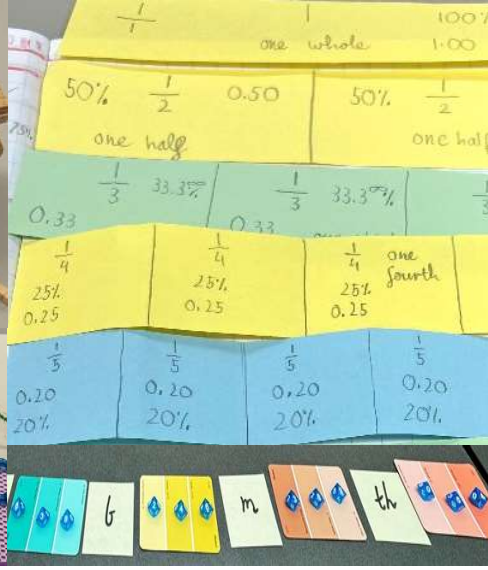


Real-Life Numeracy Years 3-6

Planning Package

Sequential units with hands-on, real-life numeracy for Year 3, Year 4, Year 5 and Year 6 students

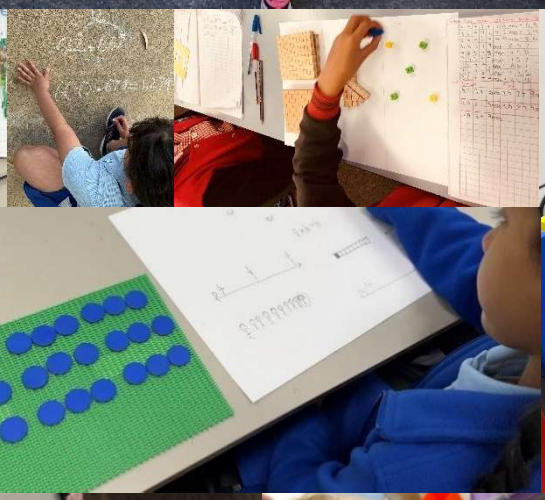
Ten years of development time in Australian classrooms.

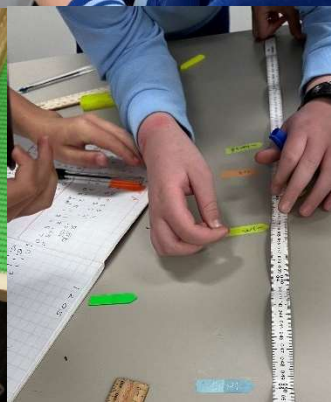
Genuinely high engagement and conceptual understanding in middle to upper primary numeracy.

Comprehensive differentiation for wide ranges: Pre-planned and workable enabling and extending prompts for every lesson.

High-impact, high-relevance professional learning on a daily basis to support planning.

Comprehensive diagnostic and formative assessments to target each sequential point-of-need.





Please note: It is not intended for teachers to attempt to deliver every lesson in this sequence, nor read the unit in full.

Units are designed as **a menu of options**, depending on the points-of-need for each class, with enabling and extending prompts included for every lesson.

Please choose lesson options based on assessed points-of-need (units are directly linked to the assessments), using either Top Ten's or other **strategy-focused diagnostic pre-assessments.** We recommend avoiding multiple-choice/click-the-answer tests, as numeracy as a discipline grows students' reasoning and thinking skills, ability to explain and show strategies, as well as deep conceptual understanding – answers alone are not the ultimate goal, or a worthy aspiration without student reasoning.

Please also select lessons that best suit students' interests and your own creativity and passion. Units are designed to share the wisdom of practice, while respecting and safeguarding the professional role of the teacher as the ultimate best judge of what students need.

Adjust how many lessons you deliver based on student progress throughout the unit, which can be tracked using the formative assessment folder.

Place Value for Year 4 – 4B
Rounding and Number Lines
Hyperlinked Table of Contents

Place Value Unit for Year 4

Curriculum Links for the following lessons

This unit is recommended for Year 4 students.

Australian Curriculum V9 AC9M4N07 and Victorian Curriculum Version 2.0 (VC2M4N07)

Number – Level 4: Choose and use estimation and rounding to check and explain the reasonableness of calculations, including the results of financial transactions

- using proficiency with basic facts to **estimate the result** of a calculation and say what amounts the answer will be between; for example, 5 packets of biscuits at $2.60 each will cost between $10 and $15 as 5 × $2 = $10 and 5 × $3 = $15
- using **rounded amounts** to complete an estimated budget for a shopping trip or an excursion, explaining why overestimating the amounts is appropriate
- recognising the **effect of rounding** in addition and multiplication calculations; rounding both numbers up, both numbers down, and one number up and one number down, and explaining which is the best approximation and why

Laying the place value foundations for content descriptors relating to place-value based strategies for operating on numbers: **Australian Curriculum V9 AC9M4N06 and Victorian Curriculum Version 2.0 (VC2M4N06)**

Number – Level 4: Develop efficient mental and written strategies and use appropriate digital tools for solving problems involving addition and subtraction, and multiplication and division where there is no remainder

- using and choosing efficient calculation strategies for addition and subtraction problems involving larger numbers, for example, **place value partitioning**, inverse relationship, compatible numbers, jump strategies, **bridging tens, splitting one or more numbers,** extensions to basic facts, algorithms and digital tools where appropriate
- using physical or virtual materials to demonstrate **doubling and halving strategies** for solving multiplication problems; for example, for 5 × 18, using the fact that double 5 is 10 and half of 18 is 9; or using 10 × 18 = 180, then halving 180 to get 90; or applying the associative property of multiplication, where 5 × 18 becomes 5 × 2 × 9, then 5 × 2 × 9 = 10 × 9 = 90 so that 5 × 18 = 90
- using **place value partitioning,** basic facts and an area or region model to represent and solve multiplication problems; for example, for 16 × 4, thinking 10 × 4 and 6 × 4, then 40 + 24 = 64, or a double double strategy where double 16 is 32, double this is 64, so 16 × 4 is 64

Australian Curriculum V9 AC9M4N05 and Victorian Curriculum Version 2.0 (VC2M4N05)

Number – Level 4: Solve problems involving multiplying or dividing natural numbers by multiples and powers of 10 without a calculator, using the multiplicative relationship between the place value of digits

- using physical or virtual materials to demonstrate the multiplicative relationship between the places
- using materials such as place value charts, numeral expanders or sliders to recognise and explain why multiplying by 10 moves the digits one place to the left and dividing by 10 moves digits one place to the right
- using a calculator or other digital tools to recognise and develop an understanding of the effect of multiplying or dividing numbers by tens, hundreds and thousands, recording sequences in a place value chart, in a table or spreadsheet, generalising the patterns noticed and applying them to solve multiplicative problems without a calculator

Western Australian Curriculum Number and Place Value – Level 4: Recognise, represent and order numbers to at least tens of thousands (ACMNA072)

- reproducing five-digit numbers in words using their numerical representations, and vice versa.

Western Australian Curriculum Number and Place Value – Level 4:

Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems (ACMNA073)

- recognising and demonstrating that the place-value pattern is built on the operations of multiplication or division of tens

NSW Syllabus – Stage 2 – Representing numbers using place value A

Whole numbers: Read, represent and order numbers to thousands

- Group physical or virtual objects to show the structure of tens, hundreds and a thousand
- Regroup numbers flexibly, recognising one thousand as 10 hundreds and one hundred as 10 tens or 100 ones
- **Compare and describe the relative size of numbers by positioning numbers on a number line (Reasons about quantity)**
- Count forwards and backwards by tens and hundreds on and off the decade
- Represent numbers up to and including thousands using physical or virtual manipulatives, words, numerals, diagrams and digital displays
- Read and order numbers of up to at least 4 digits
- Identify the number before and after a number with an internal zero digit

Whole numbers: Apply place value to partition and regroup numbers up to 4 digits

- Record numbers using standard place value form
- Partition numbers of up to 4 digits in non-standard forms (Reasons about quantity)

NSW Syllabus – Stage 2 – Representing numbers using place value B

Whole numbers: Order numbers in the thousands

- Arrange numbers in the thousands in ascending and descending order
- Recognise and describe how rearranging digits changes the size of a number (Reasons about relations)
- **Identify the nearest thousand, 10 thousand or 100 thousand to numbers**

Whole numbers: Apply place value to partition, regroup and rename numbers up to 6 digits

- Name thousands using the place value grouping of ones, tens and hundreds of thousands
- Use place value to expand the number notation
- Partition numbers of up to 6 digits in non-standard forms

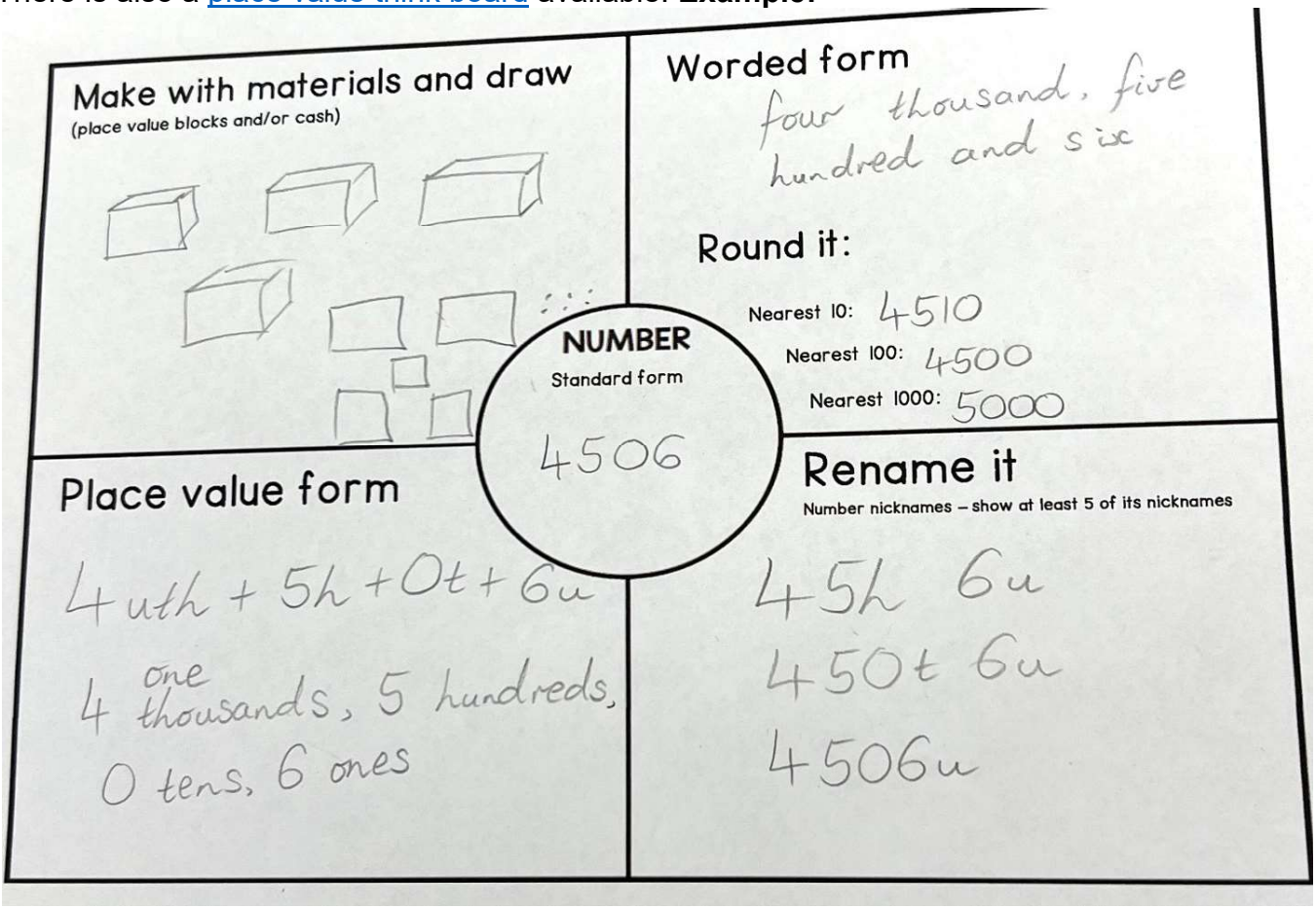
Whole numbers: Recognise and represent numbers that are 10, 100 or 1000 times as large

- Recognise the number of tens, hundreds or thousands in a number
- Describe how making a number 10, 100 or 1000 times as large changes the place value of digits

Formative Assessment

A formative assessment cross-check is available in this unit's folder with progressive learning goals and specific success criteria for this unit. This includes a grid template or a section template for notes, whichever the teacher prefers to use.

There is also a place value think board available. **Example:**

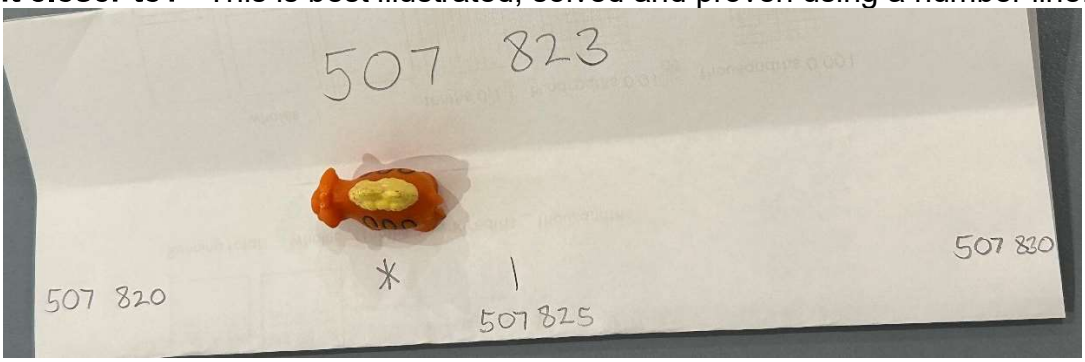


The ghost of place value past shall haunt you all year...

Rush through place value during Term 1 at your peril – its ghost will haunt you for the rest of the numeracy year. You start split strategy – students cannot partition mentally. You start jump strategy – students cannot jump in multiples of a place value, nor bridge or rename. You start multiplication, students cannot estimate because they cannot round, so produce unreasonable answers. You try division – they cannot partition or rename. It is worth the seven weeks.

Teaching Tips – Rounding

Avoid ‘rounding rollercoasters’ or ‘rounding mountains’ and instead repeat this critical question: **“What is it closer to?”** This is best illustrated, solved and proven using a number line.



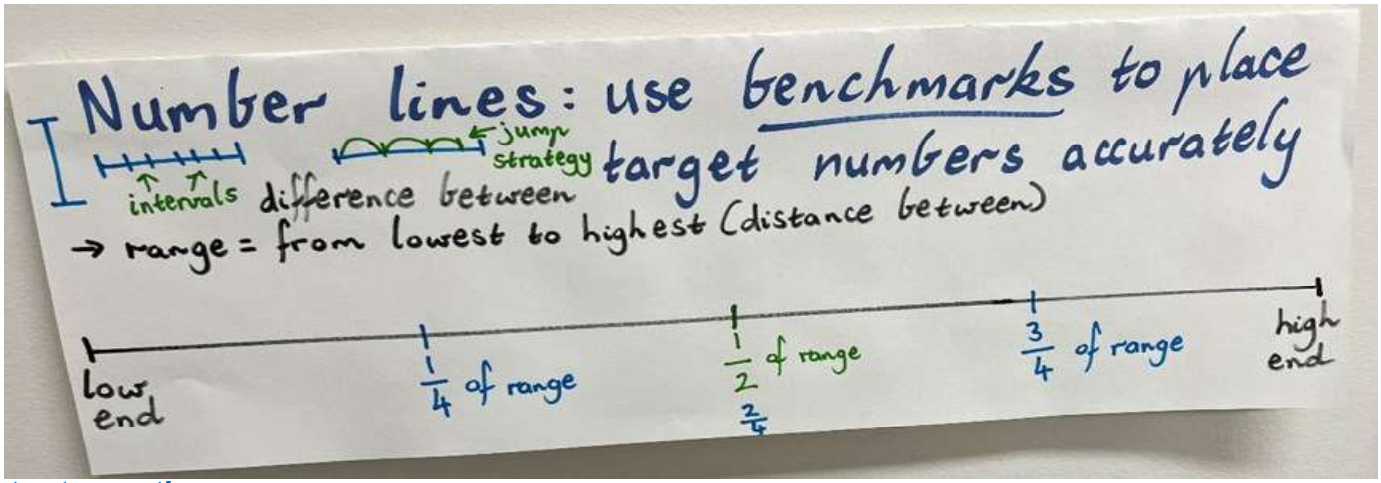
Rote rules relating to underlining the place next door, and so on, often falter in students’ memories when they are conceptually challenged, and also do not create genuine number sense in terms of number line awareness. These fragile procedures frequently fall to pieces when students are asked to round inside a place value (rounding a tens of thousands number to the nearest ten), or estimate while operating, as the rules are too fragile to be applied meaningfully and with a number sense that is critical for real-life numeracy.

Research quoted by *Clarke et al (2008)*: **According to this large-scale study, if we do not teach or emphasise rounding and estimation throughout the year of numeracy, we are setting students up to fail in more than 60 percent of real-life scenarios.**

> Surveys completed by two hundred adults over a twenty-four-hour period found that more than 60 percent of all calculations carried out in daily life only required an estimate (Northcote and McIntosh 1999). We believe that the curriculum emphasis should reflect this finding. This is one reason why teaching fraction algorithms for the four operations does not prepare students for real-life encounters with fractions, where mental estimation is the key skill.

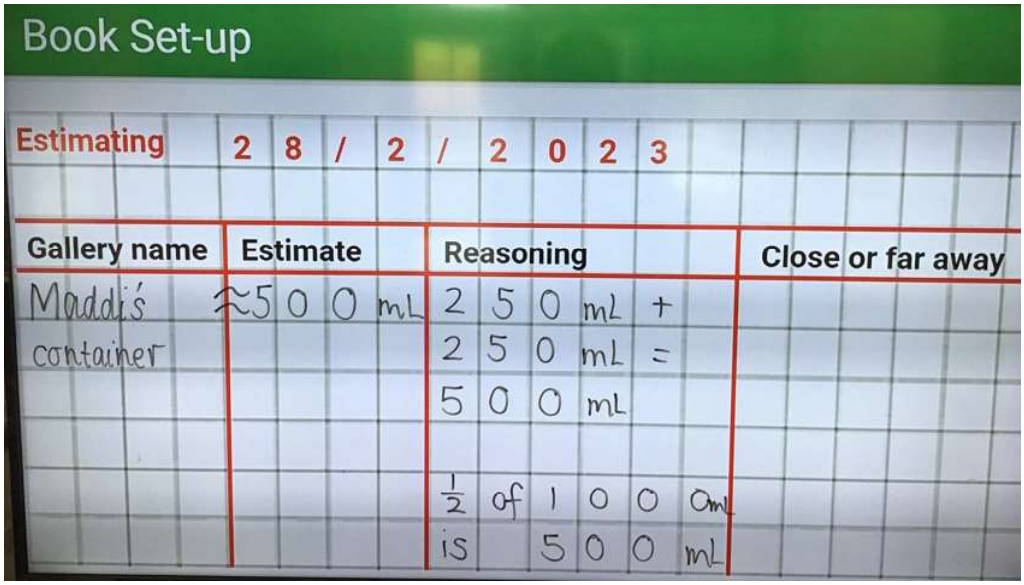
The discussion point then becomes the ‘5,’ as it lies in the centre of the number line, so does not appear to be visually closer to either side. There is a reason 5 rounds up – what do you think? (Take some thinking time before reading on…).

The reason that 5 rounds up is not simply by rule/convention – there is a mathematical basis for it. How many digits are there? There are 10 digits, including zero. So if we count on one hand – 5 digits go down, and 5 go up. That is an even or fair share for situations in life when we round down, and others when we round up.



Warm-ups	Second phase place value
Estimation Gallery Walks **Focus: Estimating large collections with increasing accuracy and recognising when an estimate (thinking guess) is reasonable or wild.**	Students set up estimation galleries, then rotate to each other's desks around the room to estimate the total of each. Students will only need to count their own pile efficiently (by arranging it into 5 as it appears on the dice, groups of 10 or arrays). When creating their jar, students place a post-it note on the bottom of their container, with the actual count listed, **so that all students receive feedback on the accuracy of their estimations** before attempting the next gallery. Emphasise that an **estimate** is meant to be a **'quick thinking guess'** – it should not be precisely correct, but nor should it be totally wild. The goal is for the estimate to be **reasonable**.  Students can label their desks A to Z (or with their name) on post-it notes, so that all students can record each estimate as they gallery walk in their grid book. **Progressively more challenging:** Vary the materials used in the estimation galleries to adjust the challenge level throughout the week. For example, on Monday and Tuesday, it could involve piles of counters, ones blocks, pompoms, or other small objects. On Wednesday and Thursday, students set up place value blocks in towers on their desk. On Friday, switch to piles of cash stacked so they cannot see every note clearly, or coloured cubes where each colour is assigned a place value. **Monday version (easier to estimate jars) and Friday version below:**

Galleries

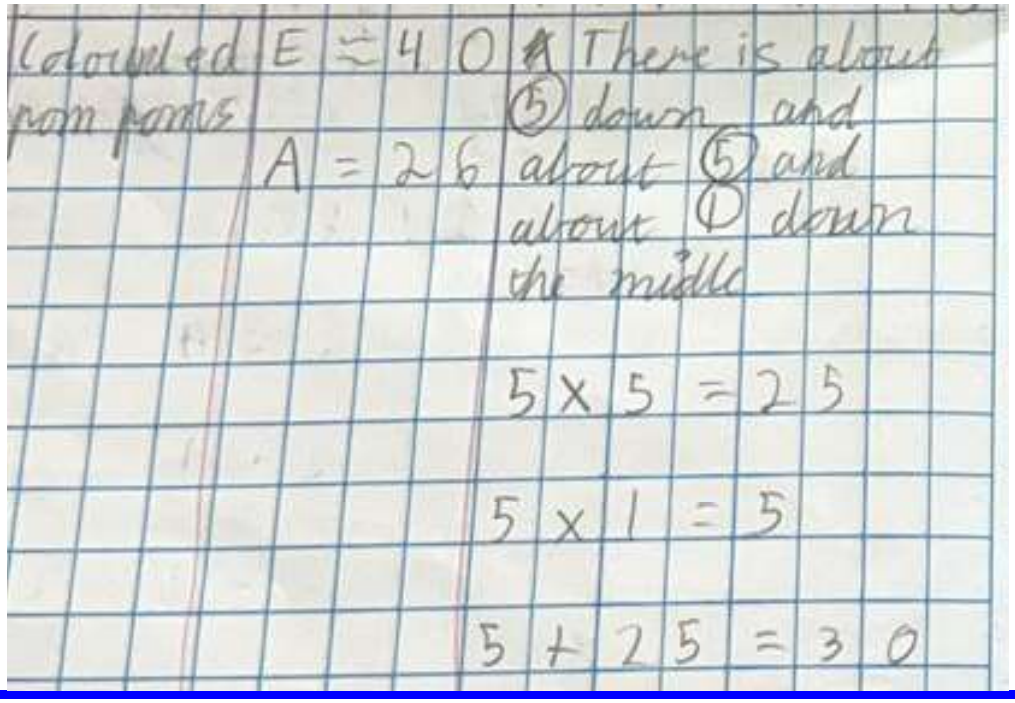


Book Set-up

Estimating 28/2/2023

Gallery name	Estimate	Reasoning	Close or far away
Maddi's container	≈500mL	250mL + 250mL = 500mL ½ of 1000ml is 500ml	

Mernda Park PS modelling of grid book set-up



Coloured pom poms

E ≈ 40

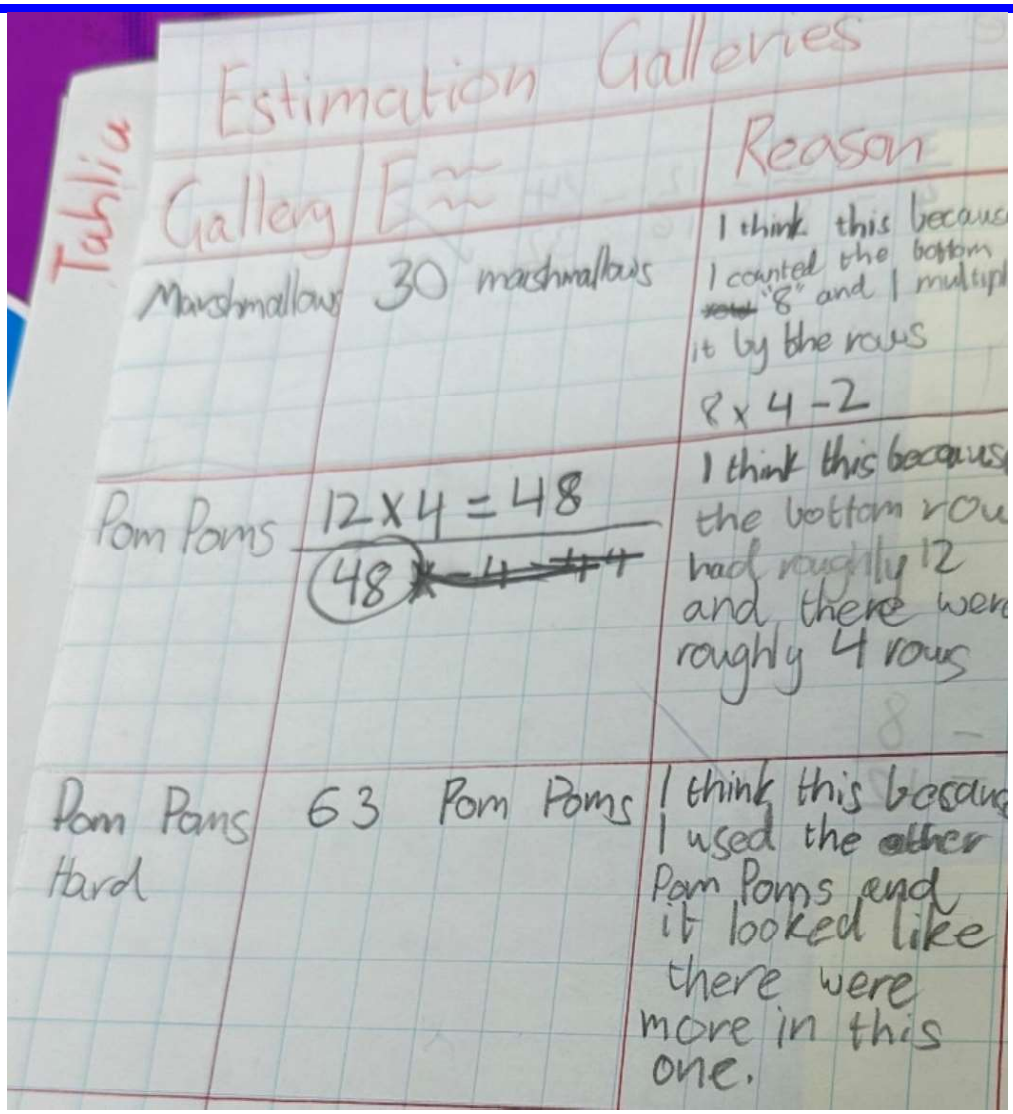
A = 26

There is about (5) down and about (5) and about (1) down the middle

5 x 5 = 25

5 x 1 = 5

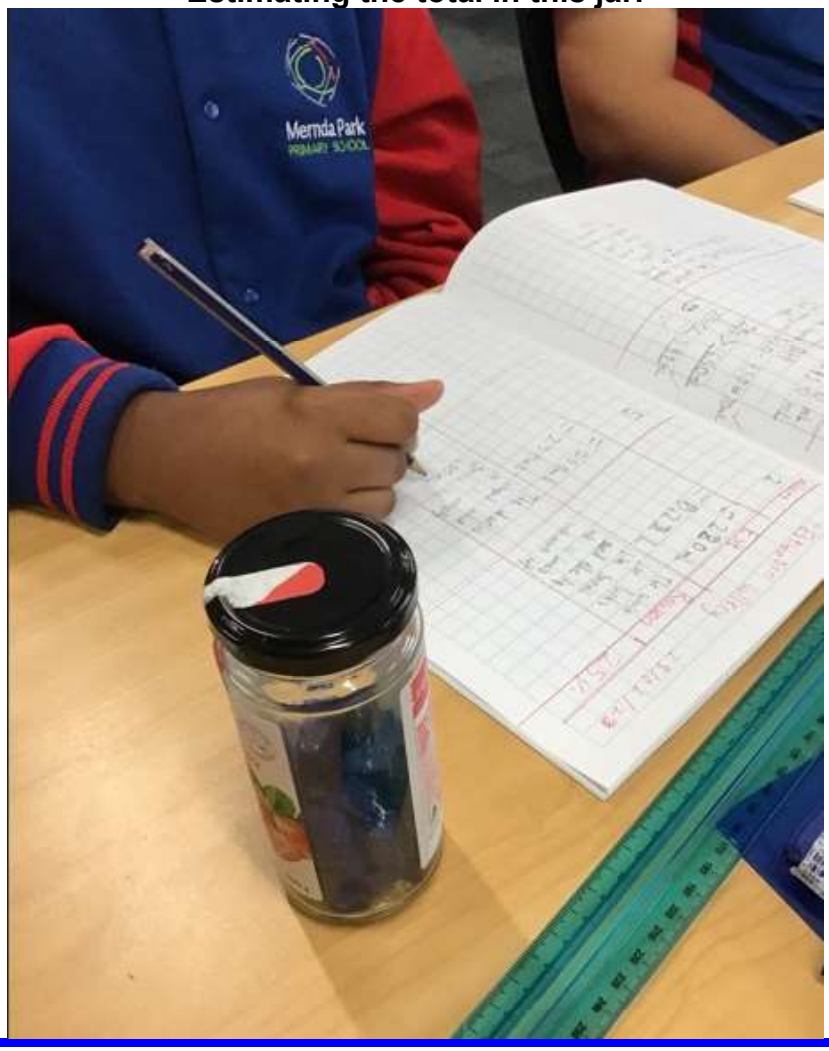
5 + 25 = 30

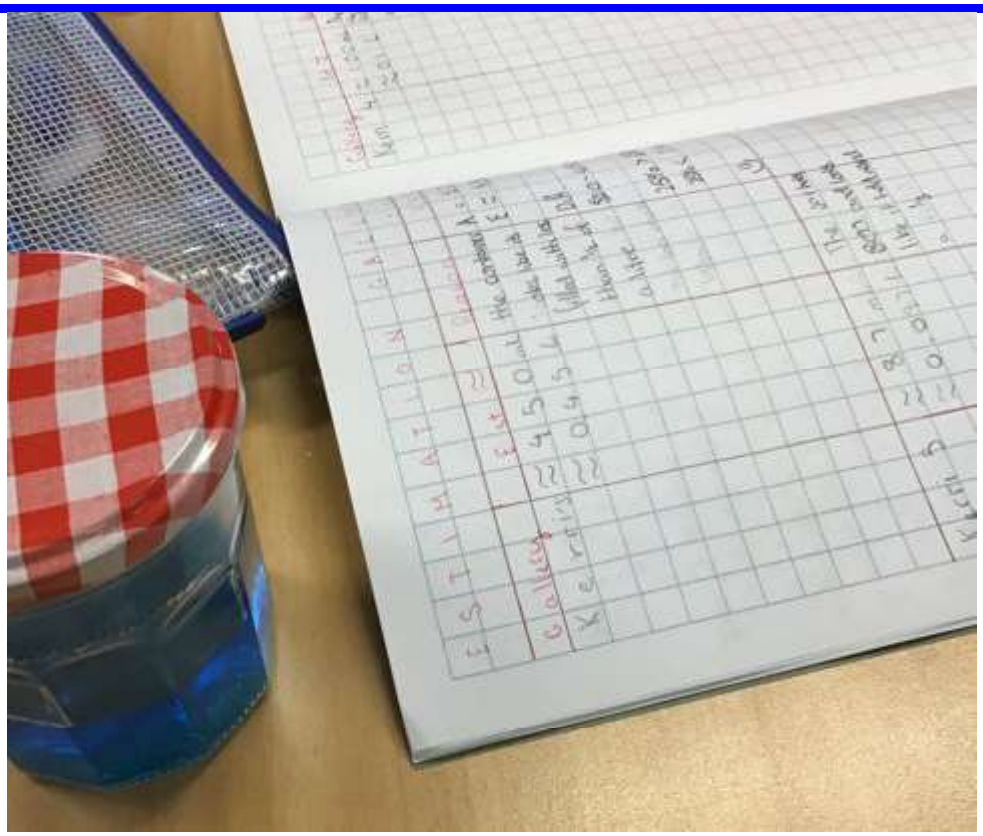


Questioning:

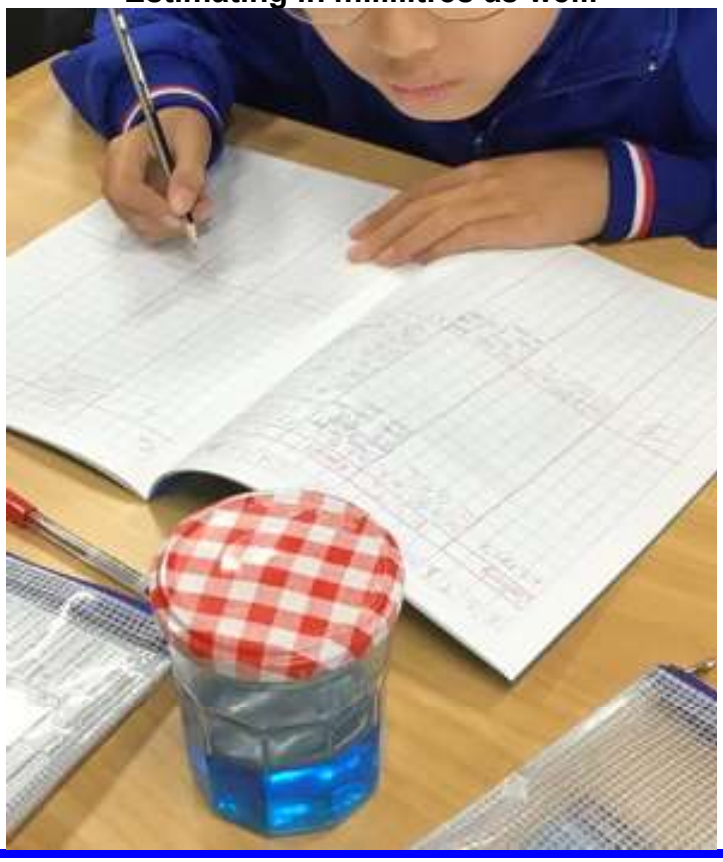
- Ask students where their eyes focused – was it on the larger or smaller place values for the blocks and cash? Which places matter the most for estimation purposes?
- Does an estimate need to be 'spot on' accurate? Should it be?
- Which professions use estimation a lot? (Painters for the amount of paint required, builders to quote a job, tree loppers for green waste costs).

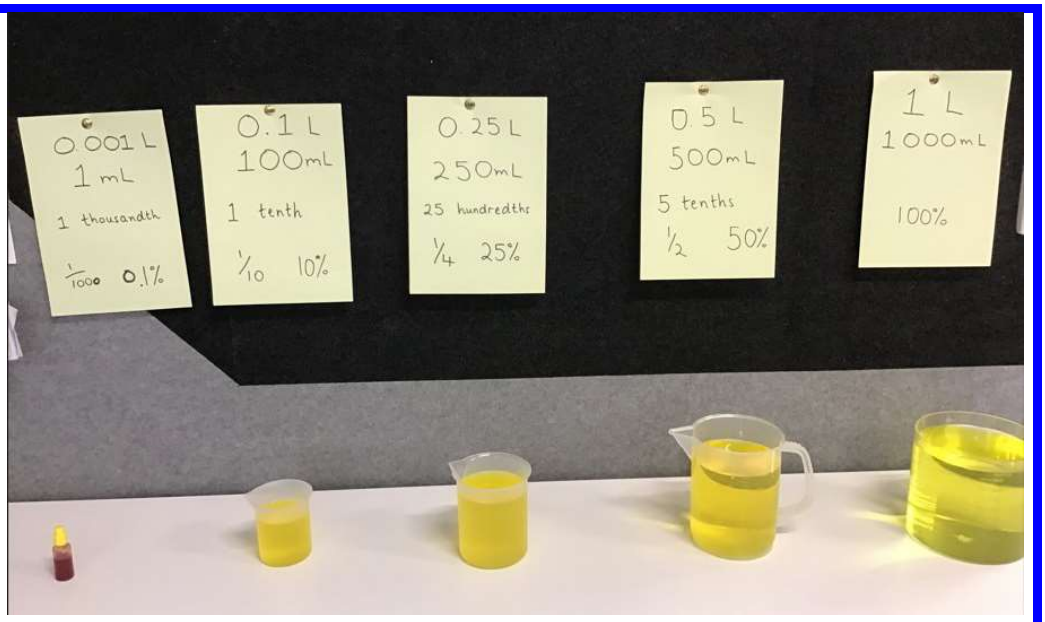
Estimating the total in this jar.





Estimating in millilitres as well.

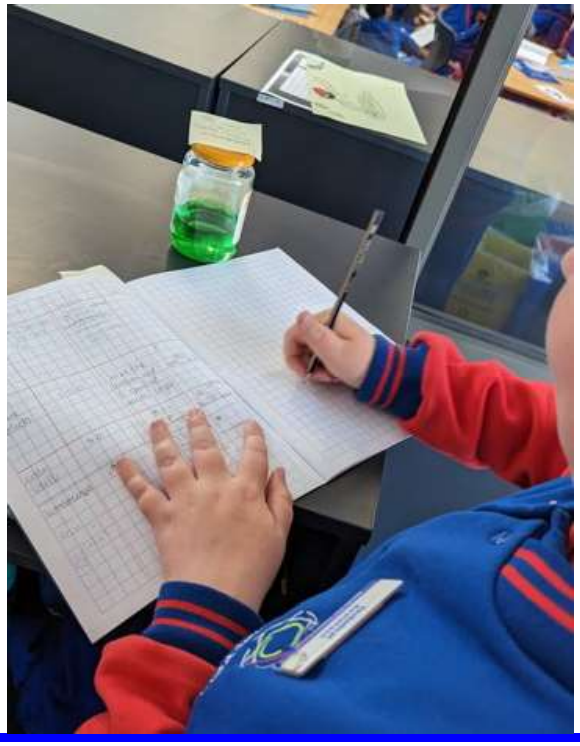


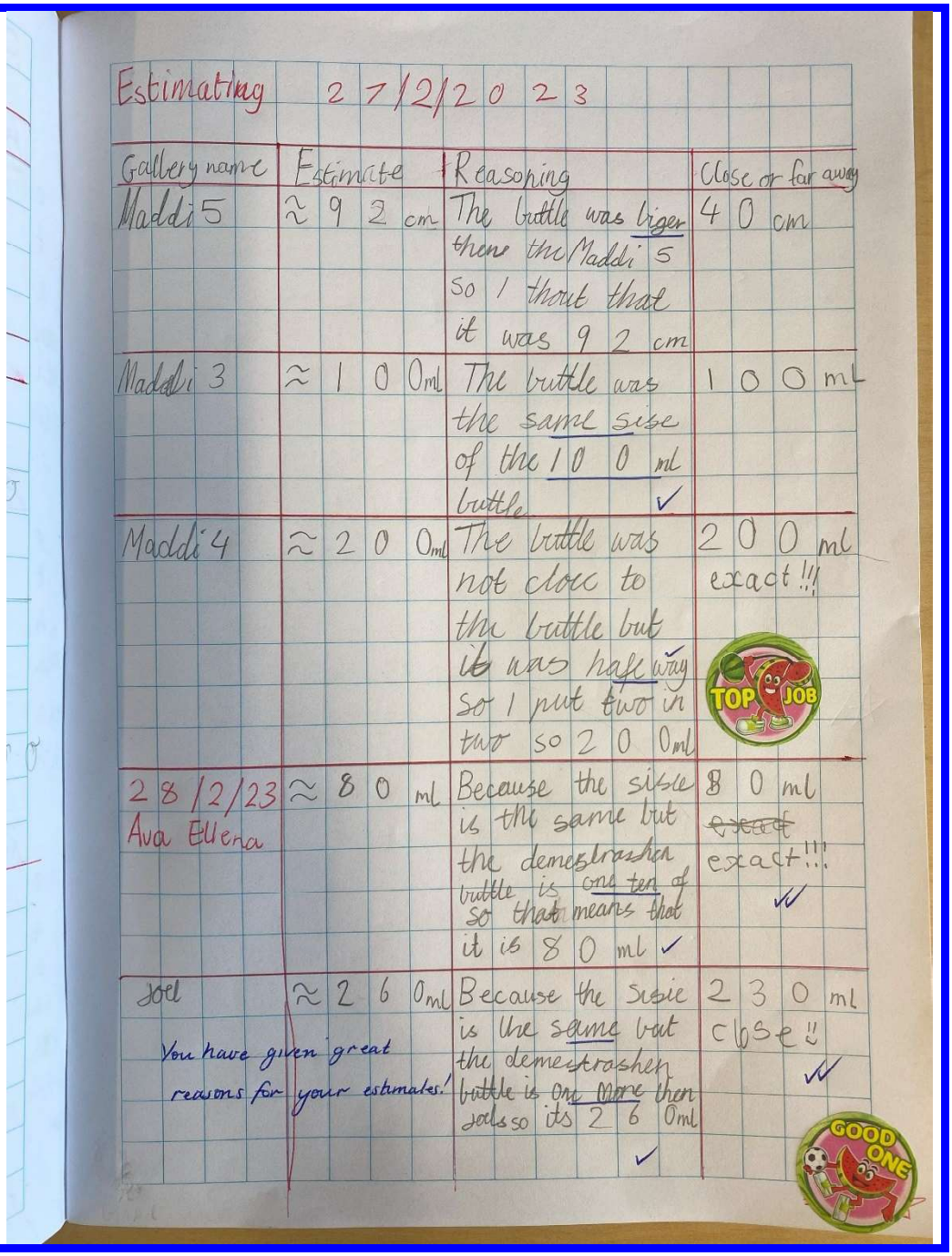


Visual benchmarks at the front of the room to assist students to estimate in millilitres and by fractions of a litre – with great thanks to Mernda Park PS.

If this is one litre, what do you think this container holds?

Excellent strategy by the leaders at Mernda Park PS to use cordial to make water colourful and visually clear.

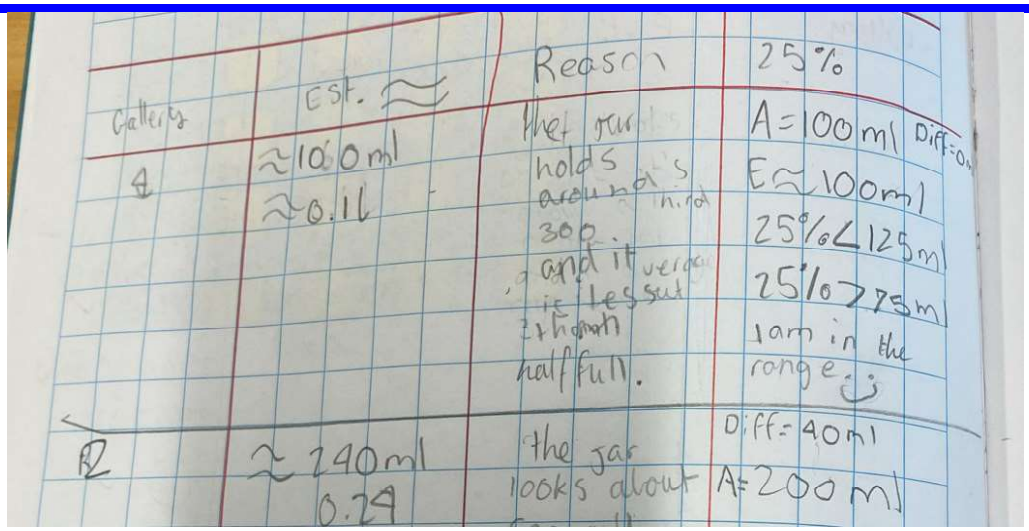




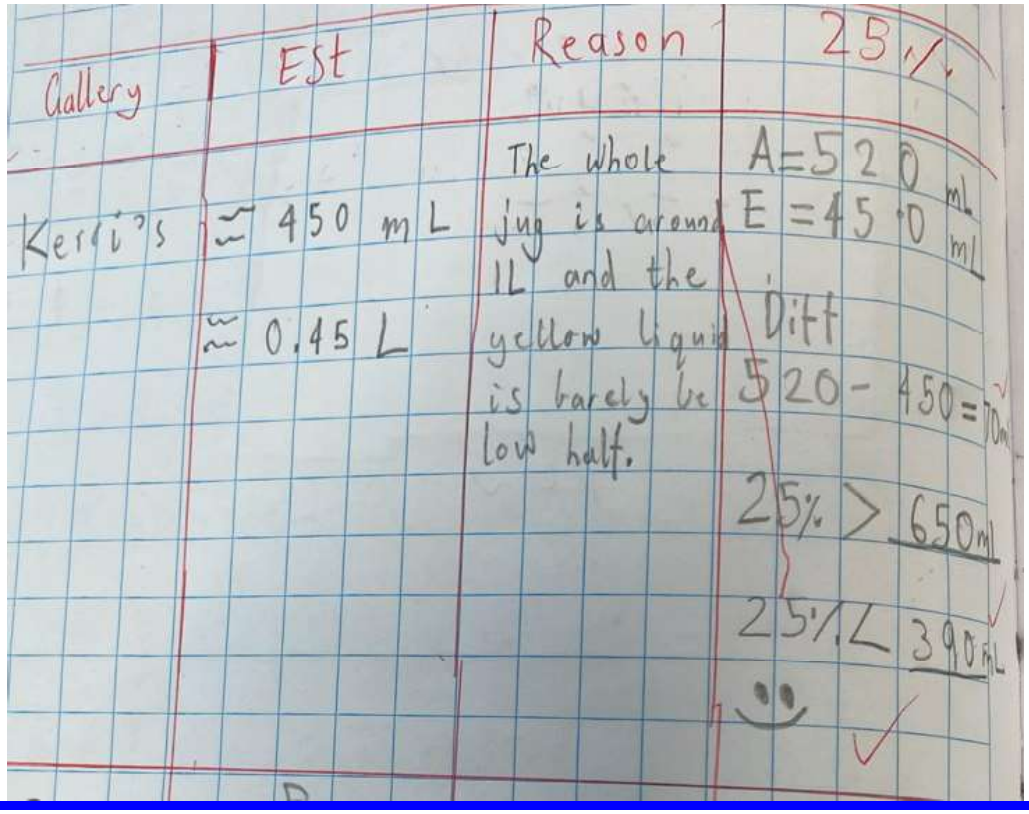
Estimating 27/2/2023

Gallery name	Estimate	Reasoning	Close or far away
Maddi 5	≈ 92 cm	The bottle was biger than the Maddi 5 so I thout that it was 92 cm	40 cm
Maddi 3	≈ 100ml	The bottle was the same sise of the 100 ml bottle ✓	100 ml
Maddi 4	≈ 200ml	The bottle was not close to the bottle but it was half way so I put two in two so 200ml	200 ml exact!!!
28/2/23 Ava Ellena	≈ 80 ml	Because the sise is the same but the demestrashen bottle is one ten of so that means that it is 80 ml ✓	80 ml ~~exact~~ exact!!! ✓✓
Joel	≈ 260ml	Because the sesie is the same but the demestrashen bottle is one more then 200 so its 260ml ✓	230 ml close!! ✓✓

You have given great reasons for your estimates!



Student work samples



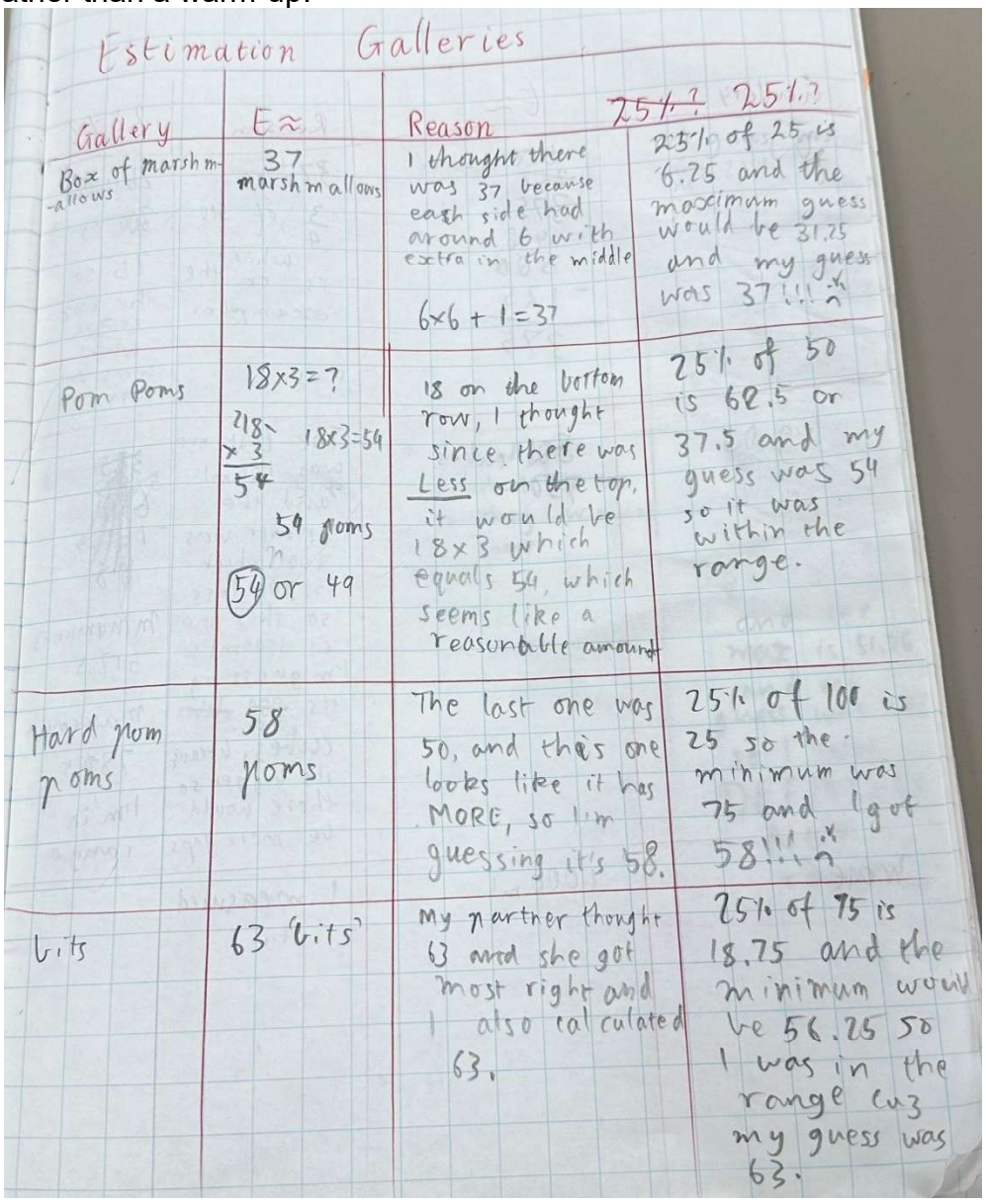
Support: Ask support students to make their galleries using larger materials and smaller jars, such as pompoms in transparent cups, Lego, pencils, and so on. Encourage support students to solve each other's galleries first, by grouping these in a set area of the room, or placing a particular coloured grip mat under their galleries so they know to gravitate towards these galleries first.

Extension: Take this opportunity to show extension students how to calculate percentages of collections. After revealing the answer, these students work out whether their estimate was within 25% (or another percentage such as 10%, or 15%, or 12.5%, to increase the challenge level of the task).

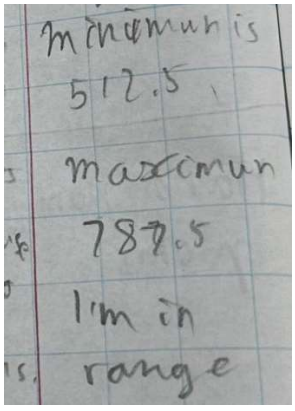
For example, the solution for one place value block gallery was 3863. Their estimate was 4000. 10% of 3863 is 386.3 (divide by 10, since 10% means 1 out of 10 parts), so if you add 386 to 3836, 4000 will be well within this, so the estimate was within a 10% leeway. Later, work with 5% leeway, by halving the 10%. For more support at the start,

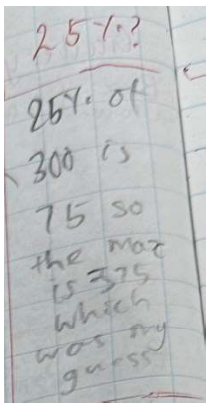
work with a 25% leeway by working out half of half of the actual answer to the gallery (solution 3836, ½ = 1918, ¼ = half of half, so 959), if the estimate was 4700, add 959 to the actual answer of 3836 to see if it reaches 4700. Since it goes above 4700 (4795), the estimate was within the 25% estimation leeway.

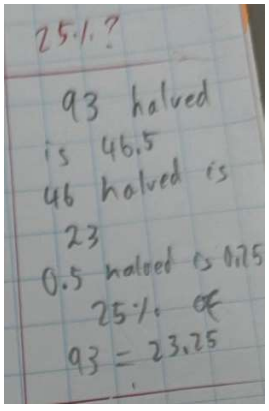
A student work sample of the extension version is copied below, where this challenge was used as an entire lesson for extension students, rather than a warm-up.

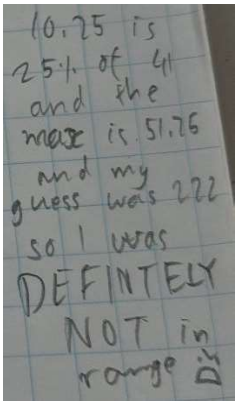


Example of Year 4 extension student recording, including the within 25% element









The engagement and on-task productivity is palpable!

Place Value Year 4B Lesson 3

Rounding Shootouts

Learning intention: Round numbers to any place value.

Maths vocabulary: round (what is it closer to), digit v. number, number line

Link to students' interests: This game is called 'rounding shootout,' where students aim to score each number on their gameboard. However, to connect it to students' specific interests, they can choose a sport with their partner, and make it a 'soccer penalty shootout,' or 'netball shootout,' or 'equestrian gallop-off' – whatever students are interested in!

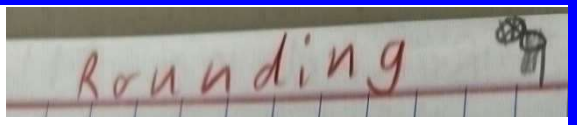
Lesson summary: Students set up a gameboard down the side of their grid book. Students then aim to 'score' rounding targets by pulling a number of cards that rounds to that target, proving it using a number line.

Example of one version of the game: **Students set up 0, 10 000, 20 000 up to 100 000 down their page. Students pull 5 cards to make a 5-digit number, then record the two nearest ten thousands on either side of a thin strip of paper to create a number line.**

Students mark key points on the number line (halfway, quarter marks, and so on), using these as benchmarks to place the number they made with playing cards. Finally, students draw an arrow to show which ten thousand is closer to their rolled number.

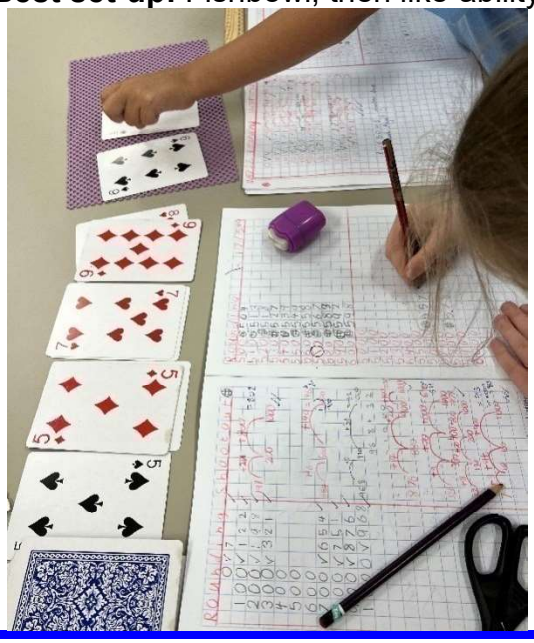
Students score that ten thousand target in their book, aiming to be the first to score every ten thousand to win!

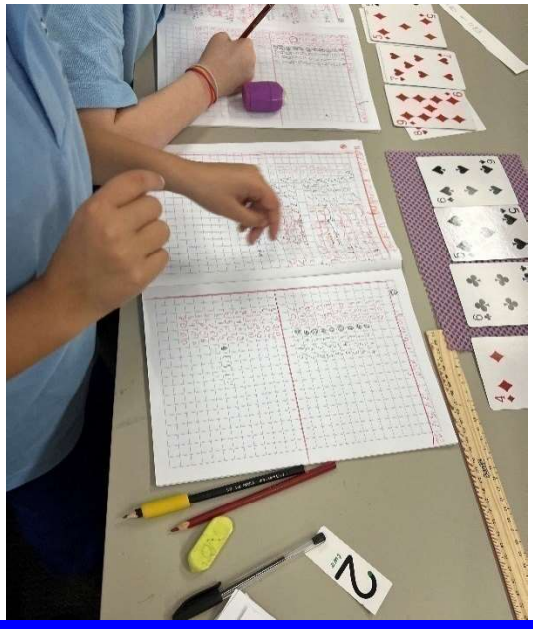
Materials:



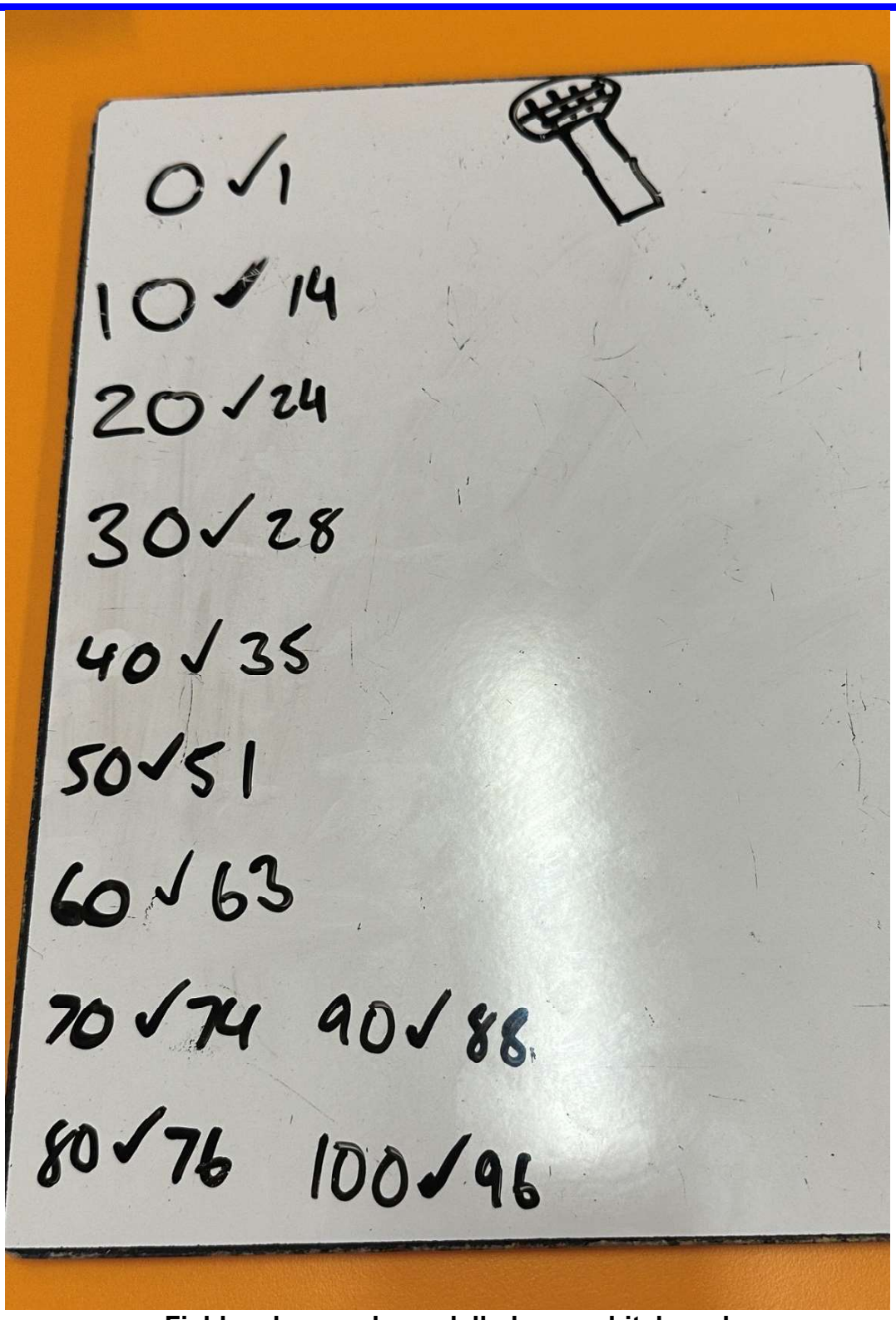
- Playing cards.
- Pre-sliced strips of A4 paper.
- *At the top of the page:* ***Students' quick sketch of what kind of shootout they are doing – this student loved netball, so it became a netball shootout.***

Best set-up: Fishbowl, then like-ability partners on mixed-ability tables.

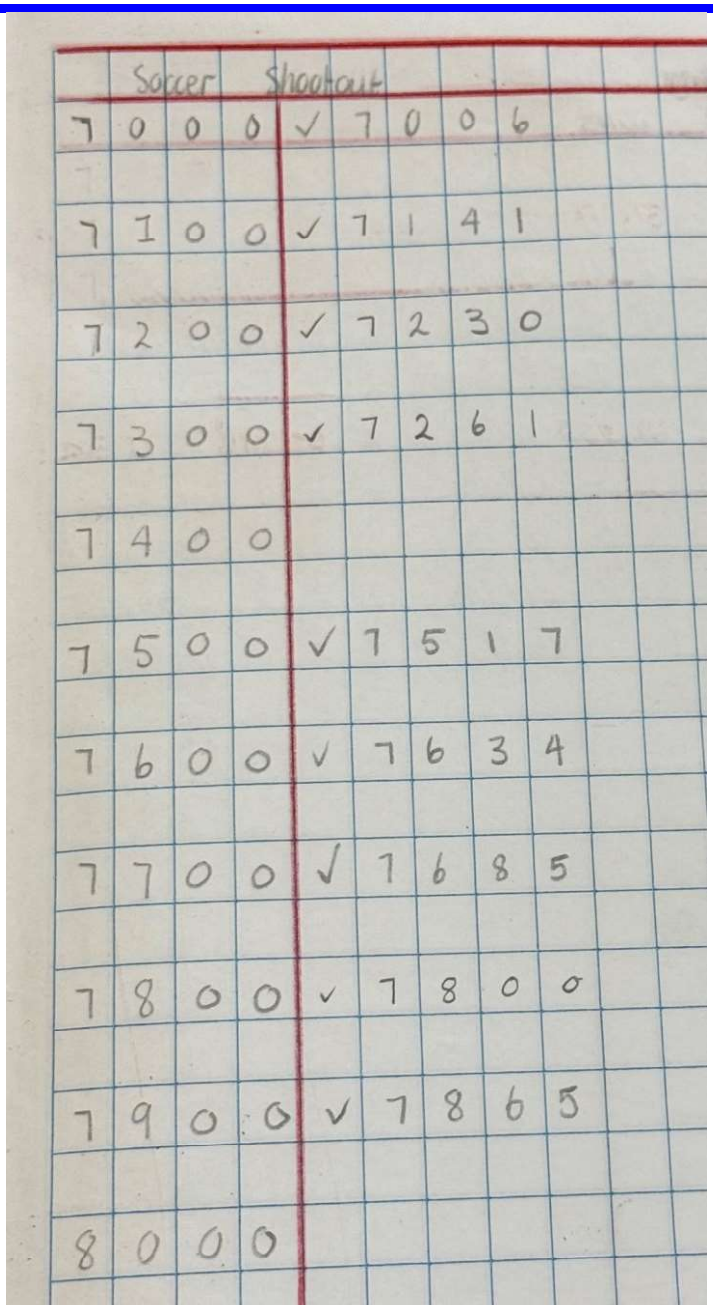




YouTube hooks: Since this is a rounding shootout, see some target practice examples https://www.youtube.com/watch?v=KU7BpDbaN7A&ab_channel=That%27sAmazing and https://www.youtube.com/watch?v=PpOErnoFR7o&ab_channel=TerriblyGoodVideos



Fishbowl example modelled on a whiteboard



Example of a rounding to the nearest hundred gameboard within thousands numbers (the '7' card stays put, the other 3 cards change each turn)

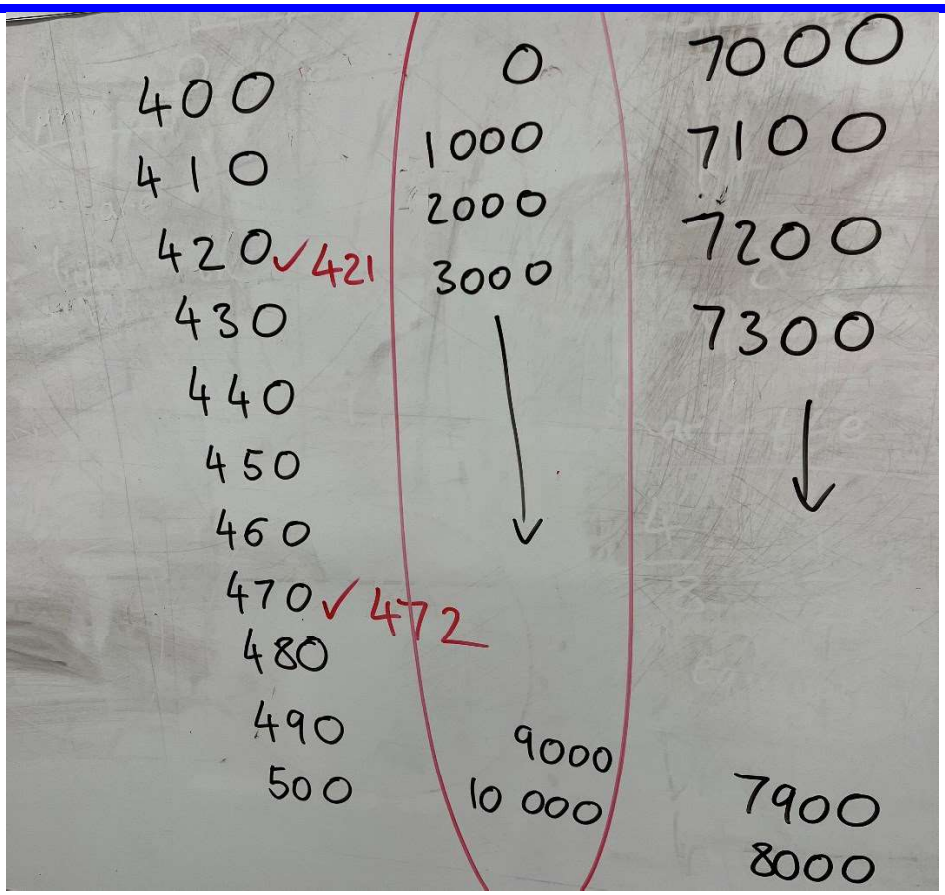
Key instructions: Set up the gameboard down your grid page, then pull cards to score the 'targets.' <u>Prove each score using a number line on an adjacent grid page</u>.

The first player to score all targets (out of the pair) wins! Then set up a new gameboard and repeat.

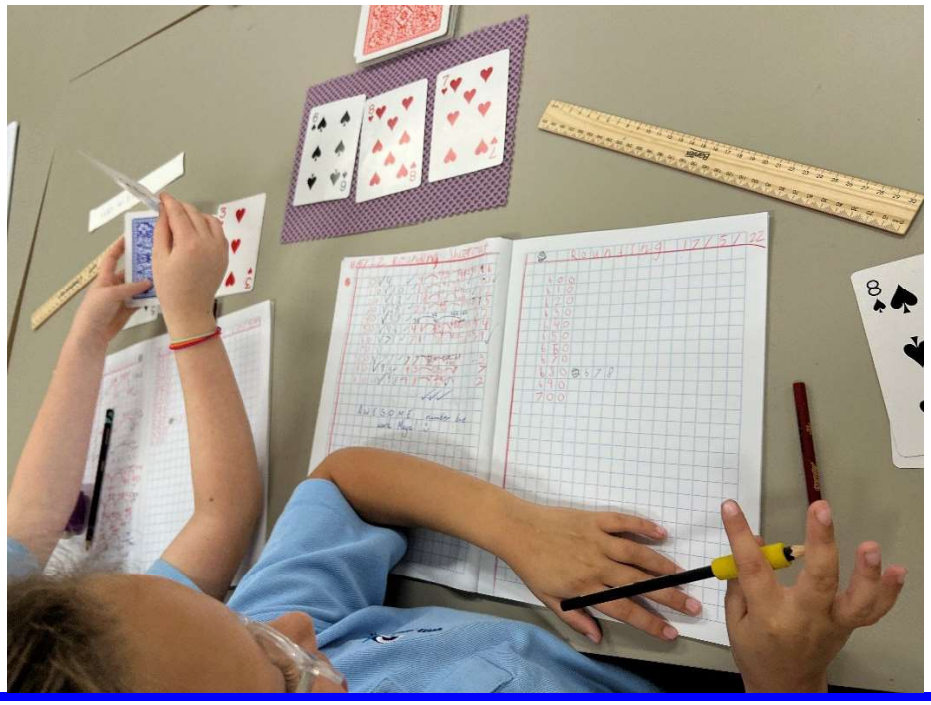
Rounding Shootout								9-3-2023	
0									
1	0	0	0	✓		1	3	5	9
2	0	0	0						
3	0	0	0						
4	0	0	0	✓		3	6	2	8
5	0	0	0	✓		5	1	4	9
6	0	0	0						
7	0	0	0						

With thanks to Natalie from Chirnside Park PS

Modelled example of a gameboard set up for rounding 4-digit numbers to the nearest thousand
(4 cards, all cards change on each turn)

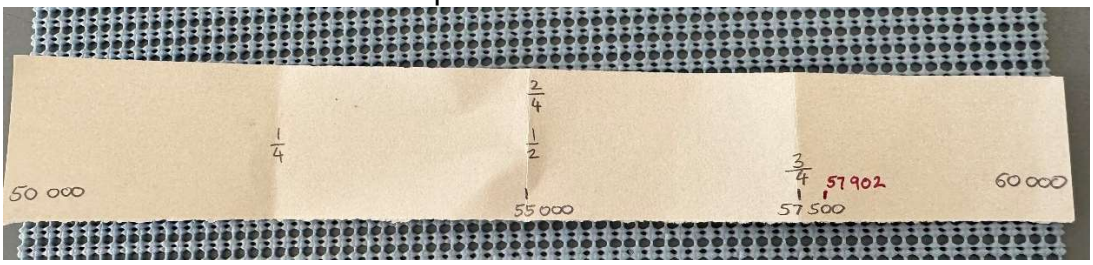


Staggered set-ups depending on points-of-need (mild, spicy, hot versions of the lesson)

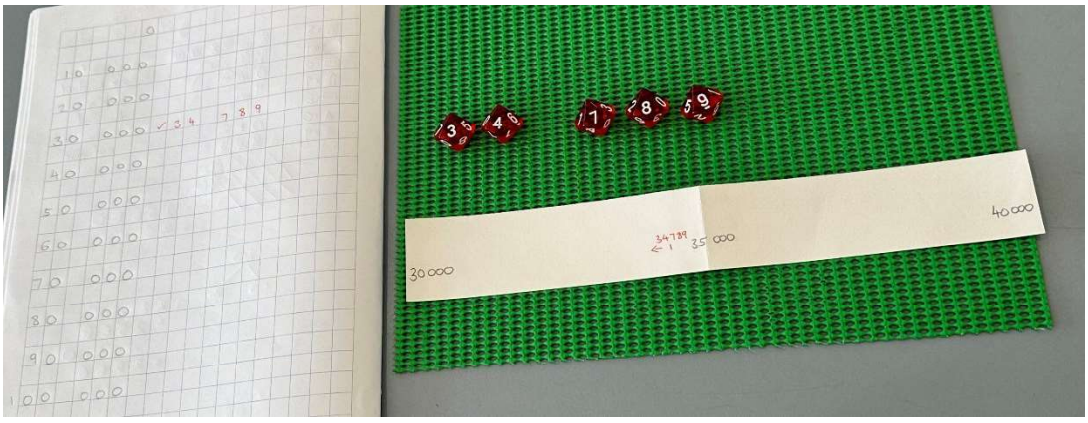


Modelling: Model that the best way to think about rounding is to always ask yourself, "What is it closer to?" For example, if I rolled/pulled 57 902, and I needed to round to the nearest ten thousand, first I would need to work out the two nearest ten thousands: 50 000 and 60 000 (the ten thousand it is in, and the next ten thousand).

Next, I need to focus on 57 thousand, and think, is it closer to 60 thousand or 50 thousand? Using the rounding patterns I learned during *Rounding Snakes and Ladders* (see *Year 3B Place Value Unit*), and similar lessons, I know 7 is closer to the next ten than the previous ten.



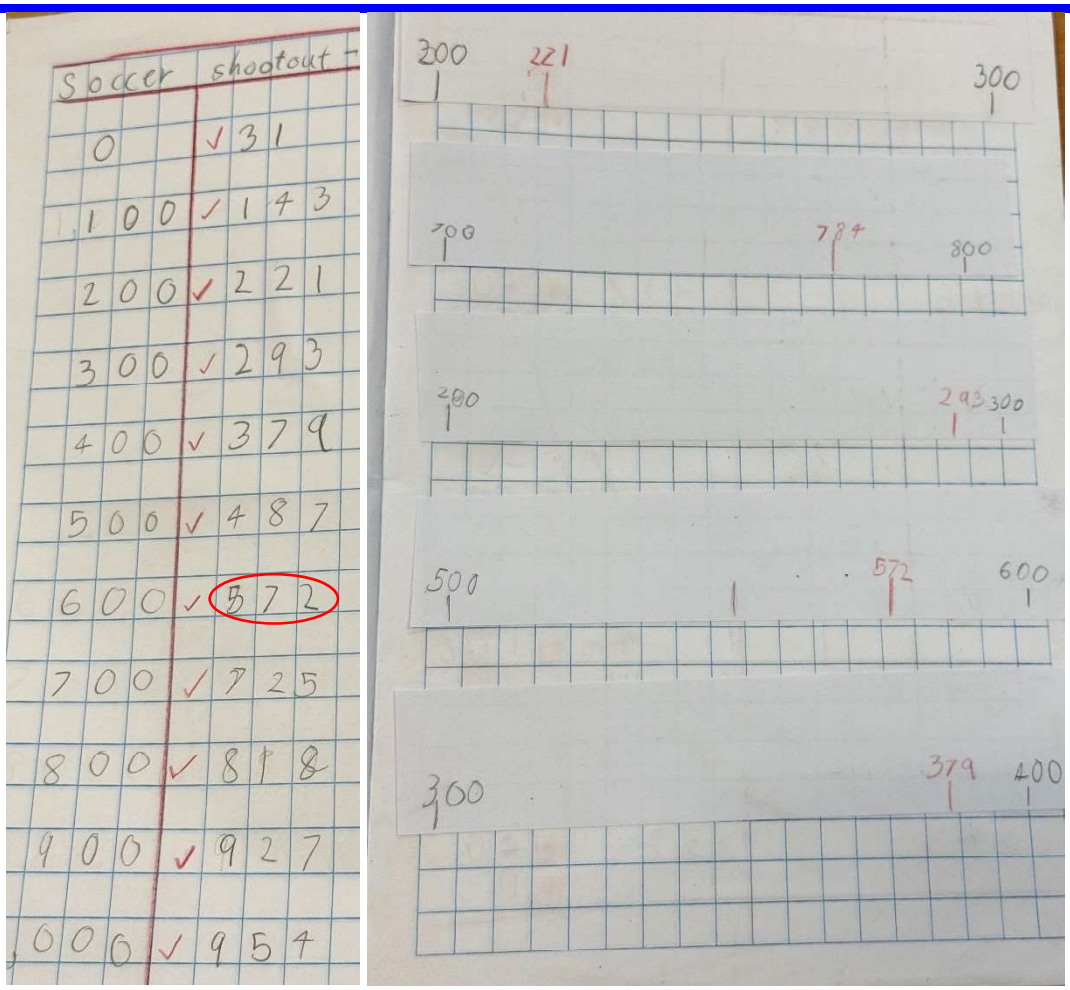
If I were playing the rounding shootout game, I could then tick my 60 000 as scored, writing 57 902 beside it. The first player to score all ten thousands, wins! **Key tip for students:** Remember, that you can move around the dice after you roll, to arrange a number that will help you score a new ten thousand. For each roll, you must first mark the number on a number line (using the pre-sliced strips of paper), to show how you worked out which ten thousand it would round to (or is closest to).



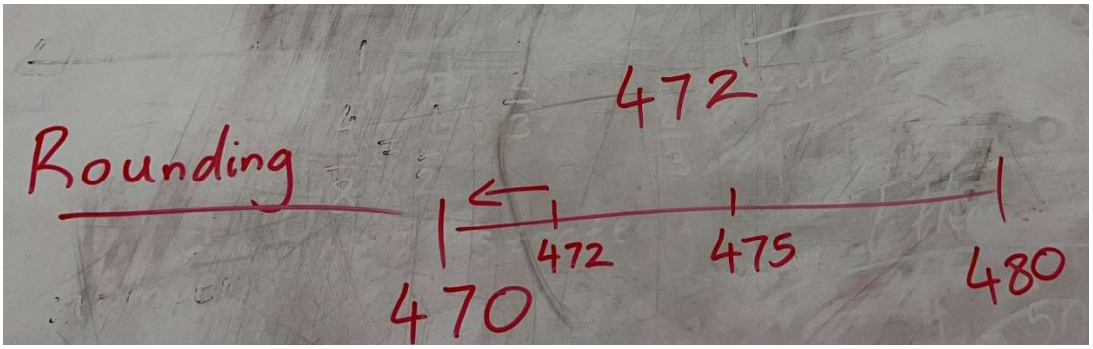
Questioning:

- When you are rounding to the nearest ten thousand, which place value matters the most? The one thousands!

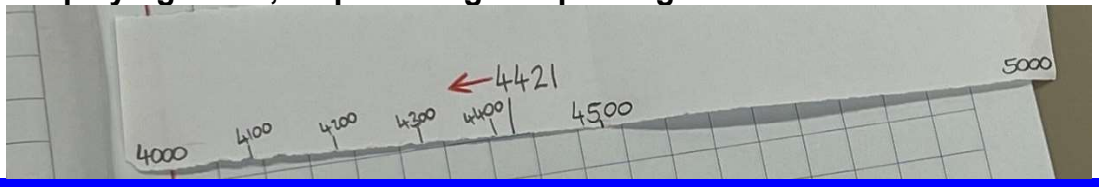
  However, do not encourage a rote-based focus on this place. Instead, encourage students to notice a pattern, and continue to use 'what is it closest to' reasoning.

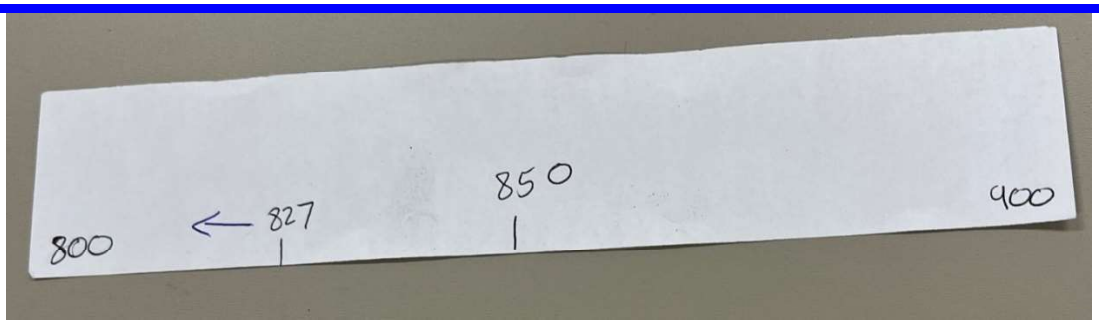


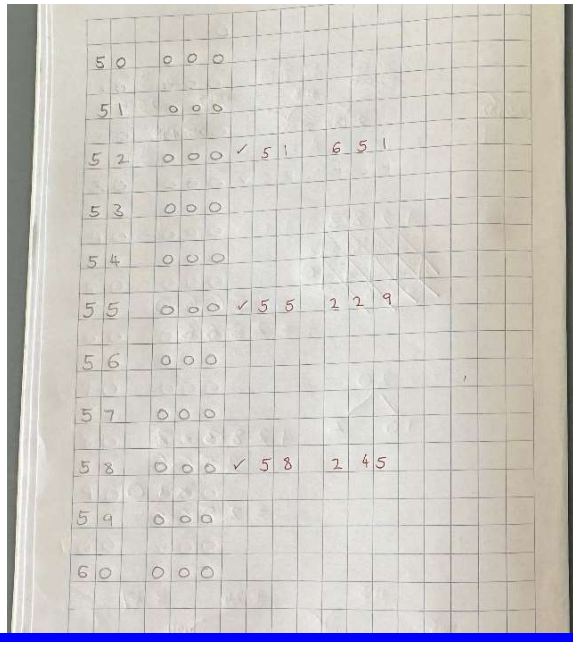
Using number lines as the conceptual foundation for rounding

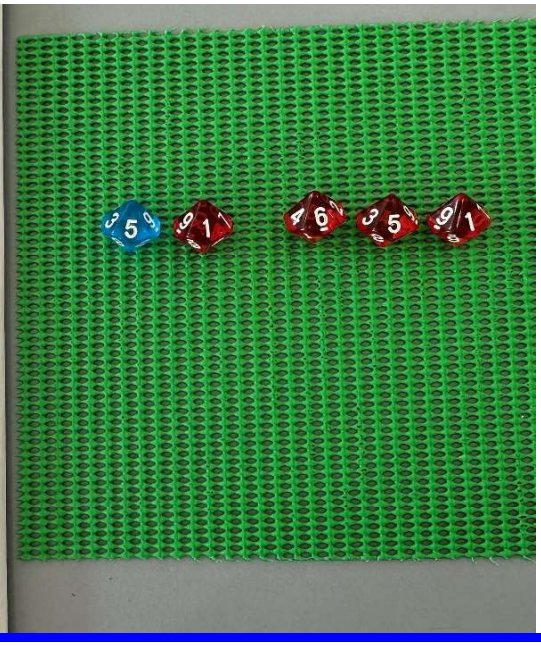


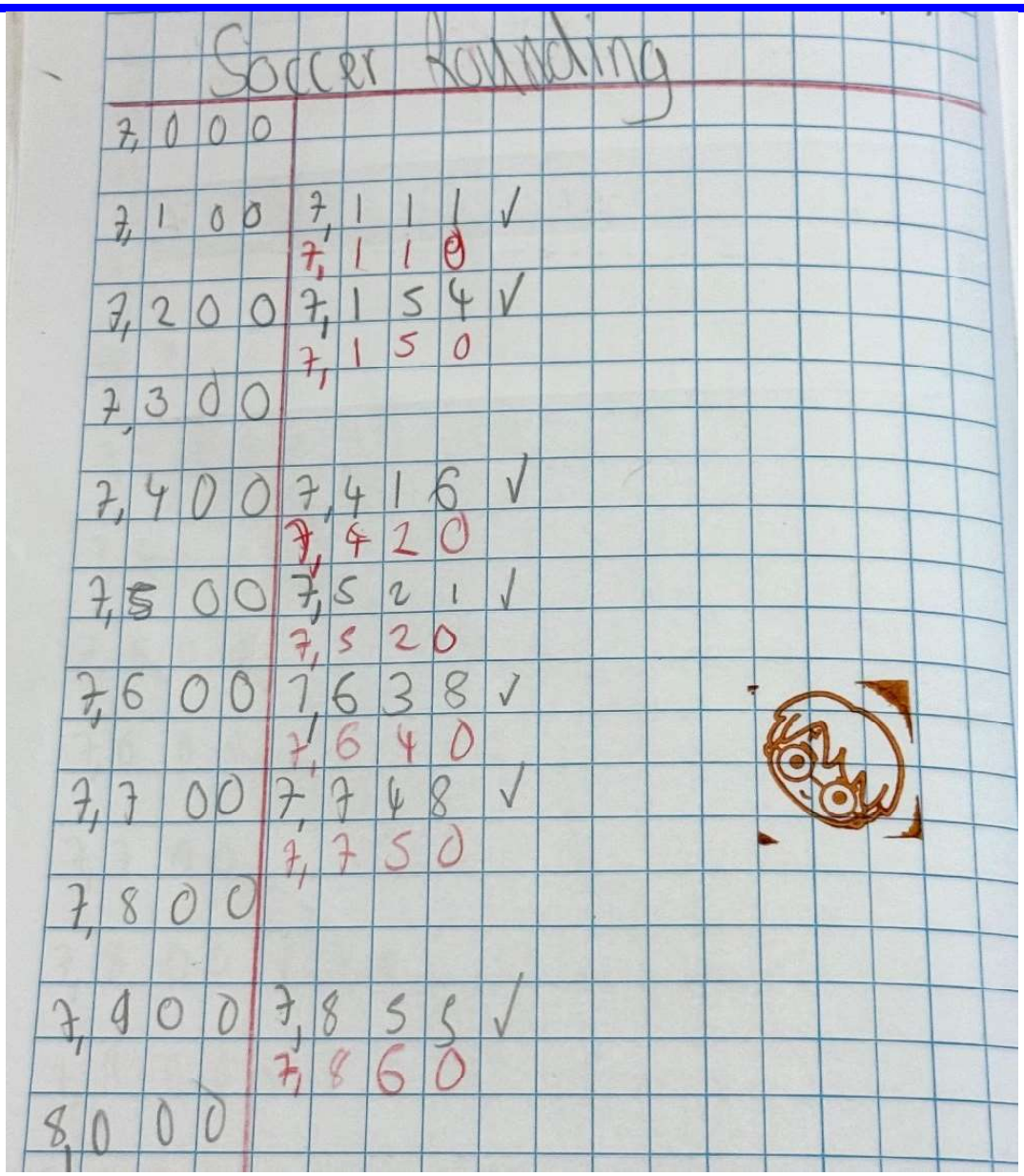
Using number lines to work out the answer for each round, after pulling the playing cards, emphasising and proving 'what it is closest to.'



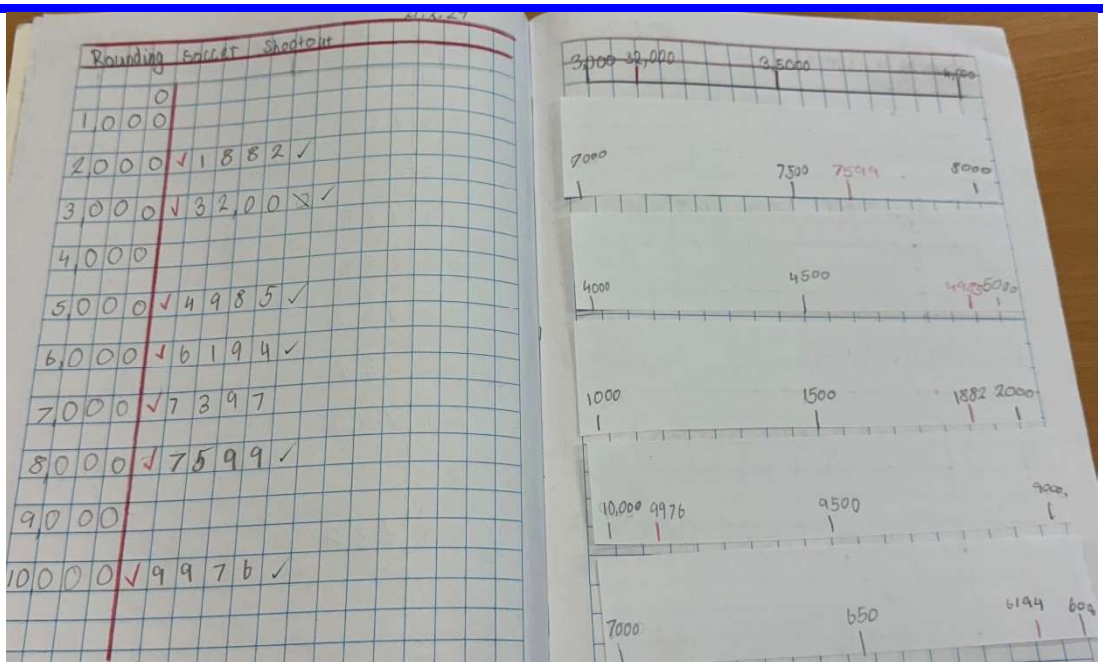




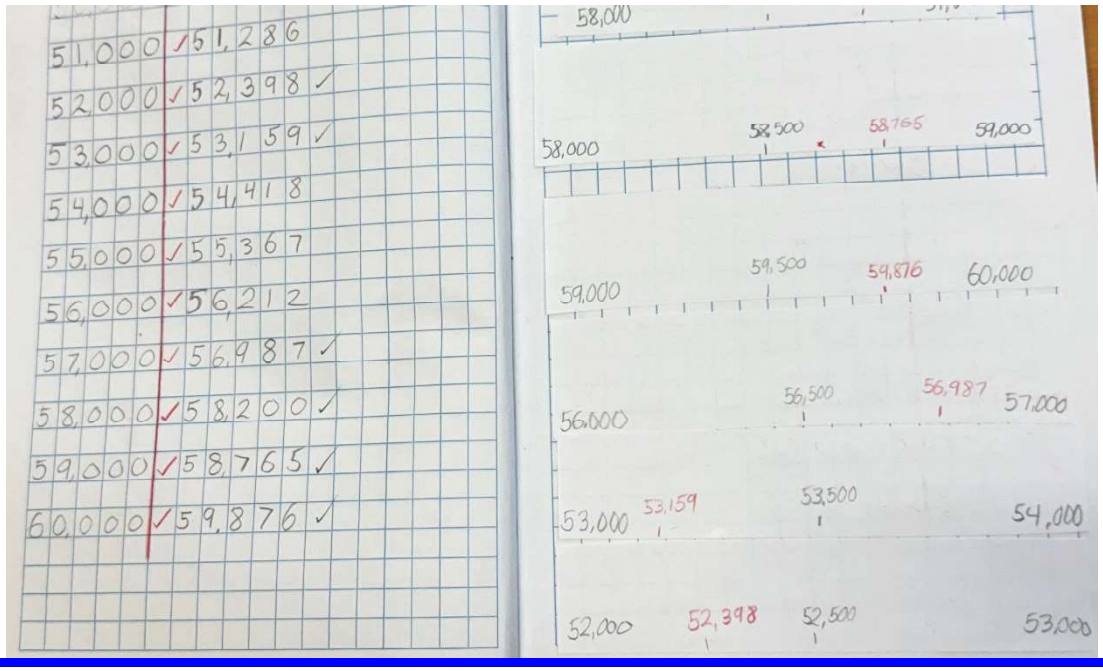


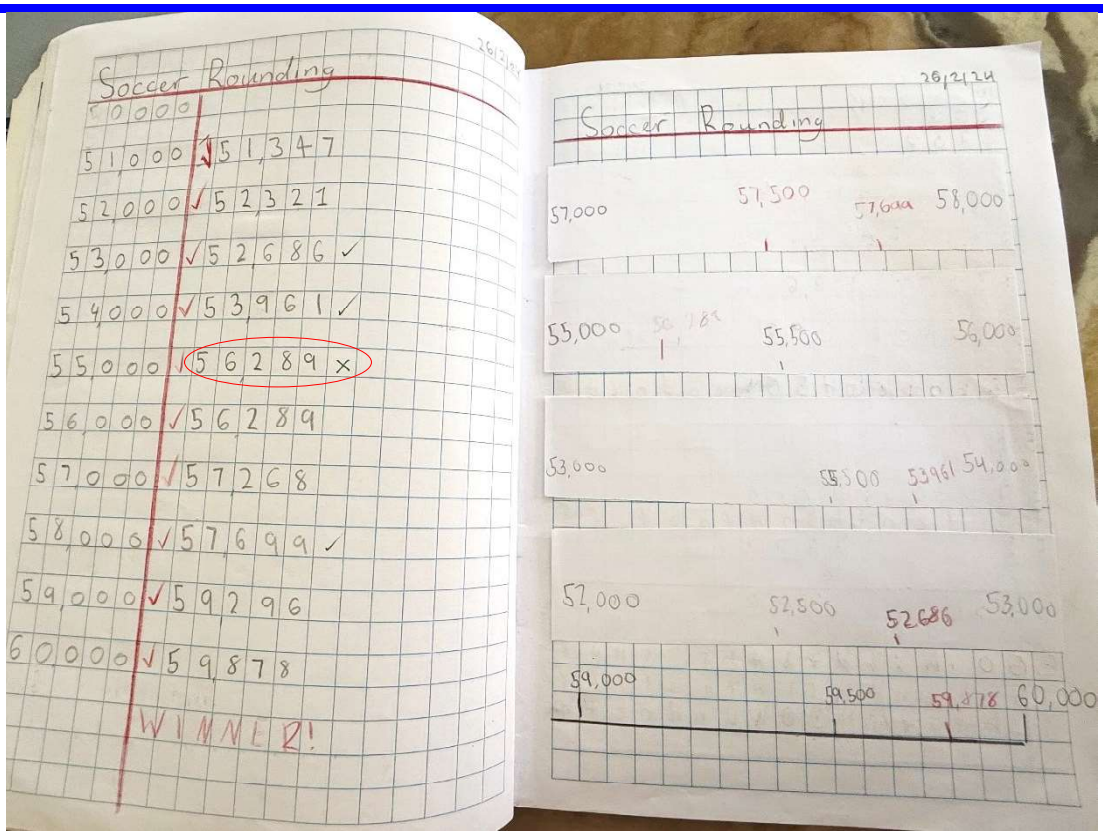


Rounding each number to the nearest ten in red pencil, as well as showing which target it scored on the board in grey-lead pencil.

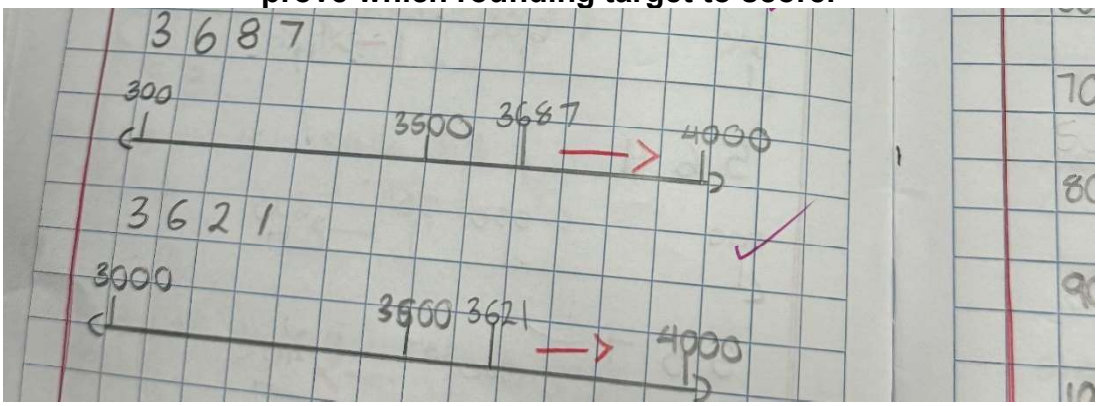


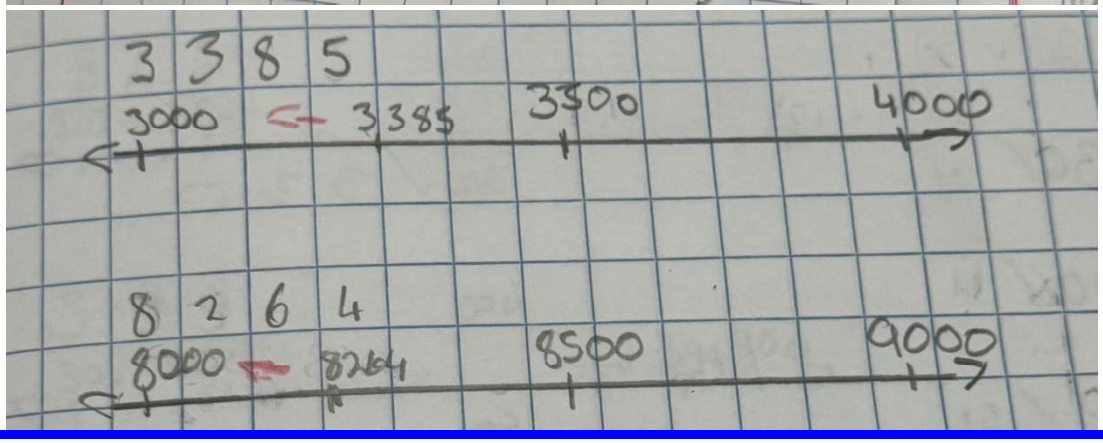
Using number lines on the other side of the grid book to solve and prove which rounding target was scored.





Using number lines on the other side of the grid book to solve and prove which rounding target to score.





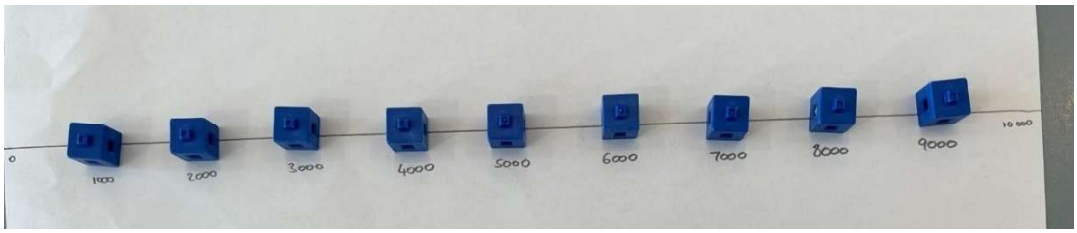
Second lesson option – Rounding to the nearest thousand, or nearest hundred, or nearest ten, within a 5-digit number

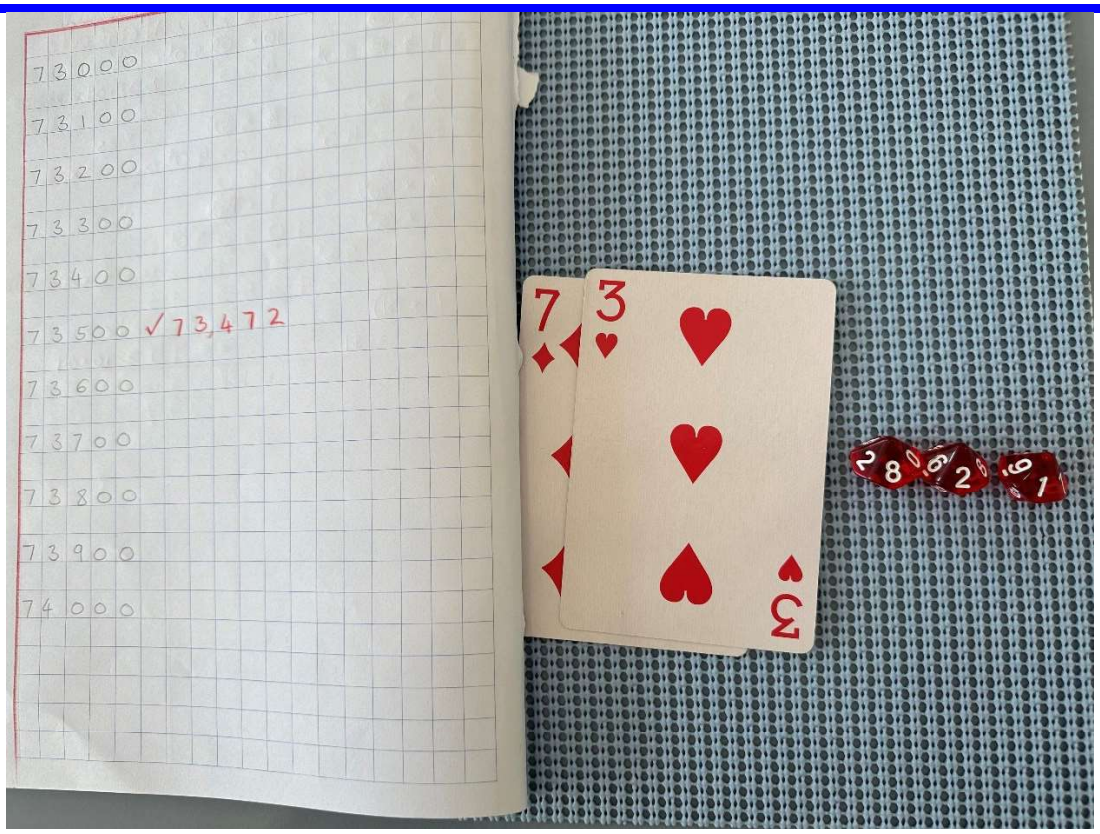
For the version of the game shown above, the grid book set-up/gameboard has nearest one thousands written down it, with the '5' ten thousands digit/dice stuck in place (never rolled). Students roll all of the other 4 dice and aim to score each number on their gameboard, aiming to round a tens of thousands number to the nearest thousand.

Tip: To remember not to roll the '5' dice each turn, make it a different colour.

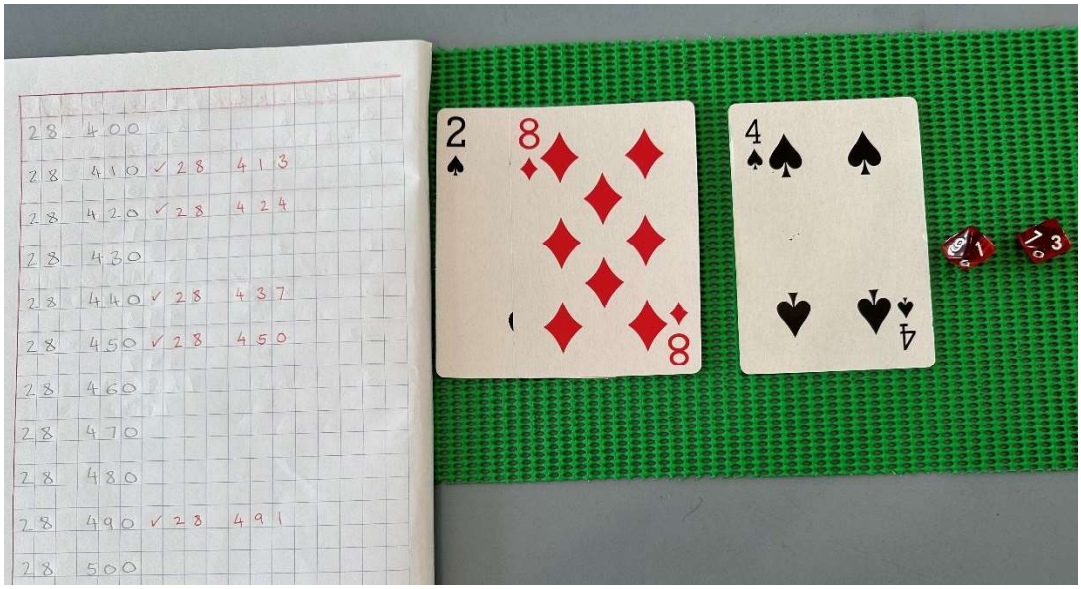
Lesson in action

Support for marking the number line with equal spacing – use counters first:



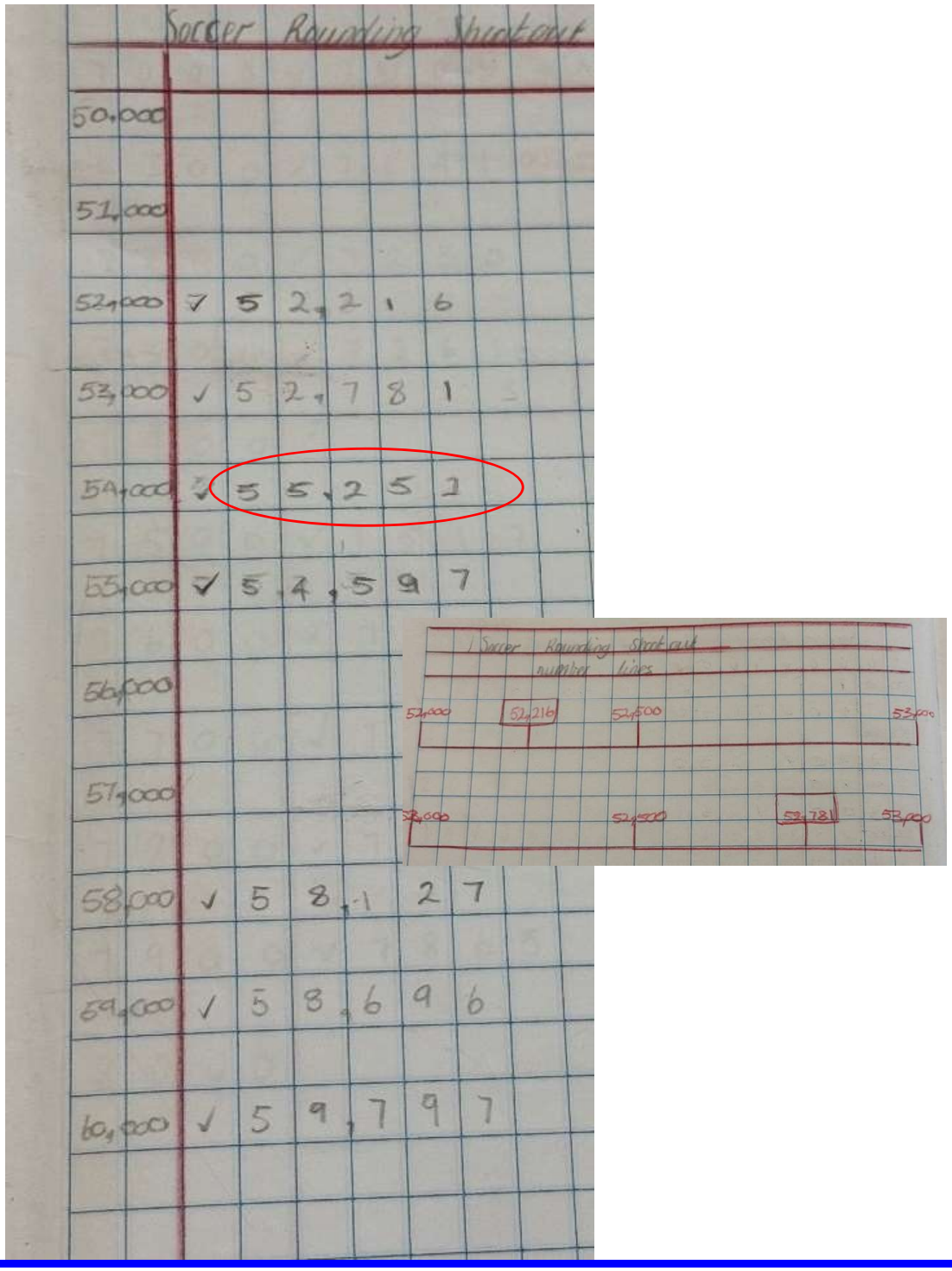


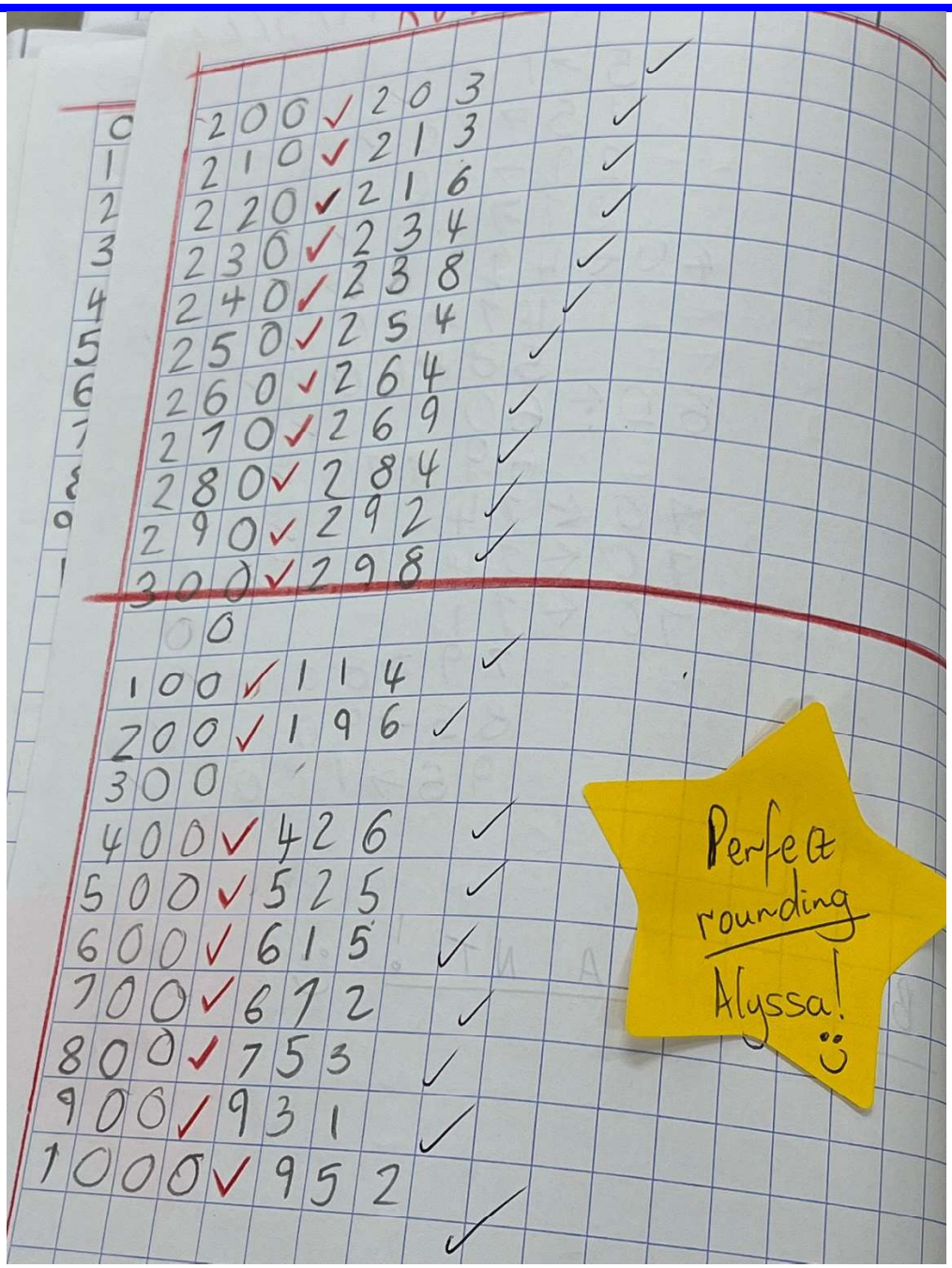
For a nearest hundred version, keep the first two dice/playing cards (ten thousands and one thousands) stuck in place, rolling the other 3 dice, and setting up the gameboard as shown above.



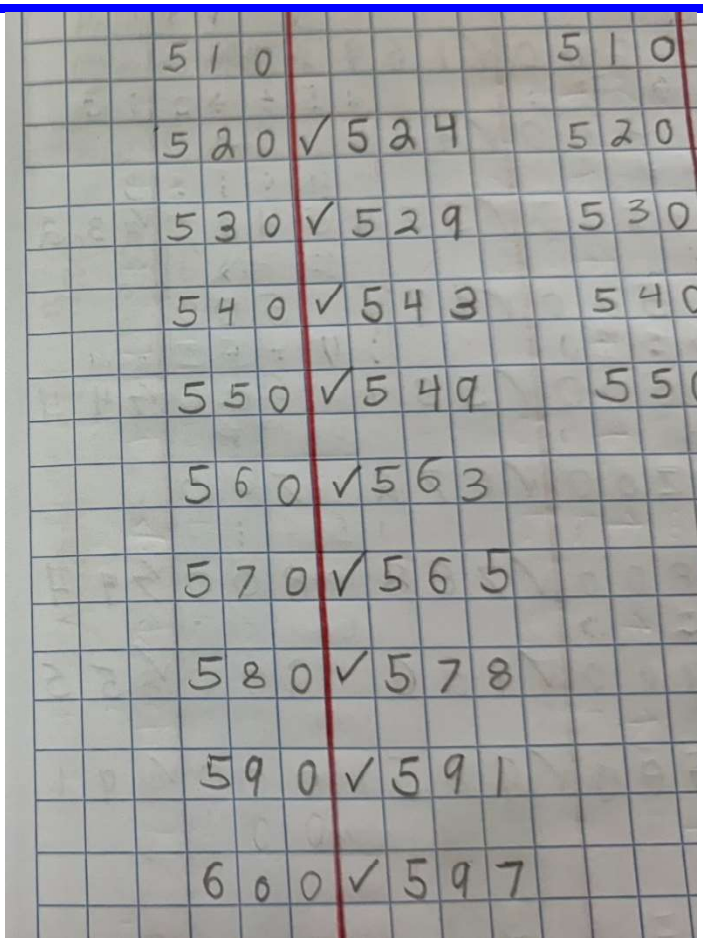
For a nearest tens version, keep the first 3 dice/playing cards in place (ten thousands, one thousands, hundreds), and only roll the final two dice, setting up the gameboard as shown above.

Misconception Alert: The final two versions of the game are critically important, as often students can round to the nearest ten thousand, but cannot round to lower place values (nearest ten) within large numbers, because they have not recognised or fully consolidated that this involves the same skill and pattern as rounding to ten, just within larger numbers.

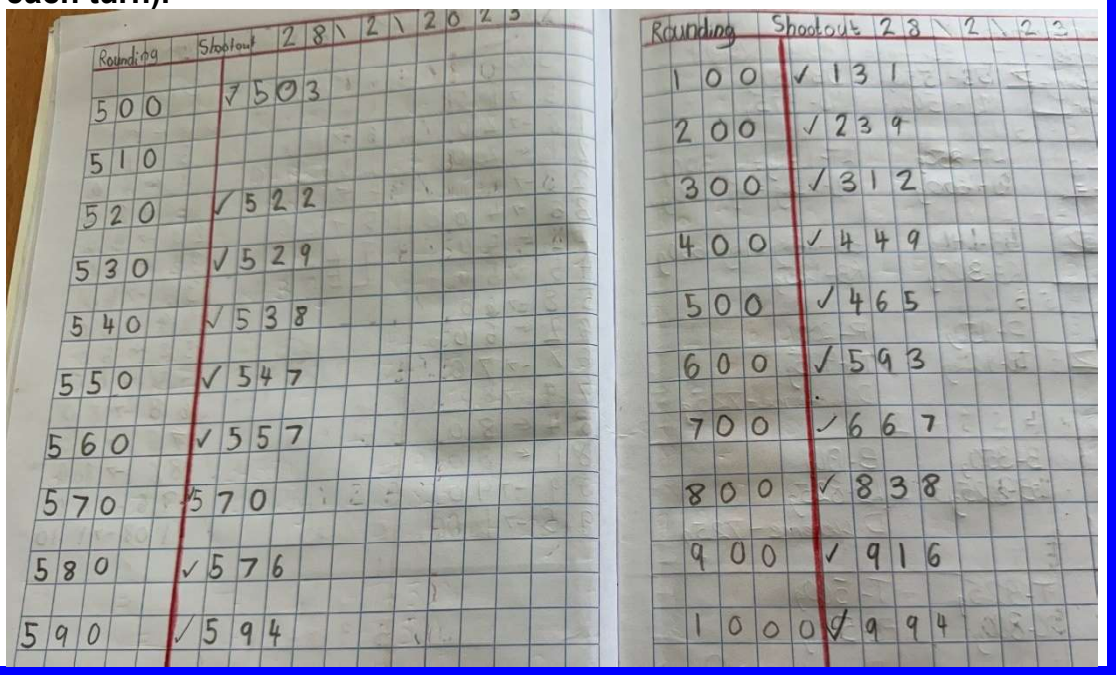


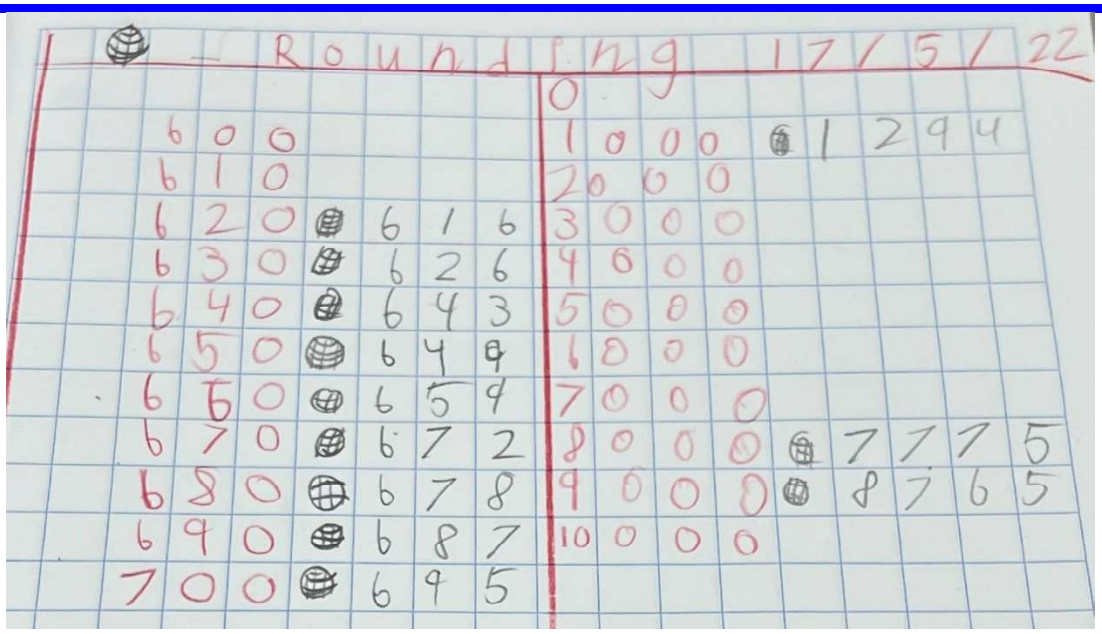


Support 1: Use the game to round smaller numbers to their nearest hundred or ten. In this work sample, there is an example of a gameboard set up for rounding to the nearest hundred (change all 3 cards), as well as a gameboard at the top set up for rounding to the nearest ten within hundreds numbers (keep hundreds card stuck in place, pull final 2 cards).

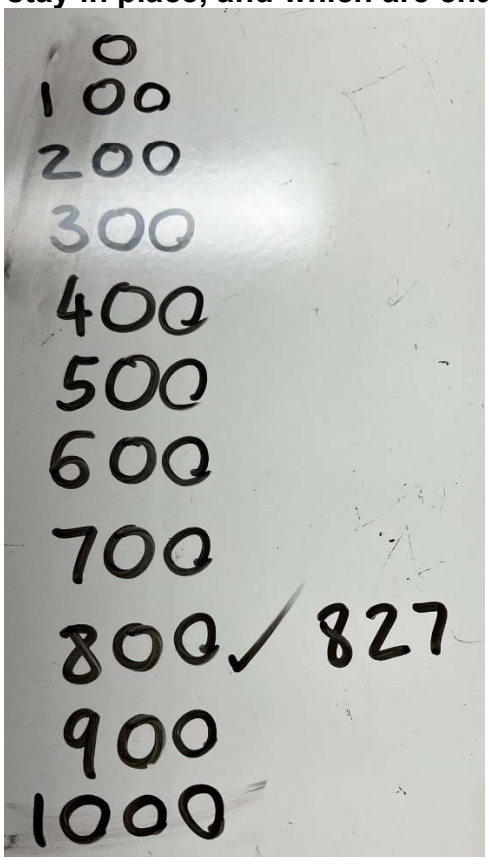


Learning to round to the nearest ten within a hundreds number (with the first card '5' stuck in place, and only the other two cards changing each turn).

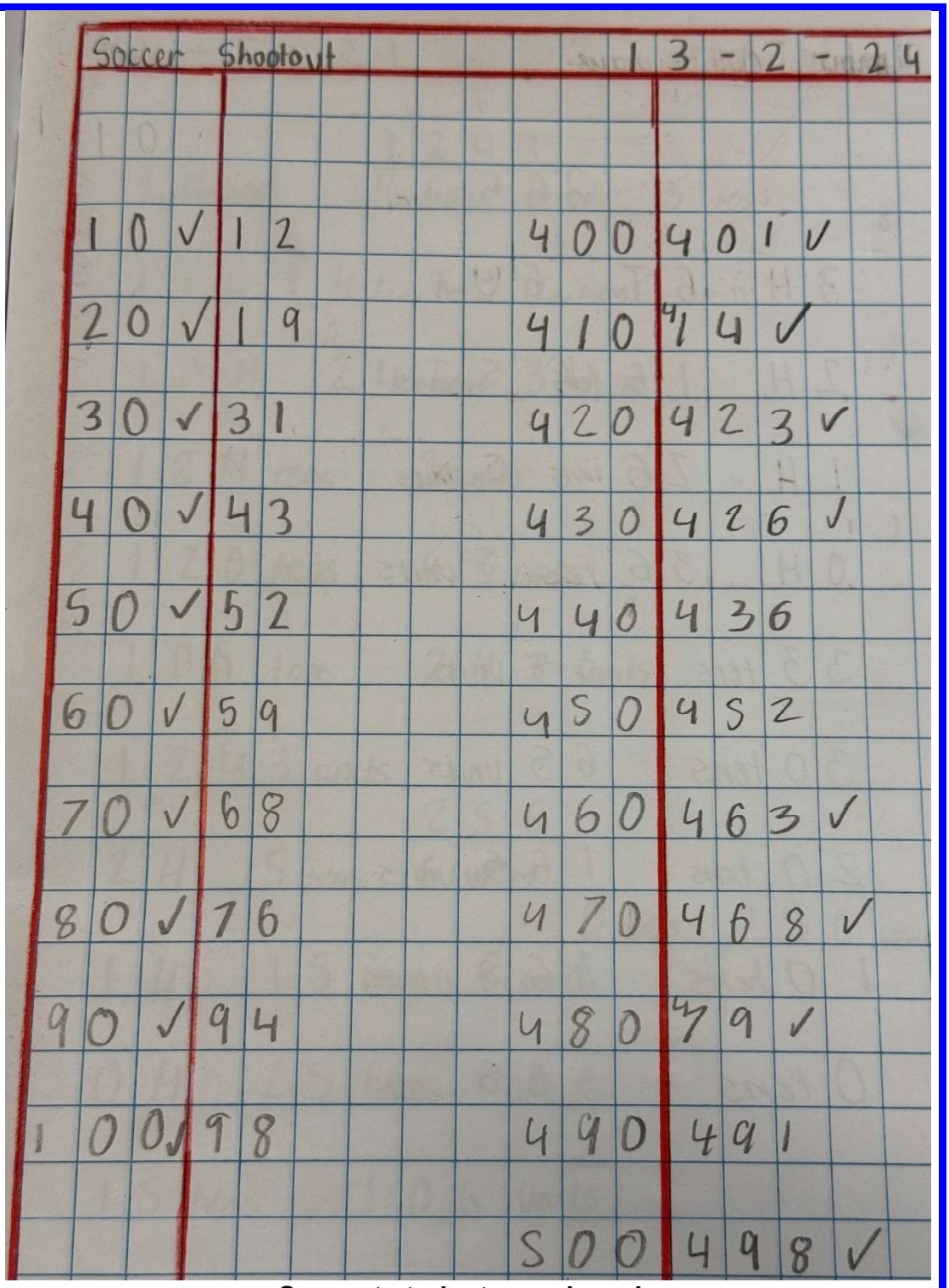




This work sample shows how students can progress to more challenging versions of the rounding shootout game when ready, simply by changing the gameboard and the number of cards pulled (as well as which cards stay in place, and which are changed each turn).

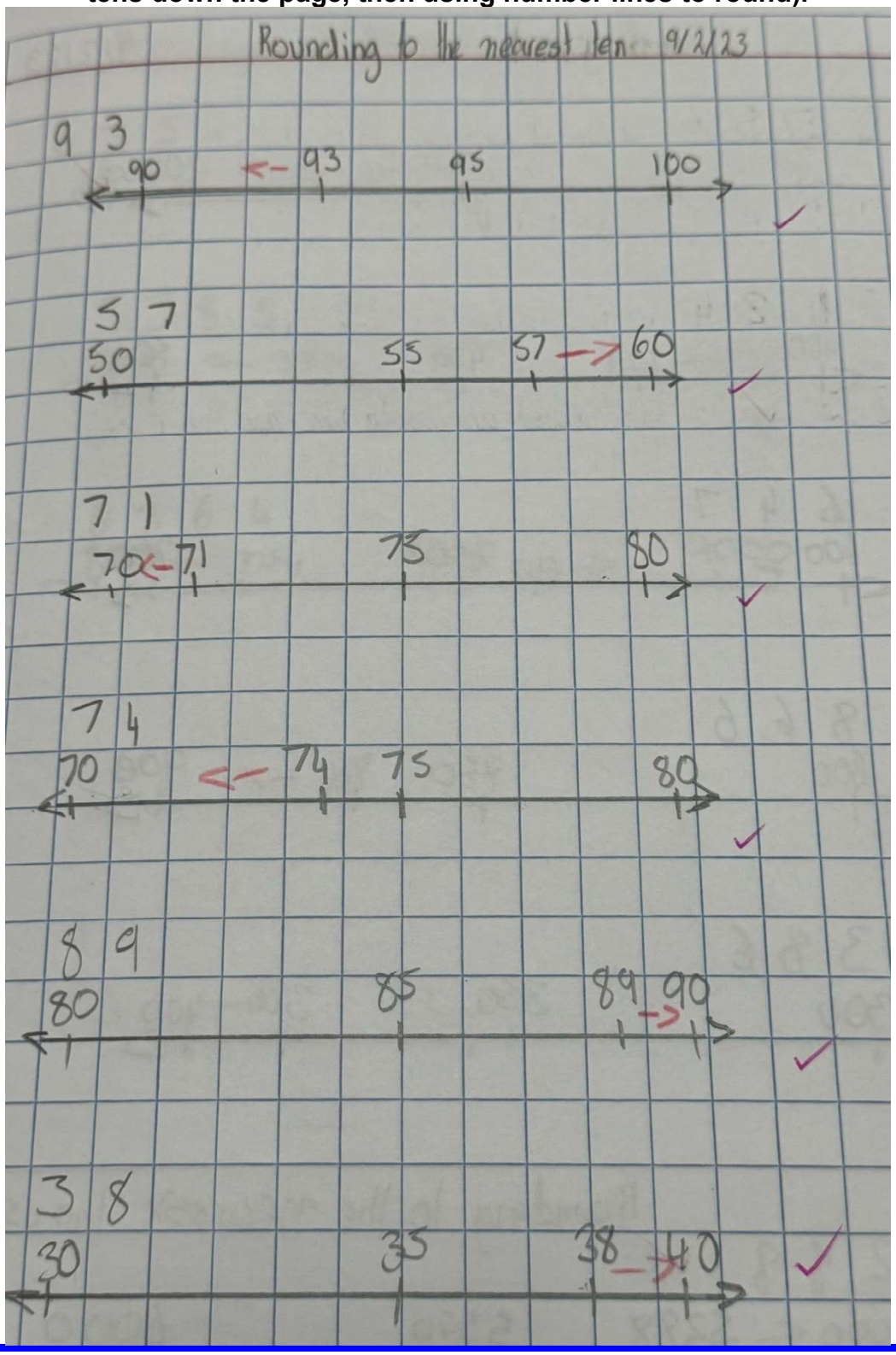


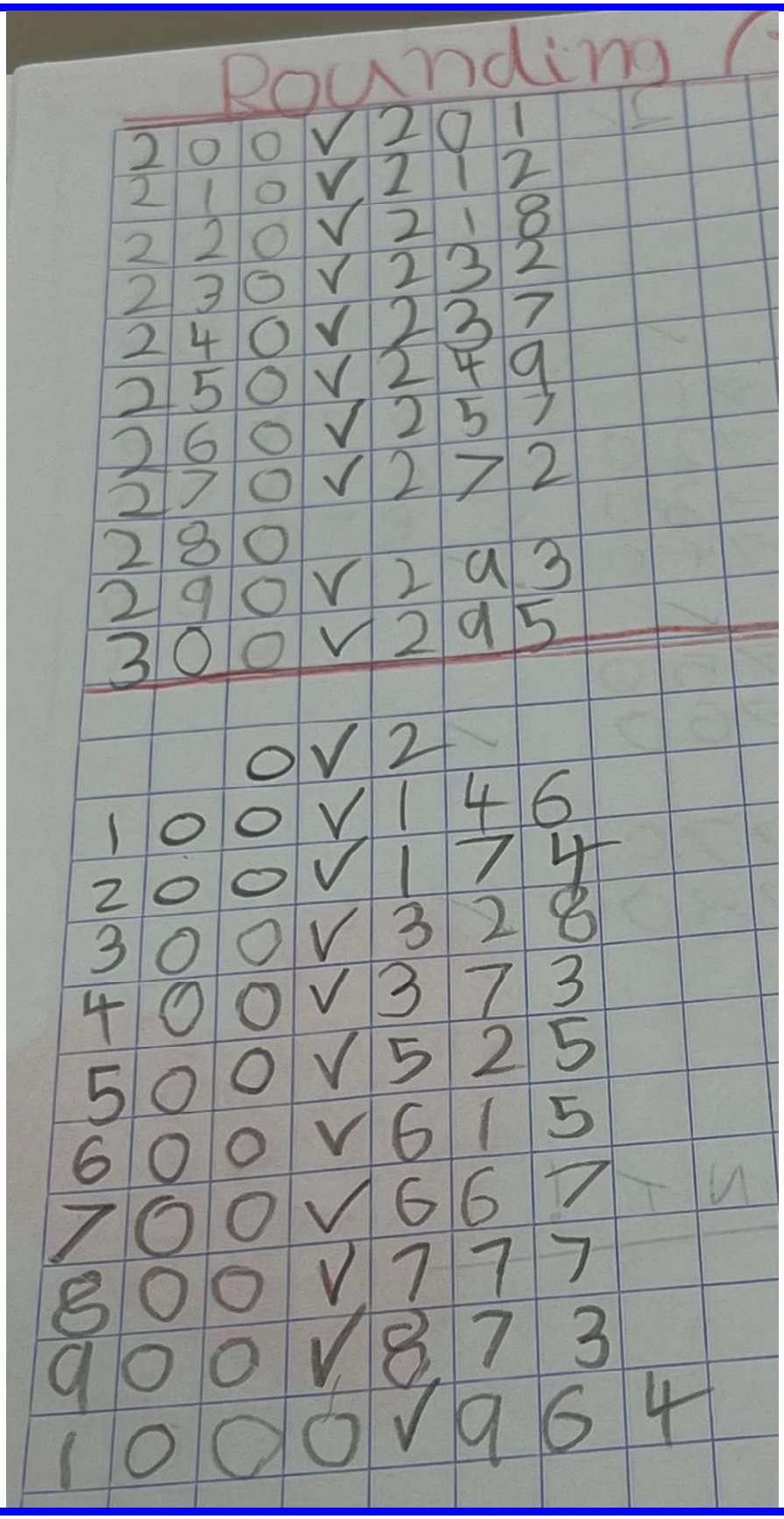
Supportive start – Rounding to the nearest hundred with this gameboard set-up, pulling 3 new playing cards per turn.

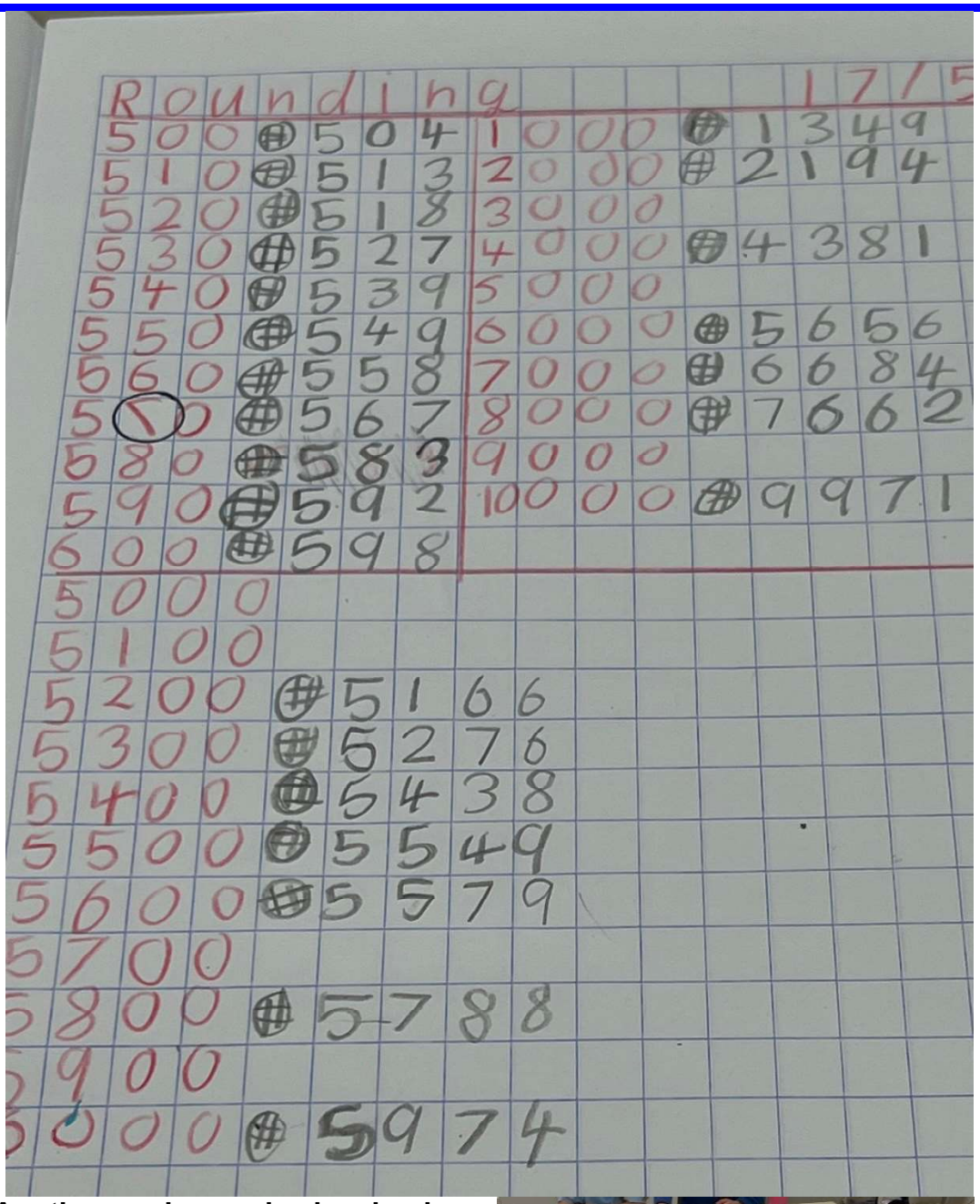


Support student gameboards

Support students starting with a gameboard of nearest 10 (0 to 100 in tens down the page, then using number lines to round).

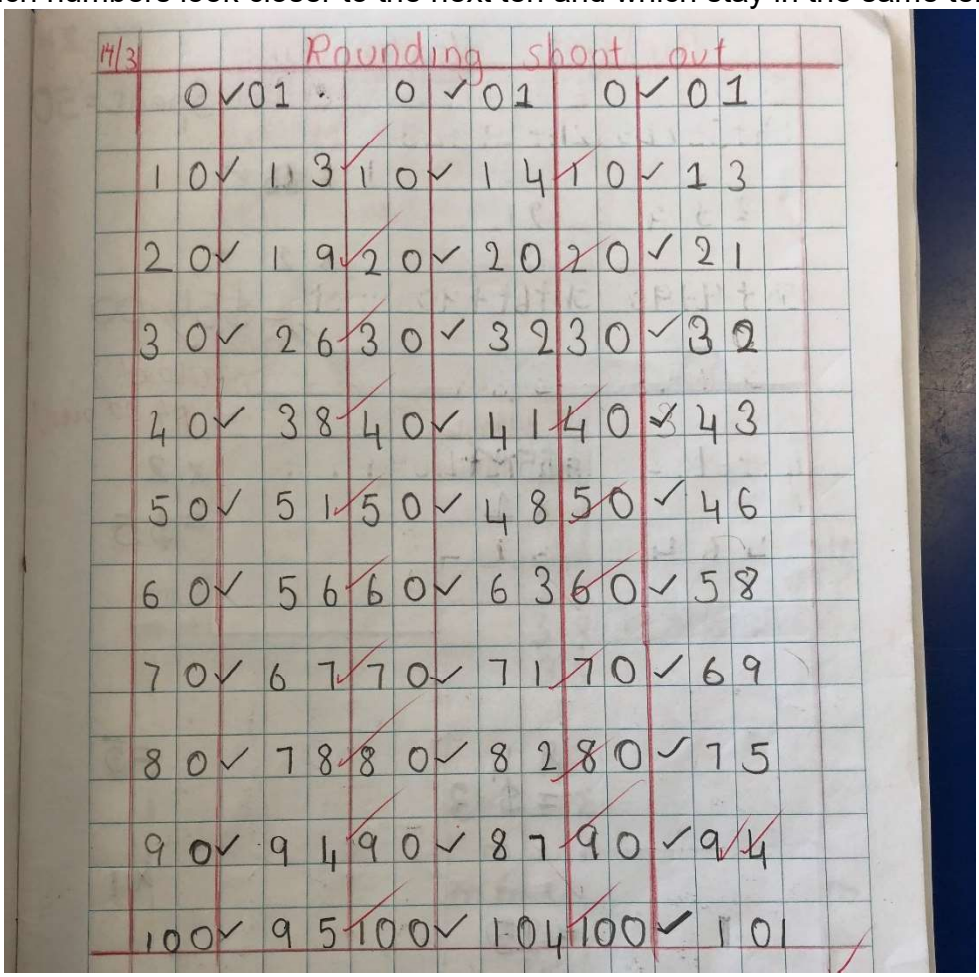




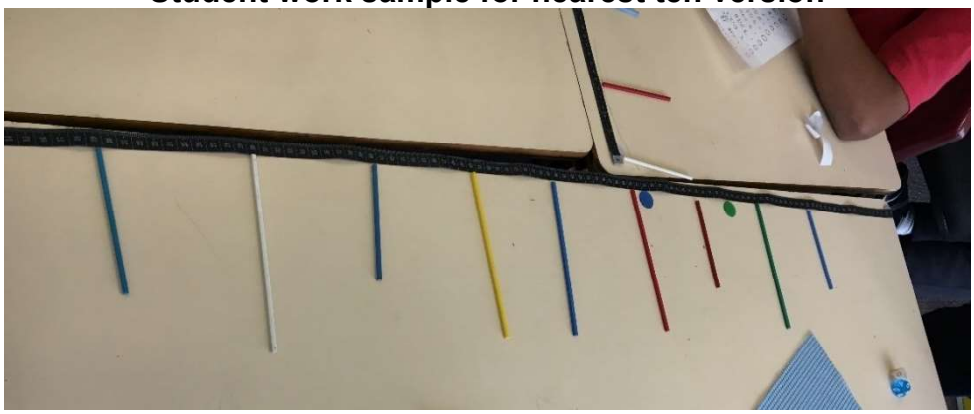


Another work sample showing how the game can progress within the one session for students who need to start with rounding to the nearest hundred, then work up from there.

Support 2: Use the tens set-up, pulling two new playing cards each round. Use a measuring tape to visually spot the nearest ten, setting up sticks at each ten and placing a cube/counter on the number you pull with cards. Which stick does your counter look closer to? What patterns are you noticing (which numbers look closer to the next ten and which stay in the same ten)?

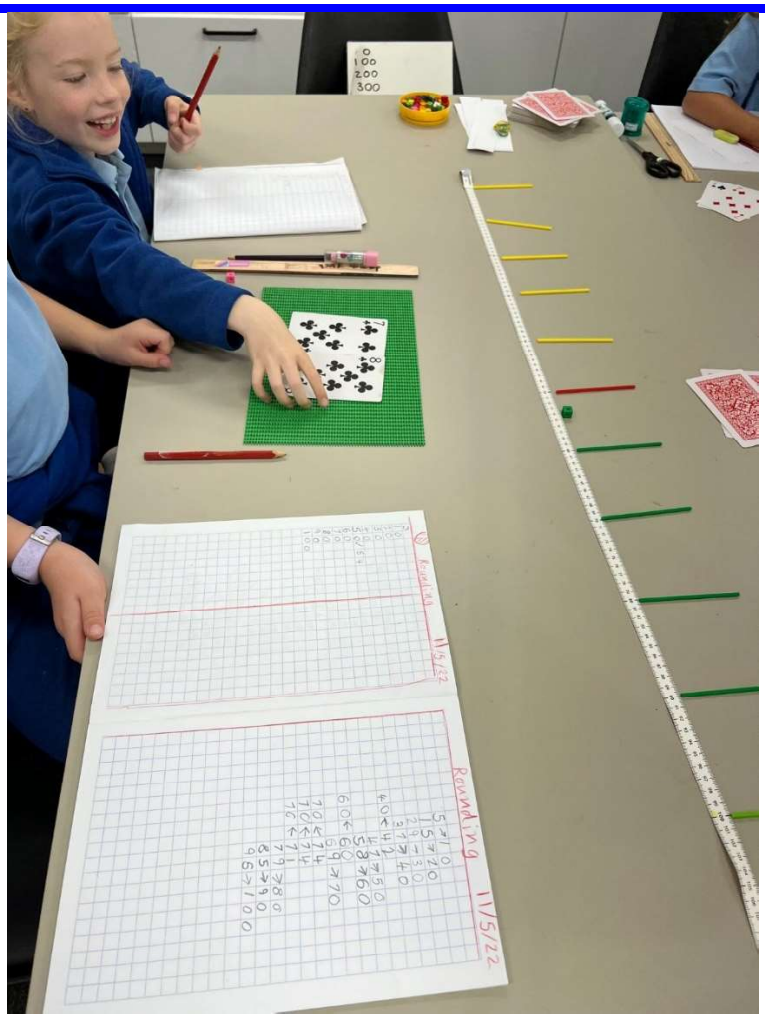


Student work sample for nearest ten version



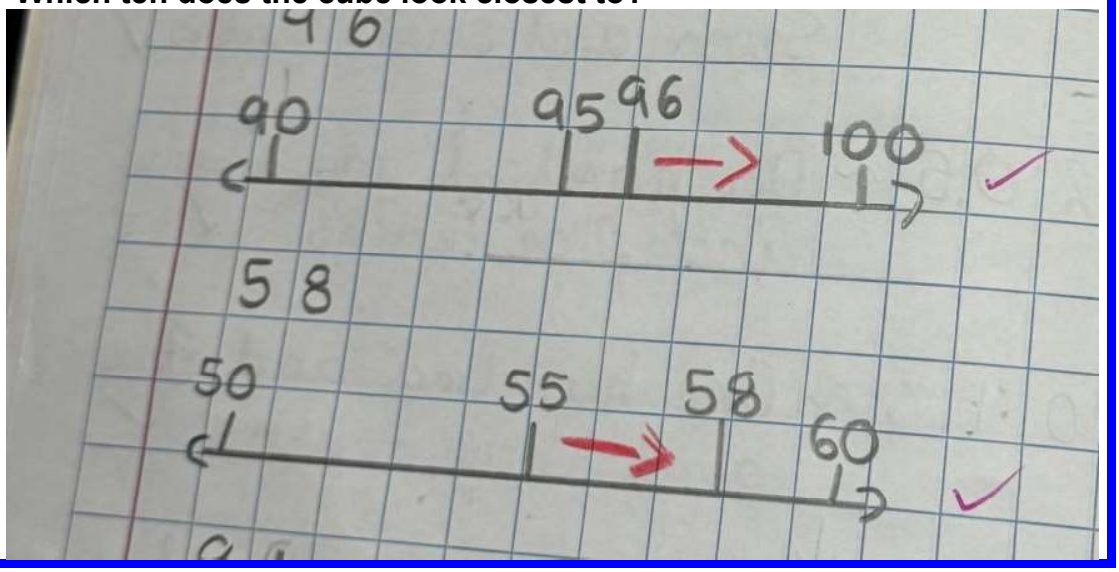
Measuring tape set-up with sticks at each ten for support

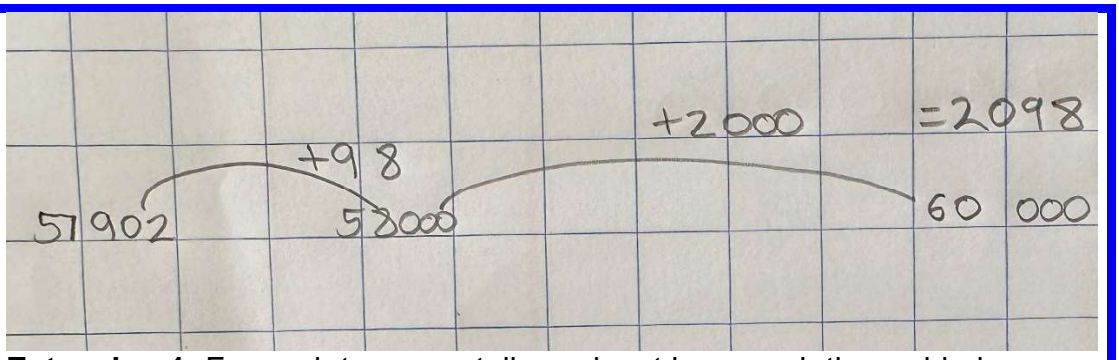
Support version in action with nearest tens rounding shootout set-up and sticks at each ten along the measuring tape



Measuring tape set-up with tens marked with sticks and a counter/cube to mark the number being rounded.

Which ten does the cube look closest to?



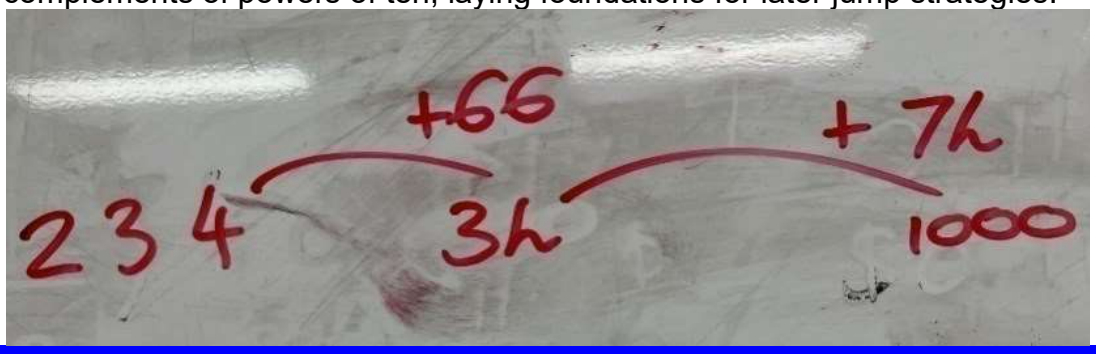


Extension 1: For each turn, mentally work out how much they added or subtracted to reach the rounding target.

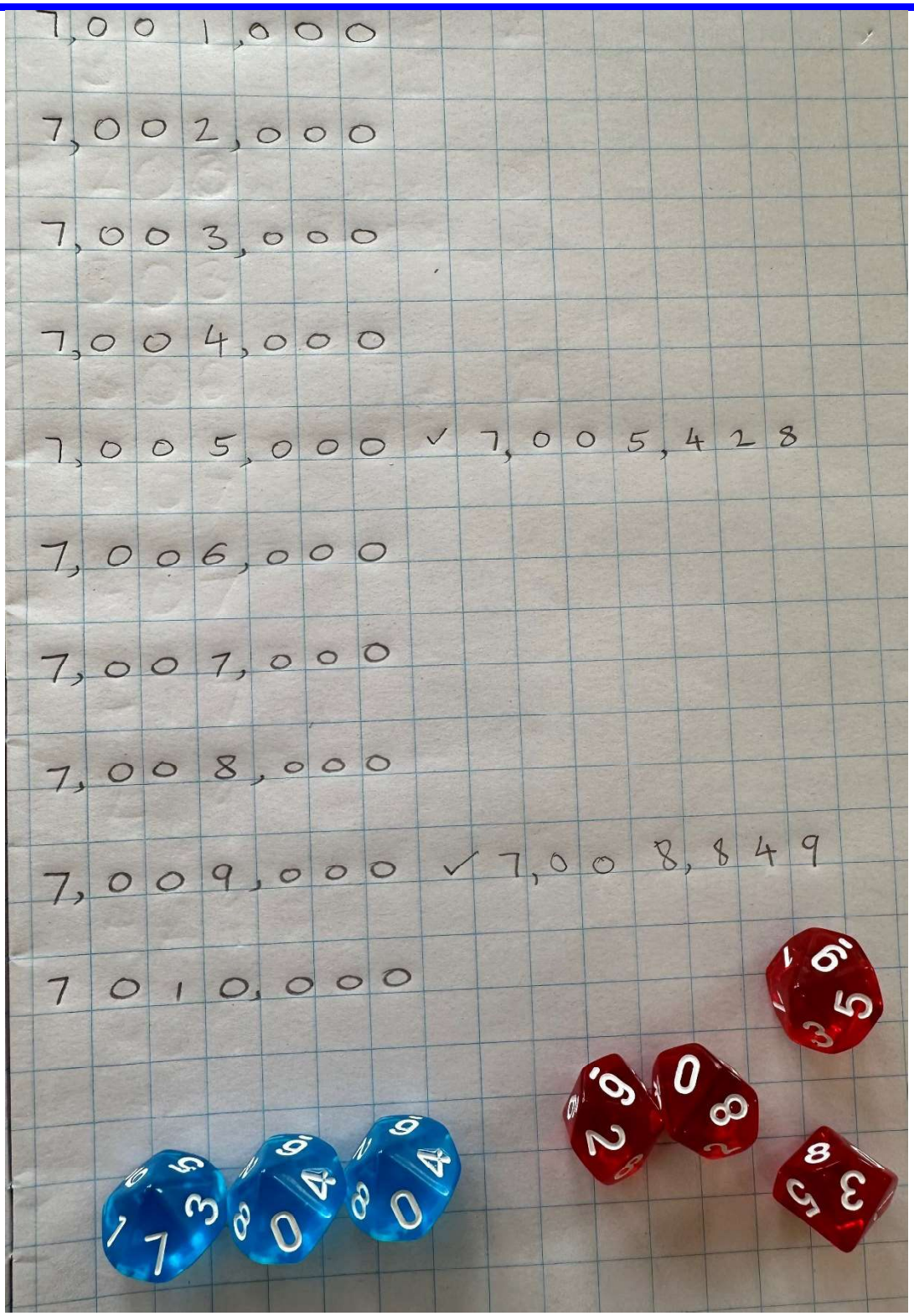
For example, for rounding 57 902 to 60 000, work out that they added 98 to reach 58 000, then another 2 one thousands, so it was 2098 off 60 000, or 7902 off 50 000 – that is why it rounded to 60 000.

If needed, use a jump strategy on a number line to work it out, but first aim to solve it mentally. **It is often an excellent extension option to challenge students to use mental strategies (no paper allowed) to work with larger additions and subtractions. Then use paper to demonstrate and verify their mental strategy and answer.**

Extension 2: How many more to the next hundred or thousand to practise complements of powers of ten, laying foundations for later jump strategies.

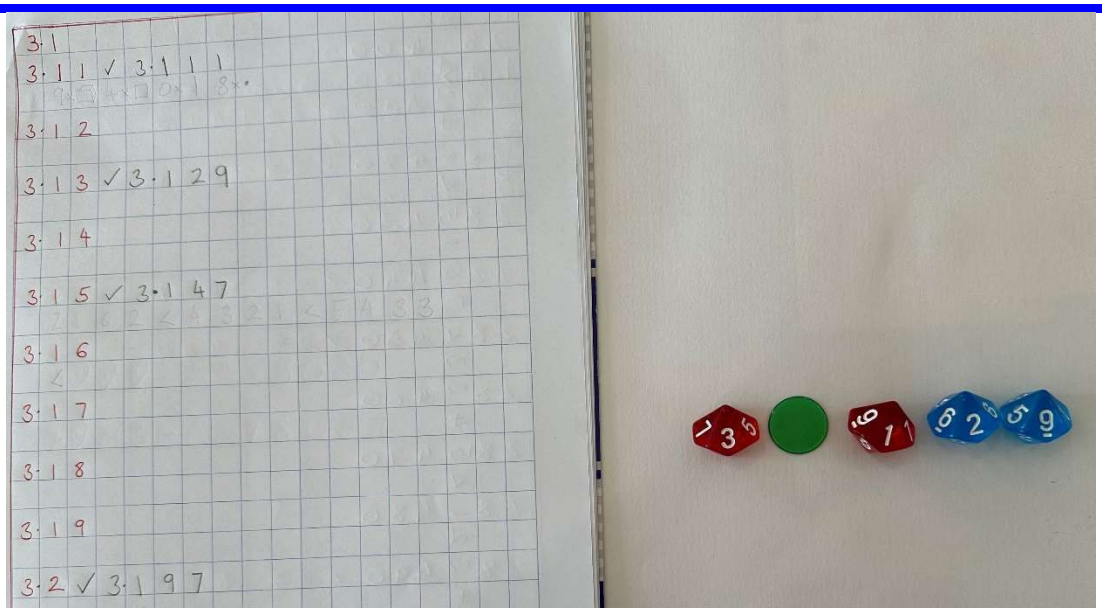


Student using an open number line in their grid book to work out 'how many more' to the next thousand.



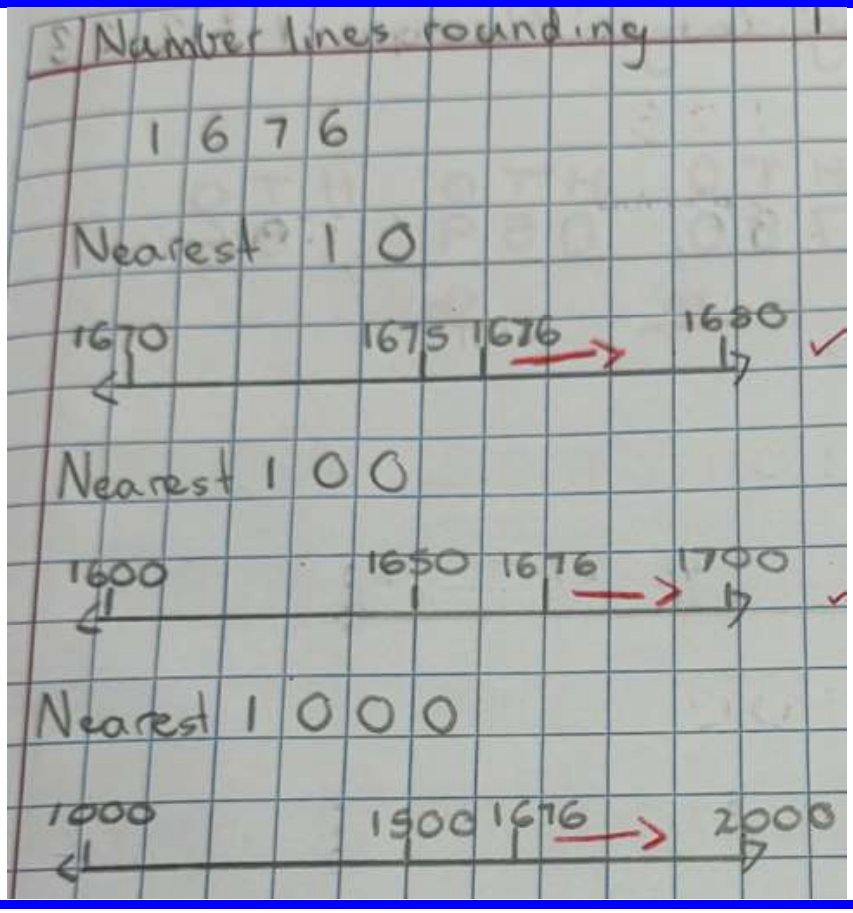
Extension 3: Play versions with more dice, rounding millions numbers to the nearest ten thousand for example, by setting up the gameboard with the millions and hundreds of thousands dice stuck in place, with all other dice rolled:

The best part of rounding shootouts is that it is very quick and easy to extend students to round higher place values, or to target place values within higher numbers, as soon as a pair of students is ready to progress, while other pairs can stay at the level they need to practise for as long as needed.

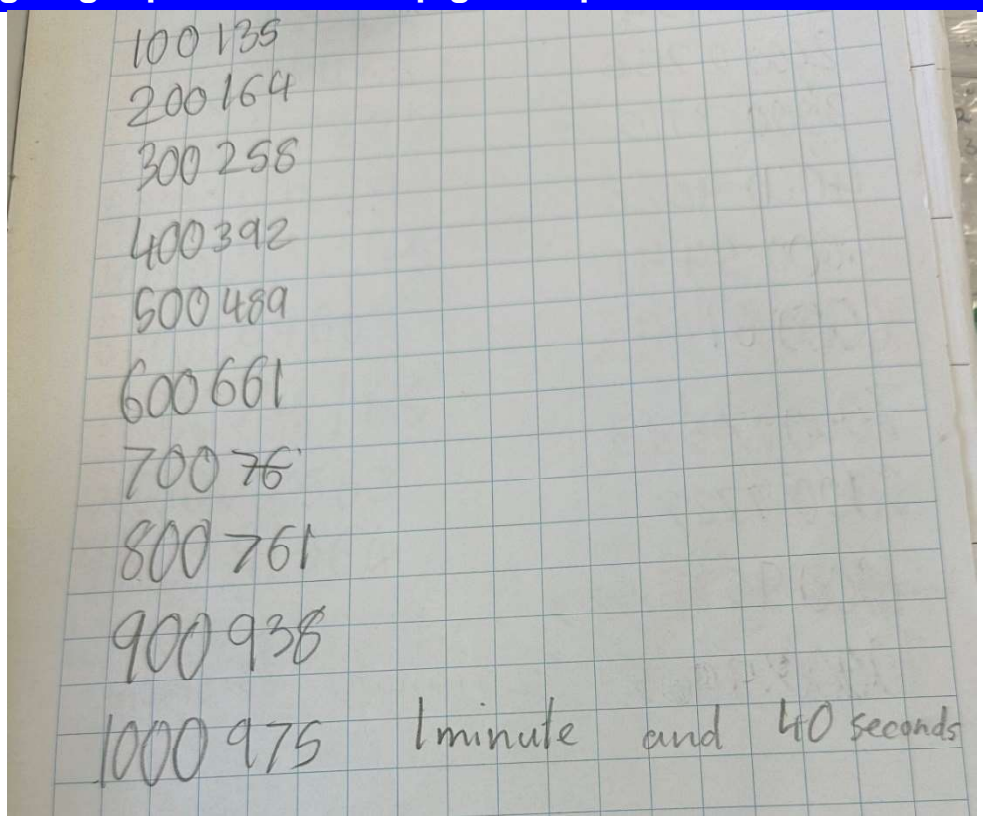


Extension 4: Play a decimal version by adding a counter as the decimal point, setting up a rounding to the nearest tenth version, or rounding to the nearest hundredth version.

Show the same number rounded to different place values and prove it using multiple number lines



Ongoing rapid-fire warm-up game option



Timed versions with no turn-taking: Finish the rounding shootout as fast as possible, aiming to beat your personal best record.