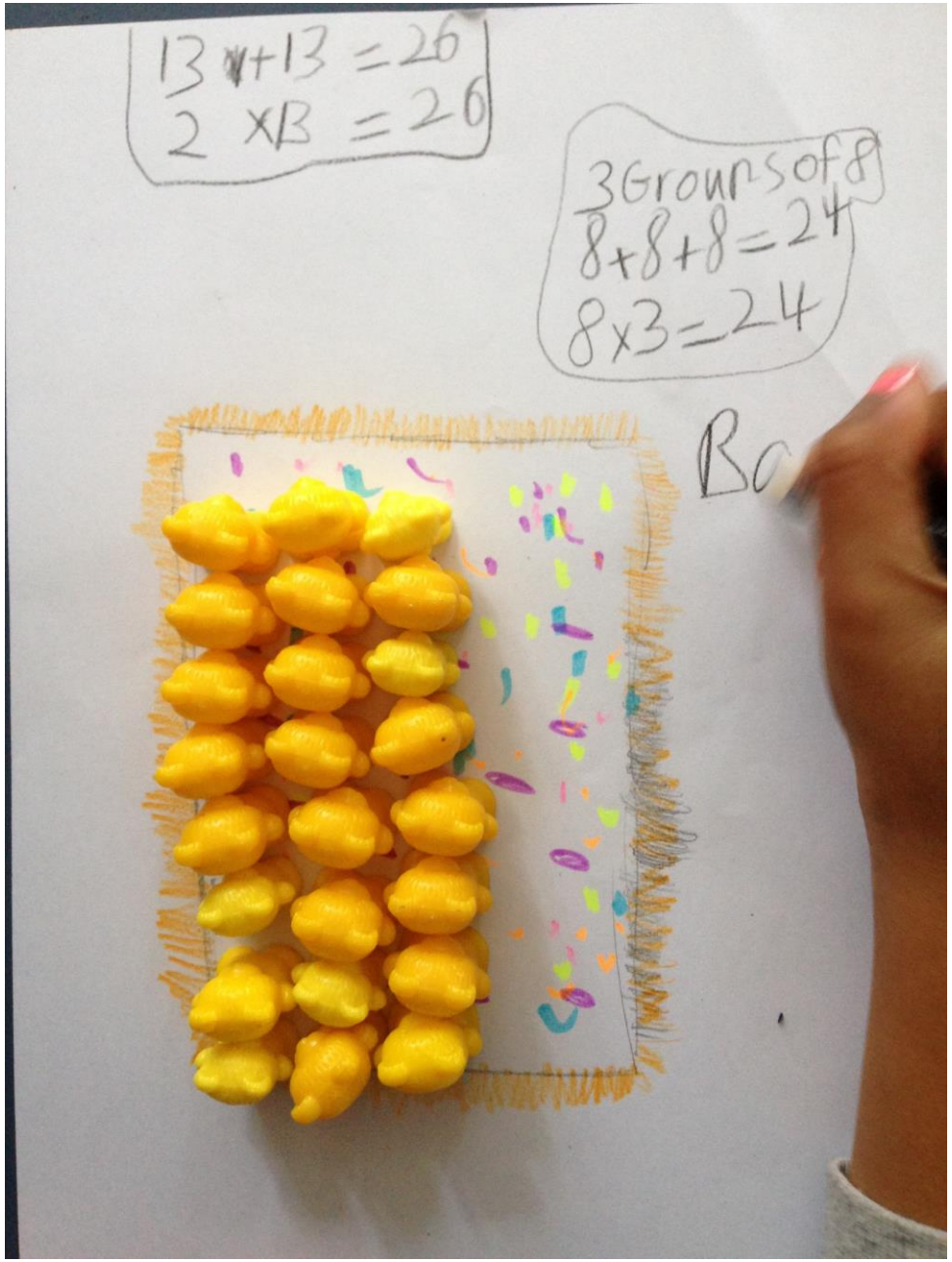
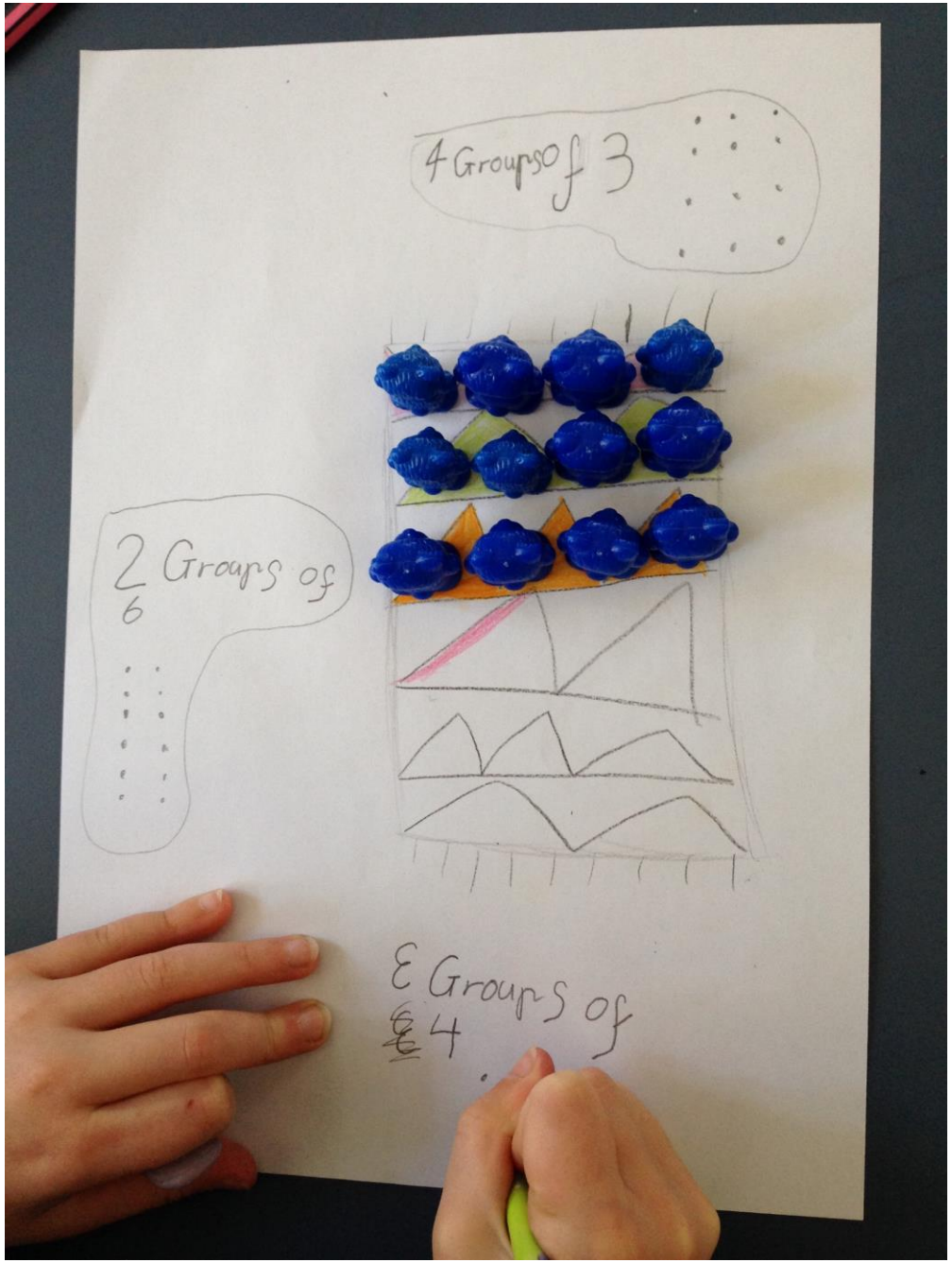
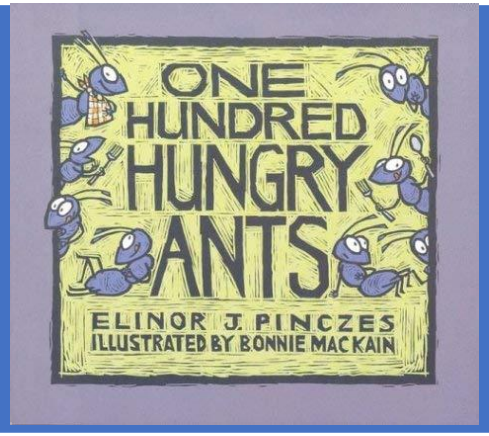
- We’re going to a picnic! A hey and a hi dee ho!

- Your 12 ants are very lucky today, they made it to the picnic rug and guess what, there was food left to eat! But before your ants are allowed to eat the yummies for their hungry tummies they have to arrange themselves on the picnic rug in lines and they must have the same amount of friends in each line. How many different ways can your 12 ants sit on the rug?




13+13=26
2 x 13 = 26
3 Groups of 8
8+8+8=24
8x3=24


4 Groups of 3
2 Groups of 6
5 Groups of 4

	Area Design a picnic rug for the ants to sit on. How long and wide will it be? How are you going to measure it? Compare with a friend, are your rugs the same size?	Use a variety of materials to make 100. Explore a range of ways to organise the resources for ease of counting.
Arrays Go on an arrays hunt. Locate and record the arrays that can be found around the classroom and or school. Take a photo of the array and record an appropriate number sentence using multiplication or division.	Sharing Your ants didn't get any yummies for their hungry tummies. If you need to feed 100 hungry ants, how many pieces of food will you need? Record how you work it out.	Partition How many different groups can your 100 ants arrange themselves into? What is an efficient way to work it out?
Arrays/Division How many different arrays can you make using 24 ants? Record the groups using 'groups of' or division.	Subtraction If everyone in our class had 100 (or 10) ants each and 2 ants ran away from everyone's group, how many ants would be left? Record your thinking? Is there another way you could work it out?	Length How big is a real ant? Estimate and draw an ant. How can you measure? Is your ant the same length as your friends? If we put all the ants in the class into a line, how long would it be?

Links between Home and School

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- https://raisingchildren.net.au/babies/play-learning/learning-ideas/early-numeracy
- **Read and have meaningful discussions**
- *'compare things of different sizes – 'big', 'small' and 'medium'*
- *What is heavy/light in our shopping trolley*
- *group things together and talk about same and different*
- *use words to describe where things are – 'over', 'under' and 'next to'*
- *help set the table*
- *fill a water bottle*
- *help with the shopping and use money to buy things*
- *divide food into equal shares*
- *Measure your child growing on a growth chart/wall*
- And when you talk with your child about maths concepts in your everyday activities, it helps her **understand how and why maths is useful**

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- ‘when talking about Maths with your child, try not to focus on teaching her, just have fun together!’

Links between Home and School

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- **Family Maths Night**: sharing in some Math's games and activities with their families and friends, showing off some of the fun ways that Math's skills are taught and practiced in our classrooms.
- **Family Maths Night - School Support Resource**

Contact

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