Numeracy Picture Book Library

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<u>40 hard copy numeracy picture books chosen by Australian teachers and maths leaders.</u>

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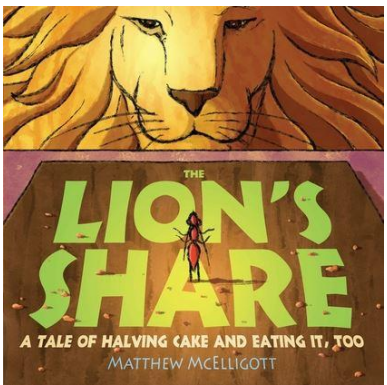
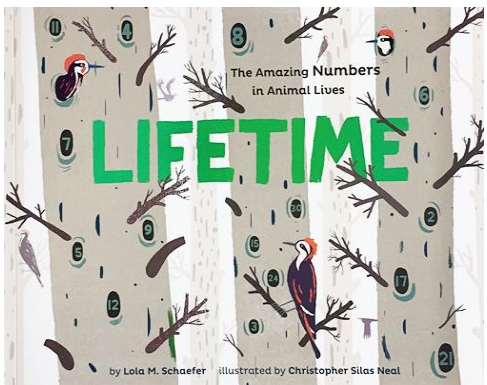
<u>Easy-to-use catalogue that organises all books by year level and specific numeracy concept.</u>





Selectively Chosen Numeracy Picture Books with Hands-on Lessons

Catalogue that organises all books by their best-suited year level and concept

150 Hands-on lesson plans inspired by each storyline, with photographs of teacher modelling, student work samples, questioning tips, as well as enabling and extending prompts for each rich task

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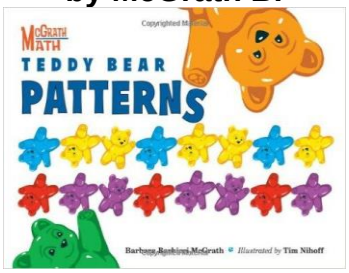
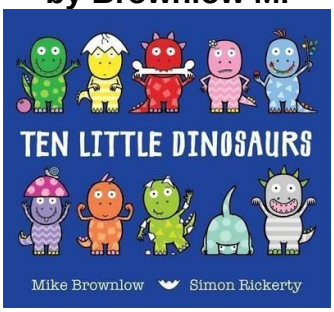
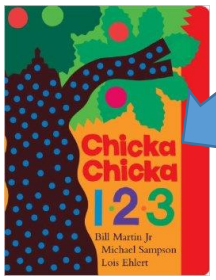
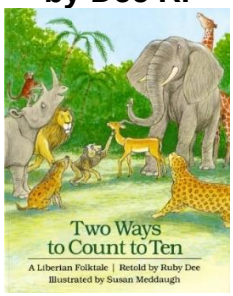
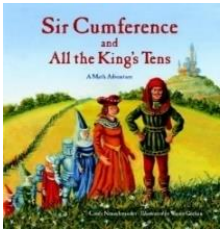
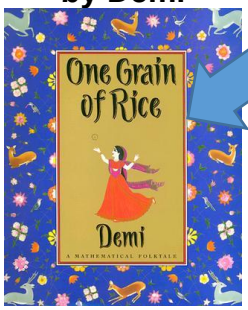
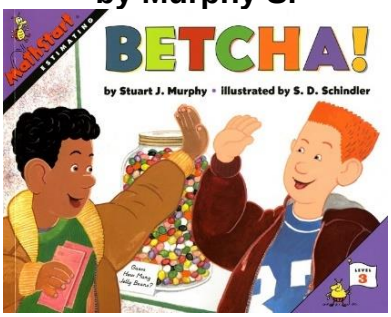
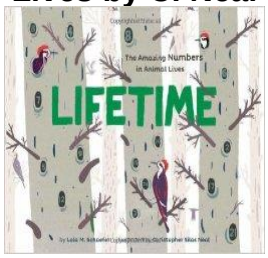
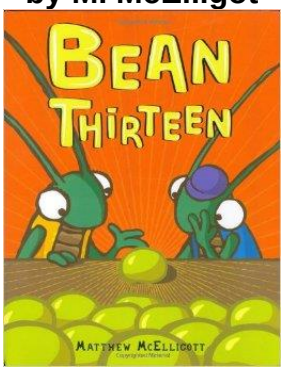
SHORT SAMPLE OF THE ORGANISED CATALOGUE

Place Value Section **(short sample only – the Place Value catalogue in the complete pack contains many more books than those listed here)**

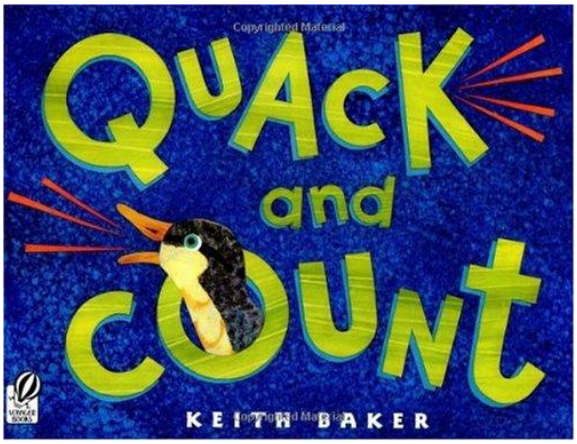
Teddy Bear Patterns by McGrath B.  **Foundation/K: Sort objects, continue and create patterns**	**Ten Little Dinosaurs by Brownlow M.**  **Foundation/K: Count backwards**	**Chicka Chicka 1 2 3 Martin B.**  **Year 1: Count to 100 by tens**
Two Ways to Count to 10 by Dee R.  **Year 2 Skip-counting**	**Sir Cumference and All the King's Tens by Neuschwander C.**  **Year 2 Partition using tens and hundreds**	**One Grain of Rice by Demi**  **Year 4 Estimation**
Betcha! by Murphy S.  **Year 4 Estimation**	**Lifetime: Amazing Numbers in Animal Lives by C. Neal**  **Year 5 Real-life contexts for numbers up to one million and decimals**	**Bean Thirteen by M. McElligot**  **Year 6 Prime numbers**

Teachers click on the front cover and are taken directly to lessons relating to that book for each year level and specific concept or point-of-need for their class.

LIST OF INCLUDED CATALOGUES IN THE 40 NUMERACY LIBRARY PACK:

PLACE VALUE, ADDITION, SUBTRACTION, MULTIPLICATION, DIVISION, FRACTIONS, MEASUREMENT AND GEOMETRY, STATISTICS AND PROBABILITY.

Quack and Count



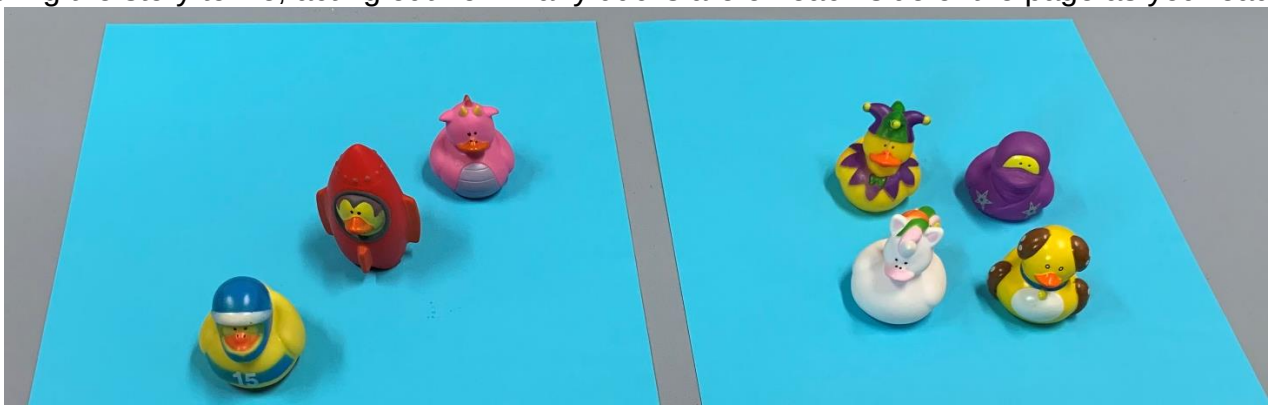
Storyline: Seven ducklings go about their day, and with each new activity some are on the right hand side of the page and some are on the left.

Best features: Clearly visible font explaining the addition/partition of the seven ducklings: *5 and 2 makes 7 ducklings.* Cute rhyming text.

Year 1 Addition: Efficient addition strategies, including partitioning (breaking apart) numbers – all the combinations that make numbers up to 20.

WHERE ARE MY 7 LITTLE DUCKLINGS?

While reading: Use two hoops or blue pieces of paper and rubber ducks or soft toys to bring the story to life, acting out how many ducks are on each side of the page as you read.



Student practice: Students use the printable ducklings and plates/blue kinder circles to investigate all the ways their own ducklings could swim between two ponds.

Materials: 2 blue kinder circles or 2 plates. *Duckling templates from page 3 and student recording template on page 4.* Model like so:

Left pond	Right pond	Makes
5	2	7
2	5	7
3	4	7
4	3	7

Alternatively, students could record using the *'_and_makes_'* templates: 5 and 2 makes 7, 5 + 2 = 7.

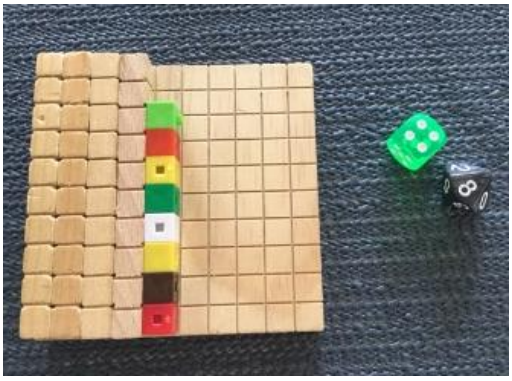
Modelling and questioning: Imagine you are the mummy/daddy duck. These circles are your ponds. These 7 ducklings are yours. One day, you wake up and your ducklings are all out swimming. If you had 7 ducklings, where could they be? What are all the possible **combinations?**

Support: Start with 5 ducks, figuring out all the ways to make 5, then add a duck to work on 6 and so on. Record using drawings (showing ducks as dots) rather than digits. Emphasise conservation and the commutative property for these students by picking up the bowls and switching their places: "Are there still 7 ducklings?"

Extension 1: Use 3 or 4 ponds, rather than 2, therefore partitioning numbers into 3 or 4 parts and brainstorming many more combinations.
Partition teen numbers, for example, investigate all the ways to make 11-19 ducklings. Where possible, record some equal groups sentences when all plates have the same amount. For example, 3 ponds with 6 ducklings each makes 18 ducklings altogether, 3 x 6 = 18.

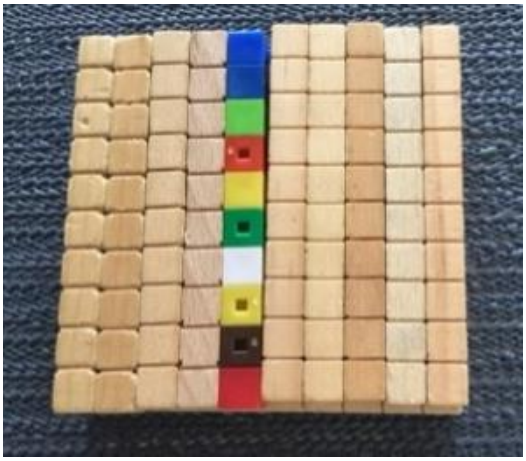
Extension 2: Create 100 'ducklings' using tens and ones blocks with a like-ability partner on top of a hundreds block.

Student A: Rolls 2 dice, one representing tens and another representing ones. "I have 4 tens and 8 ones, I have 48 ducklings!"



Record: 48 + ☐ = 100

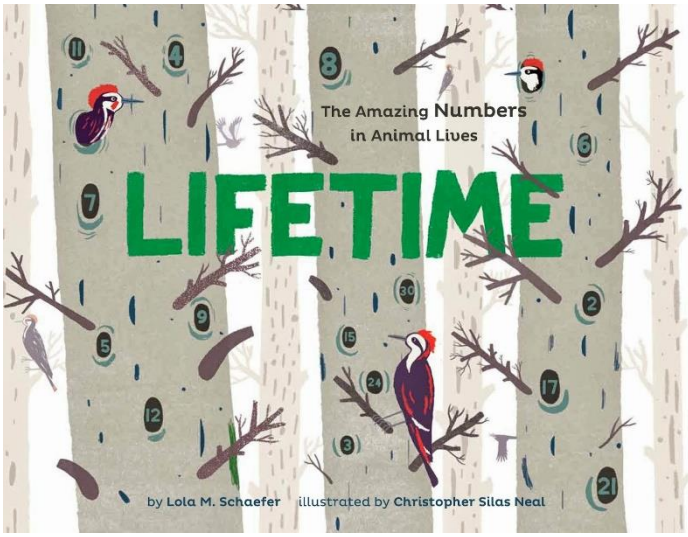
Student B: Investigate how many more are needed to make 100 ducklings altogether. Do this by filling the remaining space on top of the hundreds block with tens and ones:



Record: 48 + 52 = 100

Misconception alert: 48 + 62 = 100 because students don't account for the ones making another ten. By building the 100 ducks on top of a hundred block, students see this.

Lifetime: The Amazing Numbers in Animal Lives



Storyline: Great visual displays of numbers connected to each animal; for example, the height of a giraffe, the eggs of a crocodile, and many more.

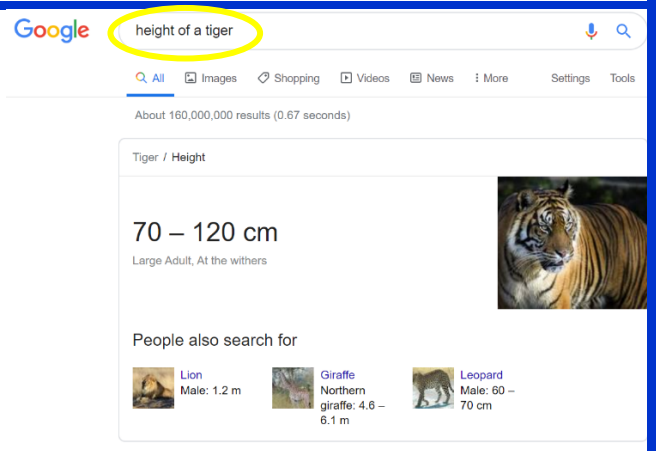
Best features: Colourful and engaging illustrations, particularly those that masterfully demonstrate the larger numbers towards the end of the book.

Year 5 Measurement: Convert between units of measurement for length.

ANIMAL MEASUREMENT WALL

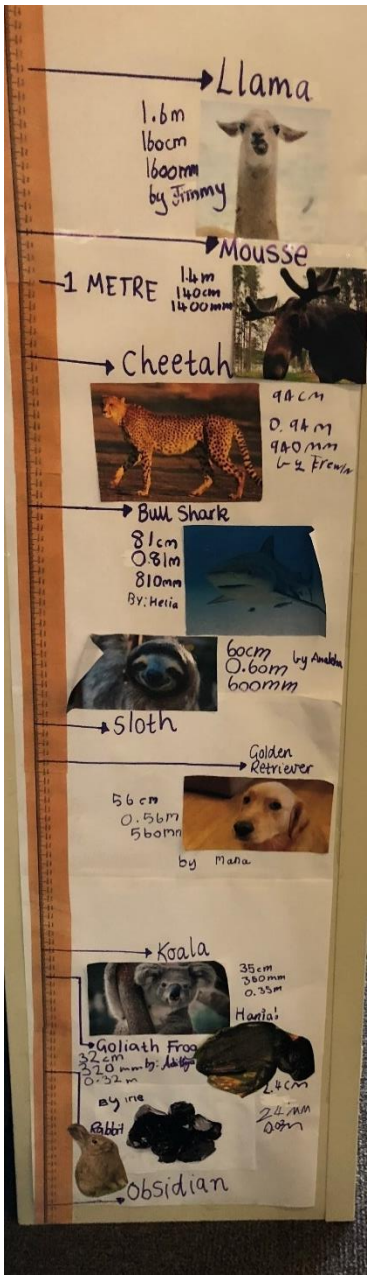
After enjoying the many facts about animal lives, students work in pairs to research the height of other animals and create their own animal measurement wall. Use a picture and post-it note to label each height in metres and centimetres. If the focus is switched to sea creatures for a following session, this can also transform into a chalk length line, rather than a height wall.

Initial research: Use the sentence stem 'height of a _____.' Google automatically puts the answers at the top of the search result so there is no wasted time trawling through websites.
For most students, just use the high end of the range (120cm for the tiger in the photograph example).



The answer pops straight up!

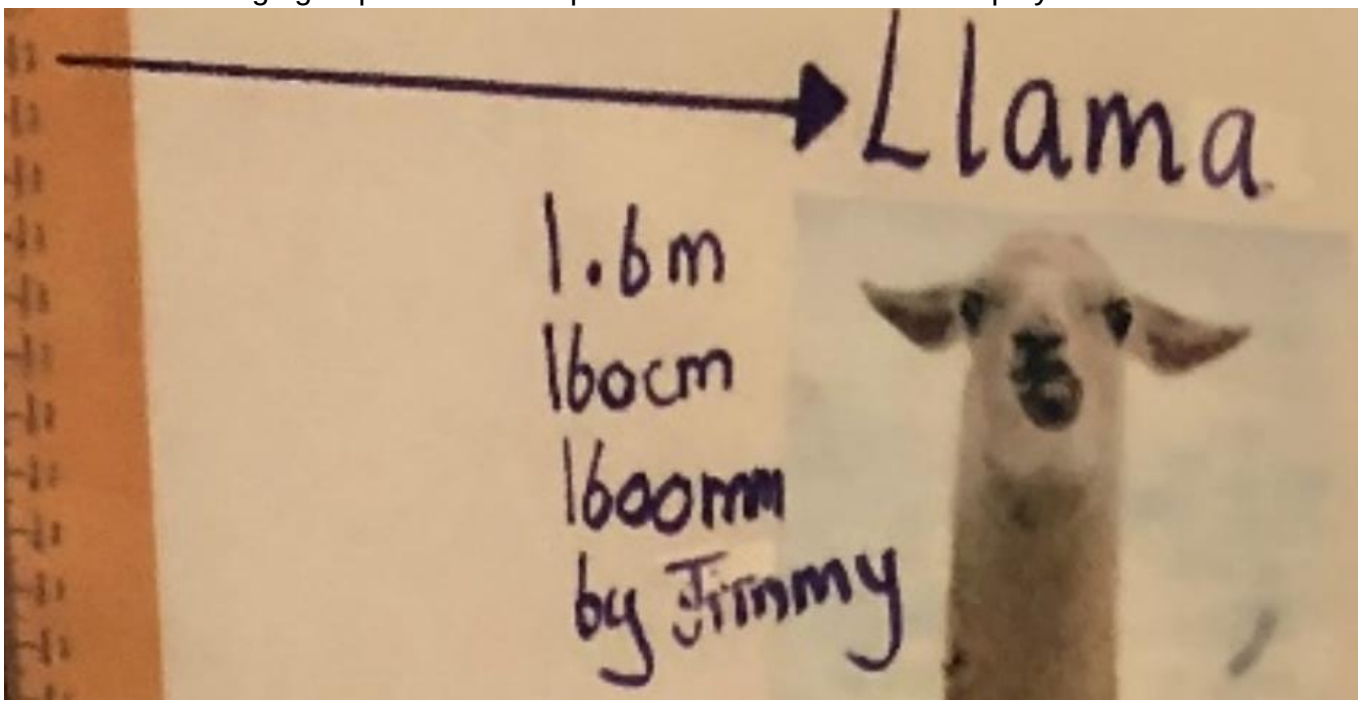
Modelling: Model how students can record the measurements in both metres and centimetres. Show students how 1m is the same as 100cm on the measuring tape. So, if the tiger is 120cm, it is more than one whole metre. Therefore, the decimal point shows where the whole and parts belong. For example, 120cm is 1 whole metre and 20 parts of the next metre, so it is 1.20m (emphasise that 1.20m, 1.2m and 1.2000000m are the same). Students can also write this as a decimal fraction by using 'out of language' for assistance. For example, the tiger is 1 and 2/10m, since it is 1m and 2 out of 10 parts of the next metre, or 1 and 20/100, since it is 1m and 20 out of 100 parts of the next metre.



So 1m 58cm is also 158cm and 1 whole metre and 58 parts of the next metre, shown as a decimal as 1.58m. Encourage students to use the measuring tape and each animal they have already investigated to help convert their measurements. For example, 508cm would be 5 measuring tapes (5m) and just a tiny bit more (0.08, 8 out of 100 parts of the next metre) because it's not almost a whole other tape (0.80 or 80cm, that would be 8 out of 10 parts of the next metre, so very close to another whole metre!).

Student work samples

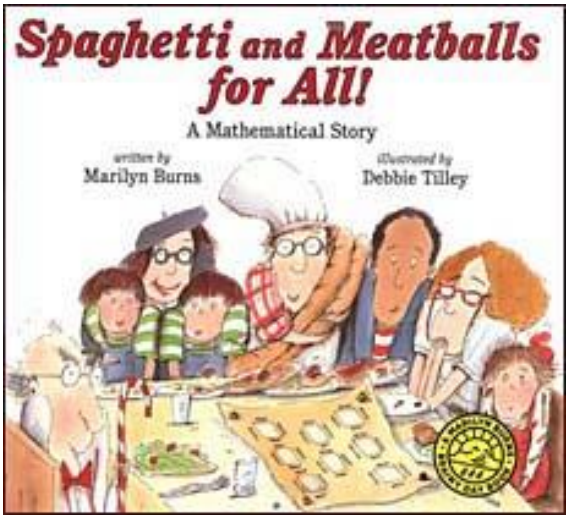
Students build their own wall with a partner, then each student can choose their most challenging or proudest example to contribute to a class display at the end:



Extension 1: Also record the conversion to millimeters and any equivalent fractions. For example, a tiger is 1200mm, because 1m is 1000mm. It is also 1 and 1/5 metres, because 20 is one out of 5 parts of 100cm.

Extension 2: Figure out the average by adding the two heights given (70cm + 120cm) and dividing this by two. Aim to do this mentally, without a calculator, then check it with a written method.

Spaghetti and Meatballs for All!



Storyline: Mr. and Mrs. Comfort organise a family reunion for 32 guests. However, as people arrive, their guests start to change the carefully planned table arrangements.

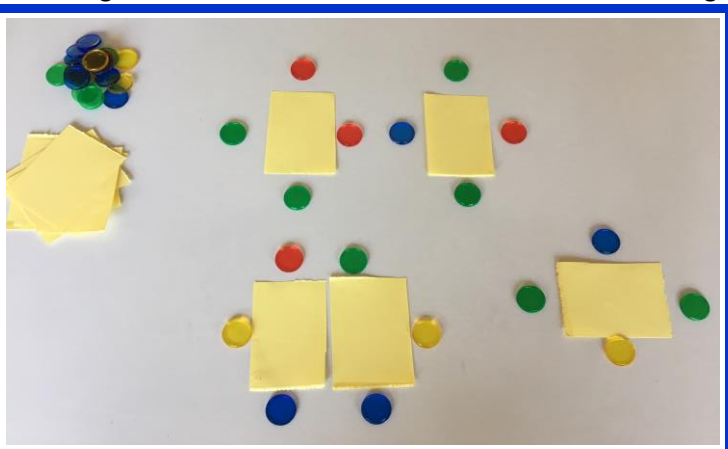
Best features: Great illustrations of the different table arrangements and real-life context for both multiplication and division through the storyline relating to the recipe and table arrangements.

Year 3 Division: Use multiplication facts to create division fact families and understand the connection between multiplication and division.

DINNER PARTY!

As you read: Pause to allow students to create the different seating arrangements using the detailed reading instructions on the right hand side of each page.

Students create the story using materials on their desks as it unfolds.
Materials: Post-it notes or 16 small square pieces of paper to represent the tables. Students could create these as part of a folding fractions warm-up, folding two A4 pages into eighths as a class. Open the paper and discuss each fraction, before refolding it into a smaller fraction each time. Counters to represent the people around the tables.
Modelling and questioning: Model how to use the square pieces of paper and counters to act out guests sitting around a table as shown in the photo.
Detailed reading instructions: Stop just before the page that starts with "Mrs. Comfort found a folding chair." Ask students to use their materials to figure out how they could seat 32 people around the tables. Then continue reading to see how Mrs. Comfort chose to do it: 8 tables of 4 people.
Stop at the next page after reading: "There's plenty of room and plenty of garlic bread." Instruct students to push 2 of their tables together like what has just happened in the story. Will 32 people still fit?
Continue this process, stopping and asking students to model the changes after the guests push tables together on each new page, always pausing to investigate whether or not the tables will fit all 32 guests when they arrive.



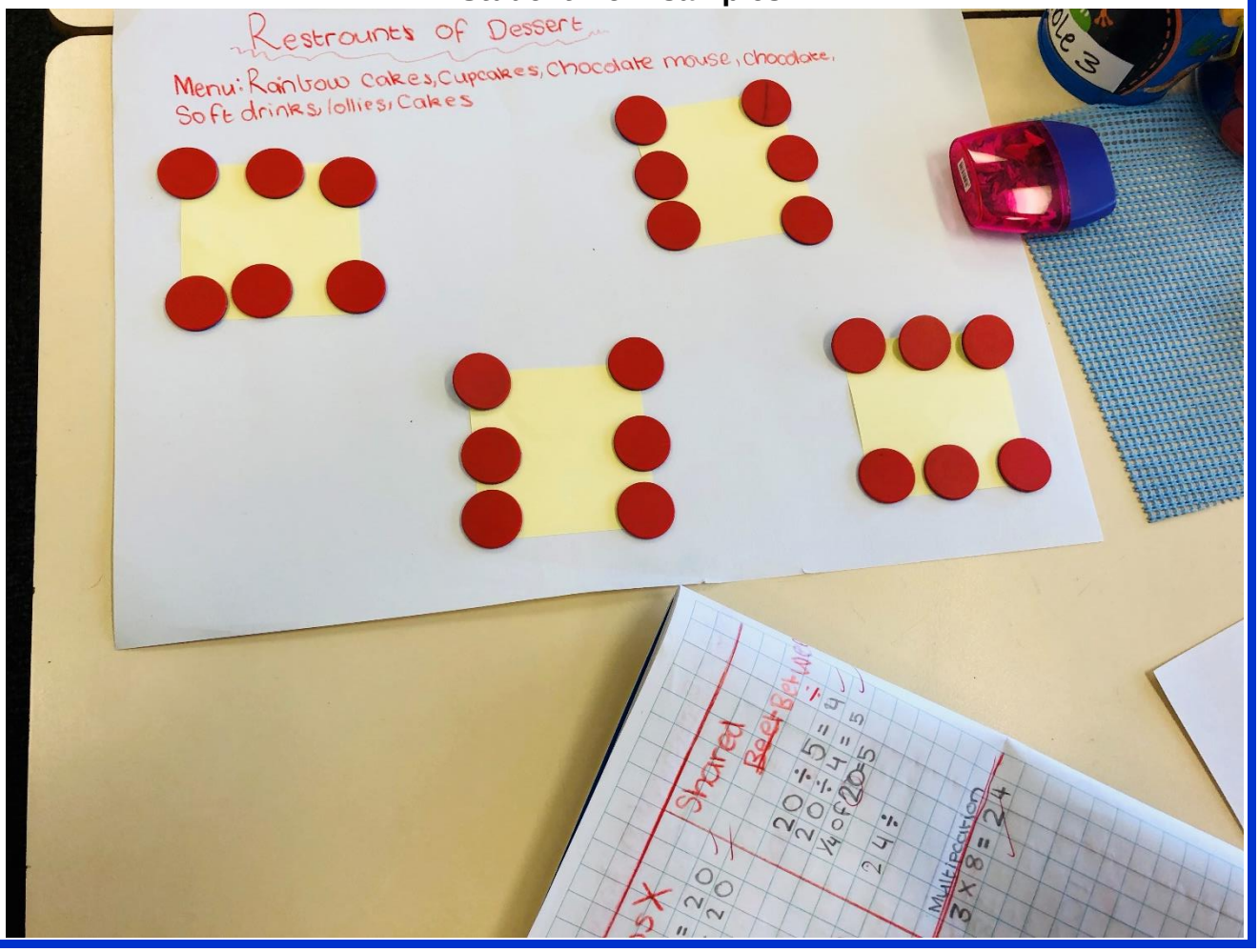
Support: Provide extra assistance while the rest of the class is doing working out.
Extension: After they model what is happening in the book, try to also find any other possible way to arrange the tables that could still work.

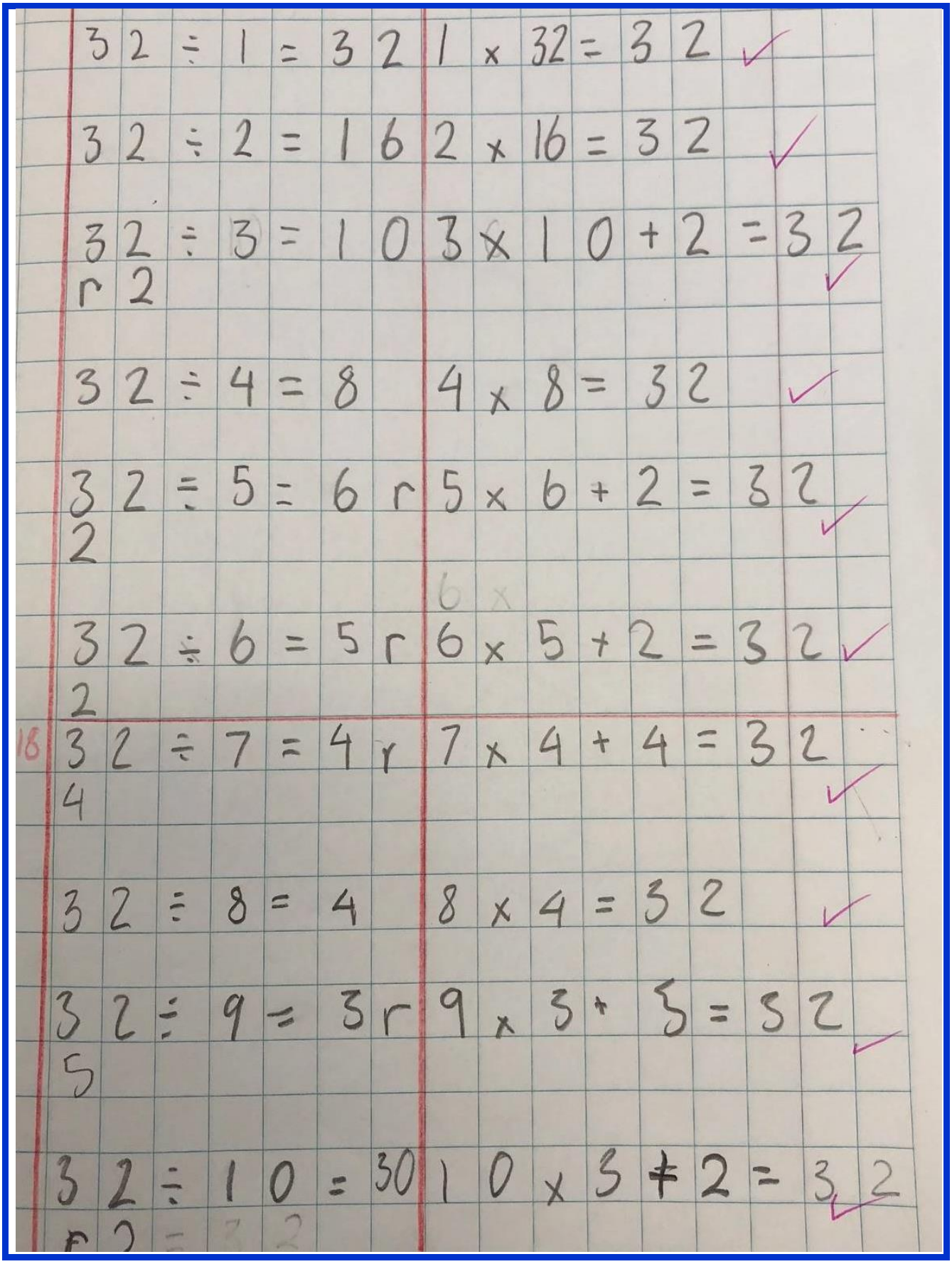
Afterwards, students create their own division dinner party. Provide students with an A3 page and three minutes to write their restaurant's name and a quick menu at the top.

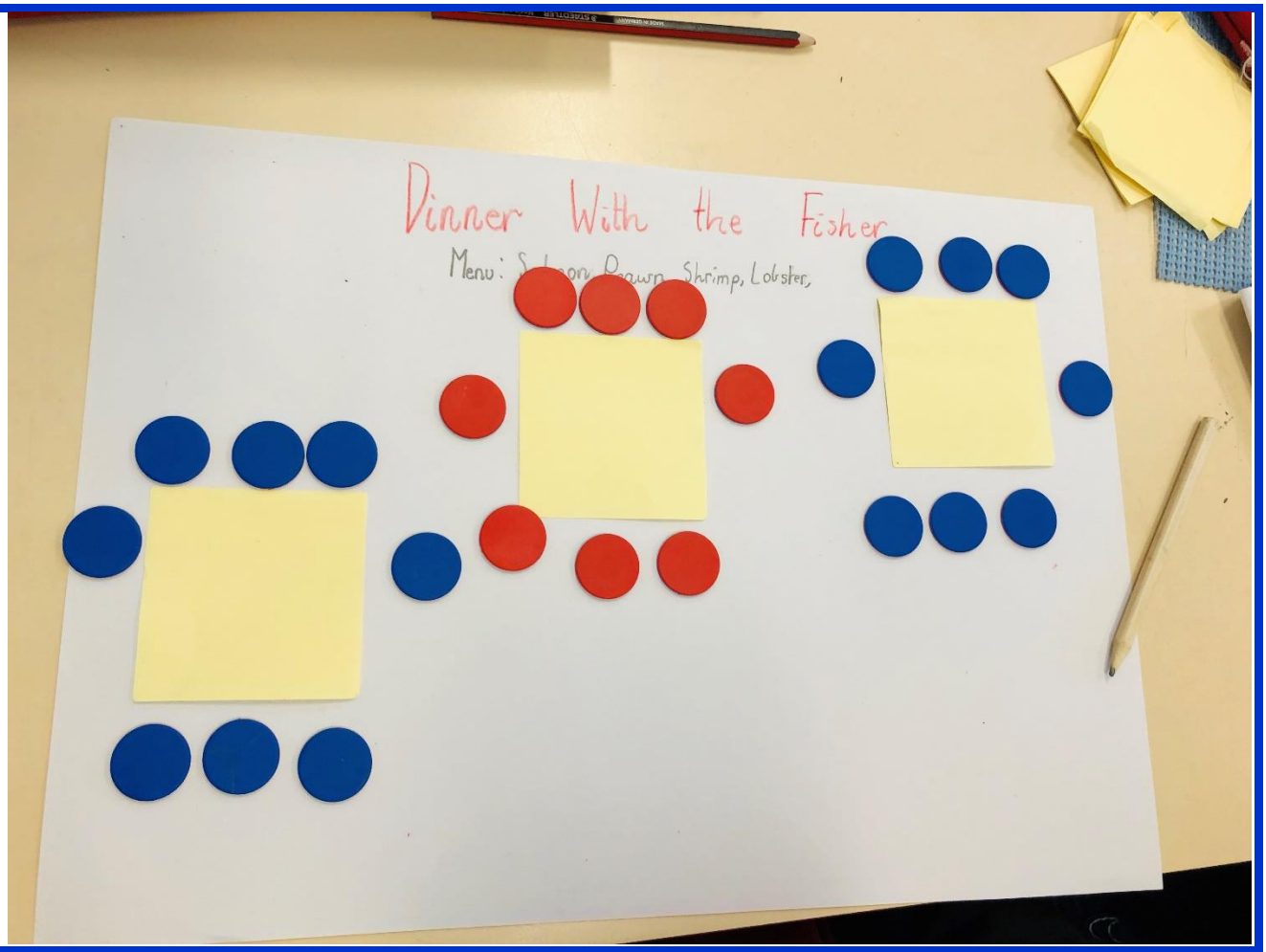
Extension and support: During this menu brainstorm time, allocate a total number of guests to each student – this is the number of people who will be dining at their restaurant that night. Allocate the total number of guests based on each student's ability. For example, extension students have 84, 64 or 56 guests, mid-range students have 30, 36 or 40 guests and support students have 12, 18 or 24 guests.

Now ask students to figure out all the ways they could arrange the tables to seat their guests. Emphasise to students that all the tables must be equal at their restaurant, to ensure everyone receives the same amount of food during their set menu dinner. Division is about equal shares, so the share must be fair! The most supportive way is to model for students to work up sequentially, adding one table at a time. For example, start with one long table, and record that 36 guests shared onto 1 table makes 36, 36 ÷ 1 = 36. Also record the matching multiplication sentence, 1 table of 36 guests makes 36, 1 x 36 = 36. Now do 2 tables, then 3, then 4, and so on until you have 36 tables. If there are any leftovers/remainders at any time, leave the unseated guests at the door, waiting for a table to become available.

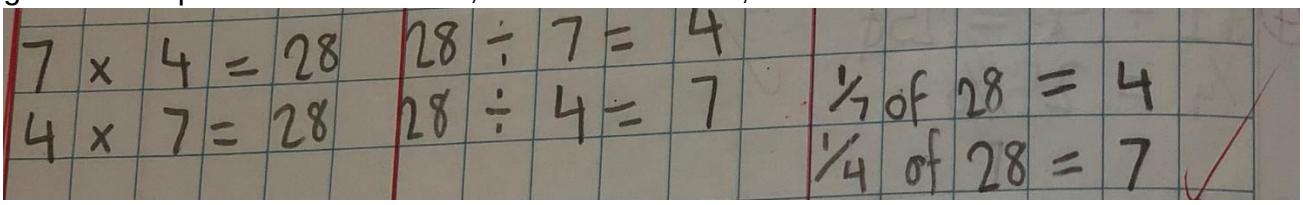
Student work samples




32 ÷ 1 = 32 1 x 32 = 32
32 ÷ 2 = 16 2 x 16 = 32
32 ÷ 3 = 10 r 2 3 x 10 + 2 = 32
32 ÷ 4 = 8 4 x 8 = 32
32 ÷ 5 = 6 r 2 5 x 6 + 2 = 32
32 ÷ 6 = 5 r 2 6 x 5 + 2 = 32
32 ÷ 7 = 4 r 4 7 x 4 + 4 = 32
32 ÷ 8 = 4 8 x 4 = 32
32 ÷ 9 = 3 r 5 9 x 3 + 5 = 32
32 ÷ 10 = 30 r 2 10 x 3 + 2 = 32

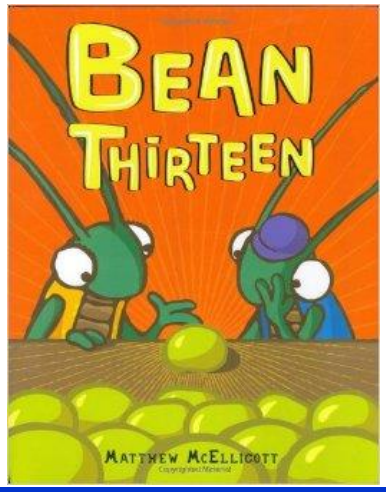


Extension: Also record the matching fraction for each arrangement. For example, for 36 shared between 2 = 18, this could also be written as ½ of 36 = 18, because ½ of the guests are on one table and half are on another, each table has 18 guests. Likewise, when the guests are split between 3 tables, it is 1/3 of 36 = 12, and so on.



1 out of 7 tables with 28 guests in total makes 4 guests on each, so 1/7 of 28 is 4
1/7 x 28 = 4
1 out of 4 tables with 28 guests in total makes 7 guests on each, so ¼ of 28 is 7
¼ x 28 = 7
I know ¼ is 25% because 1 out of 4 parts of 100 is 25, so 25% of 28 is 7, or 0.25 x 28 = 7

Bean Thirteen



Storyline: Ralph and Flora collect beans for dinner, but since they have 13 beans, no matter what number of guests they invite, they just cannot seem to share the meal equally to avoid unfair shares or leftovers.

Best features: Engaging illustrations of a range of different arrays showing the beans and remainders. Amusing characters. Fantastic use of colour on all pages.

Year 2 & Year 3 Division: Share numbers into equal groups (**Year 3:** using arrays)

THE BEAN PARTY

Read in full, emphasise the page with 4 guests (Ralph, Flora, April and Joe) with the beans set up in a perfect array – apart from the one leftover. Use this page as a model for how students will be setting up their divisions of beans throughout this lesson.

Using animal characters, students share their beans (counters) with a changing number of guests. Year 3 students (or extension year 2 students) can share using an array, then easily connect this to the formal division algorithm (as shown on the next page).

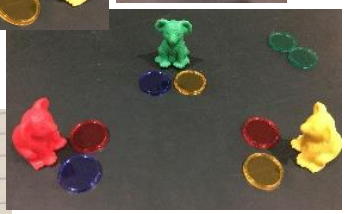
Materials: Animal manipulatives (preferable) or paper to draw smiley faces for the guests. Counters as the beans.

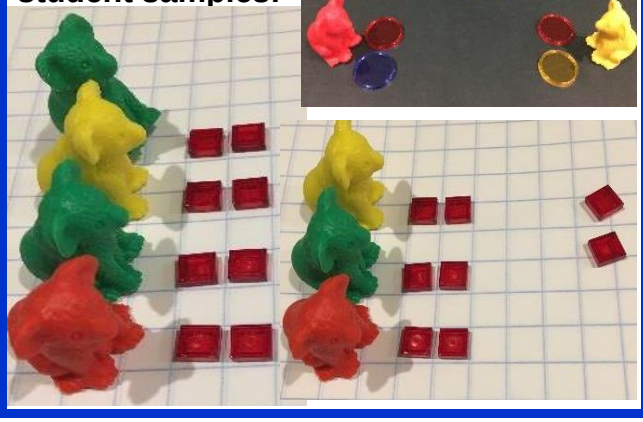
Modelling and questioning: Choose how many beans you want to collect (keep the total under 20 or 30 for most students). Starting with two guests, just like Ralph and Flora, work out how many beans each guest will be able to eat. Add an extra guest and see how many they receive now. Record:
20 beans shared between 2 guests gives 10 to each (use the division sentence stem templates for students with literacy barriers)
20 beans ÷ 2 guests = 10 beans each

See the teaching tips on the next page. Set up your beans like Ralph and Flora did in the book, in rows and columns. Maths calls this an *array*, because it is *arranged* into neat rows, and looks like a square or rectangle.

Year 2 student samples:

Higher year 2 student samples:



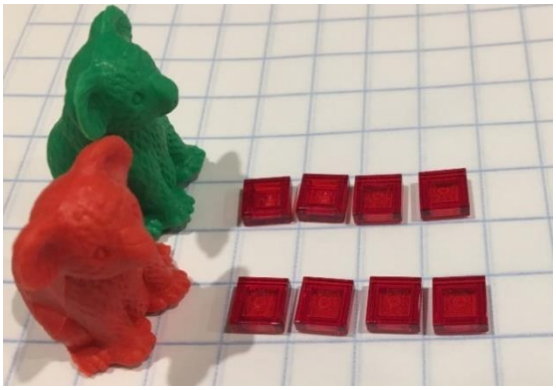


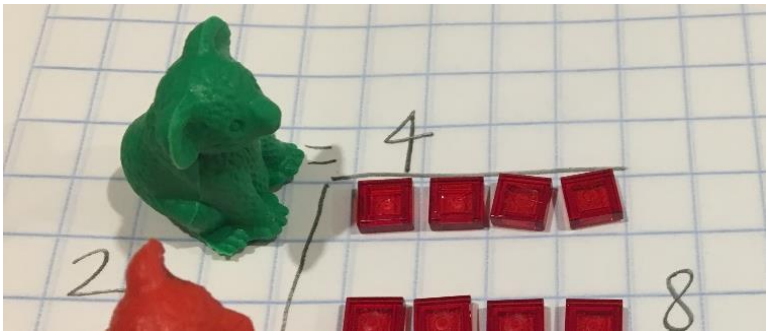
Support: Start with 12 beans (or any other 'very' composite number under 20 like 16 or 18) and investigate which number of guests works and does not work for this total of beans.

Extension: Can you find other numbers that always create remainders, no matter how many guests are involved? These are called 'prime'. How many prime numbers can you find? What do all the prime numbers have in common? (All odd; not in any of the times tables except 1 and their own).

Teaching tip to make sense of the division algorithm:

When students set up division in an array like so, the division algorithm is almost identical:



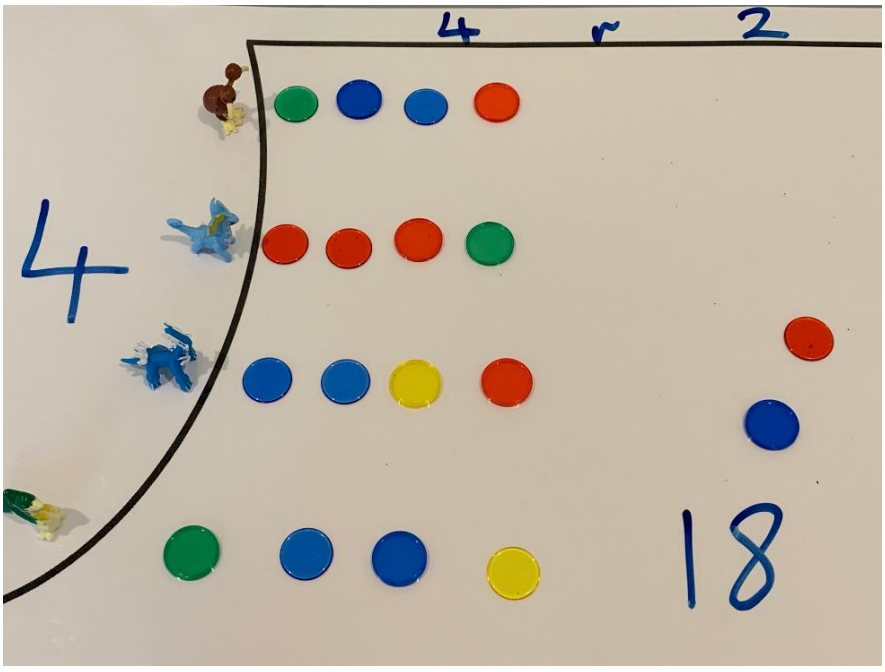


The animals are placed down the left hand side to show how many guests/groups you are sharing between – how many people are knocking on the door to come into the house. Under the algorithm, place how many things you are sharing (the total/starting number).

Share one or a few to each guest at a time. It must be an equal share when you run out! The share must be fair!

Your answer is how many things each person/animal received. This goes above the line.

Any remainders are pushed to the side and also written above the line next to the letter 'r.'



Use this A3 template of the division algorithm (available in the Templates folder) to assist students to set up their materials within the algorithm.

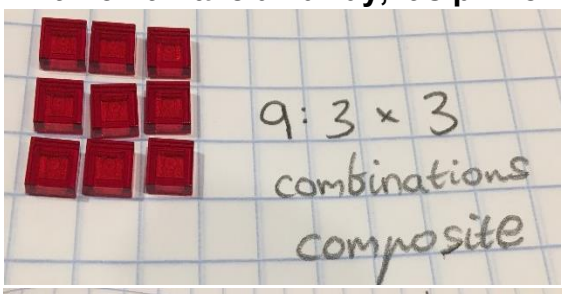
Year 6 Place Value: Identify which numbers are prime and which are composite.

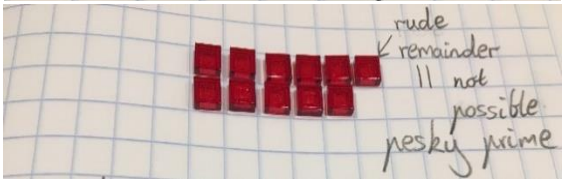
RUDE REMAINDERS, PESKY PRIMES AND COMBINATIONS COMPOSITES

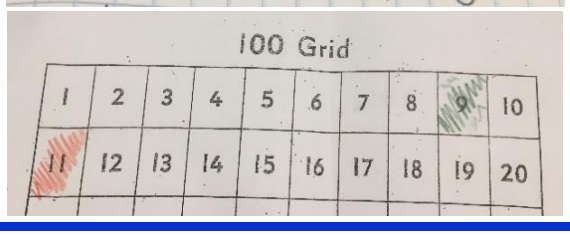
While reading:
Heavily express and emphasise the following language in the book:
"one leftover"
"that is odd"
"so it's fair"
"extra bean"

Students try to find other 'unlucky'/prime numbers like 13 in the story.
Modelling and questioning: Explain that maths calls these numbers 'prime' because they just won't be shared between any more than 1 person or any less than the actual number. Your challenge this lesson is to find as many pesky prime numbers as you can using counters for your beans.
Model this with 13, sitting first just one student at a 'dining table' desk. Give the student the 13 beans one-by-one. "Yay, it worked." Now sit two students at the dining table. Share out the beans. Nope, one left. "Maths calls this a remainder, or we could call it a 'rude remainder' because there's one remaining and it would be rude to give it to Bert because Ernie wouldn't get the same share." Hold up the remainder and chorus: "RUDE REMAINDER!" Add one student at a time around the desk all the way up to 13. So, we had rude remainders all the way up to the actual number we had, except for when we only had 1 person! Maths calls this number prime, or we can call it (chorus together): "PESKY PRIME NUMBER!" There are only two ways to share the number, like Optimus Prime from the *Transformers* movies, who only has two forms (a truck and a robot).
If there is another way to share the beans fairly, then it's not a PESKY prime, it's a: "COMBINATIONS COMPOSITE!" Print the vocabulary anchor chart on the next page so students can refer to this throughout the session.
Students can mark the numbers they find to be prime and composite on the 0-120 chart on the next page, aiming to notice a pattern or features that determine which numbers are composite and which are prime.

If you can make the number into an array (arrange the counters as a square or rectangle), it's composite. If it won't make an array, it's prime.







Support: Use animal counters to show their guests and give them a list of small numbers to try at first: 12, 16, 17, 20, 23, 25, 27.

Extension 1: Find the 'golden composite numbers' under 120. That is, which numbers under 120 have the most factors.
A golden composite number has 12 factors.
A silver composite number has 10.
A bronze composite number has 8.
How many medals can you collect? Compete against another like-ability extension student.

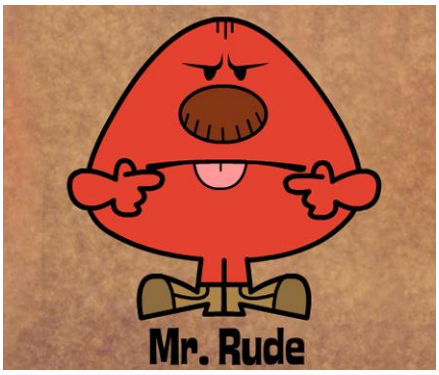
Extension 2: Challenge these students to find the largest prime number that exists, for example, 359 is a prime number. Can you find a larger one?

Shade composite numbers green and prime numbers red. Keep searching for prime numbers. What patterns do you notice for primes?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	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	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120

Vocabulary anchor chart for prime, composite and remainders:

RUDE REMAINDERS



PESKY PRIME NUMBER

COMBINATIONS COMPOSITES