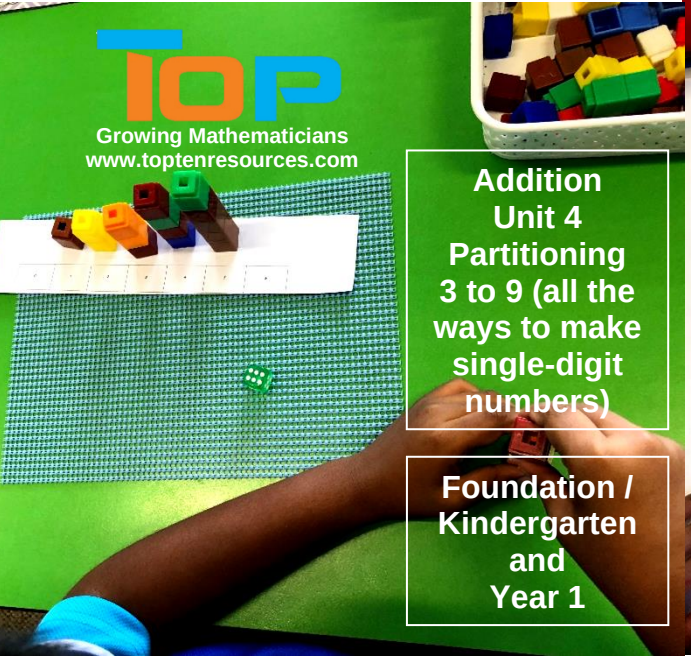

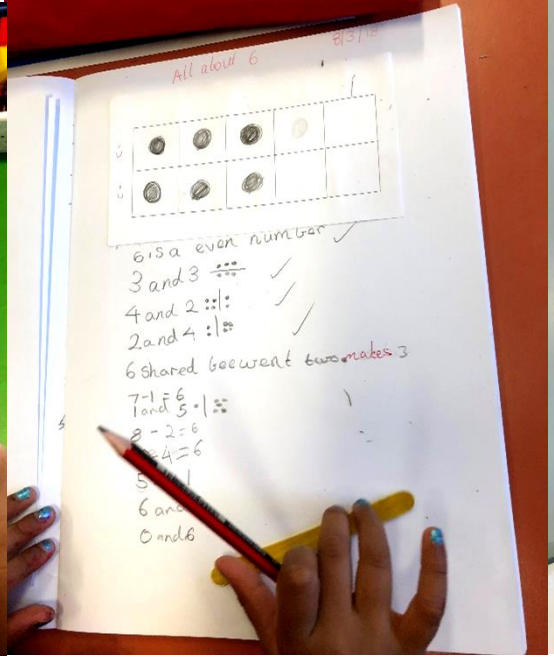

Developmentally Sequenced Materials-Based Mathematics

EARLY YEARS PACKAGE

Sequential units with materials-based mathematics for F/K, Year 1, Year 2 and Year 3 teachers and students

Active, highly visual and kinaesthetic hands-on learning with explicit teacher modelling and rich sessions that develop deep understanding, reasoning, problem-solving and fluency – no worksheets!

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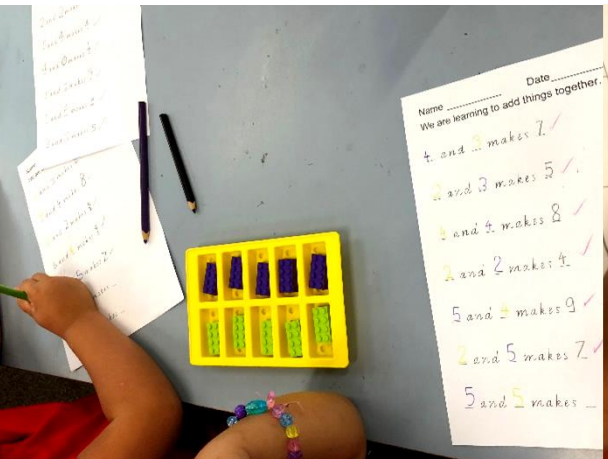

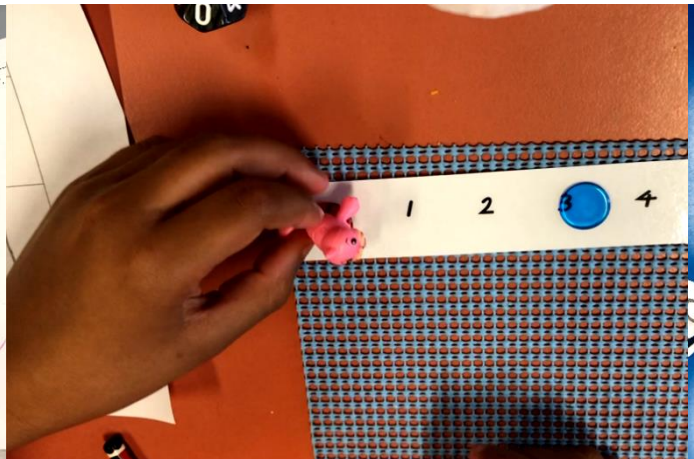

Addition Unit 4
Partitioning the numbers 3 to 9
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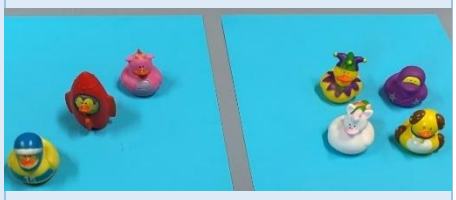
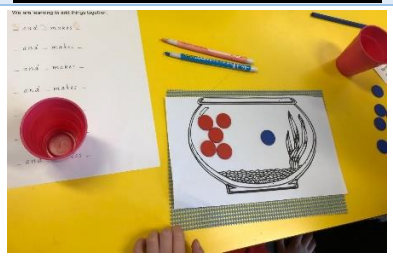
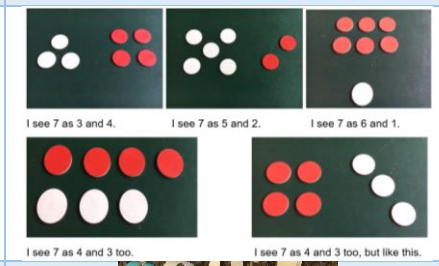
Lesson 9 6 Dots Pages 37-39		**Lesson 10** 7 Little Ducklings Pages 40-44	
Lesson 11 Pizza and Fishbowl Partitioning Pages 45-51		**Lesson 12** All the Ways to Make 7 Page 52	
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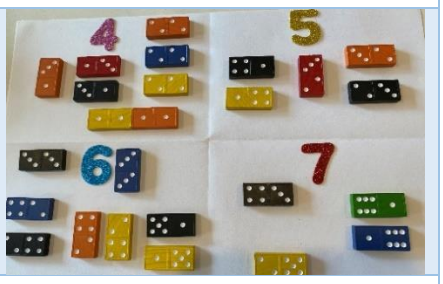
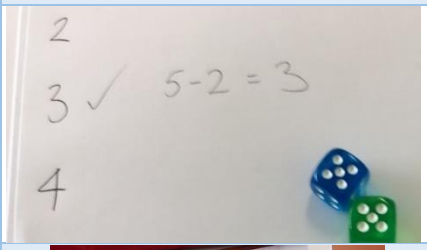
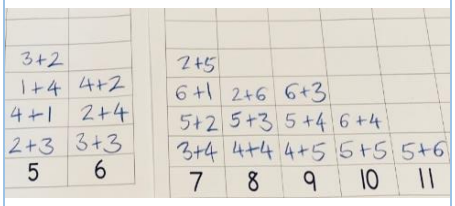
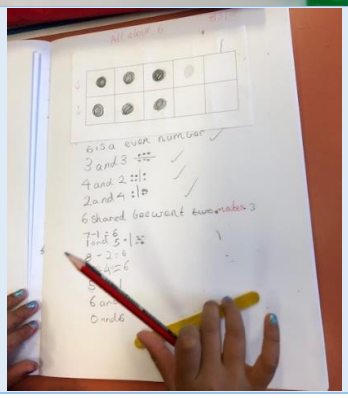
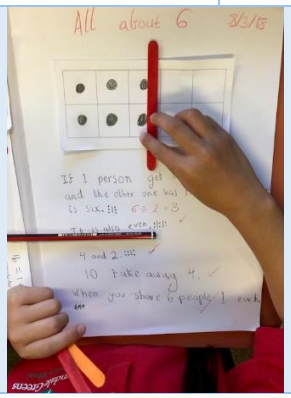
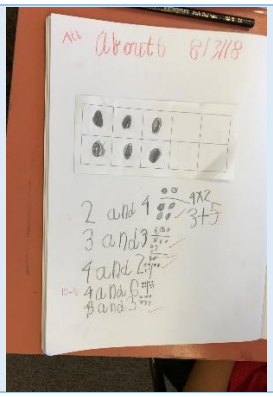
Lesson 17 Colourful Cities Pages 60-62		**Lesson 18** Domino Parking Lots and Trains Pages 63-67	
Lesson 19 Bingo! Pages 68-70		**Lesson 20** Roll it up! Pages 71-72	
Lesson 21 Number Talks Pages 73-77	  		

Addition Developmental Step 4: Break numbers up to 9 into their parts (partition); i.e. all the ways to make 7

Curriculum / Syllabus links for the following lessons

This unit is recommended for Foundation / Kindergarten and Year 1 students. It is focused on students building trust in the combinations that make the numbers below 10. It takes most students at least two years to develop a deep understanding and fluency in all the ways to make 3 to 9, which are often under-emphasised compared to the 10 facts and doubles.

Australian and Western Australian Curriculum Foundation: Represent practical situations to model addition and subtraction (ACMNA004):

- **using a range of practical strategies for adding and subtracting small groups of numbers, such as visual displays or concrete materials**
- using Aboriginal and Torres Strait Islander methods of adding and subtracting, including spatial patterns and reasoning.

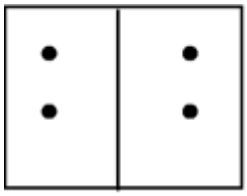
Australian and Western Australian Curriculum Level 1: Represent and solve simple addition and subtraction problems using a range of strategies including counting on, **partitioning** and rearranging parts (ACMNA015):

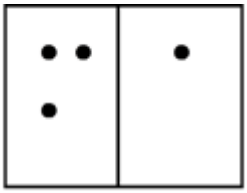
- developing a range of mental strategies for addition and subtraction problems.

Australian Curriculum – definitions:

Partitioning means dividing a quantity into parts. In the early years, it commonly refers to the ability to think about numbers as made up of two parts, such as, 10 is 8 and 2. In later years it refers to dividing both continuous and discrete quantities into equal parts.

Rearranging parts refers to moving counters, numbers, etc., in order to change the visual representation of the number; for example, '4' could be represented as either of the two combinations below.





Victorian Curriculum Foundation: Represent practical situations to model addition and subtraction (VCMNA073)

- **using a range of practical strategies for adding and subtracting small groups of numbers, such as visual displays or concrete materials**
- using Aboriginal and Torres Strait Islander methods of adding and subtracting, including spatial patterns and reasoning.

Victorian Curriculum Level 1: Represent and solve simple addition and subtraction problems using a range of strategies including counting on, **partitioning** and rearranging parts (VCMNA089):

- developing a range of mental strategies for addition and subtraction problems.

New NSW Maths Syllabus – Early Stage 1

Combining and separating quantities – Identify part–whole relationships in numbers up to 10

- use visual representations of numbers to assist with combining and separating quantities, identifying the relationship between the quantities.
- **create, model and recognise combinations for numbers up to ten (Reasons about relations).**
- use drawings, words and numerals to record addition and subtraction, and explain their thinking (Reasons about relations).

New NSW Maths Syllabus – Early Stage 1

Combining and separating quantities – Model additive relations and compare quantities

- identify situations in which addition and subtraction may be applied.
- **combine two or more groups of objects to model addition, identifying the relationship between the parts and the whole.**
- use concrete materials or fingers to model and solve addition and subtraction questions, counting forwards or backwards by ones as necessary.

<u>New NSW Maths Syllabus</u> – Stage 1 (A)

Combining and separating quantities A – Recognise and recall number bonds up to ten

- model and record patterns for individual numbers up to ten by making all possible whole-number combinations (Reasons about patterns).
- create, recall and recognise combinations of two numbers that add up to numbers less than 10.
- describe combinations for numbers using words such as *more than*, *less than* and *double* (Reasons about relations), *particularly Lesson 21.*

<u>New NSW Maths Syllabus</u> – Stage 1 (A)

Combining and separating quantities A – Use flexible strategies to solve addition and subtraction problems

- represent addition and subtraction using structured materials such as a bead string or similar model, *particularly Lessons 1, 7 and 8.*
- select and apply strategies using number bonds to solve addition and subtraction problems with one- and two-digit numbers by partitioning numbers using quantity value and bridging to 10 (Reasons about relations), *particularly Lessons 2, 5 and 15.*

<u>New NSW Maths Syllabus</u> – Stage 1 (A)

Combining and separating quantities A – Use advanced count-by-one strategies to solve addition and subtraction problems

- apply the terms ‘add’, ‘plus’, ‘equals’, ‘is equal to’, ‘is the same as’, ‘take away’, ‘minus’ and ‘the difference between’ to describe combining and separating quantities.
- recognise and use the symbols for plus (+), minus (–) and equals (=).
- record number sentences in a variety of ways using drawings, words, numerals and symbols.

New NSW Maths Syllabus – Stage 1 (A)

Combining and separating quantities A – Represent equality

- use the equals sign to record equivalent number sentences involving addition, and to mean 'is the same as', rather than as an indication to perform an operation (Reasons about relations), *particularly Lesson 19, as well as Patterns Unit 3.*
- Model the commutative property for addition and apply it to aid the recall of addition facts (Reasons about relations), particularly Warm-Up Mixing Colours Commutativity, Lessons 6, 7, 18 and 20.
- recall related addition and subtraction facts for numbers to at least 10 (Reasons about relations).

New NSW Maths Syllabus – Stage 1 (B) – *Laying foundations for Stage B content*

Combining and separating quantities B – Represent and reason about additive relations

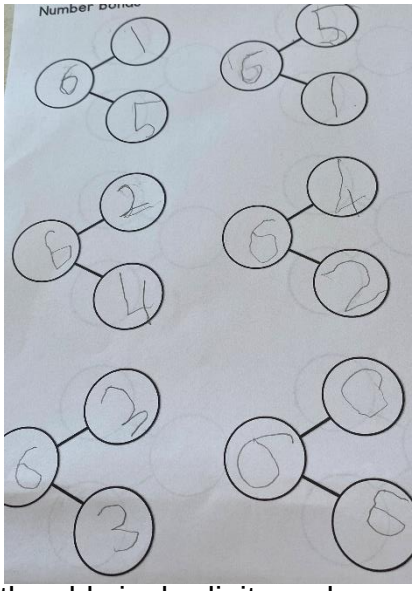
- create, model and solve word problems, using number sentences, *particularly Lessons 4, 7, 10, 11, 13 could transform into worded problem scenarios, with students creating these or solving teacher-provided problems based around these contexts.*

New NSW Maths Syllabus – Stage 1 (B) – *Laying foundations for Stage B content*

Combining and separating quantities B – Use knowledge of equality to solve related problems

- use number bonds to determine a missing number, *Lesson 2, as well as Patterns Unit 3*.
- use number knowledge to solve related problems (Reasons about relations), *particularly Lesson 21.*
- use a variety of ways of writing number sentences, *particularly Templates links from Page 6 and Lessons 19-21.*

Teaching Tips



*Part*itioning means breaking numbers into their parts. A solid understanding of the ways to make 3, 4, 5, 6, 7, 8 and 9 provides students with the ideal foundation for much of the work within later addition and subtraction units, particularly using addition to solve subtractions by harnessing the power of fact families. While in years 3-6, fluency with times tables is paramount for many units, in the early years, first an understanding, then a fluency with partitioning holds the same importance for building a solid foundation for addition and subtraction. Many teachers focus heavily on the 10 facts, while placing less importance on the combinations that make the numbers 3 to 9, which are of equal use to students throughout their mathematical development.

Once students know the ways to make 3 to 9 fluently, they can fluently add single-digit numbers with ease. Students instinctively trust their addition and subtraction answers when they have had lots of materials-based, rich learning experiences involving partitioning. This places them in an excellent position to use the split strategy in their middle years and master vertical addition, once they understand the place values behind this. Partitioning also forms a critical foundation for the building to 10 strategy – if you do not know that 5 is made of 2 and 3, you cannot add 8 and 5 by breaking 5 into 2 and 3 to make 8 + 2 + 3 = 10 then 3 more.

Dianne Siemon's *Lines in the Sand* presentation is highly recommended viewing: *The Big Ideas in Number for Each Year Level:* https://www.youtube.com/watch?v=nPLWAzK0QSQ.

Recording templates for this unit

Throughout this unit, students can record their answers using any of the three recording templates from this unit's folder.

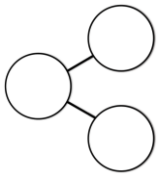
1. _ and _ makes _ template - cursive, building on the work from addition unit 1

   _ and _ makes _ stick and ball font also available

2. _ is made of _ and _, which emphasies the breaking apart (whole, part, part) nature of partitioning numbers

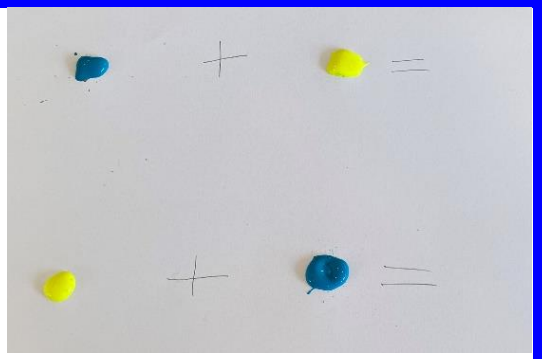
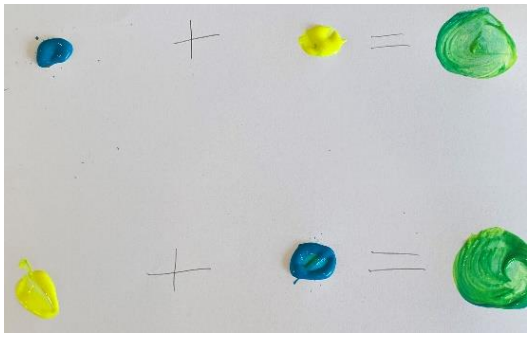
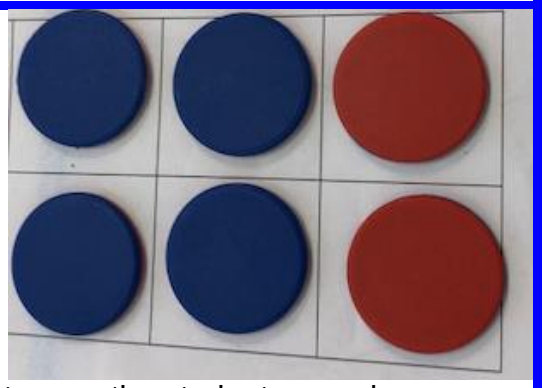
   _ is made of _ and _

3. Number bond recording templates that are very visual and particularly well-matched to the lessons where students are using their number bond mats.

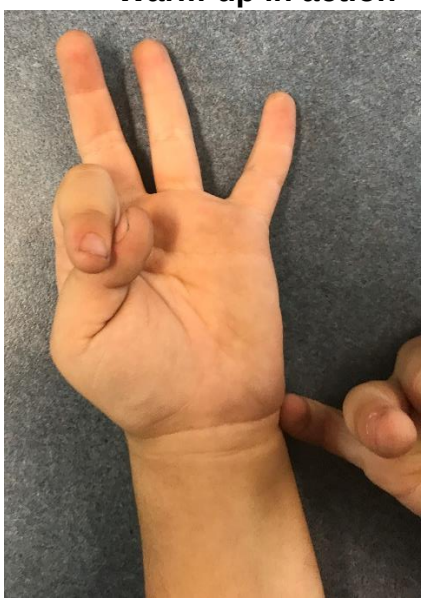
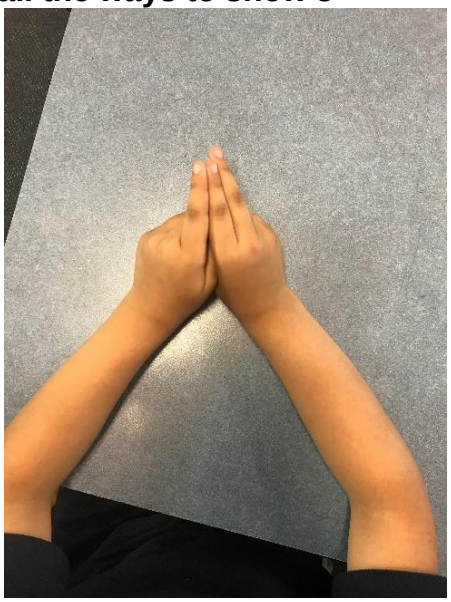
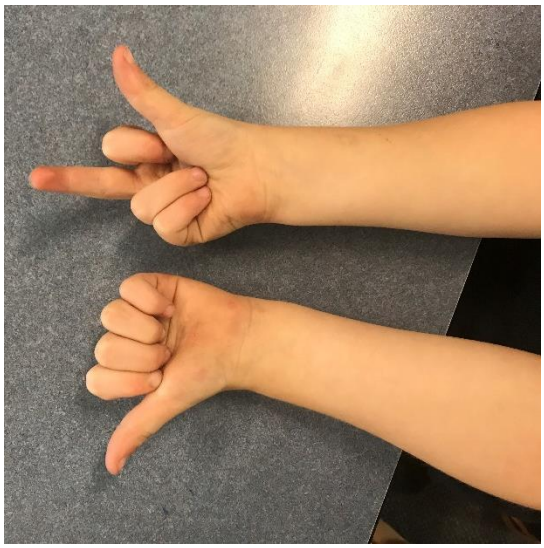
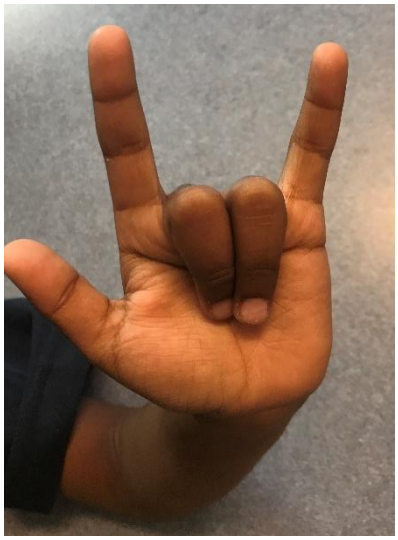


4-year pre-schooler student work sample shown at the top of this page

Warm-up Games

Game	Warm-ups for Partitioning
Mixing Colours Commutativity	Hold a whole-class demonstration where you mix two colours together. For example, blue and yellow. What will it make? Let's start with blue, then add yellow. It made green! Will it matter if we change the order? Let's start with yellow first this time, then add blue. It made green again! So, the order does not matter. Do the same with unifix cubes – add 2 blue to 3 yellow. It makes 5. Next start with 3 yellow and add 2 blue, it also makes 5! Repeat with many colours, as well as unifix for the number examples, following each colour demonstration.  
Superhero Parties!	Students use a different size frame each day. For this example, the number of the day was 6, so students were given a 6-frame. Students are allowed to invite 6 superheroes to their party. Some of the superheroes can be blue (Aquaman, Superman, Captain America, Avatars, Batman – the students can choose a blue superhero they prefer) and some can be red (Spiderman, Wonder Woman). What are all the combinations of red and blue superheroes you could invite to your party (how many blue v. how many red)? The superheroes are represented by two-sided counters. When students flip these counters, they change colours – blue is on one side, red is on the other. This assists with conservation – students know the total is always 6, they are just changing how many blue or red counters make it.  **Students can record using the 4, 6, 8 and 10 frame recording templates from this unit's folder.**

Last Hands Standing!	**Students verse each other at proposing different ways to make the number of the day using their fingers.** For example, the teacher says the number of the day is 6, or allocates different numbers to different pairs, depending on their points-of-need. Student A: Pulls out 3 fingers on their right hand and 3 on their left hand, making 6 fingers altogether. Both students record this using the _ and _ makes _ template from this unit's folder: 3 and 3 makes 6 (if the student is ready, also as): 3 + 3 = 6 Student B: Pulls out 2 fingers on their right hand and 4 on their left hand. Both students record in the template: 2 and 4 makes 6 The game continues until both players run out of ideas.  *Rule 1:* Students cannot repeat a combination that has already been recorded. *Rule 2:* Commutative (turnaround) rules are accepted. Student B proposed 2 fingers on the right hand and 4 on the left, student A can then propose 4 on the right and 2 on the left to make 6. This will encourage students to take advantage of these 'freebie' maths facts. The last player to propose an accurate combination wins – the last hands standing!

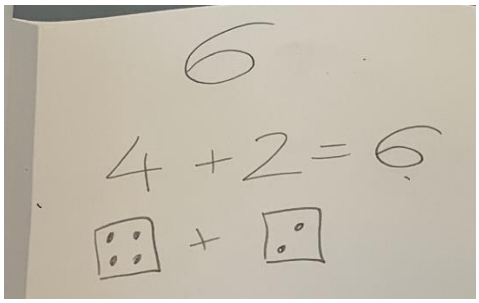
	Warm-up in action – all the ways to show 3    
Get Out of My House	Use the 0-12 Get out of My House gameboard from this unit's folder. Students play in pairs and roll two 6-sided dice. Player A has blue counters, player B has red. Aim to put your counter on as many numbers as possible. For example, if you roll 2 and 5, 2 + 5 = 7, so put your counter on 7 OR instead you can do 5 take away 2, 5 – 2 = 3, to put your counter on 3. Say 'get out of my house' if someone else's counter is on it – you can steal your partner's spots! The player with the most counters on the board when the teacher calls 'time up' wins. **Support:** 1 to 6 gameboard with students rolling 3-dot dice.

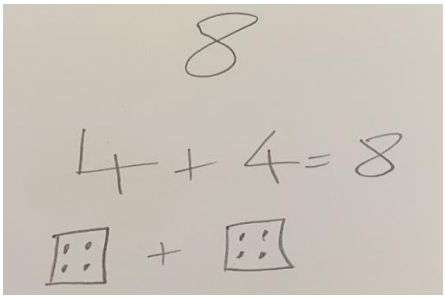
Dice Wars

A more strategic and advanced version of *Get out of my house*

Students compete in like-ability pairs using two 6-sided dice to try to create combinations that make their target number. Students choose a number between 2 and 12. Students choose a different number each, for example, player A chooses '6', player B chooses '10.' Fold/rule your page in half, writing your number on one side and your partner's on the other. If you or your partner makes your number with the rolled dice, write down how. Students can record using digits by writing 2 and 4 makes 6 (or, 2 + 4 = 6), or by drawing 2 dots in a square and 4 dots in a square to show how the dice looked, for students who are not ready to draw the digits.

Leave the choice of numbers (between 2 and 12) open-ended for students, to encourage them to create a strategy and observe results over the week. Tell students some choices are better than others – some numbers will come up more often than others. Students will start to notice that, when using two 6-sided dice, numbers like 5, 6 and 7 have many combinations, whereas totals like 2 or 12 are much rarer to score.





Rule: You cannot score a number just by rolling it – e.g. if your target number is '5' you can't just roll '5' and ignore the other die.

Variation: Students can also score their number using subtractions and multiplications. For example, student A is aiming to make 6. She rolls 8 and 2, so they instead create 6 using subtraction, 8 – 2 = 6. When using 6-sided dot dice, you can model subtractions with students literally covering the dots from the smaller rolled number on the larger dice with their finger.

Support: Roll 3-dot dice, choosing from numbers between 2 and 6.

Extension 1: Roll 10-sided dice, choosing from numbers between 0 and 18.

Extension 2: Use three 10-sided dice and divisions. For example, student B is aiming to make 10. She rolls 3 dice, for example: 5, 6 and 3. She could therefore create this equation: 5 x 6 ÷ 3 = 10

Set Up Recommendations

During this unit, many of the best set-up recommendations involve students working independently, following the teacher at-desk whole-class demonstration (fishbowl modelling). Fluently partitioning the numbers 3 to 9 can take considerable time and effort for students, which often means it is important for each student to be able to move at their own pace during these sessions, without being rushed by a more able partner for that particular number.

Formative Assessment – Oral and Ongoing

Students should begin at whichever number they cannot fluently partition (mentally, without materials). For example, ask Ernie, what are some ways to make 3? If Ernie says, '2 and 1, 3 and 0,' ask Ernie, what are some ways to make 4? If Ernie says, '2 and 2, 3 and 1, 1 and 3, 0 and 4,' ask about 5, until the student cannot fluently tell you the combinations that make that number. No materials should be given for this quick oral assessment. This is the most efficient and accurate way to assess a student's understanding of the ways to make the numbers 3 to 9.

Cross-check templates from the assessments folder can be used for quick recording and ongoing assessment throughout this unit. There is also a grid template.

Quick Exit Tickets

After each materials-based session, consolidate students' investigations and understanding for the final 5 minutes of the session, without the materials for support, using circle the parts exit tickets from this unit's folder. This is also a great time to carry out the formative cross-checks, while students are working independently.

Circle 5

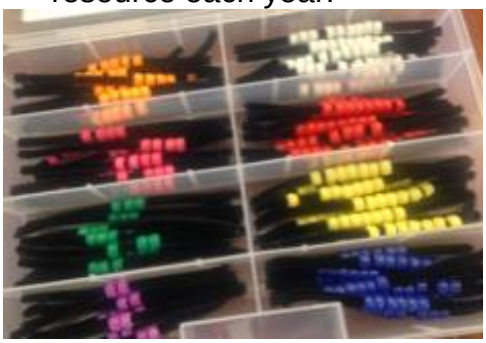
4	2	1	5	3	4
4	7	5	2	1	3
3	2	3	3	4	7
2	7	2	2	1	1
2	6	1	7	1	2
6	2	4	1	3	5
1	3	0	5	2	1
7	6	3	5	0	4
5	1	3	2	4	1
2	6	1	7	1	2
1	3	0	5	2	1

Circle 8

4	2	1	8	3	4
4	7	5	2	1	4
3	2	6	3	4	7
2	7	2	1	6	1
2	6	1	7	1	2
6	2	4	4	3	5
1	3	0	8	2	1
7	8	3	8	0	4
5	1	3	4	4	1
2	6	1	7	6	2
1	8	0	5	2	1

Students use coloured pencils to circle additions that make 5. For example, 4 and 1 (4 + 1 = 5). A mid-range extension is for students to circle 3 or 4 numbers that make 8, for exampe, 5 + 2 + 1. Extension students can use red pencil to circle subtractions, such as 7 and 2 (7 – 2 = 5), also recording their equations on an adjacent page in their maths books.

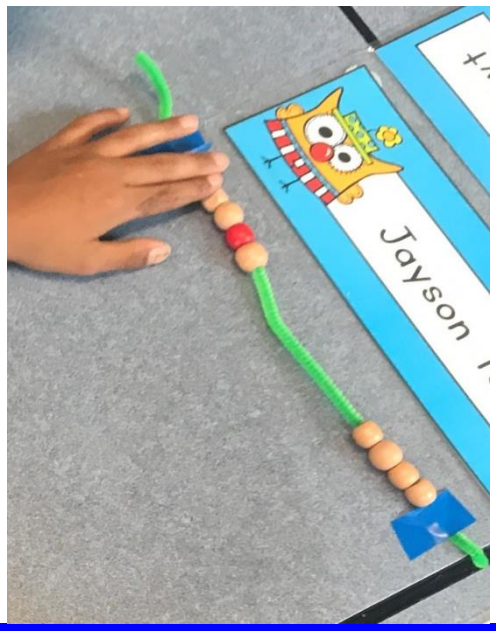
The following lessons introduce partitioning to students

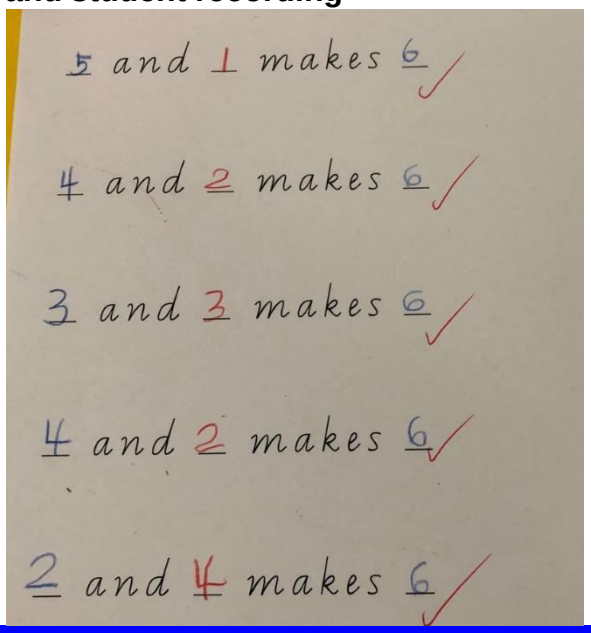
Partition Lesson 1	**Number Sliders** **Learning intention: Work out all the combinations or ways to make the same total.** **Maths vocabulary: ways to make (combinations), parts, total (all/altogether), turnaround (halfway turn, 180 degrees), left, right**
Crafts maths: Who likes arts and crafts? Today, we are doing arts and crafts maths! **The power of an idea:** Read about the *Beads for Wildlife Program*, run by Werribee Zoo, which has raised over one million dollars to support communities in Kenya and helped to save an endangered species of zebra at the same time: https://www.zoo.org.au/beads/#:~:text=Zoos%20Victoria%20is%20working%20with,artisans%20are%20paid%20each%20month	**Lesson summary: Students use a bead number slider to discover all the ways to break apart a number and make its total.** *Teacher note:* Partition means to break a number into parts (not necessarily equal parts). **Materials:** • Beads. • Pipe cleaners or dowel rods. Pipe cleaners are the easiest to source and can be sent home for continued practice as an expendable resource each year:   • _ and _ makes _ recording template from this unit's folder (stick and ball font also available). **Best set-up:** Model at a demonstration desk, then students work independently to be able to progress to each new total at their own pace. **Modelling:** Model your own example number slider, focusing on all the combinations you can discover that make one total. Put 5 beads on the slider. Push some to the **right** and some to the **left**. "4 and 1 makes 5." **Turnaround** the slider (a halfway turn or 180 degrees) so that now, "1 and 4 makes 5." That's the turnaround fact! Push the beads back to the centre and create another way or **combination** that makes 5 – "3 to the left, 2 to the right makes 5." Turn the slider around – "2 and 3 makes 5." Instruct students to make as many combinations as they can, before upgrading to a new total. Don't forget about 0! "0 and 5 makes 5." Turn it around: "5 and 0 makes 5." **Questioning:** • Can you make it another way? What's a new combination? • Can you see a pattern? 8 and 1 makes 9, 7 and 2 makes 9, 6 and 3 makes 9, 5 and 4 makes 9, 4 and 5 makes 9, 3 and 6 makes 9. Some students will describe this as: "I can see that every time one side loses a bead, the other has an extra bead, and it's still the same number/total." This is a great foundation for compensation strategies, used mostly for addition, subtraction and multiplication in years 3-6.

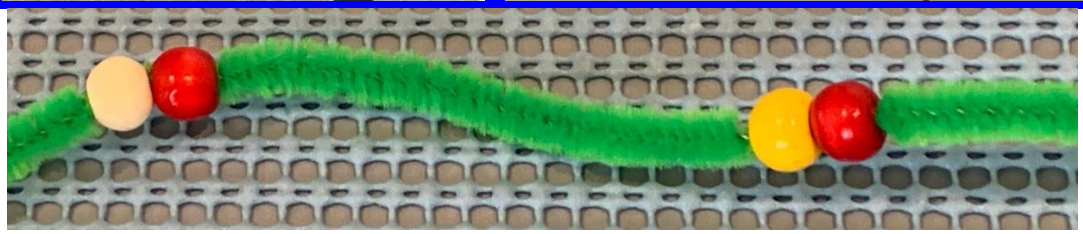
Home learning link: At the end of this series of sessions, allow students to take their bead number slider home, along with a copy of their best work. Students can continue to use the bead sliders at home to practise creating different combinations that make the same total.

Whole-class modelling: For extra visibility, at the start of the session model with sport balls, shifting these to either side of a long piece of string or rope. When fishbowl modelling, it is often beneficial to supersize your materials for extra visibility, but then model with students' materials so it looks the same as what they will be experiencing when they return to their desks.

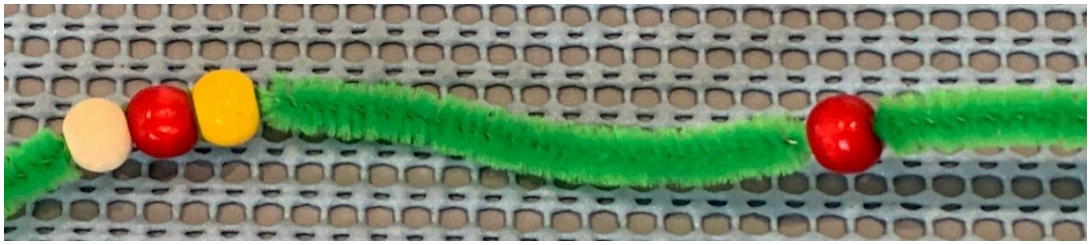
Lesson in action and student recording



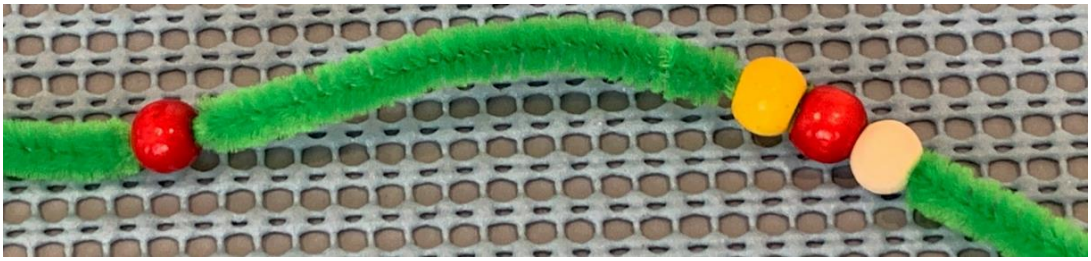




2 and 2 makes 4



3 and 1 makes 4



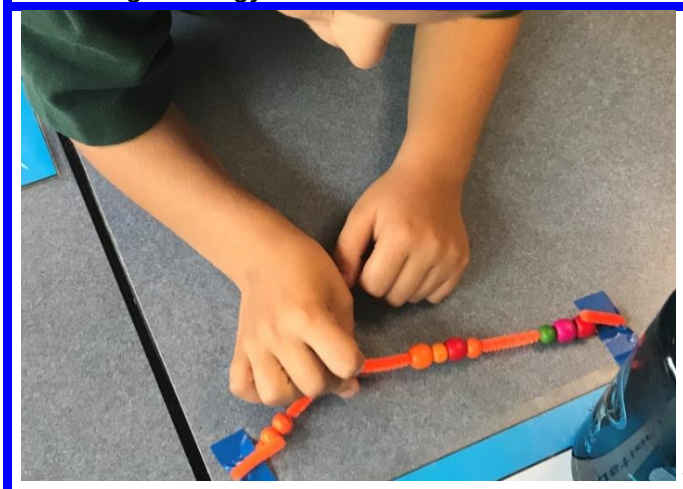
Turn it around (turnaround fact): 1 and 3 makes 4

Quick formative tip: Allocate students starting numbers based on their points-of-need, for example, support students might start with just 3 beads. Mid-level students can mostly start from 5, but will progress quite quickly as they find all the combinations that make each total and earn an extra bead.

Extension students may start with 8, but only if they can already tell you all the combinations that make 5, 6 and 7 fluently and without materials. As students begin, do a quick oral formative check on extension students: “Can you tell me all the ways to make 5?” If they cannot give all the combinations, start them at 5. “How can you make 6?” and so on, until there is a number that they cannot provide quick combinations for orally (without materials).

After students finish a number, having found all the ways to make it, add an extra bead to their slider and find all the ways to make the new total. Set this up as a video-game-style challenge – see what level/number you can reach by working hard throughout the lesson!

Support: If students cannot subitise (instantly see) the parts on either side, encourage them to count the beads one-by-one using the touch and say counting strategy. For this reason, make their starting total small (3 or 4).



3 + 4 + 1 + 2 = 10

Extension 1: Model breaking the number into 3 or 4 distinct parts along the length of the line, for example, 3 and 4 and 1 and 2 makes 10:

Extension 2: Model creating equal groups with the beads, for example, 2 and 2 and 2 makes 6, so 3 groups of 2 makes 6, or 3 twos makes 6

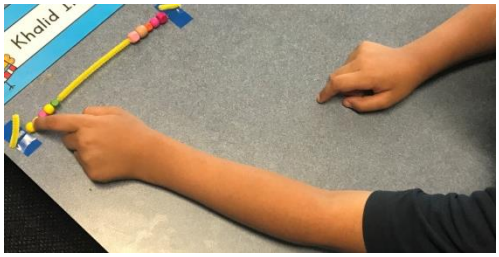
2 + 2 + 2 = 6 so 3 x 2 = 6 3 twos makes 6

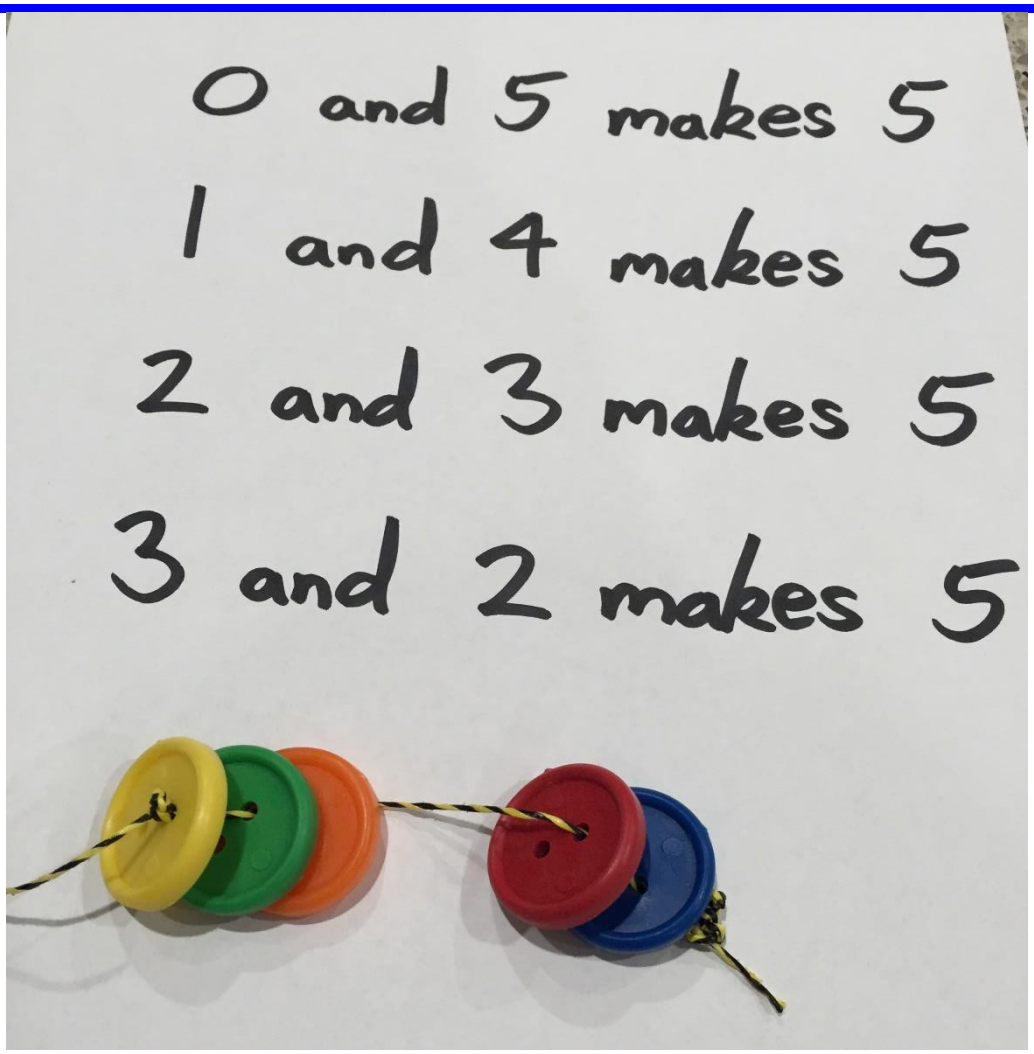
Extension 3: Use a few bead sliders at a time, all with equal totals, essentially creating arrays to practise the times tables:

3 groups of 7 makes 21, 3 x 7 = 21

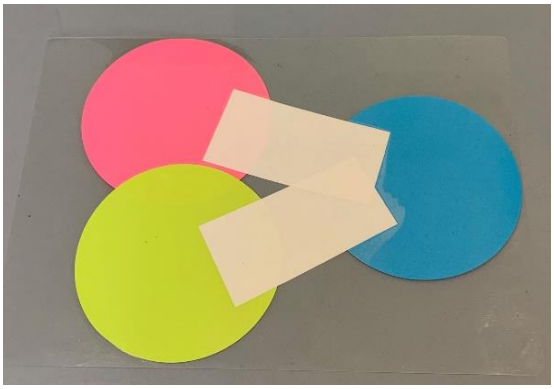
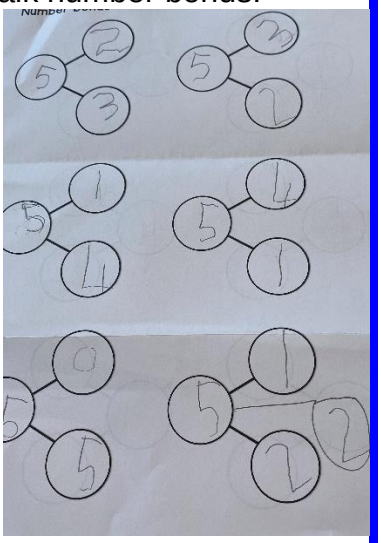
Think about the best strategy to solve it: double 7 and another 7 14 + 7 = 21

Lesson in action





Alternative material: Button sliders – all the ways to make 5. Students can turn these into bracelets and take them home to continue to practise. Once they can orally tell you all the ways to make the total on their bracelet (without wearing or using it), upgrade them by adding an extra button to their total.

Partition Lesson 2	**Number Bond Pinball** **Learning intention: Figure out all the ways to make different numbers** **Maths vocabulary: number bond, ways to make, combinations**
Link to students' interests – video games: Before video games were invented and everyone had their own PlayStation or X-box, arcade games were super popular. Number bonds are sort of like air hockey at the arcade, you flick numbers around like pucks and see where they land. In Japan (and now in Australia), there are some amazing air hockey tables that do not just stop at one puck at a	**Lesson summary: Students use number bonds (made from kinder circles) to play 'pinball' with their starting number, with some balls falling down and some going up.** Students repeat multiple times, aiming to create all the possible combinations to make their starting number. **Materials:** • Number bond laminated mats made from 3 kinder circles and a few slices of rectangular white paper:   • Buttons as the pinballs or pucks. Alternatively, pompoms or circular counters. • Number bond recording templates. • *For extension:* Fact family recording template. **Best set-up:** Fishbowl model, then students work independently. **Modelling:** Giant model using students with giant chalk number bonds:   Place the centre circle on the left and the two circles on the right. Put your starting number in the single circle on the left, for example, 5. Now push some buttons up and the rest down. How can you make 5? Record using the number bond recording templates.

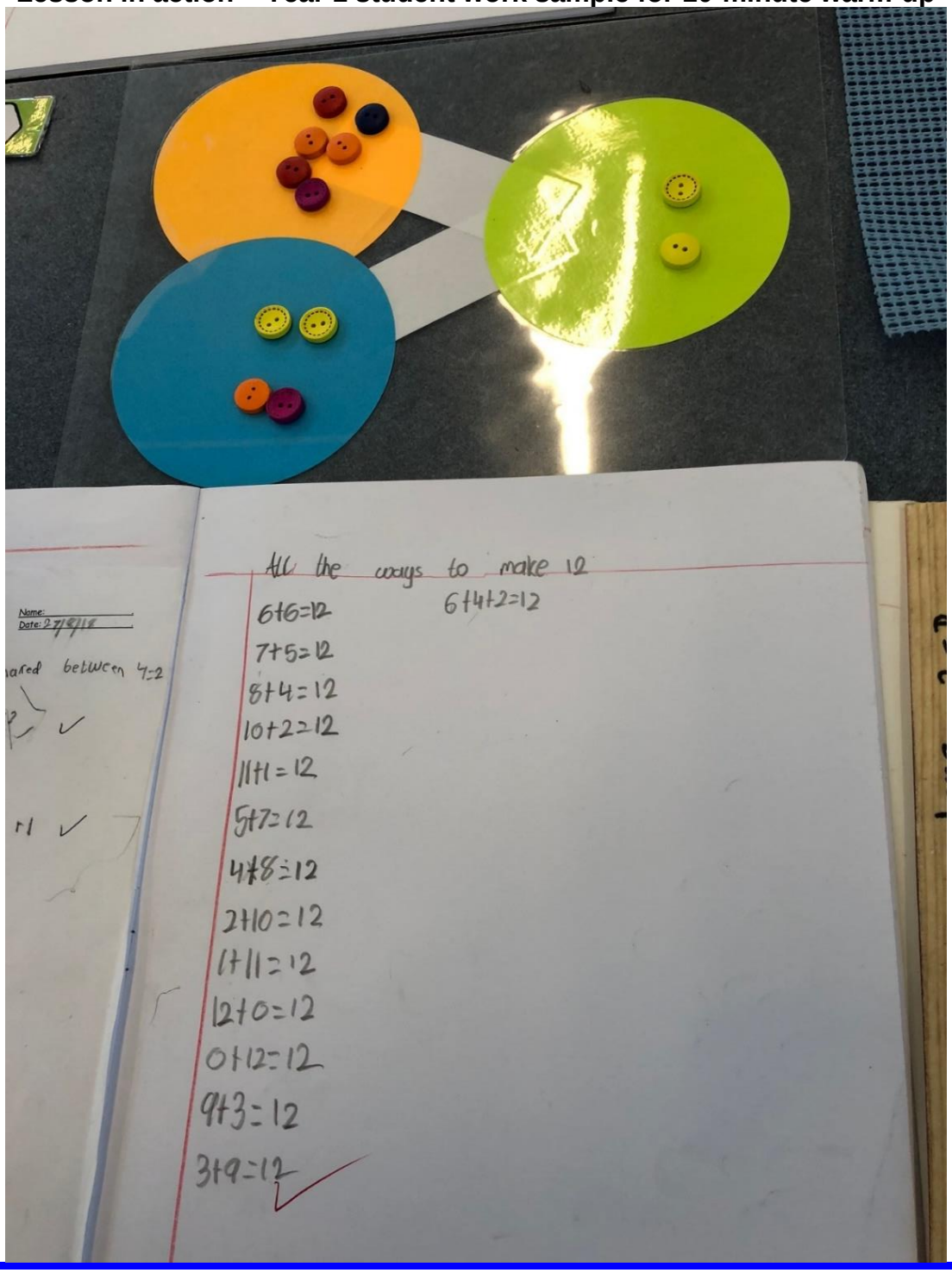
time: https://www.youtube.com/watch?v=GfGFKYzSKBc&ab_channel=JannixIV and https://www.youtube.com/watch?v=QKPXPHH8E7Q&ab_channel=ToesInTheSand2323

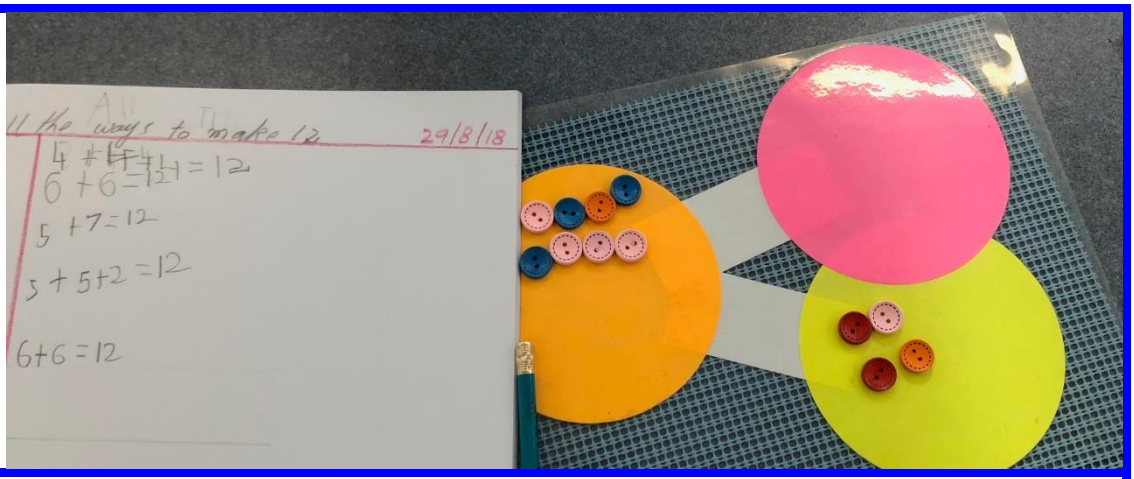
Link to students' interests – video and arcade games: One of the most popular arcade games was pinball, which is also similar to number bond mats. Play an online version with students here: https://toytheater.com/space-pinball/

Questioning:

- What patterns are you noticing? When you move a button from this side to this side, what happens to both sides? What happens to the total?
- As your starting total increases, are you finding more or less ways to make it? Do higher numbers have more combinations that make them?

Lesson in action – Year 1 student work sample for 10-minute warm-up





Support: Start with just 3 counters, working out the ways to make 3. Then progress to 4, and so on.

Extension: Record all 4 parts of the fact family:
Start from the right, with 2 and 3 in the two circles, then pushing them together:

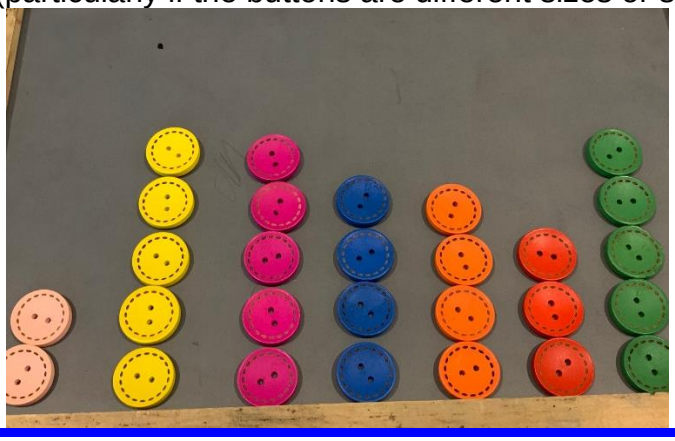
2 and 3 makes 5 2 + 3 = 5
3 and 2 makes 5 3 + 2 = 5

Start from the left, with 5 in the single circle, then pushing 2 away and seeing what is left:

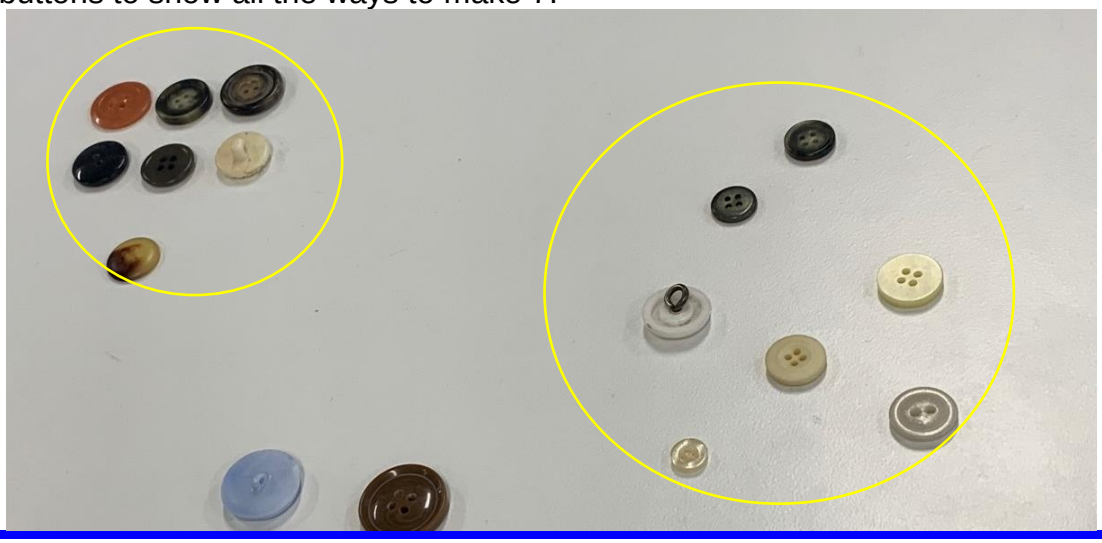
5 (in the centre circle) take away 2 leaves 3
5 – 2 = 3
5 (in the centre circle) take away 3 leaves 2
5 – 3 = 2

Use the recording template extension – fact family house from this unit's folder.

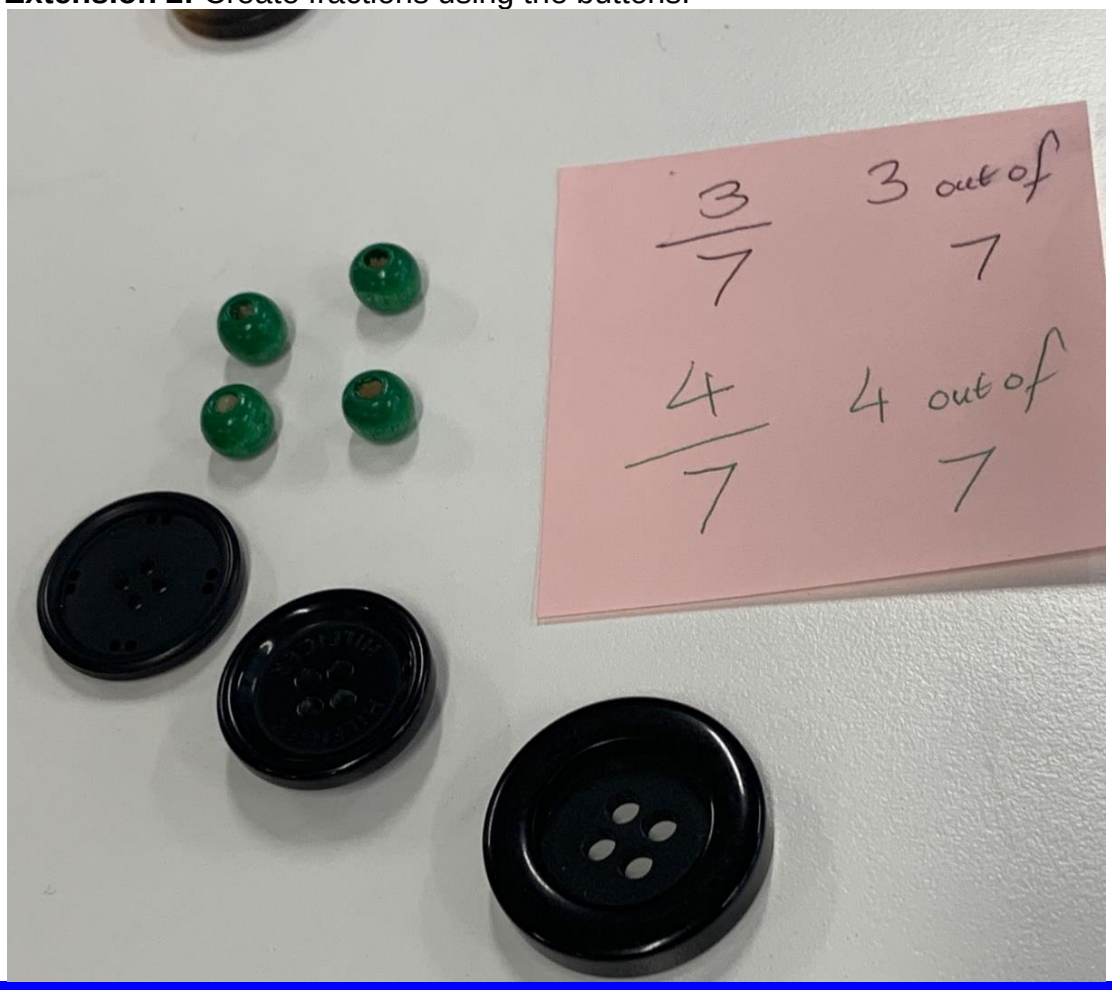
Cross-content link to graphing:
Create a pictograph using the colours of the buttons or any other categorization (particularly if the buttons are different sizes or shapes):



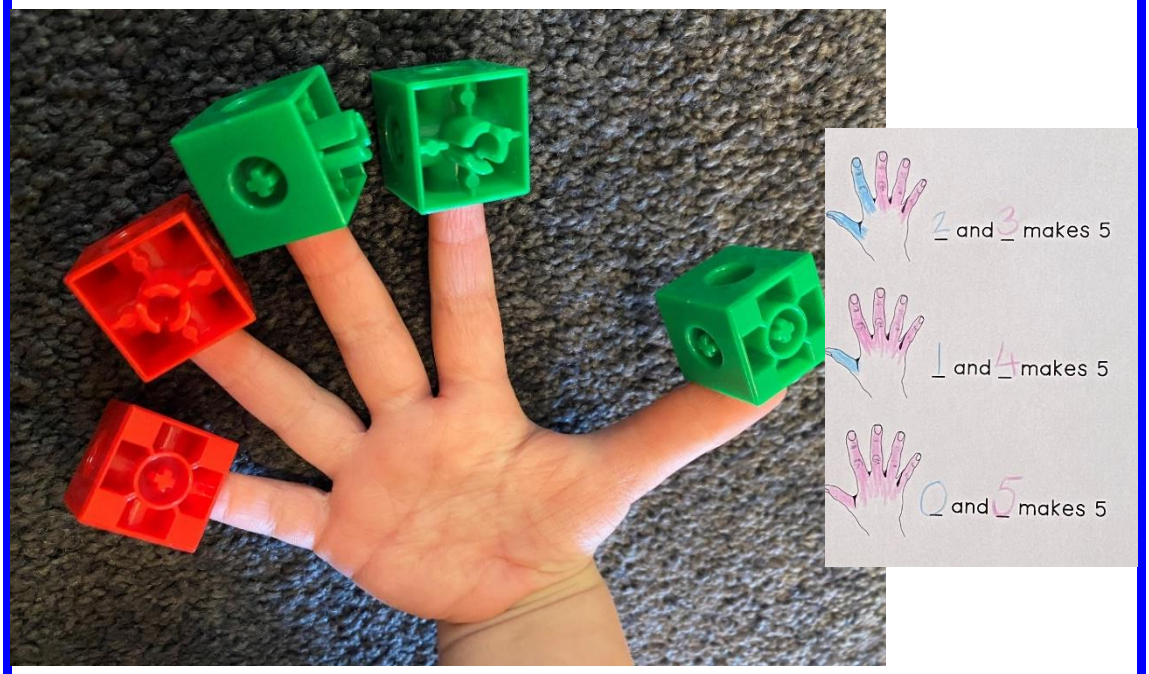
Students could also be asked to use a wide variety of shapes, sizes and colours of buttons to represent different numbers. For example, use the buttons to show all the ways to make 7:



Extension 2: Create fractions using the buttons:



The following lessons focus on ways to make 5

Partition Lesson 3	**5 Fingers!** **Learning intention: Figure out all the combinations that make 5** **Maths vocabulary: ways to make, combinations**
Excite the students: Throughout history, students have been using their fingers to do calculations. Let's see how some countries teach students maths using their fingers: https://www.news24.com/parent/learn/back-to-school/maths-finger-calculations-the-indian-way-20170227 Who likes doing maths with their fingers? Well, today your fingers are your materials!	**Lesson summary: Students put two colours of blocks on their fingers, figuring out all the ways to make 5.** **Materials:** • Blocks – 2 colours for each student. Up to 4 colours for extension. • Ways to make 5 recording template from this unit's folder. • For other numbers, students can use the _ is made of _ and _ recording template from this unit's folder. **Best set-up:** Fishbowl model, then students work independently. **Modelling:** Model all the ways to make 4 using your own fingers (4 cubes on 4 fingers) – don't model using 5, as all the answers would then be modelled for the students. **Lesson in action**  **Support:** After these students work out all the ways to make 5, try all the ways to make 4, then 3, then 2, going down by one finger each time. **Extension:** Use up to 4 colours, partitioning each number into 2, 3 or 4 parts. For example, 5 can be 3 blue + 1 yellow + 1 red. 5 can be 2 yellow + 1 red + 1 blue + 1 green. Use 6, then 7, then 8 of their fingers after they create all possible ways to make 5 using 3 or 4 colours. Record on a blank page of their maths book, using the '+' sign to mean 'and.'

Follow-on session: Fill two gloves with sand and investigate all the ways to make a number under 10 (allocate numbers based on student needs), such as all the ways to make 6, or combinations that make 7:

3 and 4 makes 7, 3 + 4 = 7

2 and 5 makes 7, 2 + 5 = 7

Switch the position of the left and right glove to make the turnaround fact for commutativity.

1 and 4 makes 5

0 and 5 makes 5

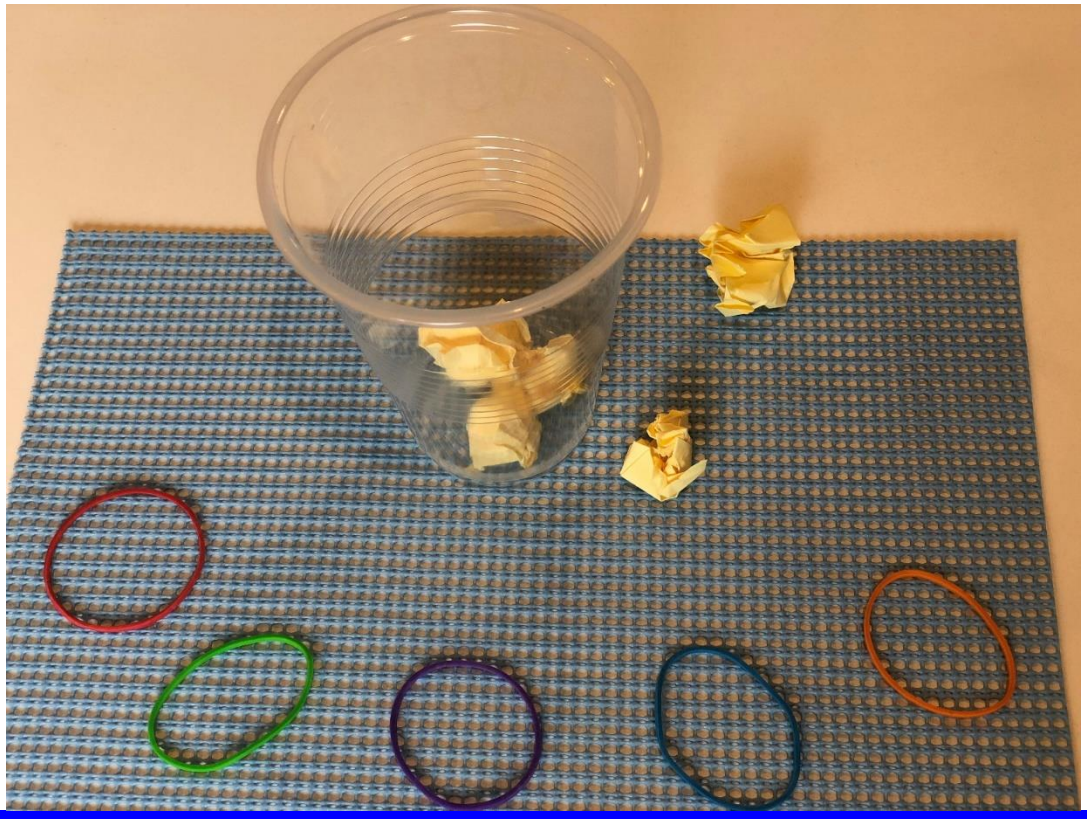
Support: For students who need more practice at ways to make 5, use the two gloves to show ways to make 5. Only progress to ways to make 6 or 7 once a student can orally and fluently tell you all the ways to make 5.

Extension: Work out different ways to make a number with 3 gloves, partitioning their total into 3 parts.

For example:

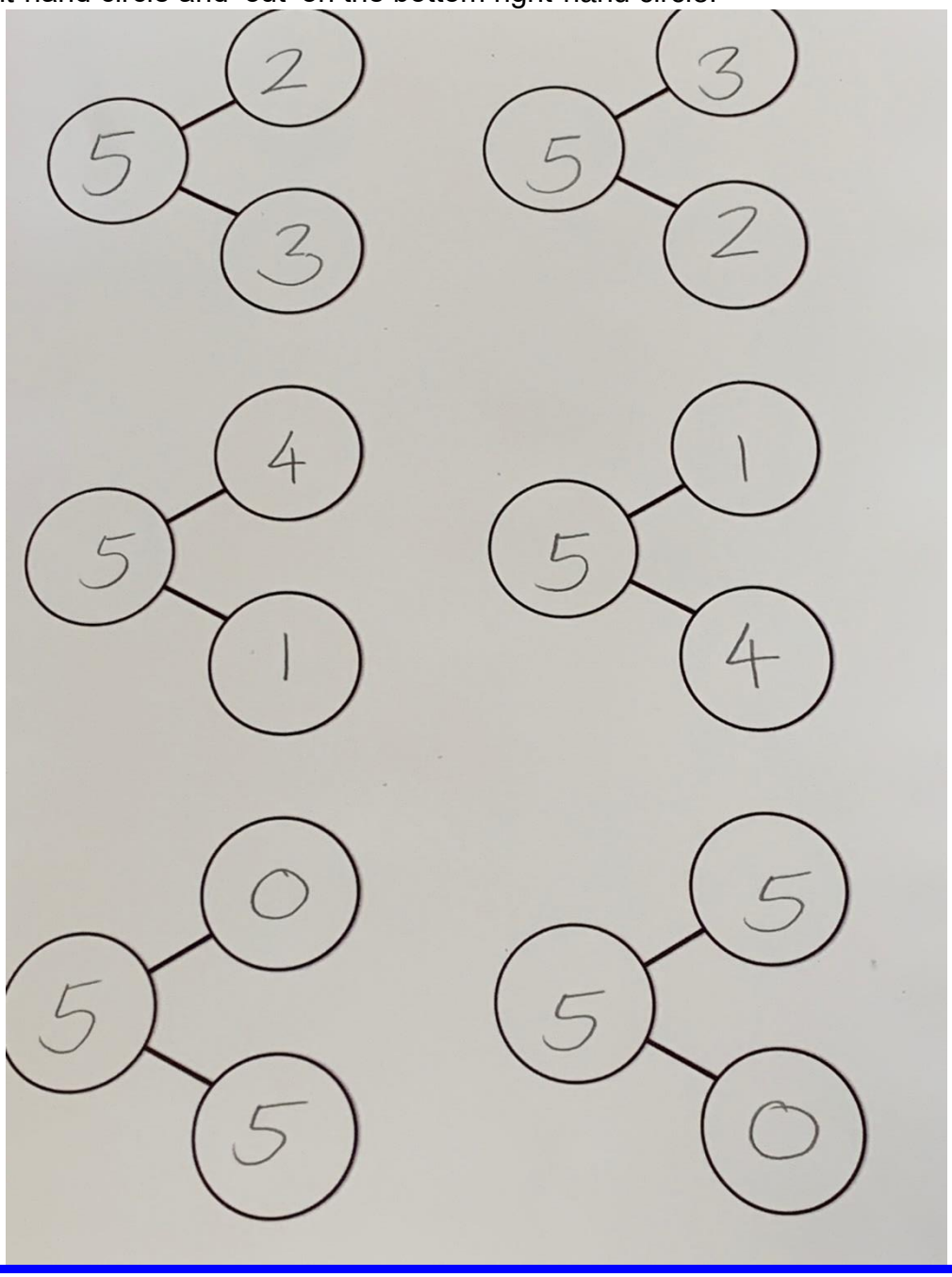
3 and 4 and 3 makes 10, 3 + 4 + 3 = 10

Brainstorm at least 20 different ways to make the same number.

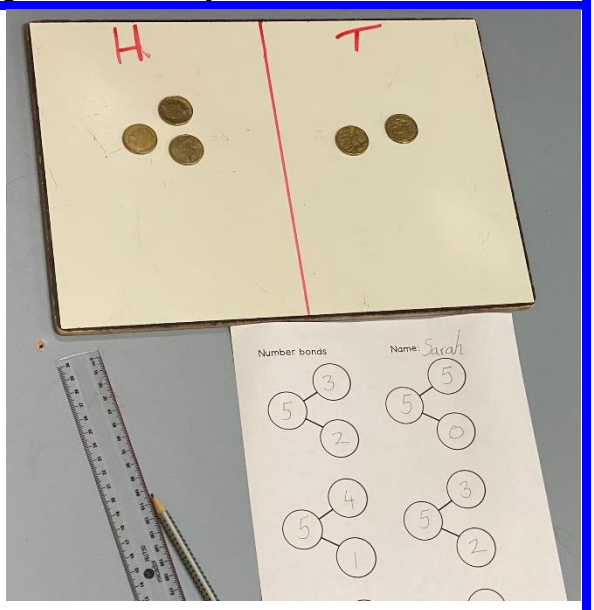
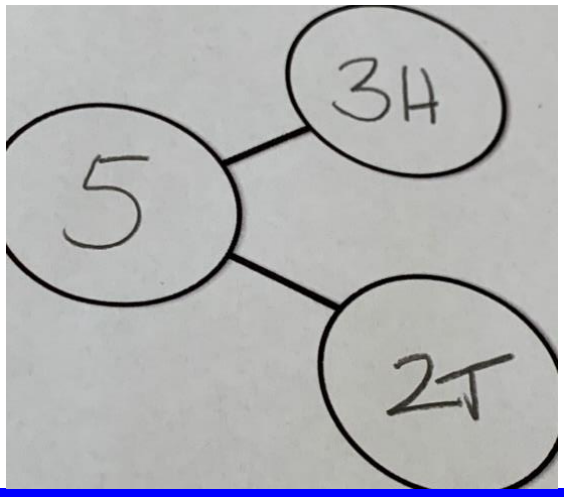
Partition Lesson 4	**Basketball Shootout** **Learning intention: Figure out all the combinations that total to 5** **Maths vocabulary: ways to make, combinations, total**
YouTube clip: Who likes basketball? Show students these clips of the longest ever basketball goals (just watch the first 2 minutes because it is a very long clip): https://www.youtube.com/watch?v=Kjwn5KzY4V0&ab_channel=SavageBrickSports and the best slam dunks of all time https://www.youtube.com/watch?v=zhvn2-c9BjA. Today we're doing basketball maths!	**Lesson summary: Students start with 5 basketballs (scrunched post-it notes) and shoot at a hoop (cup), recording the different combinations of ins-outs each time.** **Materials:** • Scrunched up post-it notes. • Cups. • Grip mats. • Rubber bands to show the starting number of basketballs (reminding students of their overall total). • Number bond recording templates from this unit's folder. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Lesson in action**  **Modelling:** Model with 6 basketballs (scrunched up post-it notes). Place 6 rubber bands on your mat – this is your total number of shots. Act out and record all the ways the shots could go – 4 in 2 out, 3 in 3 out, 6 in 0 out, 0 in 6 out. Emphasise that, if students continue to get many of the same combination (for example, 3 in 3 out), just 'cheat' and create a different combination, which avoids them becoming stuck on one level.

Set the challenge up as a video basketball game-style lesson – who can reach the highest level possible and improve the most from their starting total. For example, if you finish all the ways to make 6, you get to 7. How many levels can you conquer before time is up and the buzzer goes?

Record using the number bond recording templates, writing ‘in’ on the upper right-hand circle and ‘out’ on the bottom right-hand circle:

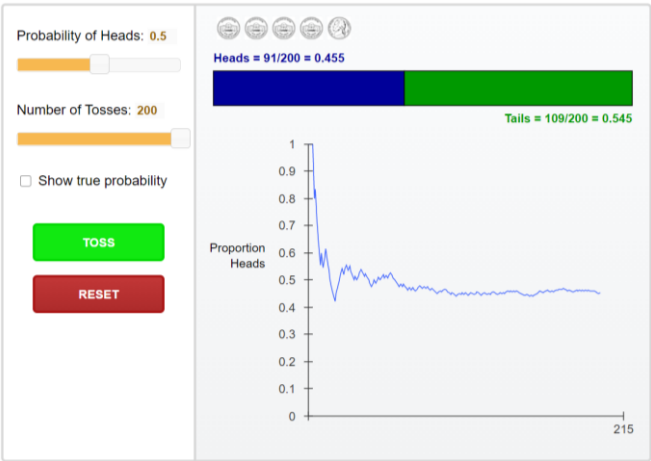


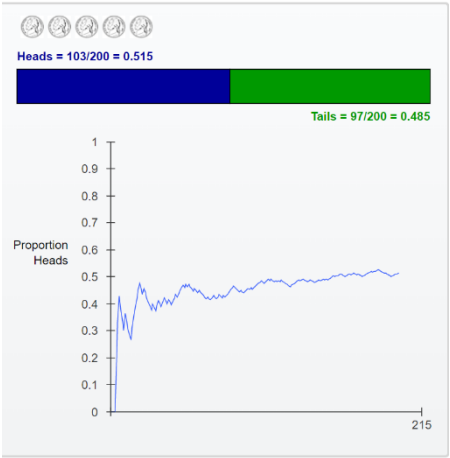
Support/Extension: Assign starting totals of basketballs based on students’ points-of-need – the number which they cannot orally and fluently partition is their starting number.

Partition Lesson 5	**Heads v. Tails** **Learning intention: Figure out all the combinations that make 5** **Maths vocabulary: probability, chance, luck, random, tally marks**
Big question: Who thinks coins have brains? Do they decide when they will land on heads or tails, or is it just chance? Use this interactive to do a tally out of 10 flips at least 3 times with the class. Students could tally the results on a mini whiteboard for each round: https://justflipacoin.com/?c=blue Record the final result: 3H 7T and as a fraction each time: $\frac{3}{10}$ H $\frac{7}{10}$ T	**Lesson summary: Students flip a coin 5 times, recording the different numbers of heads and tails out of a total of 5 flips. Students repeat the experiment many times, recording the different heads and tails combinations that can make 5. During the game, consider whether the coins has a brain, or whether the results are just chance/luck/random.** **Materials:** • Coins – one per pair. • Number bond recording template from this unit's folder. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Modelling:** Model the difference between heads and tails, by Google images searching each Australian coin type and zooming in on the heads and tails sides. Most students will not automatically know which side is heads and which is tails. Partner A writes down H I T on a mini whiteboard and flips 5 coins. Partner B records the total number of flips using tally marks. Use the rhyme 'One, two, three, four, at five your close the door!' Partner B says stop when the tally reaches 5.  Both students record the outcome using the number bond templates:  

Questioning:

- Does the coin have a side it likes best, or is it just chance/random/luck? Use this online simulator (keeping the chance of 'heads' set to 0.5), and ask students to predict how many heads and tails there will be based on different total flips you select as a class: http://digitalfirst.bfwpub.com/stats_applet/stats_applet_10_prob.html





For round 1, students chose to do 200 flips, and 91 were heads, while 109 were tails. For round 2, the result was 103 heads and 97 tails.

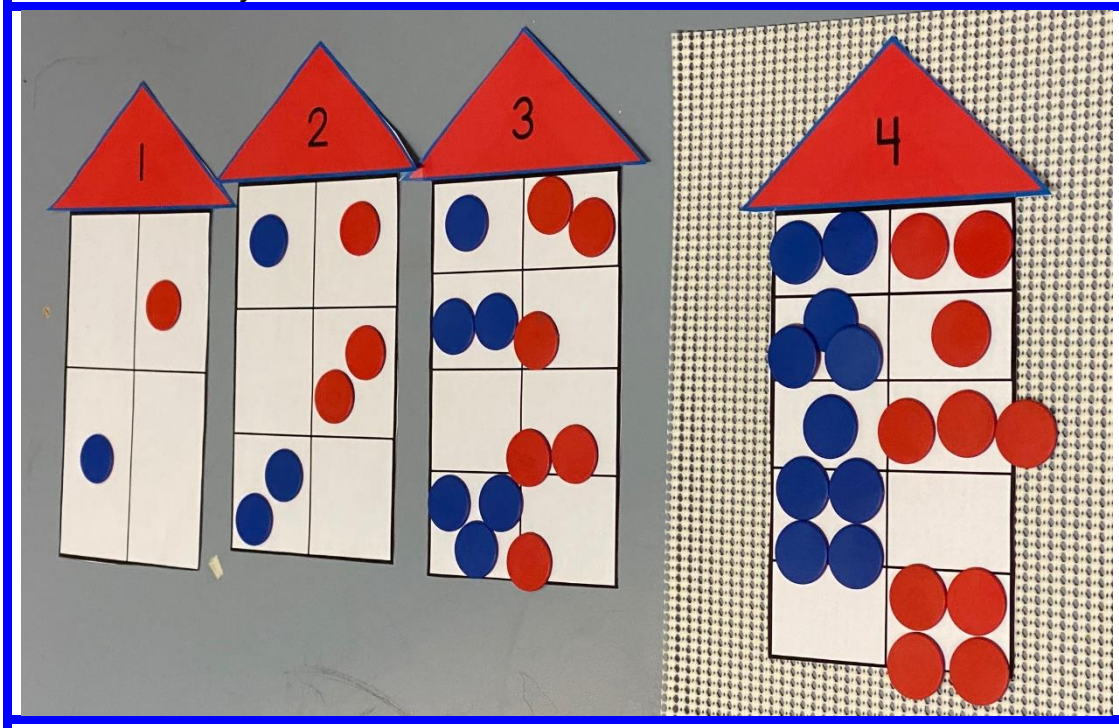
End-of-session reflection: Discuss the chance of heads vs. tails, emphasising the even or fair nature of the coin toss. It is a 50/50 chance. If we all did 100 flips, most of us would come close to 50H, 50 T. Try it, with students crossing off tosses on a 1-100 chart as their partner flips the coin. How many heads and how many tails did you get out of 100 flips? Go around the class and show students the evenness and consistency of the results, even when spread across many different teams.

Support: Begin with 3 coins, later 4, then 5, revising how to partition the smaller numbers first.

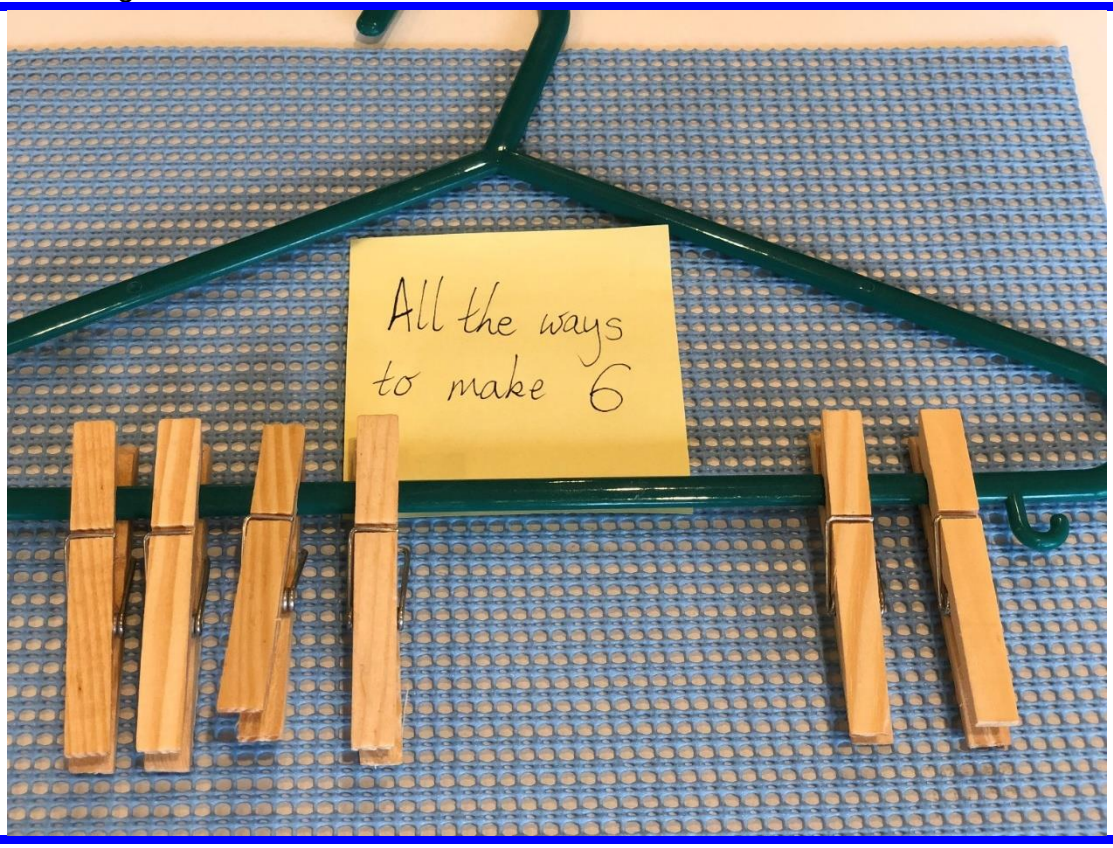
Extension: Also record using fractions to show the proportion of heads versus tails for each turn. For example, H H T H H would be 4/5 H and 1/5 T reading this as '4 out of 5 heads' and '1 out of 5 tails.'

$\frac{4}{5}$ H $\quad$ $\frac{1}{5}$ T

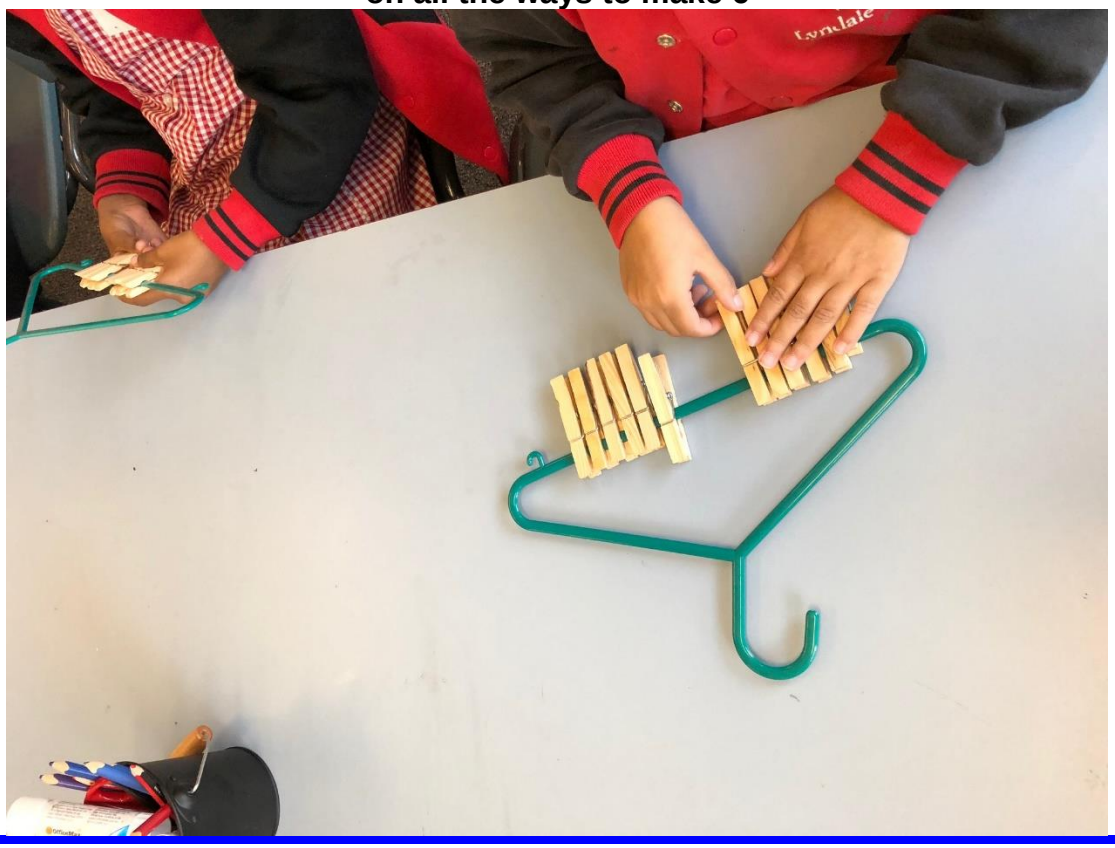
Always record fractions as a straight line, with numbers on the bottom and on top, rather than using a slanted / line. Extension students could use the fractions basketball recording template.

Partition Lesson 6	**Number Houses – revising partitioning the numbers 1 to 5** **Learning intention: Figure out all the ways to make the numbers 1 to 5** **Maths vocabulary: ways to make, combinations, total**
YouTube hook: Show students this compilation of some of the world's coolest houses: https://www.domain.com.au/news/our-list-of-the-coolest-houses-from-around-the-world-20160918-grgtj8/.	**Lesson summary: Students make number houses, working out or revising all the ways to make the numbers 1 to 5.** **Materials:** • Number houses templates from this unit's folder. • Counters – keep the size of the counters fairly small and sufficient quantities so that students can keep the counters on their house in one row, while finding another way to make the same total using more counters on the next row. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Modelling:** Model making your own version using a house of 6 as a giant modelled example, which could then be displayed on your numeracy wall. Students then try to make the houses for the numbers 1 to 5 as in the photograph. Don't forget about combinations that involve zero! **Questioning:** • Which number from 1 to 5 has the most combinations? Which has the least? Why is this?  **Extension:** Use A3 paper and work out all the ways to make the teen numbers 11 to 15, making their own giant number houses for these totals.

The following lessons focus on ways to make 6

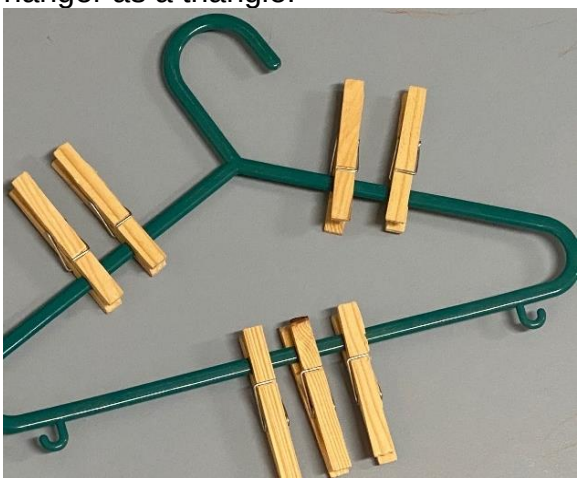
Partition Lesson 7	**Birds on the Wire** **Learning intention: Figure out all the ways to make 6** **Maths vocabulary: turnaround, ways to make, combinations**
YouTube clip: Birds on the wire Pixar animation clip https://www.youtube.com/watch?v=k2PJ6T7U2eU. Now you get to make your own birds on the wire for maths!	**Lesson summary: Students work out all the ways their 6 birds could sit on a wire.** **Materials:** • Coat hanger as the wire. • Pegs as the birds. • Number bond template for recording. Students can also write the matching addition number sentences beside these if capable: 4 + 5 = 9 **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Modelling:** Model using a different total (to avoid giving students the answers), such as by using 9 birds on your modelling coat hanger. Start with 9 pegs/birds in the middle. Push 4 to the left, 5 to the right. Record using the number bond template, with 9 in the left-hand circle, 4 on the top and 5 on the bottom. Alternatively, record using the _ and _ makes _ or _ is made of _ and _ templates, whichever your students prefer. Emphasise the **turnaround** – dramatically flip the coat hanger to find the matching turnaround fact. 5 and 4 makes 9 as well! 

Lesson in action with the student on the right-hand side working on all the ways to make 12, while the student on the left-hand side is working on all the ways to make 6

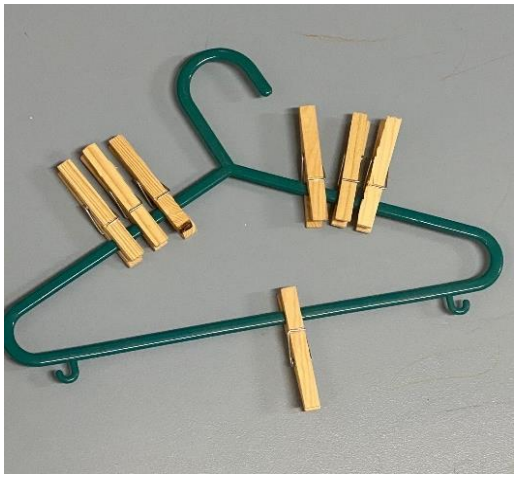


Support: After students complete 6, reduce the birds to 4 and 5 to build fluency at partitioning these smaller numbers (if they cannot orally tell you all the combinations that make those numbers).

Extension 1: Partition their total into 3 parts using the 3 sides of the coat hanger as a triangle:

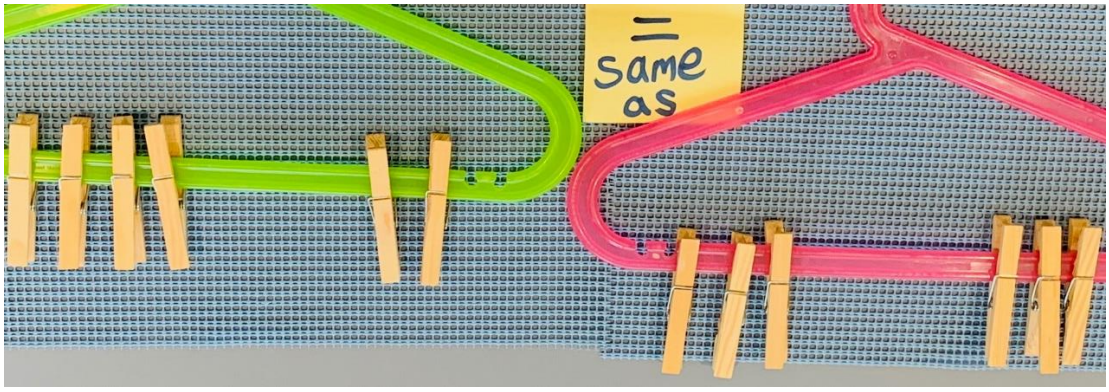


3 and 2 and 2 makes 7, 3 + 2 + 2 = 7



double 3 and 1 makes 7, 2 x 3 + 1 = 7

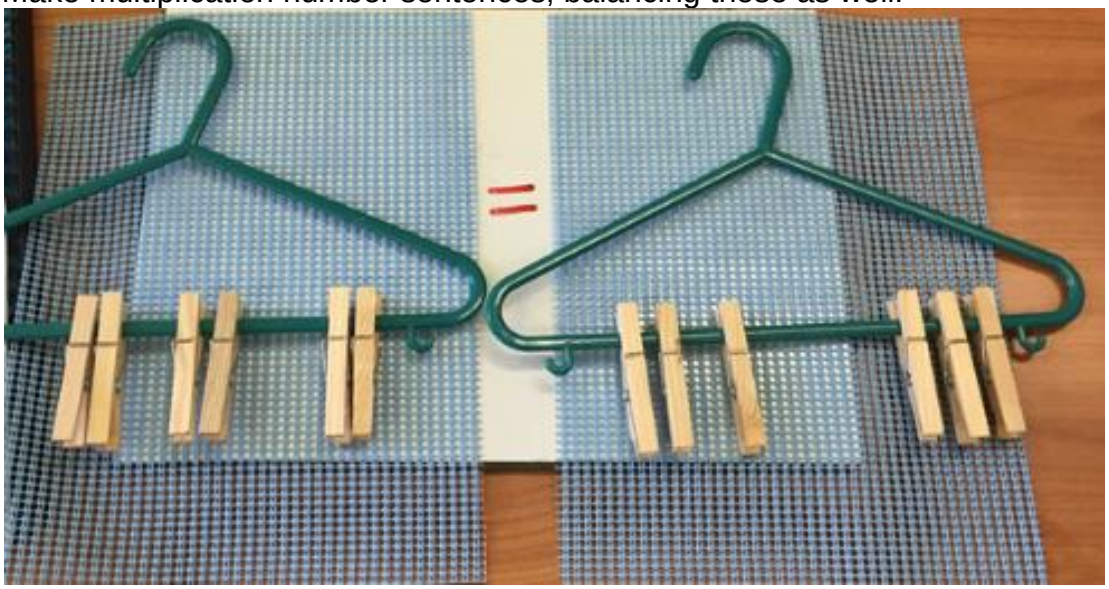
Extension 2: Work with a like-ability partner to balance equations. For example, 2 + 4 makes 6 on my coat hanger, which is the same as 3 + 3 makes 6 on your coat hanger.



4 + 2 = 3 + 3

Read the equal sign to mean 'same as.' Emphasise that students must have the same total of pegs on both of their coat hangers/wires, but then can push their pegs/birds to either side in different amounts.

Make multiplication number sentences, balancing these as well:

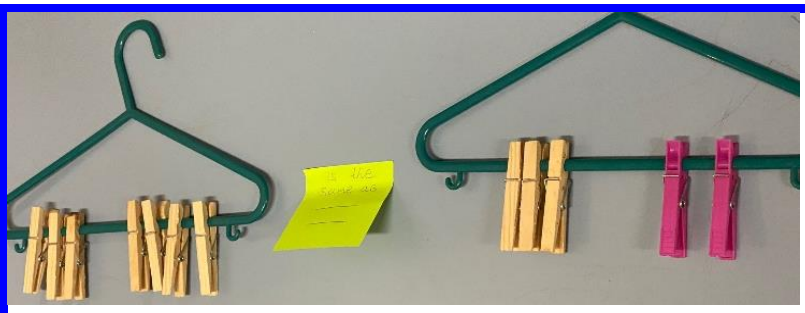


3 groups of 2 = 2 groups of 3

3 x 2 = 2 x 3

Extension 3: Make a 'mystery bird' using a coloured peg. Like in the YouTube clip, this one 'mystery bird' is worth more. Essentially it weighs more because it is a different size, like the main character in the clip. Figure out the weight of this mystery bird, using it as a mystery number or unknown – the beginnings of algebra. What will the mystery bird need to be worth to balance the equation? Next, what if there were two mystery birds?

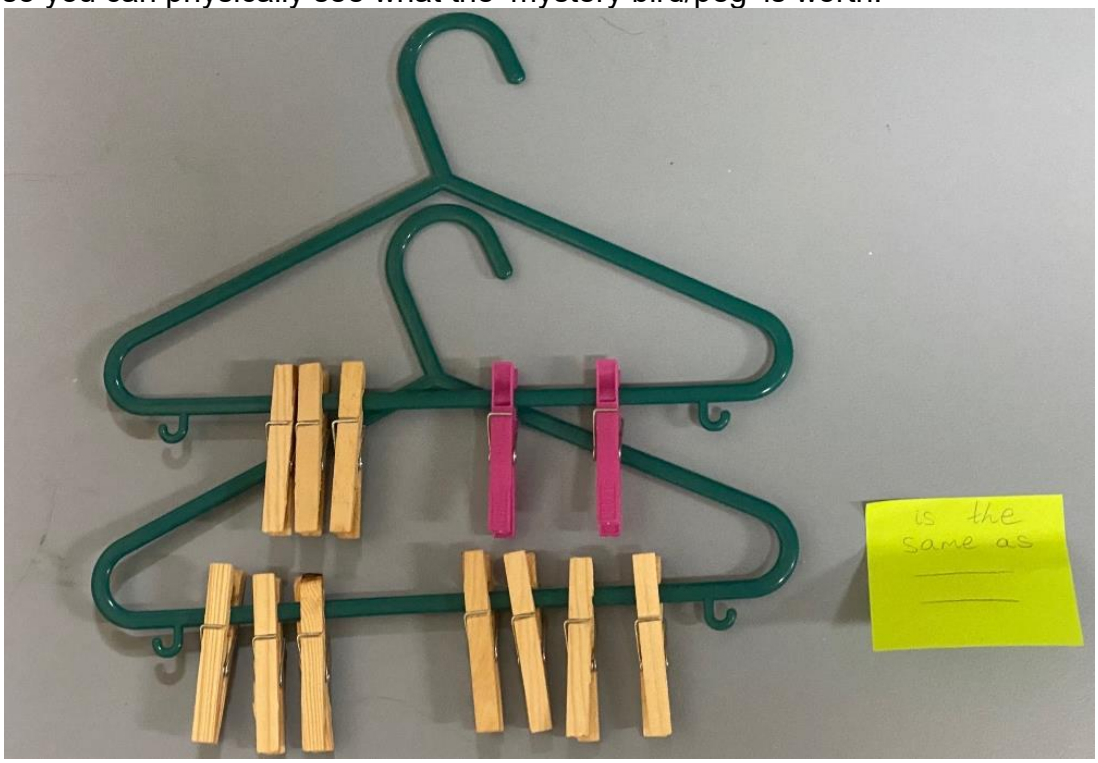
See the next page for worked examples.



3 + 4 = 3 + 2M
(2 mystery birds)

What is a mystery bird (M) worth?

To solve the mystery bird, arrange the other coat hanger so the same number of pegs are on one side, then move it across to the mystery bird coat hanger, so you can physically see what the 'mystery bird/peg' is worth:

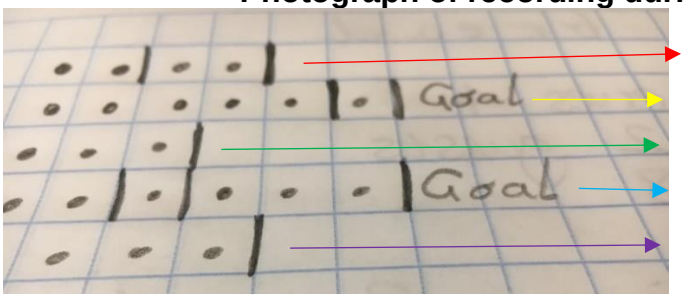


Each mystery bird is worth 2,
because 3 + 2 + 2 = 3 + 4
7 = 7

More advanced recording:

3 + M + M = 3 + 4
take away 3 pegs (-3) from both sides
M + M = 4
2 x M = 4 or 2M = 4
M = 2 (4 shared between 2)

When the mystery birds are each worth 2, the equations are balanced.

Partition Lesson 8	**Roll a Goal!** **Learning intention: Work out all the ways to make 6, including breaking it into more than two parts** **Maths vocabulary: parts, ways to make, combinations, total**
Hook: Have you ever wanted to score the winning goal after the siren on Grand Final day? Well, today our maths session is all about AFL goals. How many points do you get if you kick a goal in AFL? 6! Right, so you are going to be aiming to roll 6 as often as possible. BUT this is not just a game of luck/chance, because you can try to combine your rolls to make 6, and in that way score more goals than your partner!	**Lesson summary: Students roll a 6-sided die, aiming to make groups of 6 to score 'goals,' keeping track using 1cm² grids.**
	Materials: • 6-sided dice. • Grid paper to draw their score as they play, with each dot taking up a grid to provide structure for students' working out. **Best set-up:** Fishbowl model, then regular like-ability maths buddies.
	Modelling: Aim for a total of 6 dots in each row – you cannot go over 6, because once you have a total of 6, you have scored that goal! With each roll, students choose which row to add this to and draw the dots. Draw a line to separate this from the next roll. After they have scored 6 in total, students can record the matching addition sentence beside each row. Emphasise that students can start a new row of dots or continue from the dots they already have, aiming to create as many lots of 6 dots (goals) as they can before the 'siren.' 10 minute countdown: https://www.youtube.com/watch?v=4ASKMcdCc3g&ab_channel=AdamEschborn Allow students to break apart any rolled number and use it flexibly. For example, if you roll 5, you can break it into 2 and 3, adding the 2 to one row and the 3 to another row. **Questioning:** Roam the room, asking students what number they hope to roll next. Students must discuss this with their partner before each roll.
	Photograph of recording during the game  2 + 2 + __ 5 + 1 = 6 3 + __ 2 + 1 + 3 = 6 4 + __
	Extension 1: Aim for 'super goals' – a total of 9 points.
	Extension 2: Use 6 as a target number. Instead of drawing dots, write number equations that total to 6, rolling five 6-sided dice for the numbers they can use in their equations. Provide double points for equations that use division or subtraction (quadruple if both ÷ and - are used). For example, 5 x 6 ÷ 6 + 1 = 6 (6 points but used division so doubles to 12 points)

Extension 3 – very advanced extension: Change the game to 'Roll a Whole,' making the rolled numbers on the dice into fractions. Roll 3 or 4 dice, then use 2 of them to make a fraction for each turn.

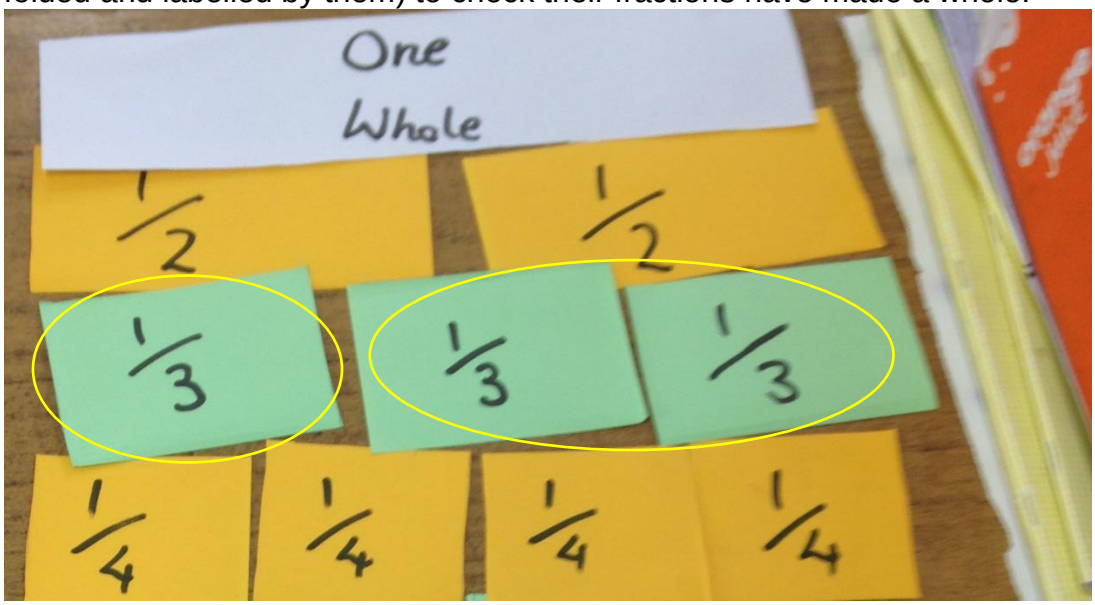
For example, the student rolled 1, 3 and 4. They chose to make:

$$\frac{1}{3}$$

Next turn, they rolled 3, 5 and 2, so they could do this with the 2 and 3:

$$\frac{1}{3} + \frac{2}{3} = \frac{3}{3} \text{ or 1 whole (goal!)}$$

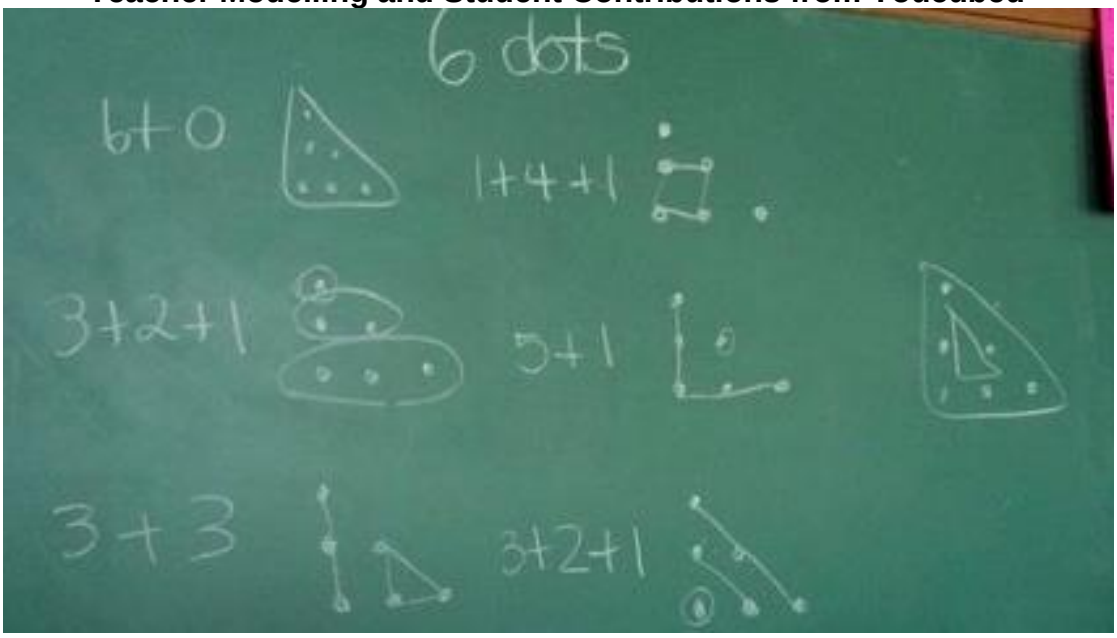
Students could be using a fraction wall made from folded strips of paper (pre-sliced from A4 paper in advance, to reduce cutting and pasting time, but folded and labelled by them) to check their fractions have made a whole.



Require that extension students have at least two fractions in each goal they score (you cannot just roll 3/3 and score it as a goal).

Extension questioning:

- Will $\frac{2}{4} + \frac{1}{2}$ score a goal? How?
- What will 1/3 + 1/2 make? Will it make 2/6? Ensure students have a line of sixths also made. Lay out $\frac{1}{3} + \frac{1}{2}$ on the top row, and $\frac{2}{6}$ on the bottom of it. No! $\frac{1}{3} + \frac{1}{2}$ is much larger than $\frac{2}{6}$. Challenge students to come up with a way to add the two fractions. What is $\frac{1}{2}$ worth in sixths? What is $\frac{1}{3}$ worth in sixths? So, how many sixths will it be?

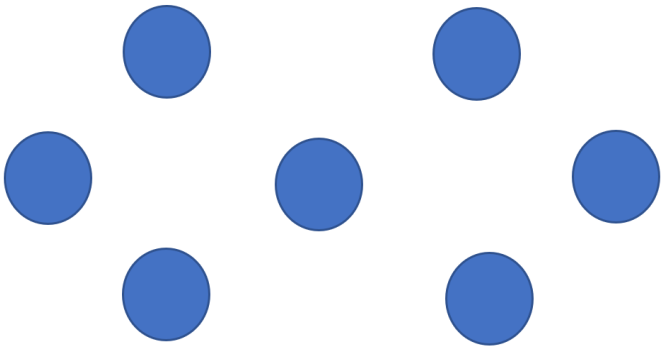
Partition Lesson 9	**Youcubed 6 Dots** **Learning intention: Identify all the ways to make 6, including breaking it into more than two parts** **Maths vocabulary: parts, ways to make, combinations, total**
Indigenous studies link: Show students dot paintings using this link. Also show students these websites that explain dot paintings and their significance to Aboriginal culture link and https://www.aboriginal-art-australia.com/aboriginal-art-library/the-story-of-aboriginal-art/.	**Lesson summary: Students use 6 dots that are arranged in a triangular format, as shown in the photo and available in the template, then circle these to create many different combinations that total to 6.** **Materials:** • Coloured pencils. 6 dots template – print one but double-sided (so 2 pages) for each student. There is also, on the pages that follow within this template, **4, 5, 7, 8, 9 and 10 dot templates** (also print double-sided for each student so they have two pages of each). This is ideally delivered as a lesson for the 4, 5 and 6 template within the one session, then as a follow-up warm-up for other templates, one per day. **Best set-up:** Front-of-room whiteboard model, then students work independently. **Modelling:** Model by brainstorming using the example of 6 as a whole-class. What are all the ways to see 6, or break it into parts? Invite students to approach the board and show their own way. Use a different coloured marker for each student and record their name beside their thinking. **Questioning:** What are all the ways to make 6? What combinations make 6? Did you think, before this lesson, there were so many ways to make 6? **Extra open-ended challenge:** Design your own template for 7 dots, drawing it at least 7 times on post-it notes, then swap these with a partner. Arrange the 7 so that it can be seen in as many ways as possible. **Teacher Modelling and Student Contributions from Youcubed**  *Source: Jo Boaler, https://www.youcubed.org/.*

Support: Use 5 dots, then 4, then 3.

Extension: Find a way to draw a teen number of dots, such as 17. Break it into all the ways you can see these dots.

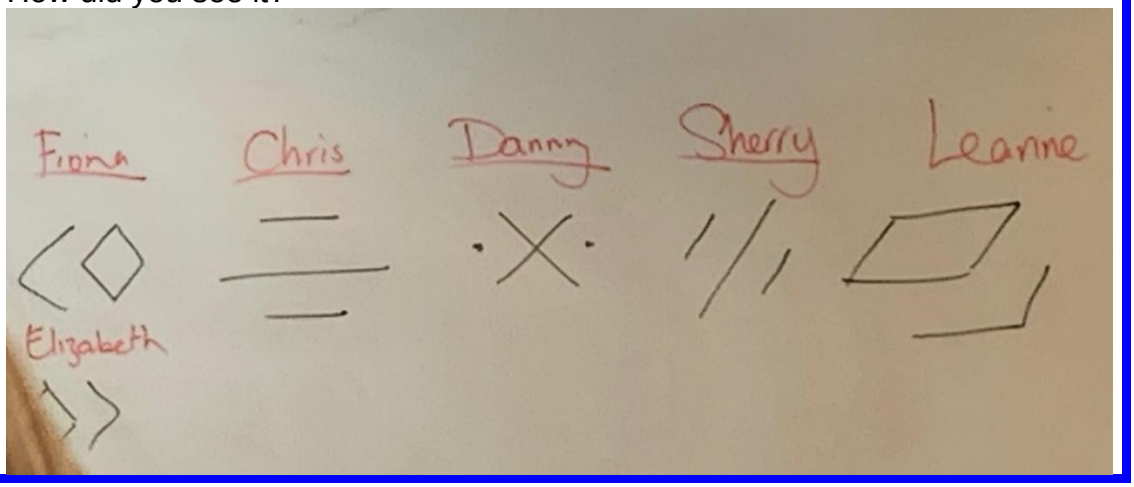
Variation or Follow-on warm-ups: Subitising PowerPoint with Dots
This lesson is also sometimes referred to as 'Dot Talks,' a subset of number talks. Number talks class procedures are explained within the final lesson of this unit. The teacher flashes a number of dots on a screen, then students explain how they saw it. The teacher records each student's name and how they saw it on the board, using lines and dots (lines for the group of dots they saw together and dots for any extras they saw individually).

Flash on screen for approximately two seconds:

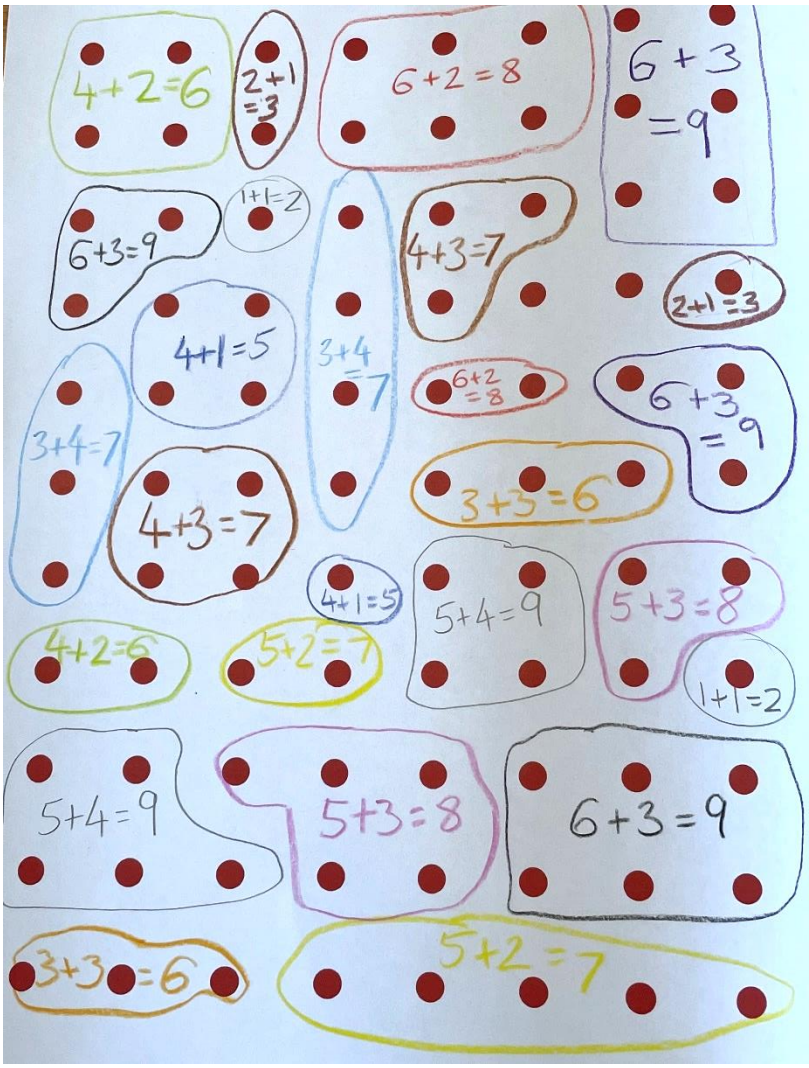


Subitising PowerPoint with Dots in this unit's folder.

How did you see it?



Follow-on game: Students compete to earn as many dots as possible. Students roll a 10-sided die, which will produce a number such as '5.' However, students cannot simply score 5 by circling around 5 dots. They must break 5 into two parts, circling around each part with a coloured pencil. The two parts cannot border one another. Students then score 5 points in their tally (since they rolled '5'). Use a different coloured pencil for each roll, and write the total in each circled part so their partner and the teacher can check their work as the game progresses (as shown in the student work sample). The player with the most dots, once the board is full, wins!



Template in this unit's folder

Support: Roll a 6-sided dice and break up that total into two parts (for example, 4 into 3 and 1. Keep track of their running total using a calculator, rather than tally marks.

More support: Roll the 6-sided dice and draw around the number of dots that matches the rolled number (rolled 5, circle 5 on the board all together). Alternatively, roll two 3-dot dice and circle around the total.

Extension: Roll two 6-sided dice and multiply the two numbers, circling around that total of dots as an array if possible (6 rows of 4). If it is not possible due to the space restrictions on the board at later points in the game, break the array up, such as into 3 rows of 4 and 3 rows of 4. To make their game last longer, print 4 templates and glue together into a massive one.

The following lessons focus on ways to make 7

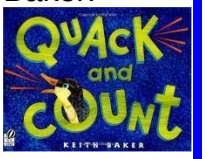
Partition Lesson 10

Seven Little Ducklings

Learning intention: Figure out all the ways to make 7

Maths vocabulary: switch places, total, ways to make, combinations

Literacy link – numeracy picture book: Read *Quack and Count* by K. Baker.



Seven ducklings do various activities, each time with some on one side of the page and some on the other. Excellent illustrations of the addition and partition of the seven ducklings on each page, for example 5 plus 2 makes 7 as five ducklings are on land and 2 flying.

Lesson summary: Students work out all the ways their 7 ducklings could swim in two ponds.

Materials:

- 2 blue kinder circles or plates.
- Duckling templates from the following pages.

Best set-up: Fishbowl model, then regular like-ability maths buddies.

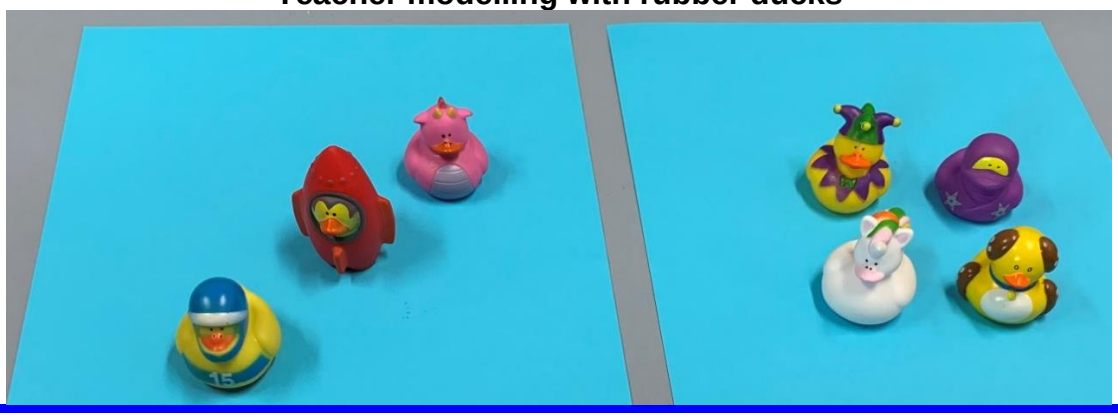
Modelling: Imagine you are the mummy/daddy duck. These circles are your two ponds. One day, you wake up and your 7 ducklings are all out of the nest. Some ducks are swimming on the left pond and some on the right. If you have 7 in total, what are all the possible **combinations?**

Emphasise the commutative property by picking up the bowls and switching their places: "Are there still 7 ducklings?" If the numbers switch places, do they still make the same total? Is 3 and 4 the same as 4 and 3?

Model recording what they find using the __ and __ makes recording template, or for support students just with digits or dots using the *3-column* template on the following pages:

Pond A	Pond B	Makes
5	2	7
3	4	7
6	1	7
2	5	7
1	6	7

Teacher modelling with rubber ducks



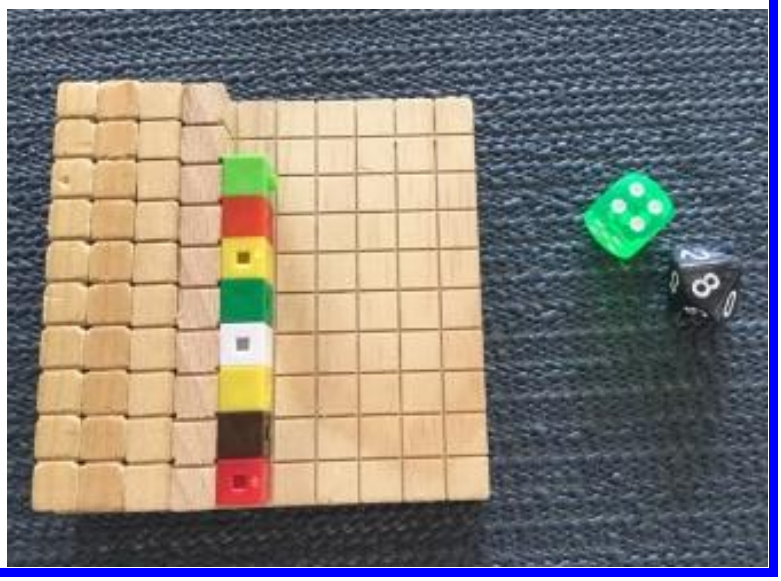
Support: Allow them to record using dots as the ducks in either column, instead of digits (if digits are not possible). Focus on finding all possible combinations for one number before moving on to another total – if they only work on 1 or 2 numbers for the whole session, that is perfectly acceptable.

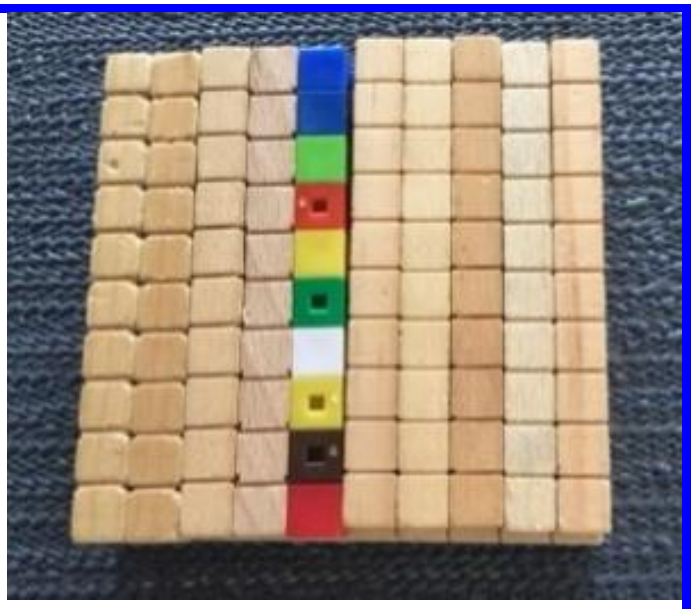
Extension 1: Use 3 or 4 ponds, rather than 2, therefore partitioning numbers into 3 or 4 parts and brainstorming many more combinations for each total. Partition teen numbers, for example, investigate all the ways to make 11-19 ducklings.
Where possible, record some equal groups sentences when all plates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

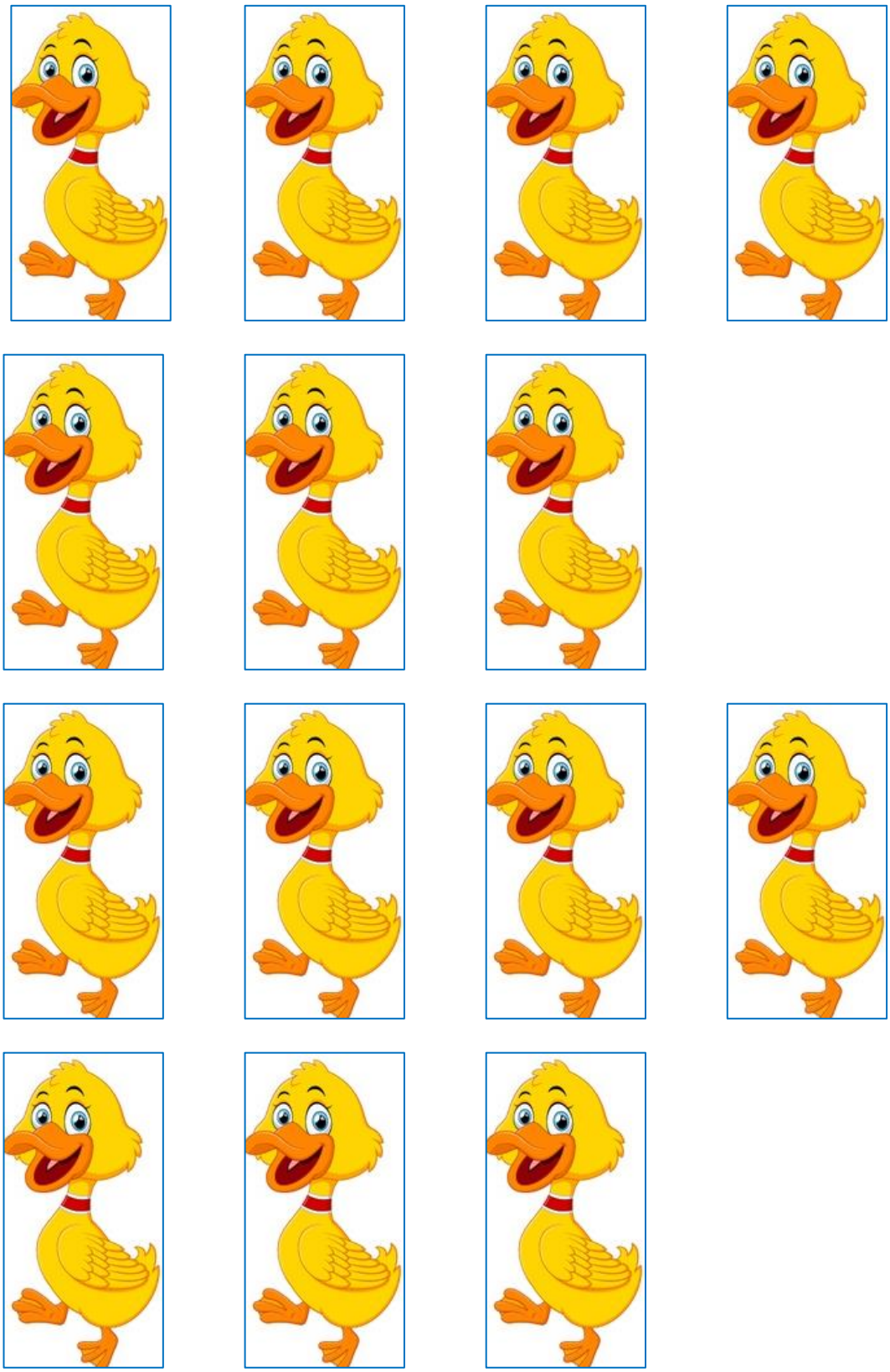
Student A: Rolls two 10-sided dice, one representing tens and another representing ones. "I have 4 tens and 8 ones, I have 48 ducklings!"

Record:
48 + ■ = 100



	Student B: Investigate how many more are needed to make 100 ducklings altogether. Try this in your head at first, then by filling the remaining space on top of the hundreds block with tens and ones blocks: *Record:* 48 + 52 = 100  **Misconception alert:** 48 + 62 = 100 because students do not account for the ones making another ten. By building the 100 ducks on top of a hundred block, students see this.

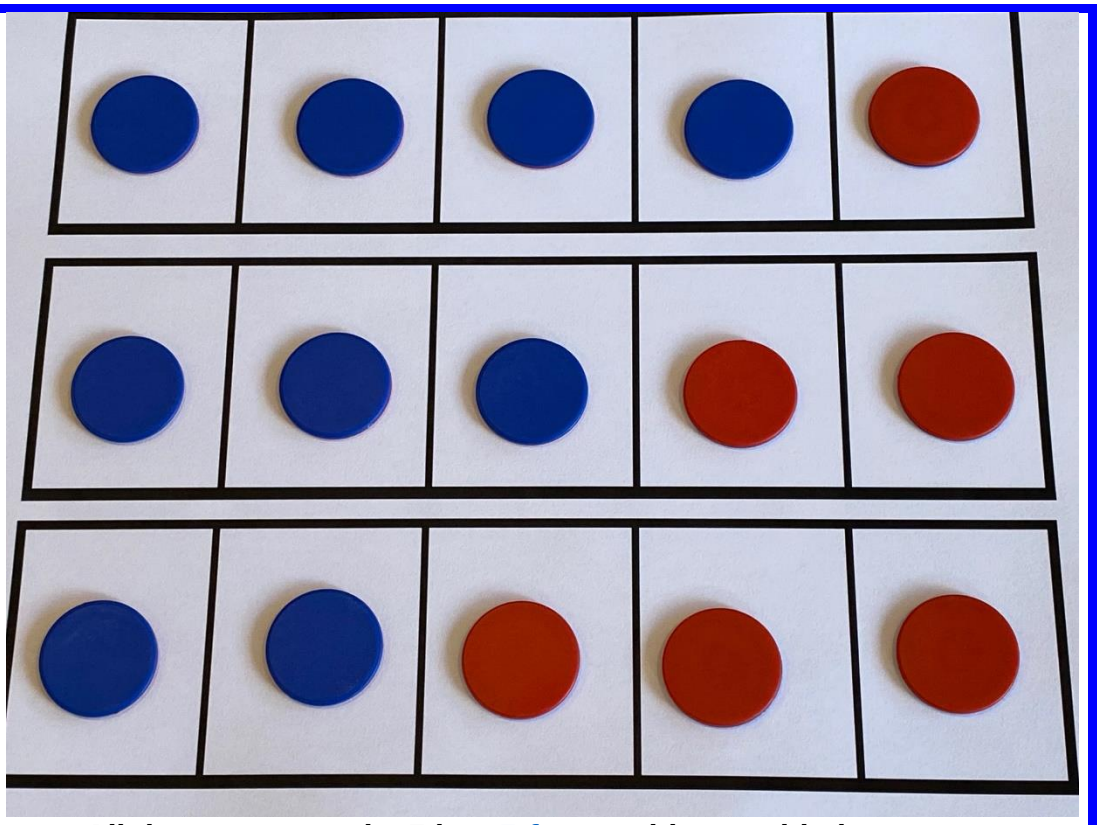
Print 7 ducklings per student (each page prints templates for 2 students):



____ ducklings Name: _____

My pond	My friend's pond	Makes

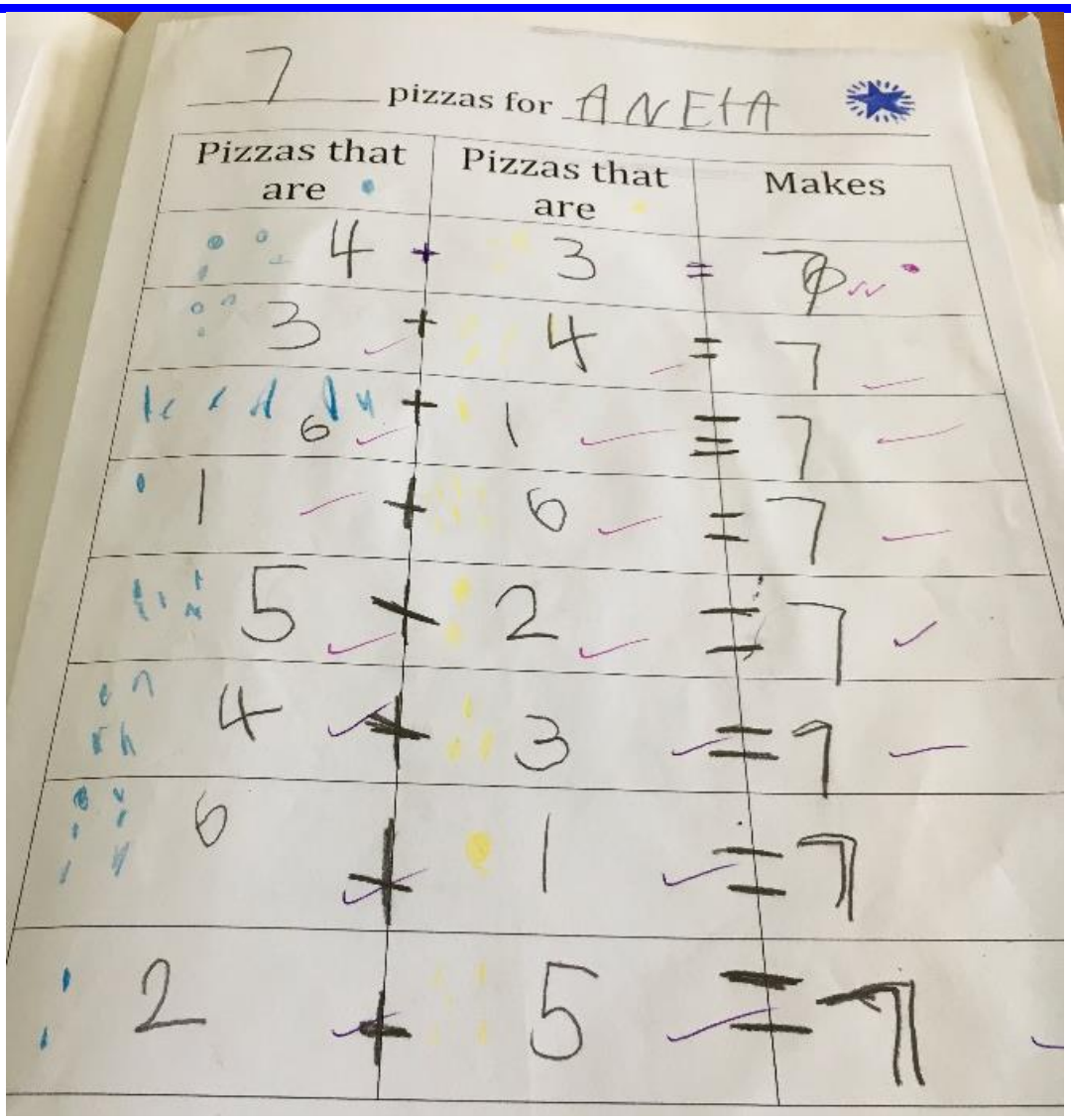
Partition Lesson 11	**Pizza Partitioning** **Learning intention: Figure out all the combinations that make the number 7** **Maths vocabulary: superhero eyes, combinations**
YouTube hook: Who likes pizza? How does pizza usually get delivered? Well, think again… https://www.youtube.com/watch?v=i9YSTtzf27o and https://www.youtube.com/watch?v=eRsb-uXjqpE (YouTube clips of Dominos Pizza in Japan trialling reindeers to deliver pizza at Christmas). So now you are going to become the reindeer and deliver pizza! Every time you deliver your pizza (tip the 7 counters onto the grip mat / tray), I want you to say, "Pizza delivery – number combinations!"	**Lesson summary: Students tip out a cup full of 7 x 2-sided/2-colour counters, recording the number that are red and the number that are white, to discover all the combinations that make their total.** **Materials:** • 2-sided counters, i.e. counters with red one side and white on the other side (margherita and garlic pizzas), or similar. • Cups. • Grip mats for the counters to land on. • Pizza partitioning recording template from this unit's folder. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Class management tip:** Distribute two-colour counters in groups of 7 to each desk (pre-counted in cups prepared by the teacher before the lesson). **Modelling:** Model tipping the 7 pizzas out of the cup. When the counters land, arrange them so they are easy to see, like how the number appears on the dice. Now solve it using your maths superhero eyes (revision of Subitising Unit 6) by seeing, rather than counting one-by-one: "I see 5, I see 2, So I see 7." Emphasise the different ways that students see numbers. Now, I'll put the 7 back in and shake it. Is there still 7 in the cup (conservation)? Emphasise the vocabulary of combinations – what are all the ways to make a number. Students can record using the _ is made of _ and _ template: 7 is made of 5 and 2 **Questioning:** • How did you see that number? Show me how you saw it by circling around the parts with your finger – "I see _, I see _, altogether that makes_." • Are there any other ways to make that number that haven't come up yet? Try to find another way that the cup hasn't delivered to you. 



All the ways to make 5 in a 5-frame with two-sided counters.

The pizza delivery reindeer bringing the lesson hook to life!

Superhero eyes (seeing numbers – rather than counting them)!

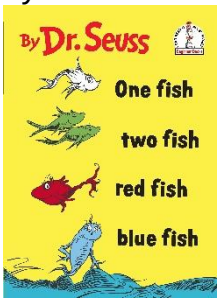


Support: Start with just 3 pizzas. Once they have mastered all the ways to make 3, move onto 4, then 5, and so on. Emphasise finding all possible combinations, before moving onto any higher numbers. Also use this session to revise subitising skills.

Extension 1: Partition 20 (all the ways to make 20) and see if these students can figure out a pattern, i.e. 20 red, 0 blue; 19 red, 1 blue; 18 red, 2 blue; and so on. How would you arrange that number so that it is easy to see?

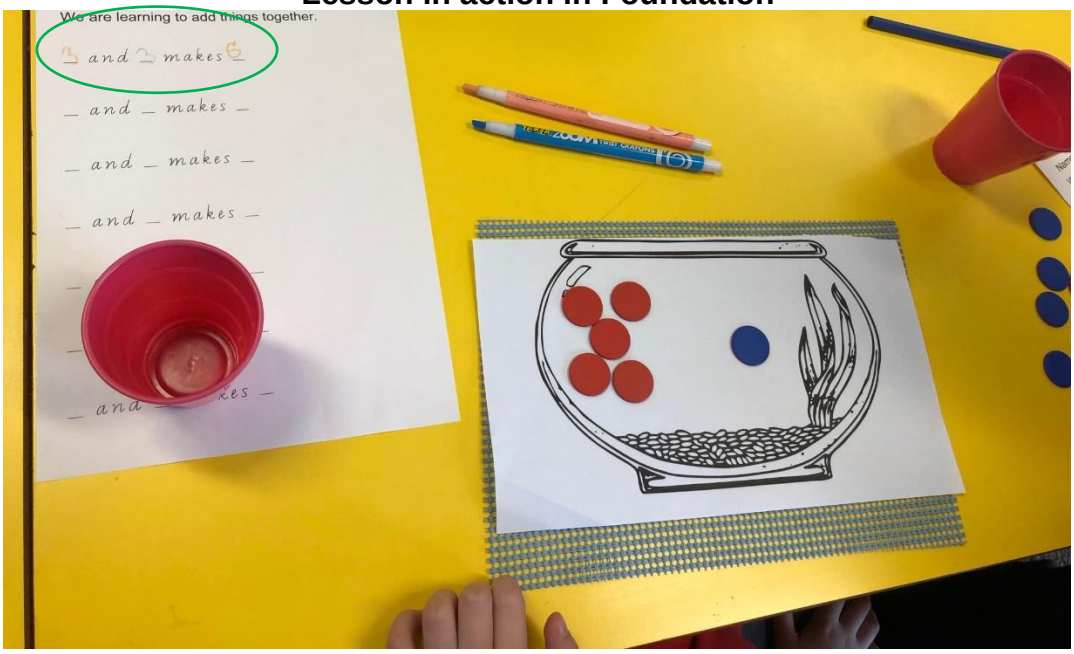
Extension 2: Use a laminated 100 block, drawing on it with whiteboard markers to continue to discover (from the previous session's extension) all the ways to make 100. Partition 100 block templates are in this unit's folder.

Literacy Link: Read *One Fish, Two Fish, Red Fish, Blue Fish* by Dr Seuss.

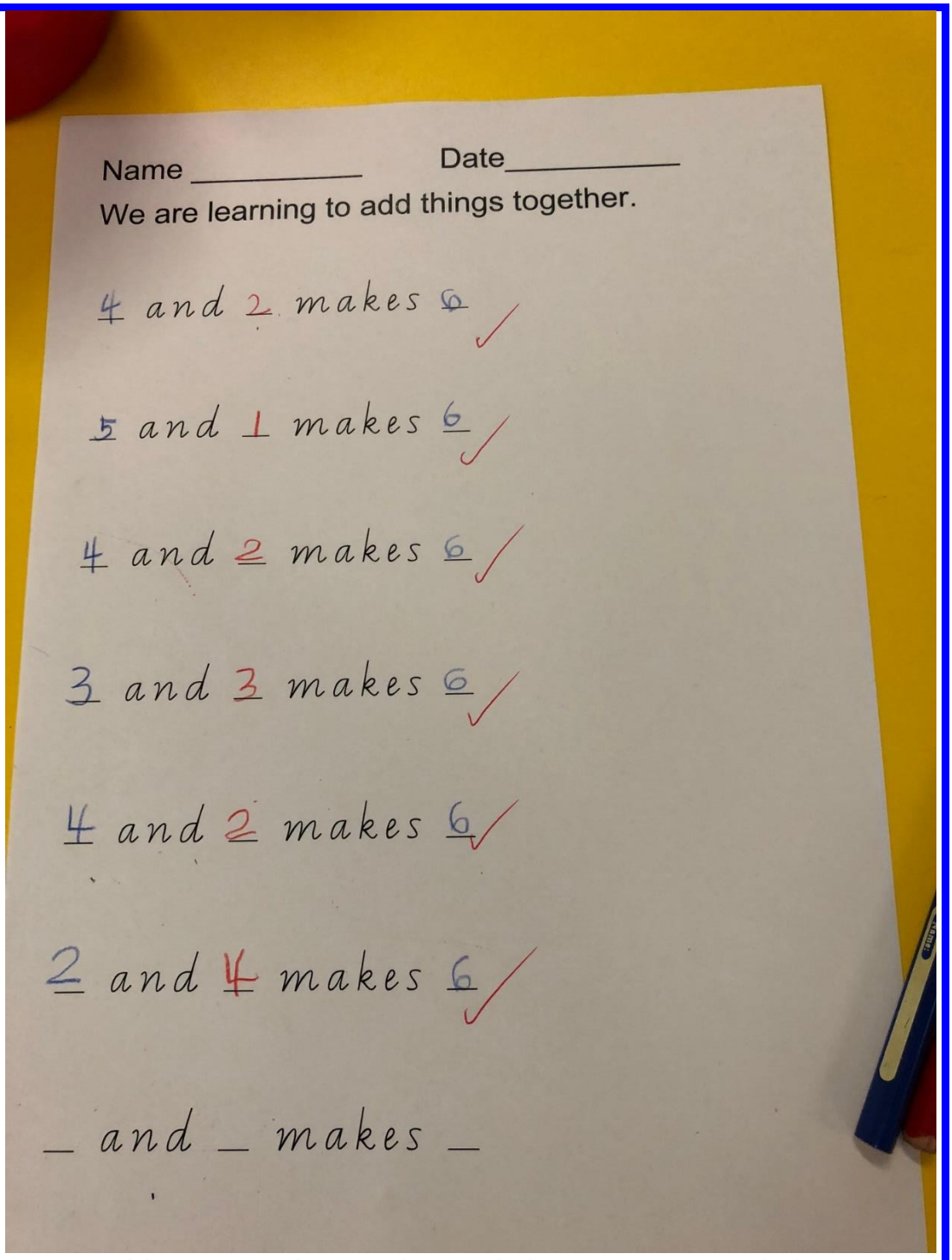


Variation to keep engagement high while students still need more practice: Students use the two-sided counters as fish in a fishbowl, recording using the _ and _ makes templates. As shown in this student work sample (photograph below), emphasise for students to arrange the fish (after they land) so they are easy to see, for example, how that number looks on dice. As can be seen in the photos, students used coloured pencils to match the colours of the fish with their recording.

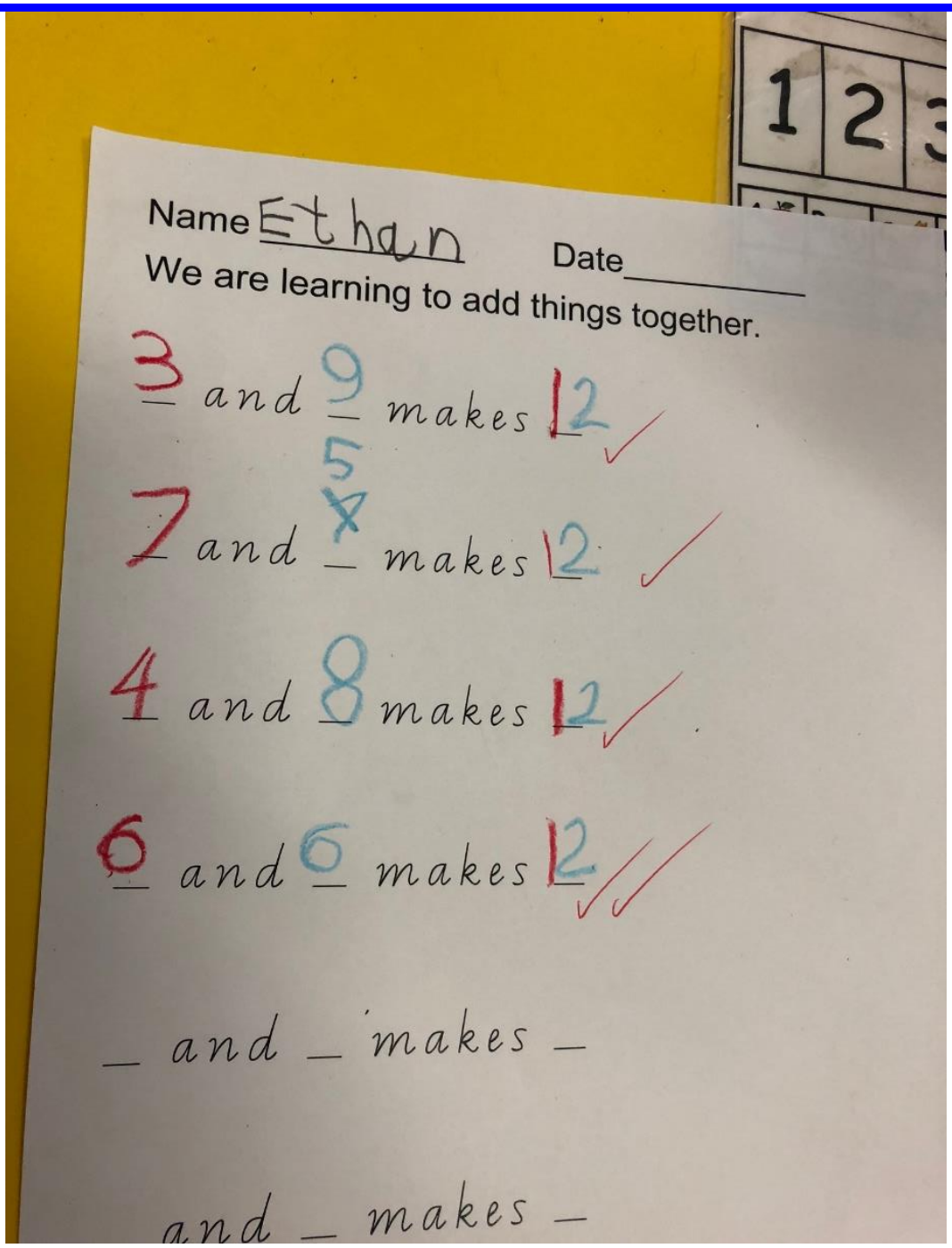
Lesson in action in Foundation



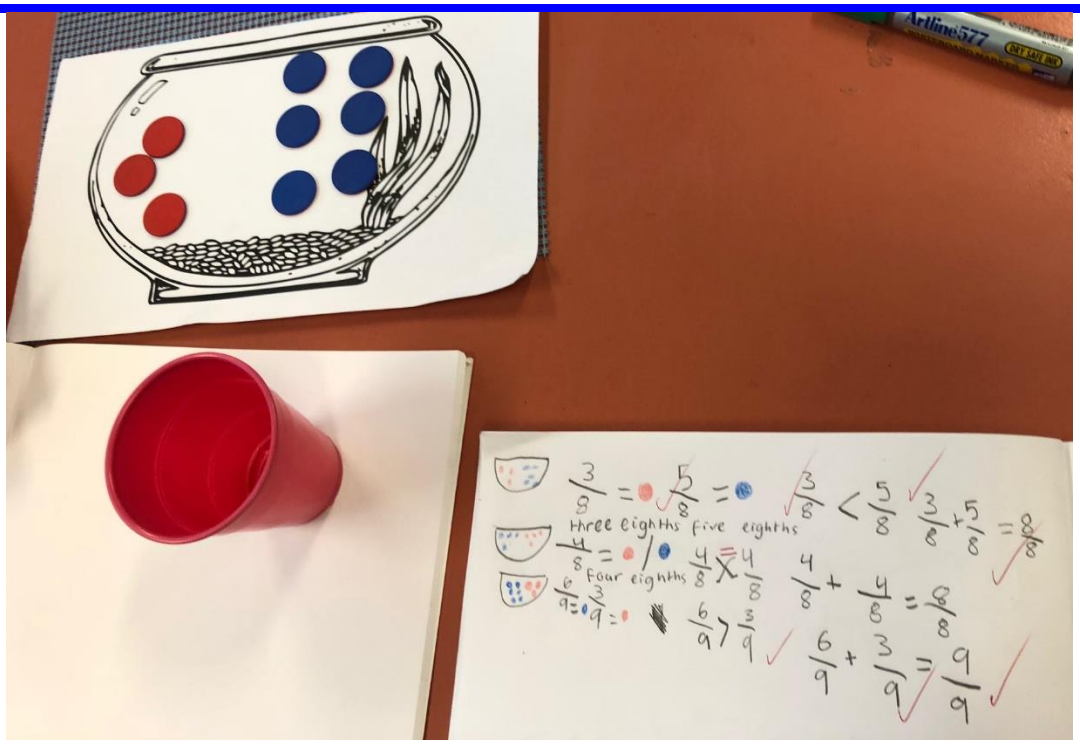
Fishbowl templates are in this unit's folder.



Mid-range student work sample in term 4 of Foundation



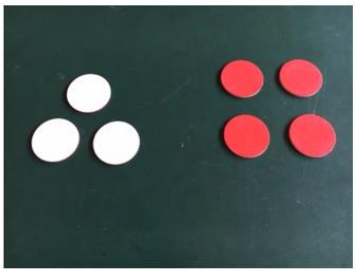
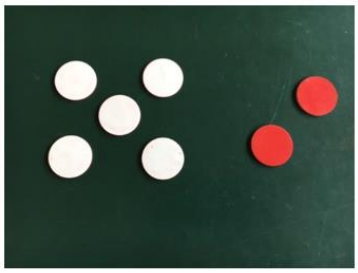
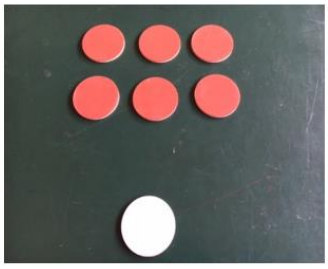
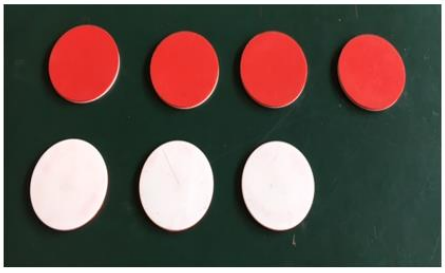
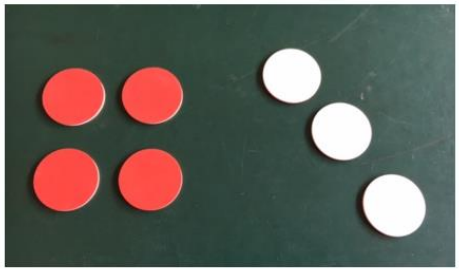
Extension Foundation lesson in action, focusing on partitioning teen numbers of fish



Extension 2: An alternative extension is for the student to see the coloured fish as fractions, which is also a lesson in the [Fractions Unit – Fractions Fishbowl](). For example, 3 out of 9 are red, 6 out of 9 are blue, which makes 9 out of 9 fish altogether:

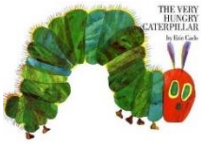
$$\frac{3}{9} + \frac{6}{9} = \frac{9}{9}$$

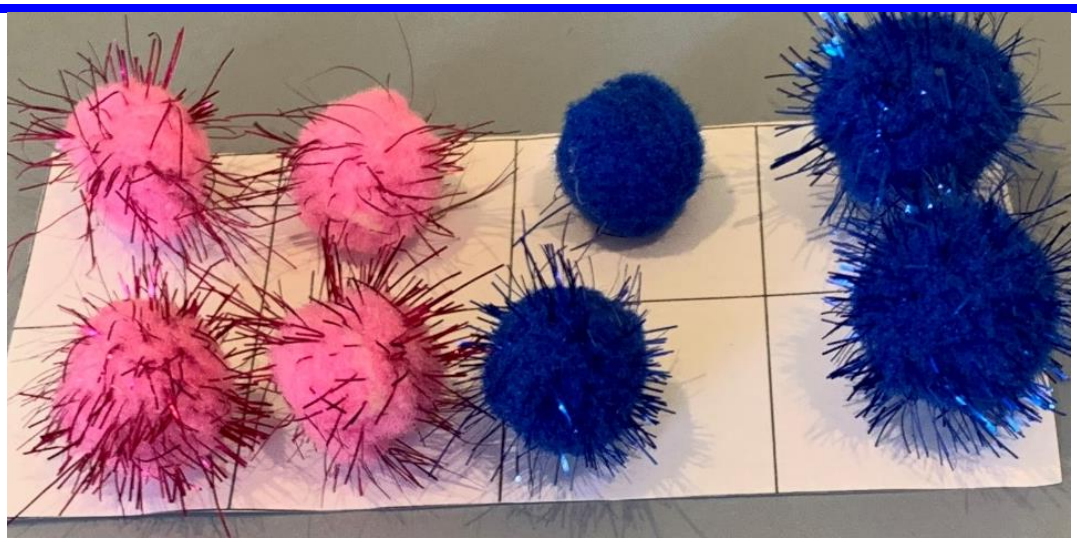
Compare the fractions: A crocodile or shark would be expected to swim towards the 6/9 blue fish instead of the 3/9 red fish: 6/9 > 3/9
The greater than sign faces its 'mouth' towards the larger fraction of fish.

Partition Lesson 12	**How do you see 7?** **Learning intention: Explain how you like to see numbers and your mathematical thinking** **Maths vocabulary: thinking, strategy (how you did it), superhero eyes (subitise)**
Valuing every mathematician Do you know that everyone in this class, in the school and even in the whole world does maths a little differently? Even though maths often has one correct answer, there are hundreds of ways to get to it. Every single person has a different way of doing maths! As a mathematician, the important thing is not just to use the method that I show or tell you. What is important is that whatever strategy you use, you need to be able to explain your thinking and how you prefer to work with numbers.	**Lesson summary: Students work with a like-ability partner to create all the different ways they can see a total.** Once a pair have created all the combinations that they can brainstorm, they increase their total by one, and repeat. **Materials:** • 2-sided counters. • Grip mat. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Questioning:** Model like below, taking turns with a student partner at a desk with counters. “This is how I think of 7. How do you see 7? **Modelling photographs**  I see 7 as 3 and 4.  I see 7 as 5 and 2.  I see 7 as 6 and 1.  I see 7 as 4 and 3 too.  I see 7 as 4 and 3 too, but like this. **Support:** “When I think of 5, I see it like this. How do you think of 5?” **Extension:** All the ways you see 18, 19 and 20. Find a pattern that makes it easy to figure out all the combinations that add to these totals. **Recommended exit ticket package:** The package available through this series is published by another author and an excellent paper-based follow-on to this session as a formative assessment or exit tickets for a few sessions: https://www.teacherspayteachers.com/Product/Part-Part-Whole-How-I-See-Numbers-1490760.

The following lessons focus on ways to make 8

Partition Lesson 13	**Gingerbread Buttons** **Learning intention: Create all the combinations that make 8** **Maths vocabulary: + (and), addition equation, parts, combinations, total**
YouTube clip: What do gingerbread people love? They love this one thing more than anything else in the world! They love…their gumdrop buttons! YouTube clip from Shrek about how much the Gingerbread man loves his buttons https://www.youtube.com/watch?v=FpBJih02aYU.	**Lesson summary: Students work out all the ways to arrange a total number of buttons onto 2 gingerbread people. When done, they can add a third, then a fourth gingerbread person to figure out all the ways to arrange the number into 3 or 4 parts as well.**
	Materials: • Buttons. • Gingerbread people templates from this unit's folder. • Gingerbread partitioning recording template. *Alternative recording options:* 1 of the 3 recording templates: _ and _ makes _ , _ is made of _ and _ or number bonds, or students can record in their books using the addition symbol when ready. • *Giant teacher modelling materials:* 2 gingerbread people cut out from A3 paper and kinder circles. **Best set-up:** Fishbowl model, then students work independently.
	Modelling: Whole-class model by making all the combinations that form a total of 12, using two giant gingerbread people cut out form A3 paper, and kinder circles to represent massive buttons or counters. Students then try 8 themselves. Emphasise for students to arrange their buttons on the gingerbread people so that these are easy to see with their maths superhero eyes (drawing on prior learning experiences from the Subitising Units). Students can record using the + symbol and writing the addition equations they created that totalled to 8. Read and model the + symbol as 'and,' 4 buttons and 4 buttons makes 8 buttons. Emphasise that we are not sharing or learning about division, so the shares do not need to be fair. Addition can involve adding together very different numbers, so the number of buttons that each gingerbread person receives does not need equal or fair. 
	Support: Pre-count the total of 8 buttons into a cup to ensure these students start with the correct total. Start with lower totals as needed.
	Extension: Add a third or fourth gingerbread person – partitioning the number into 3 or 4 parts. For example, 8 can be 3 and 1 and 2 and 2: 8 = 3 + 1 + 2 x 2

Partition Lesson 14	**Paperchain Caterpillar of 8** **Learning intention: Create all the combinations that make 8 and write the matching addition equations** **Maths vocabulary: + (and), = (makes) addition equation, parts, combinations, total**
Literacy link – numeracy picture book: Read the literary classic *The Very Hungry Caterpillar* by E. Carle.  The caterpillar took 8 days to fill up his belly – a week and an extra day – Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and then Sunday again!	**Lesson summary: Students make their own caterpillar of 8 parts, using either different colours of pompoms, or strips of paper as caterpillar chains.**
	Materials: • Pompoms – 2 colours at first, then 3 different colours, 4 and so on. • Alternatively, pre-sliced pieces of green and red paper to make paper chain caterpillars. This material will slow down the session because it will become more craft-oriented. This may be a good end-of-session display for each student to make their favourite combination that totals to 8, during the final 10 minutes of the session, rather than the way the students initially work out all the ways to make their caterpillars of 8. • 8 frames – 8 printed boxes to support students to keep their total constant. Use ten frames and slice off two squares. **Best set-up:** Fishbowl model, then students work independently.
	 Caterpillars of 6 example: "6 and 0 makes 6, 1 and 5 makes 6, 2 and 4 makes 6, 3 and 3 makes 6," and so on.
	Modelling: Model making a caterpillar of 10 using sport balls that are different colours. Model using the + symbol to record, reading this as 'and,' as well as the = sign to mean makes or 'is the same as.' Model making it with 2 colours, then 3, then 4. Now students make their own caterpillar of 8 using paperchains. Emphasise that, once students create all the combinations that make a caterpillar of 8 using two colours, they can then add a third colour, finding ways to make 8 using three parts. Then try 4 different colours. Keep checking that your caterpillar makes 8, not 9 or 7.



4 and 4 makes 8 4 + 4 = 8

5 and 3 makes 8 5 + 3 = 8

Later, use 3 colours to partition the number into 3 parts:

4 and 2 and 2 makes 8 4 + 2 + 2 = 8 4 + 2 x 2 = 8

Support: At first, start with 4 pompoms for a caterpillar of 4, focusing on all the ways to make 4 using 2 colours. Use a 4-frame to support this with pompoms, replicating the colours from their paperchain. As the numbers increase, use frames to ensure they have the correct total – that their caterpillar is in fact 5, 6 or 7 parts long, placing the strips of paper in a giant A3 frame, or matching pompoms in a mini 6-frame (or 5 or 7-frame), *before* connecting them into a caterpillar.

Extension: Make caterpillars of 18 parts, rather than 8, partitioning 18 into 3 or 4 parts.

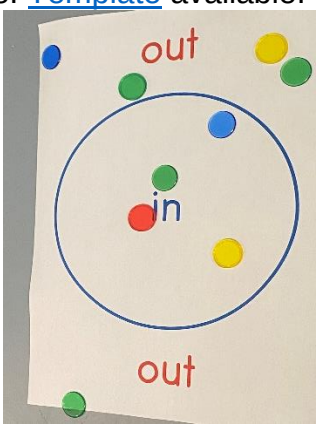
Students could also write matching groups of or multiplication sentences where there are equal groups of the same colour. For example, 4 x 4 + 2 = 18 (4 groups of 4 colours + an extra 2) as shown here:

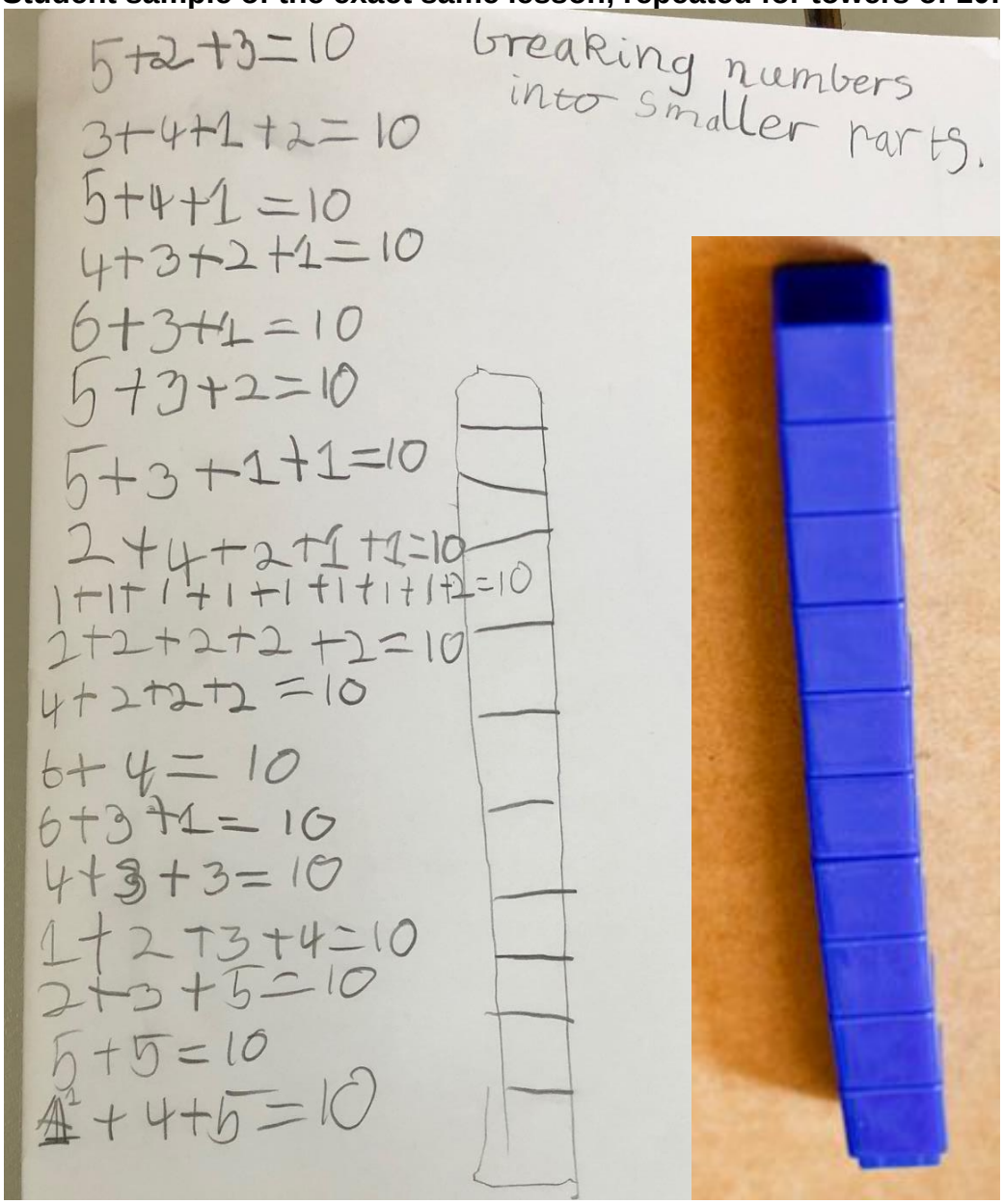
Formative Assessment – Exit Ticket: "8 preps are visiting from another school tomorrow to make some art and crafts with us, then play sport with us. How many girls and boys could there be?"

Alternative to match the session: "8 caterpillars pop out of their cocoons as awesome butterflies. How many girl and boy caterpillars could there be?"

Students can use drawings, materials and numbers to try to answer this, aiming to brainstorm as many possible combinations as they can.

The following lessons focus on ways to make 9

Partition Lesson 15	**9 Bean Bags** **Learning intention: Figure out all the ways to make 9 and write addition equations** **Maths vocabulary: inside, outside, + (and), = (makes), addition equation / addition number sentence, parts, combinations, total**
Winter Olympics hook: This session is similar to the unusual sport of curling, shown here https://www.youtube.com/watch?v=uj-U45zUxP4 **Outside maths:** Today, we are going outside and doing sport for maths!	**Lesson summary: Students throw a total of 9 bean bags towards hoops outside, recording the combinations that make 9 in terms of how many landed inside and how many landed outside the target.**
	Materials: • Hoops and bean bags. **Alternative:** Students slide (like Winter Olympics curling) or flick 9 counters, aiming for these to land inside the circle of the in-out template. Counters that land anywhere else are placed back onto the template page, but outside the circle. • One of the three recording templates from this unit's folder (the number bonds template is the most suitable for this session). Alternatively, students can write the addition equations free-hand in their books. **Best set-up:** Fishbowl model, then regular like-ability maths buddies.
	Modelling: Model using 9 bean bags as a class. Emphasise that students must record as they play – if they are caught just playing the game without doing the maths, they can be given a worksheet about 9, instead of enjoying fun maths sessions that use materials. **Midway mini extension:** Create a third category – close or near throws – on the edge of the hoop or within 5cm (a little finger) away from the hoop. This partitions 9 into three parts: 3 (in) + 4 (out) + 2 (close) = 9
	In-classroom version for a repeat session: The hook for this repeat session could be the Winter Olympic sport of curling on the ice: Template available.   2 in and 7 out makes 9 2 + 7 = 9
	Support: Use a smaller total, aiming to become more fluent at partitioning 5, 6 or 7 – whichever number is their current point-of-need.
	Extension: Students can throw 2 different colours of bean bags, recording the partition in 4 parts: 2 (yellow bean bags in) + 3 (yellow out) + 3 (blue in) + 1 (blue out) = 9 2 + 2 x 3 + 1 = 9

Partition **Lesson 16**	**Towers of 9** **Learning intention: Figure out all the ways to make 9, including breaking it into more than 2 parts, and write matching addition number sentences** **Maths vocabulary: + (and), = (makes), addition equation / addition number sentences, turnaround, parts, combinations, total**
Real-life link: Who likes building towers? During the eating time prior to this session, show students this YouTube clip, which has plenty of measurement, about some of the tallest towers in the world: https://www.youtube.com/watch?v=V72PbkoGXGQ.	**Lesson summary: Students make a total tower of 9 unifix, then break it apart in all the possible ways they can.** **Materials:** • Connectable cubes – all the same colour for each student. **Best set-up:** Fishbowl model, then students work independently. **Student sample of the exact same lesson, repeated for towers of 10:**  *Credit for the photograph to Natasha, Numeracy Leader from Oakleigh PS.*

	Modelling: Model making a tower of 12, then breaking it and recording all the addition number sentences. 12 5 + 7 7 + 5 (turn the tower around – the turnaround fact) 4 + 8 4 + 4 + 4 3 groups of 4 or 3 x 4 **Questioning:** • If you turn your tower around (rotate it 180 degrees), does that equation still make 9?
	Support: Use a total that is more suited to their point-of-need for partitioning (i.e. a tower of 5, 6, 7 or 8). Emphasise the turnaround facts as fun freebies!
	Extension: Towers of 19. Emphasise finding multiplications that make 19. For example, 3 groups of 6 + 1 extra makes 19, 3 x 6 + 1 = 19 Halfway through the session, King Kong or Godzilla attacks their tower! Snap blocks off their tower to create subtraction equations as well. For example, 9 take away 2 leaves 7, 9 – 2 = 7 Try to create multiplications and subtractions in the same number sentence: 2 x 5 – 1 = 9
	Formative Assessment – Exit Ticket: "9 friends are playing in a cubby house. Some are inside and some are outside. How many could be inside and outside?" Students can use drawings, materials and numbers to try to answer this, aiming to brainstorm as many possible combinations as they can.

The following lessons revise partitioning from 3 to 9 – different numbers can be assigned to students, depending on their capability to partition numbers so far during this unit. ***Please note:*** **10 facts involve partitioning ten, therefore that skill falls into the upcoming Addition Unit on 10 Facts.**

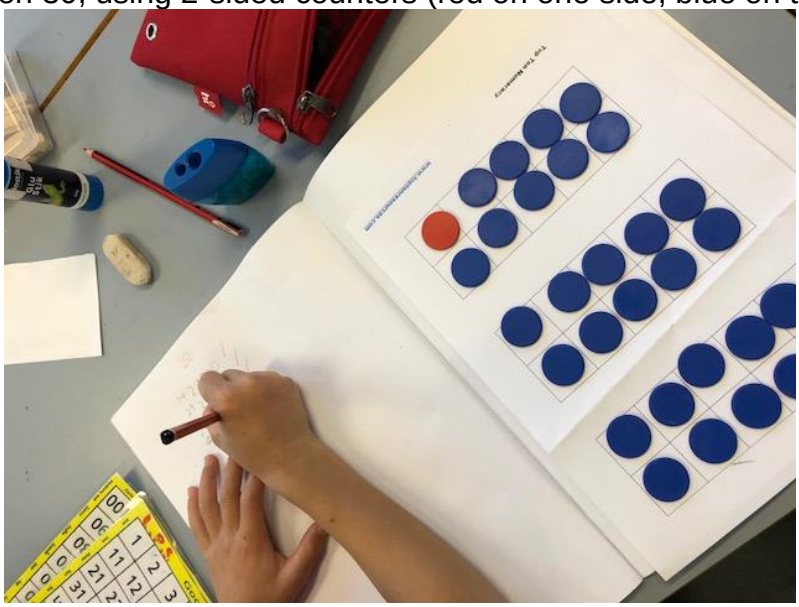
Partition Lesson 17	**Colourful Cities** **Learning intention: Figure out all the ways to make 4, 6, 8 and 10, including breaking those numbers into more than two parts** **Maths vocabulary: + (and), = (makes), addition equation, parts, combinations, total**
Real-life hook: Google image search 'colourful cities.' You may also wish to Google image search specifically for the 'Rio favelas' (Brazil) and 'Cinque Terre' (Italy), or zoom into the images on the following page to display these for students.	**Lesson summary: Students create all the ways to make a number using two colours of blocks or counters on top of the different number frames.** **Materials:** • Colourful connectable cubes (prepare cups that have 2 colours in them). • Ten frames that have been sliced to become 4, 6 and 8 frames as well. • 4, 6, 8 and 10-frame recording templates from this unit's folder. **Best set-up:** Fishbowl model, then regular like-ability maths buddies. **Modelling:** Model an example of a number together as a class, aiming to find all the ways to make that colourful city. For example, for 6: 6 blue, 0 yellow 5 blue, 1 yellow 4 blue, 2 yellow (shown to the right) 3 blue, 3 yellow 2 blue, 4 yellow 1 blue, 5 yellow 0 blue, 6 yellow  As students become confident, increase the type of number frame in use and also add an extra colour (red in addition to yellow and blue). **Questioning:** • Can you see any patterns? • Do some numbers have more ways to make them than others?

Hook images to tune students into the concept of colourful cities

Support: Start with lower numbers, i.e. all the combinations that make 4, then 5, by swapping their 4-frame for a 5-frame. Build up gradually after students first master all the combinations for the previous number.

Extension 1: Use 3 or 4 colours to figure out 3-way and 4-way partitions. For example, 8 can be 2 blue, 2 yellow, 2 red and 2 green or 4 groups of 2, 4 x 2. 8 can also be 5 blue, 1 yellow, 1 red and 1 green, 5 + 3 x 1 = 8; or 5 blue, 2 yellow, 1 red, 5 + 2 + 1 = 8.

Extension 2: Use multiple tens frames to figure out all the combinations that total 20, then 30, using 2-sided counters (red on one side, blue on the other).



1 and 29 makes 30. 2 and 28 makes 30. Continue until you see a pattern.

Questioning: How are the 30 facts similar to the 20 facts and the 10 facts? Once you know your 10 facts, do these help you with your 20, 30 and 40 facts? How so? Can you make all the 50 facts without materials?

Partition Lesson 18	**Domino Parking Lot and Domino Trains** **Learning intention: Quickly recall the combinations that make 0 to 9, and beyond** **Maths vocabulary: superhero eyes (subitise), ways to make, count on, total, addition equation, turnaround fact / commutativity, rotate, 180 degrees**
Read: Read (or YouTube search) the *Domino Addition* or *12 ways to get to 11* numeracy picture books.  **Games link:** Who likes playing dominoes? Well, the more dominoes we place around our addition facts today, the bigger our massive domino wall will be at the lesson's conclusion AND…we will be knocking it over! Watch a few minutes of this clip: https://www.youtube.com/watch?v=	**Lesson summary: Students using subitising and ways to make to work out the total of dominoes, placing these into a 'domino parking lot.' Students record each addition equation in their books.** **Materials:** • Dominoes. • Domino parking lot template from this unit's folder. • **Alternative set-ups:** Kinder circles with totals written in the centre *or* A3 paper folded into quarters, as shown in photos on the following pages. **Best set-up:** Fishbowl model, then students work independently. **Modelling:** Model subitising the numbers into visual lots of 2, 3 and 4s, using enlarged examples of dominoes made using A4 paper folded in half with dots drawn onto them. Use ***maths superhero eyes*** (Subitising Unit) to ***see*** the numbers, rather than count them. "I don't need to count that there's 3 dots on that side, I can just ***see*** 3!" See the parts, then use "I see_, I see_, so I see _" to solve the total.  Emphasise for students to use their knowledge of combinations and ways to make numbers to trust the total, rather than counting all. For example, you know 5 is made of 2 and 3, so if a domino has 2 on one side, and 3 on the other side, it makes 5, you don't need to count the dots, trust what you know! When you place a domino on its parking spot, record the two parts as an addition equation in your book: 2 + 3 = 5, reading this as, "2 and 3 makes 5." If students do not know what two numbers make, encourage them to cover the larger side of the domino, then **count on** from there by touching the smaller side's dots one by one. For example, for a 7 I 2 domino (if they do not know it makes 9 using ways to make, cover the 7 and say "7," then tap the 2 dots on the other side while counting, "8, 9!" Discuss if an equation holds true if you rotate the domino 180 degrees (a half turn). Students should record the **turnaround** equations as well in their book, rotating the domino 180 degrees: 2 + 3 = 5 3 + 2 = 5 (also refer to this as the **commutative law of addition**)

DQQN_79QrDY&t=83s&ab_channel=Hevesh5	**Lesson in action**  **Questioning:** • How many dots are on this side of the domino? Did you count that or just see it? • *If the student cannot solve it using their trust in the 'ways to make' a number:* Which side of the domino would you start counting from to work out the total as quickly as possible? • If I rotate that domino 180 degrees, does it still make _? • Which total was the most popular in your parking lot? Why do you think that was?

Alternative set-up: Fold an A3 poster page into quarters and write four numbers at the top of each section. Allocate the numbers based on students' progress so far during the unit (which numbers they need to revise, or cannot yet fluently partition). Place dominoes that match each total into the sections:

End-of-session peer-assessment: Ask students to check the parking lots of like-ability peers. Then combine their parking lots into one. Reflect on which numbers have more and less combinations and possible reasons for this. The larger the total, the more combinations it has!

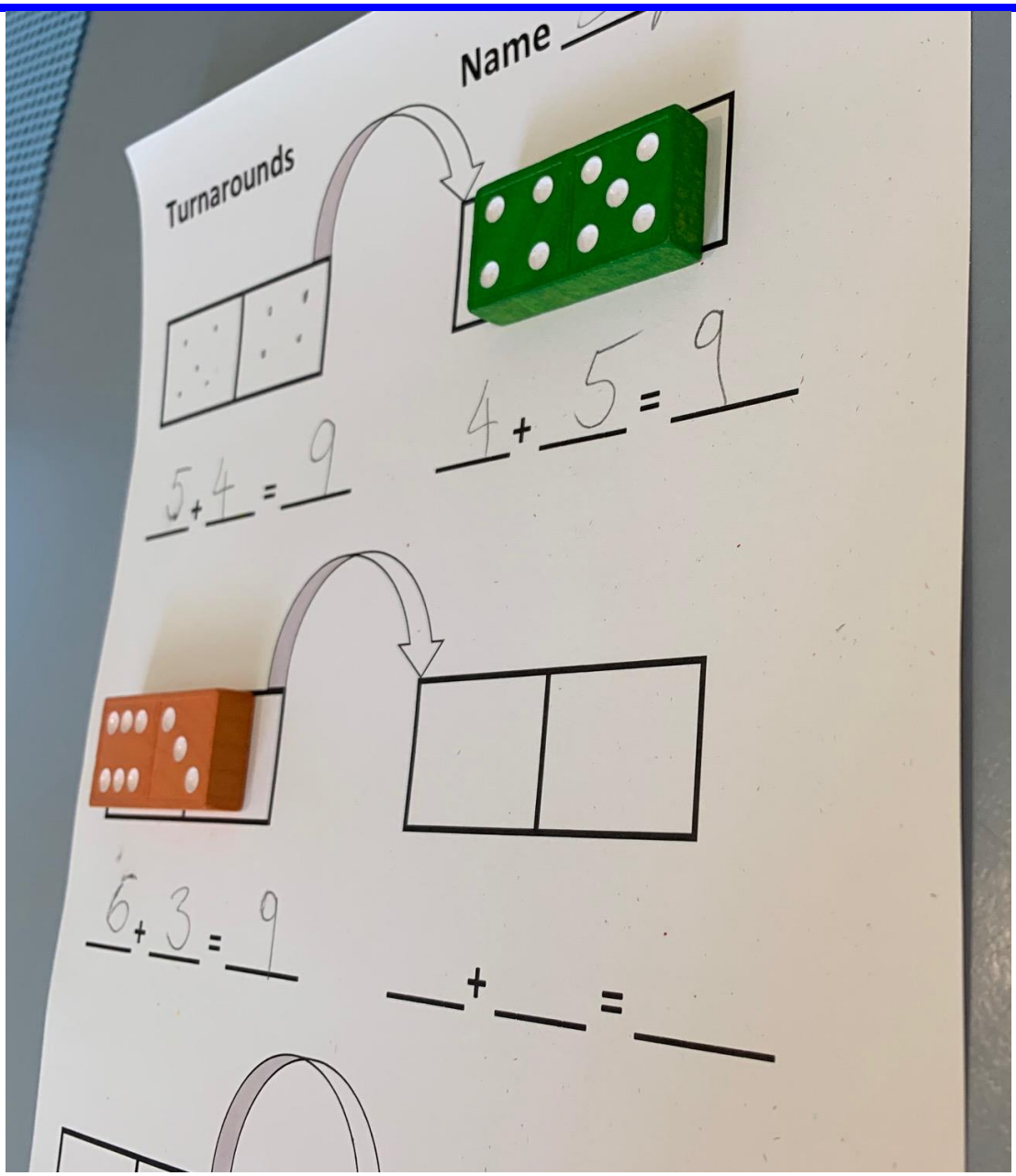
Support: Use a pre-organised cup of smaller dominoes that total to just 6, with a reduced size car park cut off at 1 to 6 (the top row of the template).

Extension: Record all 4 parts of the fact family.

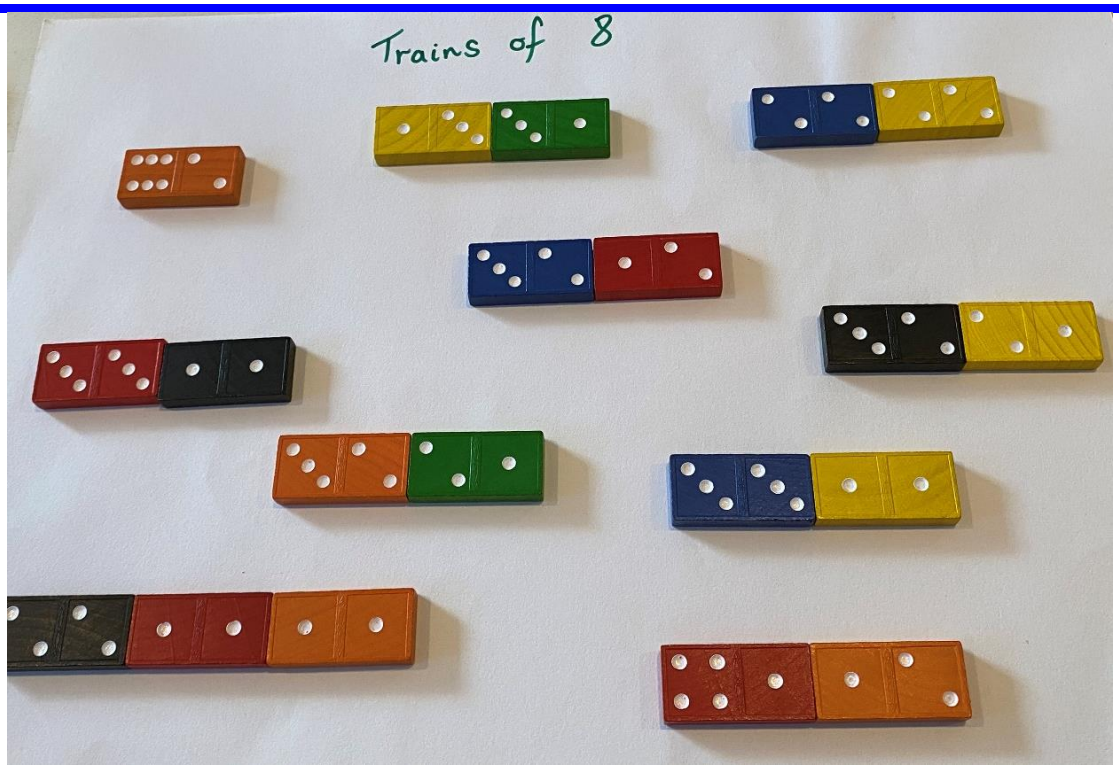
Cover one side of the domino, 4 take away 3 makes 1: 4 – 3 = 1

Cover the other side, 4 take away 1 makes 3: 4 – 1 = 3

Record using the recording extension fact family house template in this unit's folder.

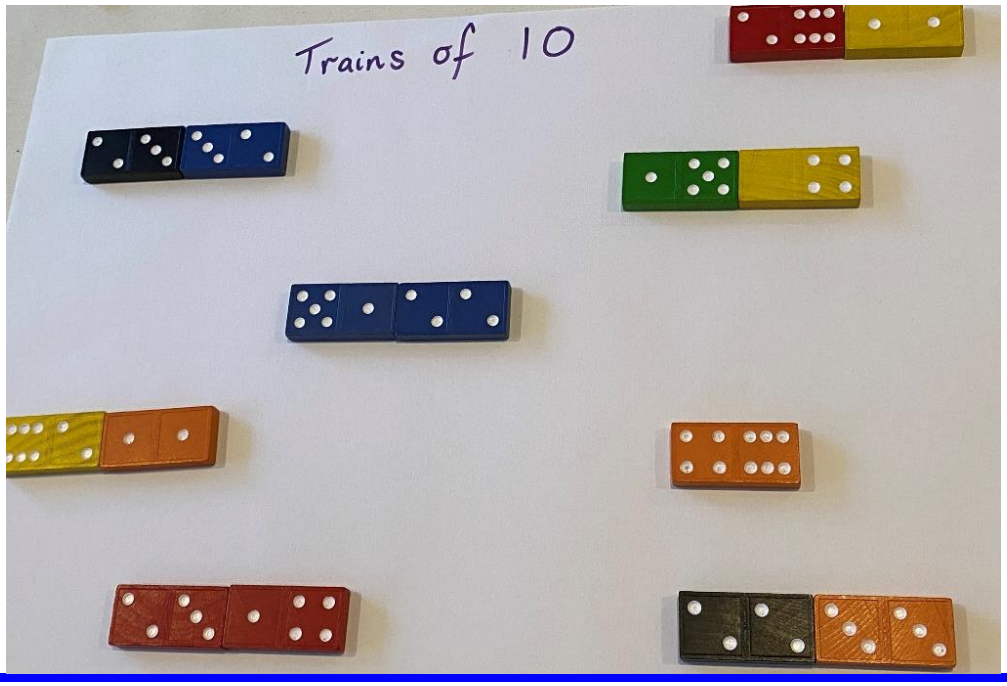


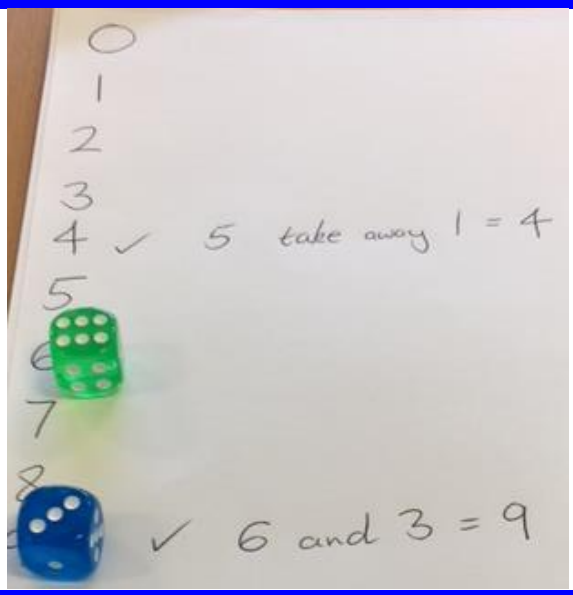
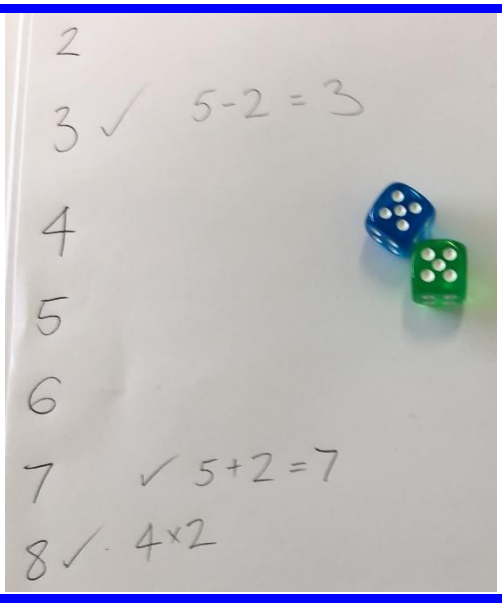
Variation: Use dominoes to learn about turnarounds, recording using the domino turnarounds template from this unit's folder.



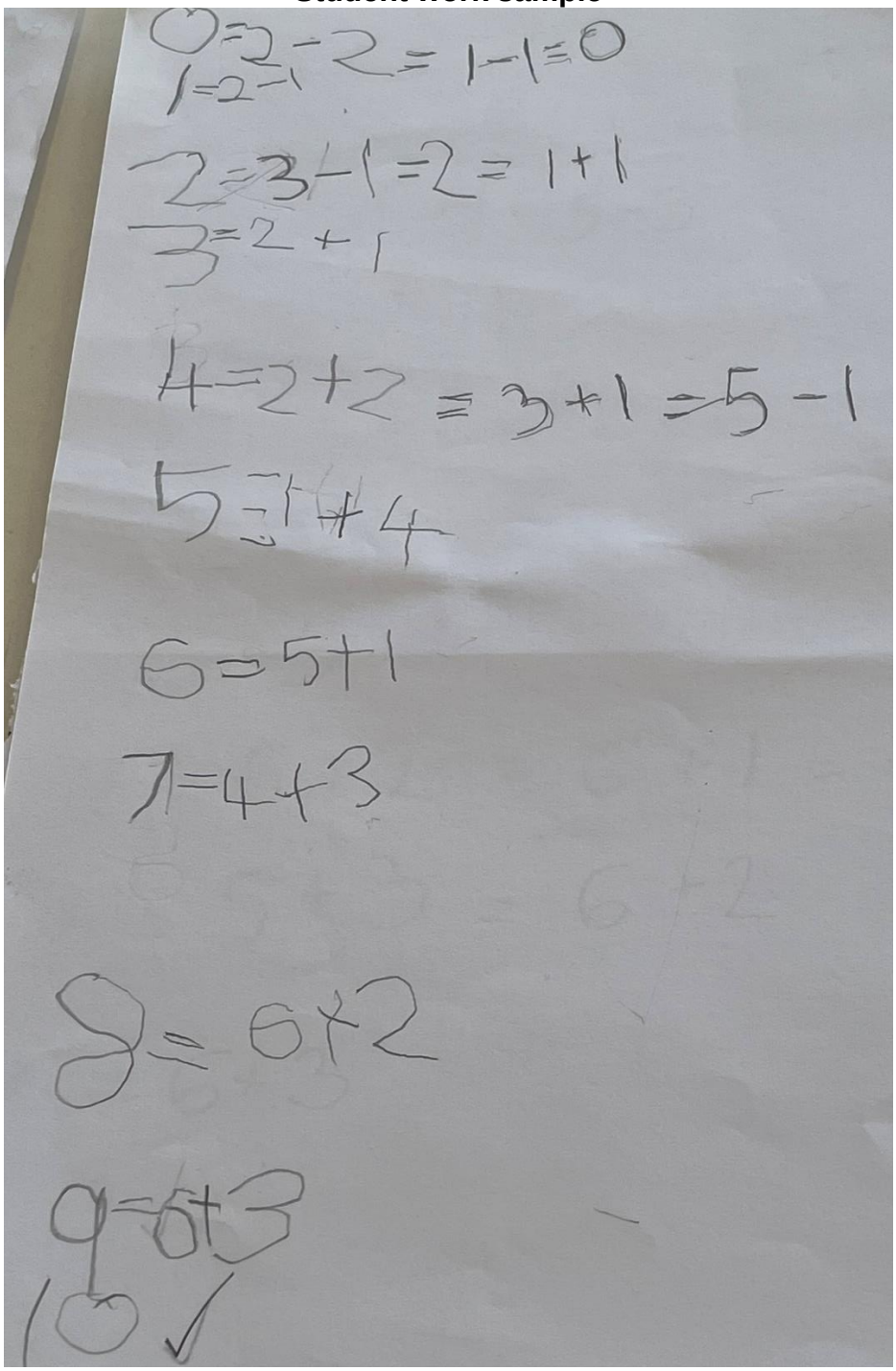
Part 2 – Domino Trains!

Allocate one number to each student, based on their current progress. Students are then challenged to make domino trains that total to this number. For example, for 8, a student could just place down a domino that shows 4 and 4 (4 + 4 = 8). Or the student could use two dominoes, the first showing 2 and 2, the second showing 3 and 1 (2 + 2 + 3 + 1 = 8). Students can even use 3 or 4 dominoes to make their total.



Partition Lesson 19	**Bingo!** **Learning intention: Be able to quickly recall the combinations that make 0 to 9** **Maths vocabulary: number combinations, counting on, total, addition equation**
Games link: Play a regular version of bingo with students first, so they understand the nature of the game. Students could create their own board, writing down 9 numbers that range from 0 to 100, then using this free interactive (choose the 0-100 number range) to read out numbers www.abcya.com/games/number-bingo or using Google's random number generator (setting it to 0 min and 100 max).	**Lesson summary: Students verse a like-ability partner to achieve bingo by 'scoring' the numbers 0-9 using mostly addition, but also subtraction equations where the student is capable of these and wants to use them for the purpose of the game's end goal.**
	Materials: • One 6-sided and one 3-dot dice per pair. **Best set-up:** Fishbowl model, then regular like-ability maths buddies.
	Modelling: Write the numbers 0 to 9 down your page. Roll a 6-sided die and a 3-dot die. Add the two dice together, then write the equal sign to mean 'same as' and record the equation beside that total. Use your trust in ways to make the number to work out the total, seeing both parts, thinking, "I see_, I see_, that makes_." For example, 6 and 3 makes 9 (score 9 by recording: 9 = 6 + 3). If you do not know the total using ways to make, use counting on by putting 6 in your head (hands literally on their head), then tapping the dots on the smaller rolled number, "7, 8, 9!" Alternatively, you could use subtraction to score a number, particularly if you had already scored 9. For example, 6 take away 3 leaves 3 (score 3, 3 = 6 – 3). The first player to 'score' all the numbers wins. Always record the equation you used beside each. There is a way to get 0 – ensure you show this in your modelling: 5 take away 5 (cover the 5) leaves 0.
	 
	Support: Write the numbers 2 to 9 to avoid needing to use any subtraction equations.
	Extension: Write the numbers 0 to 18, rolling two 10-sided dice and including subtraction equations. Allow the use of multiplication and division, providing a 'free extra number scored' bonus whenever a division is used in any of their equations.

Student work sample

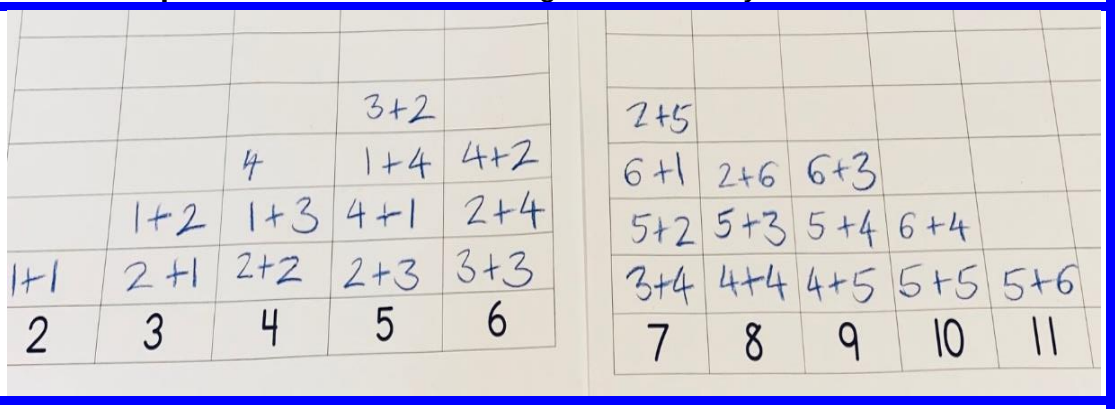


Note how the equal sign is used to mean 'same as' and starts from the left, rather than always being right-oriented. Students read this as, "9 is the same as 6 and 3." Or "2 is the same as 3 take away 1."

Here the student rolled examples that made 4, 2 and 0 many times, so there were multiple recordings for those totals. 10 was ticked, because it could not be rolled using a 3-dot and 6-sided dice.

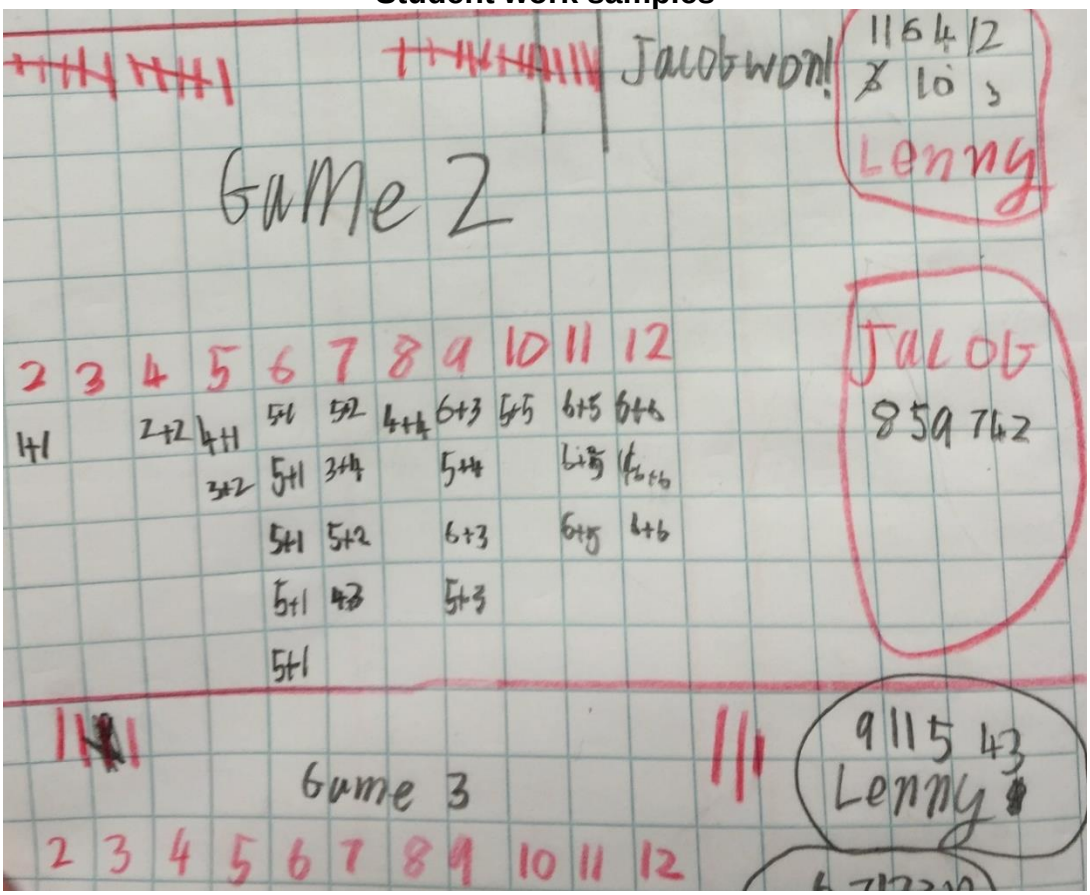
Whole-class reflection and exit ticket:

Create this as a class, with a few equation cards given to each student (written on coloured paper). For reduced teacher preparation time and more involvement for students, students could create the equation cards themselves, writing 5 equations such as 3 + 4 = ___, then swap cards with a like-ability partner to place them correctly along the giant class number line.

Partition Lesson 20	**Roll it up!** **Learning intention: Be able to quickly recall the combinations that make 0 to 9** **Maths vocabulary: number combinations, counting on, total, addition equation**
YouTube hook: The sport of 'dice stacking.' Watch the first 2 minutes of this YouTube clip showing a pro at this sport: https://www.youtube.com/watch?v=7G7zQXTfnnU&list=RDCMUCc4JGh0O0_AO0Asj6MAS0-w&start_radio=1&t=17&ab_channel=JoshHorton **Competitive game:** This dice game involves a bit of luck and a bit of skill. Who will win?	**Lesson summary: Students roll two 6-sided dice, recording the total of their roll using the roll it up template in this unit's folder.** **Materials:** • 2 x 6-sided dice. • Roll and graph recording templates from this unit's folder – players record using the one sheet between them. **Best set-up:** Fishbowl model, then regular like-ability maths buddies.  **Modelling:** Giant model around a desk, using an A3 enlarged version of the roll it up recording template for your teacher modelling, and two 6-sided dice (giant ones if possible). Always enlarge the materials for the at-desk demonstration for better visibility for students (first 5-8 minutes), then play for the second part (final 5 minutes) of the modelling with the regular materials. Invite a student partner to compete against you. Ask them to choose their favourite number, shading over this in green on the recording sheet. Then you choose a number yourself, shading this in red. Continue until each player owns 5 numbers (e.g. you own 5, 3, 6, 4 and 8; I own 7, 9, 10, 2, 11), with 1 of the 11 possibilities belonging to no one (e.g. 12). Model rolling the dice and combining them to figure out the total. Emphasise for students to use their superhero eyes to see what they rolled, then to use their knowledge of number combinations that make totals (partitioning), or counting on if needed, by covering the larger rolled number and counting on by tapping the dots on the smaller rolled number. Write the matching addition equation in the correct column, creating a column graph that will highlight the most frequently occurring total. If the total belongs to you, you get a point. If the total belongs to your partner, they get a point (it does not matter who rolled, just who 'owns' the total from the choices made at the start of the game). Whoever has the most points, after one column is full, wins! Collect a new gameboard and repeat.

Students who are capable can also use their grid books to record.

Student work samples



Support: Use two 3-dot dice and the roll it up support version that only includes totals from 1 to 6.	**Extension:** Use 3 dice and allow subtractions in their equations. For example, if a student owns the numbers 5, 9, 8, 4 and 2, then rolls 5, 6 and 1, they would not want to make 12. So, instead, they may do 6 + 1 – 5 = 2 to make a total that they own. Also encourage the use of multiplication and division in their equations, offering an extra point for equations that include these operations (or two extra points for division).

End-of-session reflection: Without rolling the two dice, brainstorm with their partner all the ways to make each of the totals on the gameboard, recording this in the columns. Figure out the best numbers that they should have chosen (5, 6 and 7), and the worst numbers (2 and 12), according to which numbers have the most and fewest combinations when rolling two 6-sided dice.

Variation: Change the dice rolled, such as rolling a 3-dot and 6-sided dice, or rolling one 6-sided and one 10-sided dice. How does this change which numbers you select to 'own' at the start of the game? Which numbers have the most combinations now? Which numbers would you avoid selecting?

Partition Lesson 21	**Number Talks for 6 to 10** **Learning intention: Show everything you know about our number of the day** **Maths vocabulary: ways to make, and (+), take away (-), groups of (x), shared between (÷), odd, even, double, less, more, missing from ten**
Mathematician talk: You are all mathematicians and you know so much about numbers already. I want you to reach deep within that maths brain of yours and show me everything you know about this number. <u>What do you notice?</u>	**Lesson summary: Students discover and show everything they know about 6, 7, 8 and 9, after a modelled whole-class number talk.** **<u>Number talk strategies:</u>** No hands up. Students instead hold a fist to their chest. Put one thumb up when they have one strategy and the answer. Two fingers up (still with their fist held against the middle of their chest, to avoid long waving hands distracting others) for two strategies. Three fingers up for three strategies, and so on. After a few minutes of thinking time, students are called upon to contribute strategies, with their name and strategy illustrated on the front whiteboard. Other students wave their fist in a surfing "Yeah dude!/Hang 10!" motion (closed fist, little finger and thumb out waving) if they used the same strategy, to recognise their own thinking as well. Students are also encouraged to mention and build upon other students' strategies, such as, "Mine was similar to Jenny's, except I did…" Number talks are about mental strategies (no paper-based strategies). The strategy is then shown in number sentences or drawings on the whiteboard, basically as an imprint of the student's thinking for others to see and consider.
	Materials: • <u>All about 6 to 10 Number Talks PowerPoint</u> from this unit's folder. • <u>Ten frames</u> for students to draw the number of the day. • Popsicle sticks for students to move around and manipulate the drawings on their ten frame. **Best set-up:** Model using a whole-class number talk, then students work independently.
	Modelling – "What do you notice about 6?" During the first number talk, model in detail using the <u>PowerPoint display</u>, with students approaching the board with the screen displayed and holding their rulers to show you something they notice about 6. "I see 6 as 4 and 2," (using their ruler to show the parts they saw). "I see 6 as double 3." "I see 6 as 4 missing from 10." "I see 6 is even because everyone has a partner." **Questioning:** Detailed questioning tips are outlined at the start of the <u>All about 6 to 10 Number Talks PowerPoint</u>, particularly on page 1 of the PowerPoint and are also copied on the next page.

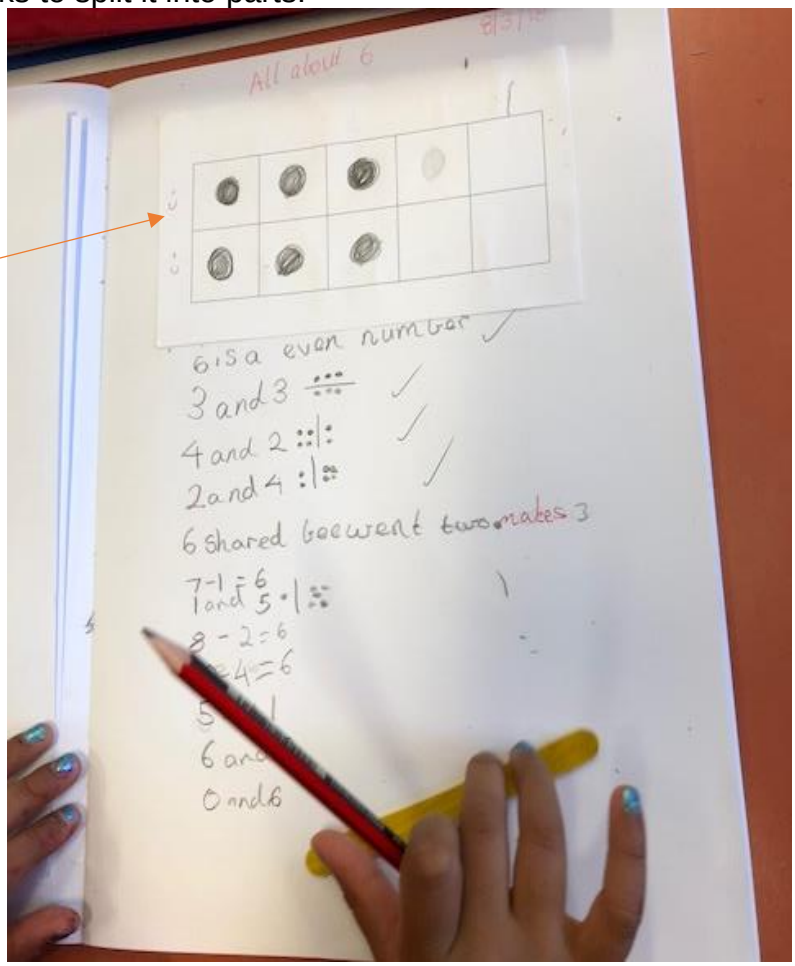
What can you tell me about 7?

- Does everyone have a partner, or is there a person without a partner? So, is 7 odd or even? (Draw 7 in the ten frame as two rows of 3 and one extra, rather than as 5 and 2).
- What is 7 made of? Can you break it into parts? Use a 1m ruler to show this on the screen, “I see 4 on the first row, I see 3 on the bottom, I see 7. I see 6 like on the dice, I see 1 more, I see 7. I see 3 and 3 and 1 more. I see double 3 and 1. I see 8 take away 1. I see 4 and 4 take away 1.” Record on the whiteboard in worded and number sentences as students contribute ideas.
- Did anyone see it another way? For example, I see 4 like on the dice on the left-hand side, and 3 more on the right-hand side.
- I can see that 3 are missing, so 10 take away 3 makes 7.
- If we cover some dots, what can you say about 7? 7 take away 1 makes 6. 7 is 1 more than 6. 7 is 1 less than 8.

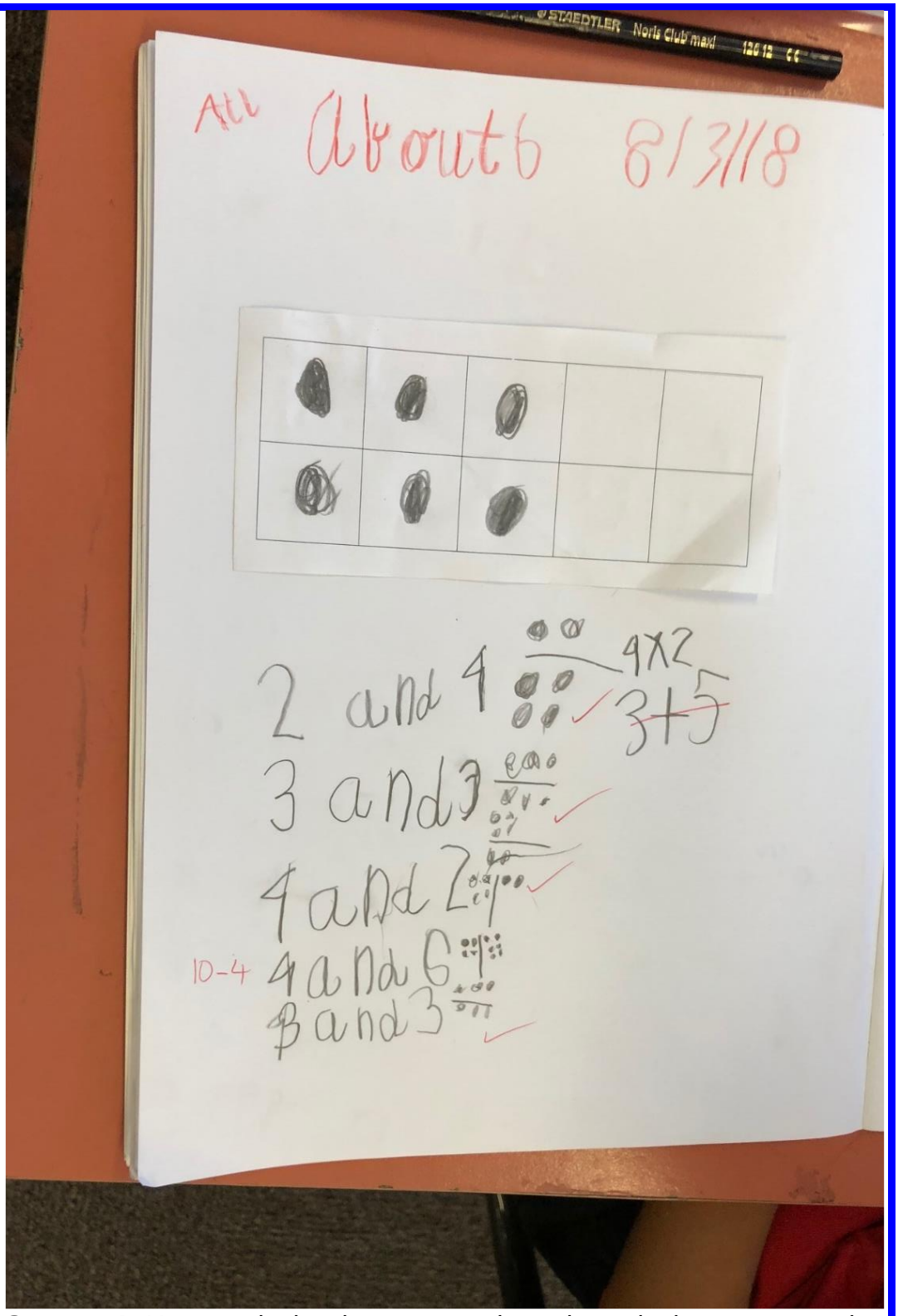
Student work samples

If recording is challenging for certain students, encourage them to use dots and lines to record. Show all the ways to make the number with dots, using popsicle sticks to split it into parts.

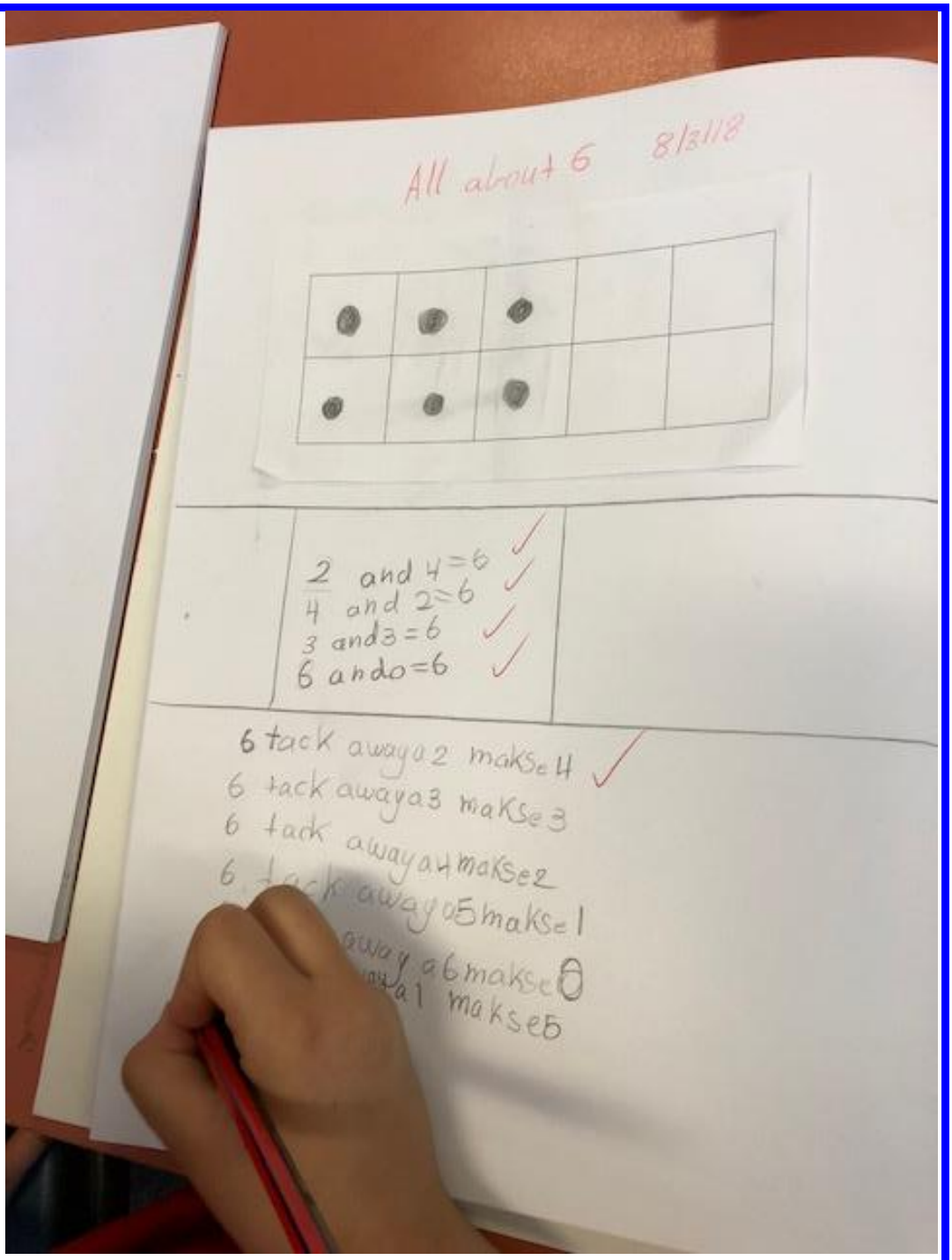
The student drew smiley faces at the start of the rows to work out 6 shared between 2 makes 3 (6 ÷ 2 = 3). Smiley faces could also be drawn on top of the 3 columns to work out 6 shared between 3 makes 2 (6 ÷ 3 = 2).



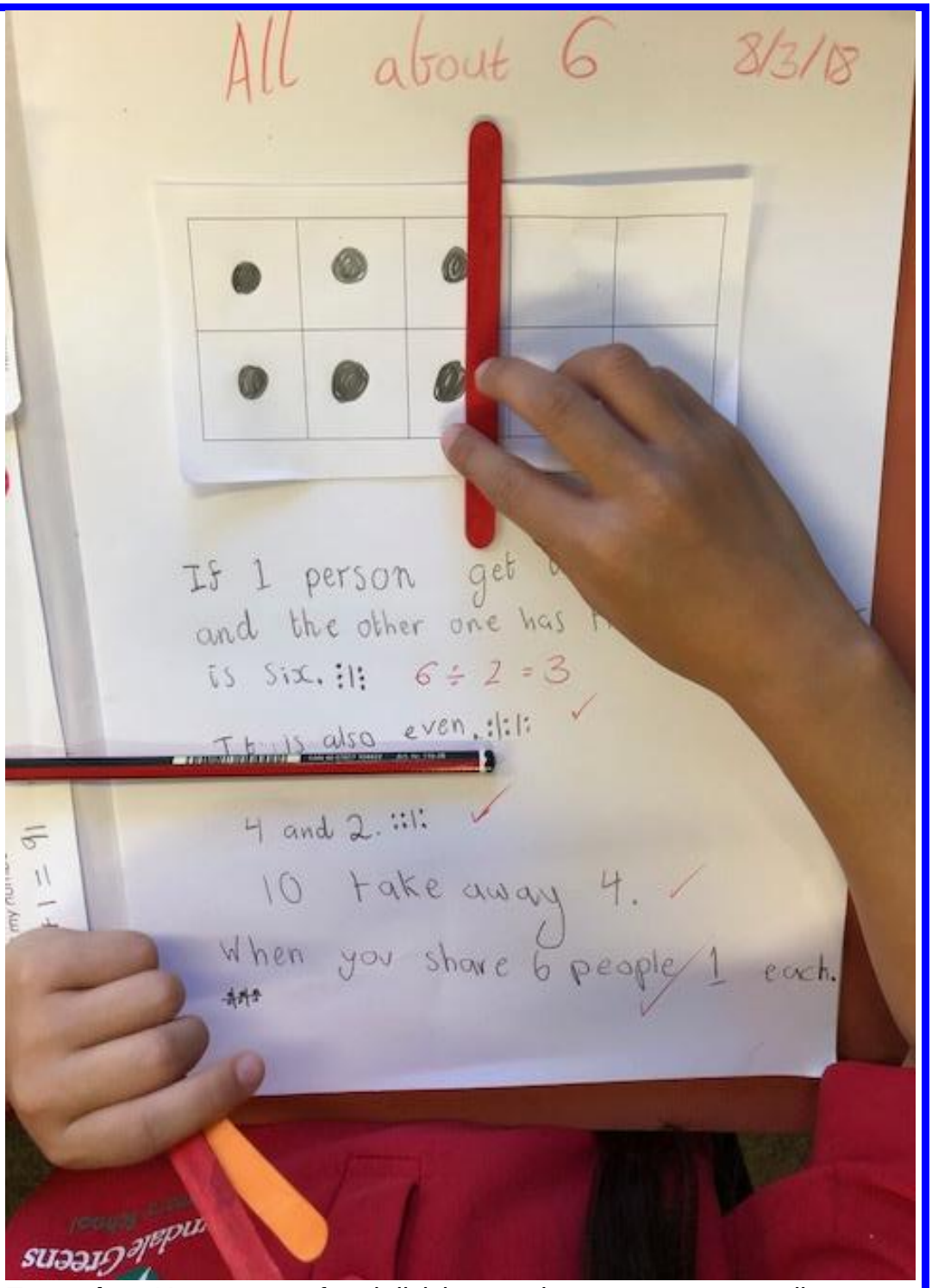
Mid-range year 2 student sample during term 2



Support 1: Use mostly drawings to record, as shown in the support work sample above.



Support 2: Focus mostly on addition – ways to make it. Then taking away from it, as they use their fingers to progressively cover more dots to act out the subtraction physically.



Extension: Use groups of and division number sentences as well. Student samples are photographed in the first few pages of the PowerPoint to visually demonstrate support and extension versions.

