# Mathematics – Stage 1 – Unit 34



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## Unit description and duration

This two-week unit develops student knowledge, understanding and skills of measurement. Students are provided opportunities to:

* measure, record, compare and estimate a variety of attributes including length, area, volume and mass using informal units
* explore and connect mathematical measurement concepts
* apply mathematical measurement techniques to solve investigations and communicate their thinking.

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### Student prior learning

Before engaging in these teaching and learning activities, students would benefit from prior experience with:

* measuring the length of objects using informal units of measurement
* comparing the sizes of shapes and objects using informal units of measurement
* filling different size and shape containers with water, marbles, rice or sand to compare which can hold the most
* using an equal-arm balance to compare the mass of different objects.

## Lesson overview and resources

The table below outlines the sequence and approximate timing of lessons; syllabus focus areas and content groups; and resources.

|  |  |  |
| --- | --- | --- |
| Lesson | Syllabus focus area and content groups | Resources |
| [**Lesson 1: Take a letter!**](#Lesson_1)75 minutesInformal units can be used to compare attributes of shapes. | **Representing whole numbers*** Represent the structure of groups of ten in whole numbers

**Combining and separating quantities*** Use advanced count-by-one strategies to solve addition and subtraction problems
* Use flexible strategies to solve addition and subtraction problems
* Form multiples of ten when adding and subtracting two-digit numbers

**Geometric measure*** Length: Measure the lengths of objects using uniform informal units
* Length: Compare and order lengths, using appropriate uniform informal units

**Two-dimensional spatial structure*** Area: Measure areas using uniform informal units
* Area: Compare rectangular areas using uniform square units of an appropriate size in rows and columns
 | * [Resource 1: Think about maths!](#Resource_1)
* 6-sided dice
* 8-sided dice
* Concrete materials
* Items to be used as informal units of measurement for length
* Number charts and number lines
* Writing materials
 |
| **[Lesson 2: Which length would you choose?](#Lesson_2)**65 minutesThe size of a unit makes a difference to the number of units needed to measure length. | **Representing whole numbers*** Form, regroup, and rename three-digit numbers

**Forming groups*** Represent and explain multiplication as the combining of equal groups

**Geometric measure*** Length: Measure the lengths of objects using uniform informal units
* Length: Compare and order lengths, using appropriate uniform informal units
 | * 50c, $1 and $2 coins or same size replicas
* 6-sided dice
* MAB blocks
* Mini whiteboards
* Writing materials
 |
| [**Lesson 3: Larger and smaller**](#Lesson_3)65 minutesConsistent units of measurement are needed for comparison. | **Representing whole numbers*** Form, regroup, and rename three-digit numbers

**Geometric measure*** Length: Measure the lengths of objects using uniform informal units
* Length: Compare lengths using uniform informal units
* Length: Compare and order lengths, using appropriate uniform informal units

**Two-dimensional spatial structure*** Area: Measure areas using uniform informal units
* Area: Compare rectangular areas using uniform square units of an appropriate size in rows and columns
 | * [Resource 2: Animals everywhere](#_Resource_2:_Animals)
* 6-sided dice
* Chalk
* Flexible concrete materials such as wool or string
* Items to be used as informal units of measurement for length
* Mini whiteboards
* Writing materials
 |
| [**Lesson 4: How do we compare?**](#Lesson_4)70 minutesUsing a consistent unit of measurement enables ordering and comparing. | **Forming groups*** Represent and explain multiplication as the combining of equal groups

**Two-dimensional spatial structure*** Area: Measure areas using uniform informal units
* Area: Compare rectangular areas using uniform square units of an appropriate size in rows and columns
 | * [Resource 3: Dice](#Resource_4)
* [Resource 4: Rectangles, corners and squares](#Resource_5)
* [Resource 5: Squares and rectangles](#Resource_6)
* Writing materials
 |
| [**Lesson 5: What can I fit inside?**](#Lesson_5)70 minutesVolume is the space occupied by a container and capacity is a measure of how much it can hold. | **Representing whole numbers*** Use counting sequences of ones and tens flexibly
* Form, regroup, and rename three-digit numbers

**Combining and separating quantities*** Represent and reason about additive relations

**Three-dimensional spatial structure*** 3D objects: Recognise familiar three-dimensional objects
* Volume: Measure and compare the internal volumes (capacities) of containers by filling
* Volume: Measure the internal volume (capacity) of containers by packing
* Volume: Compare containers based on internal volume (capacity) by filling and packing
* Volume: Compare volumes using uniform informal units
 | * [Interactive spinner](https://www.didax.com/apps/spinners/)
* Coloured bricks
* Cups and other small containers
* Examples of open cubes and rectangular prisms
* Items to be used as informal units of measurement for internal volume
* MAB blocks
* Mini whiteboards
* Writing materials
 |
| [**Lesson 6: Multiple masses**](#Lesson_6)70 minutesDifferent informal units can be used to demonstrate conservation of mass. | **Combining and separating quantities*** Use advanced count-by-one strategies to solve addition and subtraction problems

**Non-spatial measure*** Mass: Compare the masses of objects using an equal-arm balance
 | * Equal-arm balance
* Items to be used as informal units of measurement for mass
* Writing materials
 |
| [**Lesson 7: Measurement investigators!**](#Lesson_7)60minutesThe unit of measure to use is determined by what needs to be measured. | **Geometric measure*** Length: Measure the lengths of objects using uniform informal units
* Length: Compare lengths using uniform informal units
* Length: Compare and order lengths, using appropriate uniform informal units

**Two-dimensional spatial structure*** Area: Measure areas using uniform informal units
* Area: Compare rectangular areas using uniform square units of an appropriate size in rows and columns

**Three-dimensional spatial structure*** Volume: Measure and compare the internal volumes (capacities) of containers by filling
* Volume: Measure the internal volume (capacity) of containers by packing
* Volume: Compare containers based on internal volume (capacity) by filling and packing
* Volume: Compare volumes using uniform informal units

**Non-spatial structure*** Mass: Compare the masses of objects using an equal-arm balance
 | * Items to be used as informal units of measurement for length, area, volume and mass
* Writing materials
 |
| **[Lesson 8: Project presenters!](#_Lesson_8:_Project)**70 minutesMeasurement concepts can be communicated through words, symbols, numbers, diagrams and actions. | **Geometric measure*** Length: Measure the lengths of objects using uniform informal units
* Length: Compare lengths using uniform informal units
* Length: Compare and order lengths, using appropriate uniform informal units

**Two-dimensional spatial structure*** Area: Measure areas using uniform informal units
* Area: Compare rectangular areas using uniform square units of an appropriate size in rows and columns

**Three-dimensional spatial structure*** Volume: Measure and compare the internal volumes (capacities) of containers by filling
* Volume: Measure the internal volume (capacity) of containers by packing
* Volume: Compare containers based on internal volume (capacity) by filling and packing
* Volume: Compare volumes using uniform informal units

**Non-spatial structure*** Mass: Compare the masses of objects using an equal-arm balance
 | * Concrete materials used in investigations
 |

## Lesson 1: Take a letter!

**Core concept**: Informal units can be used to compare attributes of shapes.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* numbers can be partitioned in different ways
* mathematical reasoning can be used to explore attributes
* uniform informal units can be selected to estimate and measure length and area.
 | Students can:* partition a two-digit number to make it bigger or smaller
* explore and explain ideas about length and area
* use tiles to estimate and measure length and area.
 |

### Daily number sense: Closest to 100! – 15 minutes

1. Build student understanding of place value by partitioning dice throws.
2. Explain that the aim of this game is to get as close to 100 as possible after 3 turns.
3. Model one game. For example:
* Turn one: Student A throws two 6-sided dice. A 5 and a 2 appear. The numbers can make 25 or 52 and the student chooses 52. Player B repeats the process. Ask students if they agree or if they would have chosen another number and why. Students A and B record their throws and results. Ask students to think about possibilities for their next 2 rounds and what throws will get them closest to 100.
* Turn 2: Both students throw their dice again and choose another number. They add this to the result of their first turn and agree that their progressive totals are correct. If there is disagreement about the progressive total, use more than one strategy to check. For example, adding the tens and then the units or counting on. Ask students if they agree or if they would have chosen another number and why. Students record throws and results.
* Ask students to predict what dice throws will help get closest to 100 with their last throw.
* Turn 3: The students throw the dice. Ask students which possibility they should choose.
* Decide who the winner was.
* Ask students if there were any other ways of using the dice throws that would have got them closer to 100.
1. Students play the game in pairs.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students organise 2 dice throws to make different totals that will get them closest to 100? **(MAO-WM-01, MA1-RWN-02)**
* Can students communicate strategies to calculate and check progressive totals? **(MAO-WM-01, MA1-CSQ-01)**

What to collect:* observational records **(MAO-WM-01, MA1-RWN-02, MA1-CSQ-01)**
* work samples of cumulative totals and strategies used to check answers. **(MAO-WM-01, MA1-RWN-02, MA1-CSQ-01)**
 | Students cannot calculate a progressive total.* Use a number chart or number line.
* Use concrete materials.
 | Students use mathematical thinking to get close to 100.* Students play the same game with an 8-sided dice
* Students then play 5 rounds of dice throws with a 6-sided dice.
 |

### Which one doesn’t belong? – 55 minutes

1. Display [Resource 1: Think about maths!](#Resource_1) In small groups, students make letters from square tiles to think about the similarities and differences between the letters. Encourage students to think about length, area and other ways to measure each letter, for example, counting corners around the outside of the letters.
2. Use one letter to demonstrate how to find total length by taking all the tiles and laying them end to end with no gaps or overlaps. For example, the letter T has a total length of 7.
3. Demonstrate how to find area by taking all the tiles in a letter and making an array. For example, the letter A has 12 tiles which can be made into different arrays. Students then use repeated addition of rows or columns to calculate area.
4. Students have individual thinking time and then [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to discuss mathematical reasons for how each of the letters doesn’t belong.
5. Students share ideas.

**Note:** In this type of mathematical thinking, students can find at least one way that each element displayed doesn’t belong. In the table, only one idea is suggested for each letter but there are more solutions.

The table below outlines stimulus prompts to generate conversation about the topic, along with anticipated responses from students.

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * Which one doesn’t belong?
* How can you explain your thinking?
 | * The M is the only letter that is 5 units wide.
* The letter A is the only one with an enclosed space.
* The T is the only one made with less than 10 square tiles.
* The letter H is the only letter that has exactly 4 square tiles in a row or column.
* The S is the only letter that contains 3 horizontal lines or rows.
 |

**Note:** Display [Resource 1: Think about maths!](#Resource_1) in the classroom and encourage students to return to this problem when they have a new idea.

1. In small groups, students use square tiles to investigate letters for a given criteria and make a ‘Which one doesn’t belong?’ For example, the first letter of several:
* days of the week
* months of the year
* first names or family names
* Australian animals
* local street names.
1. Students select a uniform informal unit of measurement, for example, square tiles, counters, paper clips. They make 4 or 5 letters using their chosen criteria. They estimate and explore attributes such as length, area in arrays, corners, rows, columns and so on to decide how each element doesn’t belong. Record a minimum of one idea for how each one doesn’t belong on a piece of card.
2. Move between groups, assessing students’ ideas and revising that units need to be placed end to end without gaps or overlaps. Groups leave their answer card upside down next to their display for a [gallery walk](https://education.nsw.gov.au/teaching-and-learning/learning-from-home/teaching-at-home/expectations/contemporary-learning-and-teaching-from-home/learning-from-home--teaching-strategies/gallery-walk).
3. Give students time to move around, discuss several investigations and then turn the answer card over to see if they agree.
4. As a class discuss what types of measurement have been used to investigate the problem. The answer is area and length.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students select and use uniform informal units to investigate area, length and other attributes of shapes? (**MAO-WM-01, MA1-GM-02, MA1-2DS-02**)
* Can students justify why each element in their group doesn’t belong? (**MAO-WM-01, MA1-GM-02, MA1-2DS-02**)

What to collect:* observational records (**MAO-WM-01, MA1-GM-02, MA1-2DS-02**)
* photographs of gallery walk displays and work samples of answer cards. (**MAO-WM-01, MA1-GM-02, MA1-2DS-02)**
 | Students cannot choose or investigate letters.* Students make the first letter of the months May, August and September with coloured tiles.
* They find one reason why each one doesn’t belong.
 | Students can identify why an element doesn’t belong.* Students identify 2 ways each element doesn’t belong.
* Students add one more element and then discuss whether their rules still apply.
 |

### Consolidation and meaningful practice: Which one doesn’t belong – 5 minutes

1. Reflect on the investigations by asking students:
* What part of the investigation did you enjoy most? Why?
* What was most challenging about creating a Which one doesn’t belong? Why?
* If you did this investigation again, is there anything you would change? Why? Why not?

## Lesson 2: Which length would you choose?

**Core concept**: The size of a unit makes a difference to the number of units needed to measure length.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* numbers can be partitioned in different ways
* length can be described by the type of unit used and how many are needed
* there is a relationship between the size of a unit and the number of units needed to measure its length.
 | Students can:* partition a three-digit number in different ways to explore place value
* use uniform informal units to measure length; placing units end to end repeatedly without gaps or overlaps
* describe how using different size units makes a difference to the answer when measuring length.
 |

### Daily number sense: Closest to 1000! – 20 minutes

1. Build student understanding of place value in three-digit numbers by partitioning dice throws.
2. Revise the game Closest to 100 from [Lesson 1](#Lesson_1) and explain that the aim of today’s game is to work together to help Student A and Student B get as close to 1000 as possible after 3 rounds.
3. Model the game. For example:
* Round one: Student A throws three 6-sided dice, a 5, a 2 and a 7. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to discuss what numbers can be made and record ideas on mini whiteboards showing hundreds, tens and units. Share ideas verbally as a class. Student A can make 725, 752, 275, 257, 572 or 527. Ask students which number they would choose. Student B repeats the process. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to discuss what numbers can be made and record ideas on mini whiteboards. Ask students to [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to think about possibilities for the next 2 rounds and which will get them closest to 1000.
* Round 2: Students A and B throw their dice. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) to discuss what numbers can be made and record ideas on mini whiteboards. Share ideas as a class. They choose their numbers and add it to their turn one number to get a progressive total. Demonstrate finding the total with MAB blocks or adding hundreds, tens and then units to find the progressive total. Student A and Student B record their throws and results.
1. Ask students to predict what dice throws from the last round will help Student A and Student B get closest to 1000.
2. Students take their third turn and determine the winner.
3. Ask students if they think there were any other ways of using the dice throws that would have got them closer to 1000.
4. In their pairs, students play the game again.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students use 3 dice throws to make different totals and describe them using hundreds, tens and units? **(MAO-WM-01, MA1-RWN-02)**
* Can students communicate strategies to help Student A and Student B get closest to 1000? **(MAO-WM-01, MA1-RWN-01)**

What to collect:* observational records **(MAO-WM-01, MA1-RWN-02)**
* photographs of partitioning on white boards showing different solutions using dice throws. **(MAO-WM-01, MA1-RWN-02)**
 | Students cannot understand the place value of a hundred in three-digit numbers.* Use concrete materials to demonstrate adding hundreds, tens and then units.
* Model adding one to 99 with MAB blocks to show students how a number changes from a two-digit number to a three-digit number.
 | Students use mathematical thinking to get close to 1000.* Students play the game in pairs instead of as a whole class. Some play to 500 and some play to 1000.
* Students play the game with 5 rounds of dice or choose not to include one of the rounds.
 |

### Which length would you choose? – 40 minutes

**Note:** This activity could be completed using real money but pretend money or concrete materials with the same dimensions are suitable. The class will need approximately 50 of each type of coin to investigate this problem.

1. Tell students that you have won a prize at a local fair. The prize is a choice of lengths of coins:
* half a metre of $2 coins
* a metre of $1 coins.
1. Provide $1 and $2 coins and ask students to investigate to help you choose which prize. Remind students that these units of measurement need to be laid end to end with no gaps or overlaps.
2. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves), look at the coins, and estimate which will be the best prize to choose.
3. As a class, students share and justify decisions. The best prize to choose should be the half-metre of $2 coins option because that will give you $50 and the metre of $1 will give you $40. Explain that even if a coin doesn’t completely fit in at the end, it is still part of the prize.
4. Ask questions to further develop how to solve multiplication problems using repeated addition:
* How did you use addition to count the $2 coins? For example, counting in twos, or 5 lots of 2 at a time to make 10 and so on.
* What would the prizes be if there was a metre of $2 coins and 2m of $1 coins?
1. As a class discuss what types of measurement they used to investigate this problem. The answer is length, but number was used in this process.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students use uniform informal units to measure lengths, placing units end to end without gaps or overlaps? **(MAO-WM-01, MA1-GM-02)**
* Can students describe how using different units makes a difference to the answer when measuring lengths? **(MAO-WM-01, MA1-GM-02)**
* Do students use understanding of different units of measurement to make choices about the prizes? **(MAO-WM-01, MA1-GM-02)**

What to collect:* observational records **(MAO-WM-01, MA1-GM-02)**
* photographs of accurate measurement with coins end to end showing no gaps or overlap. **(MAO-WM-01, MA1-GM-02)**
 | Students cannot work out the total of money in each line.* Model counting on in ones and twos, pointing to each coin in turn.
* Students take 2 counters for each $2 coin and then count them to find a total.
 | Students work out the best length option.* Students work out how to find the totals if they only had enough $1 and $2 coins to make a quarter of a metre.
* Students work out how many 50c coins they would need to have more money than the best prize.
 |

### Consolidation and meaningful practice: Counting in twos – 5 minutes

1. Ask students how much money they would have if they had:
* three $2 coins
* ten $2 coins
* six $2 coins
* five $2 coins and three $1 coins
* ten $2 coins and ten $1 coins
* two 50 cent coins
* ten 50 cent coins.

##

## Lesson 3: Larger and smaller

**Core concept**: Consistent units of measurement are needed for comparison.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* numbers can be partitioned in different ways
* units of measurement can be selected to estimate, measure, record and compare areas and lengths
* the length of an object remains constant when rearranged.
 | Students can:* partition a three-digit number in different ways to explore place value
* recognise a piece of string is still the same length even when rearranged
* select and justify appropriate units of measurement to make a ruler
* record and compare lengths and areas using numerals and words.
 |

### Daily number sense: Throw 3 dice – 15 minutes

1. Build student understanding of place value of in three-digit numbers by partitioning dice throws.
2. Students write answers to questions on mini whiteboards.
3. Throw three 6-sided dice and ask students to show you all the three-digit numbers that could be made. Ask which is the largest number and which is the smallest number. Ask them to say all the numbers in order from smallest to largest.
4. Using 6-sided dice what 3 throws would get you:
* the smallest number possible? 111
* the biggest number possible? 666
* the number closest to 500? 511.
1. Using 6-sided dice what 3 different throws would get you:
* the smallest number possible? 123
* the biggest number possible? 654
* the number closest to 500? 512.
1. Throw 3 dice and ask students to write the numbers before and after on their mini whiteboards and hold them up.
2. Throw 3 dice and ask students to write:
* the next multiple of 10
* the next multiple of 100.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students use 3 dice throws to make different totals and describe them using hundreds, tens and units? **(MAO-WM-01, MA1-RWN-02)**
* Can students find all the possible totals and order them from smallest to largest? **(MAO-WM-01, MA1-RWN-02)**
* Can students use partitioning to solve place value problems? **(MAO-WM-01, MA1-RWN-02)**

What to collect:* observational records **(MAO-WM-01, MA1-RWN-02)**
* photographs of white board responses **(MAO-WM-01, MA1-RWN-02)**
 | Students cannot understand the place value of a hundred in three-digit numbers.* Use concrete materials to demonstrate hundreds, tens and then units. Count them into a place value chart.
* Model adding one to 99 with MAB to show students how a number changes from a two-digit number to a three-digit number.
 | Students use three-digit numbers to answer given questions.* Students throw 3 dice and write the next multiple of 10 and the next multiple of 100. Then write the closest multiple of 10 and the closest multiple of 100. Repeat 3 times. Discuss answers.
* Students create their own questions using three 6-sided dice.
 |

### How big is that? – 50 minutes

**Note**: The animals shown in [Resource 2: Animals everywhere](#Resource_2) are from paintings and carvings around the world. Consider using representations of animals from your community if they are available.

1. Display [Resource 2: Animals everywhere](#Resource_2). Explain that, in the past, many groups of people drew or carved animals because animals were very important to them. Ask students if they can think of any reasons why. Explain that people need animals to survive by using them for food, clothing and making tools. Animals are so precious that people painted and carved them in many places. Often the paintings and carvings were bigger than life size to show how important animals were. The paintings do not include lots of detail and are usually flat or two-dimensional, but it is still obvious exactly what animals they are.
2. Take students outside and help them to draw a simple outline of an animal with chalk. Ask the class to decide on one special animal, draw it and measure it in different ways. Draw it bigger than life-size and include an outline that makes it recognisable but not with lots of extra detail.
3. The class measures a piece of string that goes all the way around the animal. Use the string to make a fun blobby shape beside the chalk animal and discuss whether the length of string is still the same.
4. Ask students how they could measure the length around the animal using uniform informal units.

**Note:** Revise how in Unit 3, students made their own ruler with uniform informal units to avoid using too many single units.

1. Show students a straight ruler and discuss whether this would be useful to measure the animal. Students should point out that as animals have curves, this ruler won’t work.
2. Provide flexible concrete materials to make a ruler such as string and pipe cleaners. Students handle materials and talk about why they are appropriate. Students then choose a uniform informal unit of measure to mark their ruler, such as paperclips, blocks or counters and justify their choice to a partner. See Figure 1 for an example of using uniform informal units to make a ruler.

Figure 1 – Student ruler showing uniform informal units used



1. Ask students to measure an object and compare the length with a partner. Students record their measurement. Ask what they will need to remember about their choice of unit. Discuss how they need to choose the same unit to make their ruler with and why. Students make a ruler of their chosen length making sure to place units end to end without gaps or overlaps. Discuss why one ruler could be 10 units long and another ruler could be 20 units long, but the people who use them can still compare their animal lengths if they both use the same uniform informal unit.
2. Move between groups to support students using their rulers end to end and think about how to record their counting as it moves into larger numbers. If a ruler is made of 10 units, some students may choose to count in tens while others might make a tally mark each time they use a ruler length. Students who chose the same informal unit to make their ruler can compare their object lengths. Students check their measurement by placing paperclips or blocks all the way around the object to see whether their ruler is accurate.
3. Ask students how they could measure the space inside the class animal using uniform informal units. Help the class to choose an appropriate consistent unit of measurement and estimate how many counting units and part units there would be. Support students to record their counting as it moves into larger numbers, for example by using a tally mark for each 10 units used.
4. As a class, ask students:
* What was the area of the animal?
* What was the length all the way around?
* What went well?
* What were the challenges?
* Would you change anything if you did this activity again?
* How could you halve the number of uniform informal units needed to measure the area of the animal?
1. As a class discuss what types of measurement they have used to investigate this problem. The answer is area and length.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Do students choose an appropriate informal unit of measurement to make a ruler? **(MAO-WM-01, MA1-GM-02)**
* Do students select appropriate units of measurement to estimate and measure lengths and areas, identifying any parts left over? **(MAO-WM-01, MA1-2DS-02)**
* Can students justify choice of units of measurement for area and length? **(WMO-WM-01, MA1-GM-02, MA1-2DS-02)**
* Can students record and compare lengths and areas using drawings, numerals and words? **(MAO-WM-01, MA1-GM-01, MA1-2DS-02)**
* Do students understand why the length all the way around the animal does not change when rearranged into a different shape? **(MA1-GM-01)**

What to collect:* observational records of students choosing units and measuring **(MAO-WM-01, MA1-GM-02, MA1-2DS-02)**
* work samples of recording using words, pictures and numbers. **(MAO-WM-01, MA1-GM-02, MA1-2DS-02)**
 | Students cannot measure the length and/or area of the animal.* Model placing units end to end with students to make a flexible ruler.
* Model using the ruler to measure halfway along the string. Students continue measurement.
* Model using an appropriate uniform informal unit to measure part of the animal, identifying left-over parts. Students continue measuring.
 | Students find the length and area of the animal.* Students draw a new animal and measure the distance all the way around with their flexible ruler.
* Students use string to measure the outline of the animal and compare this to the class animal.
 |

## Lesson 4: How do we compare?

**Core concept**: Using a consistent unit of measurement enables ordering and comparing.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* using a consistent unit of measurement enables ordering and comparing
* repeated addition of rows or columns of squares can be used to find area
* the units in a square or rectangle can be rearranged but the area will remain constant.
 | Students can:* select methods to estimate, measure and compare areas of squares and rectangles
* explain how parts of a square or rectangle can be rearranged but the area remains the same.
 |

### Daily number sense: Which dice doesn’t belong? – 10 minutes

1. Build student understanding of number by comparing dice.

**Note:** Students will think mathematically to apply a range of strategies from the focus areas ‘Representing whole numbers’ and ‘Combining and separating quantities’. These will vary from student to student.

1. Display [Resource 3: Dice](#Resource_4)
2. Revise with students how in [Lesson 1](#Lesson_1) they looked at letters and found reasons why each one didn’t belong.
3. Give students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) time to discuss why each of these dice doesn’t belong. Explain and justify ideas as a class.

### How do we compare? – 50 minutes

1. Display [Resource 4: Rectangles, corners, squares](#Resource_5) and ask students what they can see. Explain that they are going to compare these shapes in different ways:
* area
* length
* length all the way around.
1. Ask students for ideas to investigate which is longest and does the shape with the biggest area have the longest length all the way around.
2. Revise how students measured in [Lesson 3](#Lesson_3) and ask if there are any skills or materials they could use again. Ask what might be different, for example, selection of squares as uniform informal units of measurement, using arrays to find area and so on.
3. Revise how to use rows and columns to describe squares and rectangles and find area.
4. Look at one of the corner shapes together and discuss how arrays could be used to find the area. Some possibilities are:
* splitting the shape into 2 parts
* splitting the shape back up into individual squares and making one array.
1. In pairs or small groups, students estimate, record and order the shapes in [Resource 4: Rectangles, corners, squares](#Resource_5) for area, length and the length all the way around.
2. Discuss results as a class. Ask students if there were any surprises. For example, whether the longest shape did not have the biggest area or if the shape with the biggest area did not have the longest length all the way around.
3. Discuss what types of measurement students have used to investigate this problem. The answer is area and length.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students select methods to estimate, measure and compare areas of squares and rectangles? **(MAO-WM-01, MA1-FG-01, MA1-2DS-01)**
* Can they apply these skills to corner shapes? **(MAO-WM-01, MA1-FG-01, MA1-2DS-01)**
* Can students explain how parts of a square or rectangle can be rearranged but the area remains the same **(MAO-WM-01, MA1-FG-01, MA1-2DS-01)**

What to collect:* observational records and photographs of strategies used to measure area and length **(MAO-WM-01, MA1-FG-01, MA1-2DS-01)**
* work samples of students recording and comparing data for shapes. **(MAO-WM-01, MA1-FG-01, MA1-2DS-01)**
 | Students cannot find areas of shapes.* Model counting each square inside a shape one-by-one
* Students make each shape with square tiles.
 | Students measure and compare the shapes for length, area and length all the way around.* Students find other criteria to investigate. For example, comparing the number of outside corners in each shape, or finding bigger squares inside shapes
* Present findings to the class.
 |

### Consolidation and meaningful practice: Arrays – 10 minutes

1. Display [Resource 5: Squares and rectangles](#Resource_6). For the top row of shapes, ask students how they can use repeated addition of rows or columns to find area.
2. For each shape in the bottom row, ask students to find area first by adding the rows together and then by adding the columns together. Discuss why the answers are the same.
3. Choose 2 arrays. Take away a row at a time or a column at a time and count down together. For example, a 5 by 5 array will start at 25 and then the pattern will be 20, 15, 10, 5 and zero. Reconstruct the array. Ask students how they could remove columns and/or rows to make a given number of rows or columns, for example, 3 rows of 5 or 2 columns of 5.

## Lesson 5: What can I fit inside?

**Core concept**: Volume is the space occupied by a container and capacity is a measure of how much it can hold.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* place value can be used to identify numbers before and after a three-digit number
* units of measurement can be selected to efficiently estimate, measure and compare capacity
* containers of different shapes can have the same volume and/or capacity
* volume is the space taken up by an object and capacity (internal volume) is a measure of how much a container can hold.
 | Students can:* identify the number before and after a given three-digit number, including for numbers ending in zero
* select appropriate uniform informal units to estimate, measure and compare volume and capacity
* identify containers of different shapes that have the same volume
* understand the difference between volume and capacity.
 |

### Daily number sense: Before and after – 10 minutes

1. Build student understanding of place value by finding the number before and after a given three-digit number.
2. Use an [interactive spinner](https://www.didax.com/apps/spinners/) 3 times to get 3 digits, for example, 7, 9 and 6. Using mini whiteboards, students make:
* the biggest number possible; write it and then record the number before and the number after
* the smallest number possible; write it and then record the number before and the number after
* the number closest to 500; write it and then record the number before and the number after.
1. Select students to display their whiteboards. Choose several solutions from whiteboards and ask students to count forwards and backwards by tens.
2. Repeat the process twice.
3. Ask students what the number before and the number after would be if the spinner provided the number:
* 120
* 600.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students identify the number before and after a given three-digit number? **(MAO-WM-01, MA1-RWN-01)**
* Can students identify numbers before and after a three-digit number ending with a zero? **(MAO-WM-01, MA1-RWN-01)**
* Can students count forwards and backwards by tens, on and off the decade? **(MAO-WM-01, MA1-RWN-01)**

What to collect:* observational records (**MAO-WM-01, MA1-RWN-01)**
* photographs of white board responses. **(MAO-WM-01, MA1-RWN-01)**
 | Students cannot work with three-digit numbers.* Model a three-digit number and the number before and after with MAB blocks. Use a hundreds, tens and units number chart to record numbers.
* Students work with two-digit and then three-digit numbers.
 | Students find all before and after numbers.* Students find the number 5 before and 5 after for given three-digit numbers.
* Students find the next multiple of 10 and the closest multiple of 10 for given three-digit numbers.
* Students use a given three-digit number as the answer to a number sentence. Create 3 different addition sentences for the answer.
 |

### What can I fit inside? – 50 minutes

1. Explain that students are going to be making containers. Give students a two-minute challenge to find and name three-dimensional objects and containers in the classroom.
2. Show students examples of open cubes and rectangular prisms, for example, a box, crate or lunchbox. Explain that they are going to make one of these containers with coloured bricks. In pairs, students make one open cube and one open rectangular prism and count how many bricks they used.
3. Provide the class with a range of uniform informal units of measurement such as paper clips, counters, marbles, tiles, small cubes. As a class, students select and justify choice of 2 appropriate units, for example, paper clips and counters.

**Volume:** The amount of space occupied by an object.

**Internal volume (capacity):** A measure of how much a container can hold.

1. Back in pairs, students estimate how many of the first unit will fit into their container and measure and record capacity. They identify which of their 2 containers has a greater internal volume (capacity).
2. Students select another unit and justify why they will need more or less of this unit than the first one. Estimate, measure and record capacity. Discuss any issues with the units chosen.
3. Ask if any students used the same number of units to build their container. Think about why these containers may have different volumes. If no 2 containers used the same number of units, select the closest 2 or 3 to talk about.
4. Ask the class if any of the containers have the same capacity. Display these to the class and compare, thinking about why containers might look different but have the same capacity. If no 2 containers are the same, select the closest few in internal volume.
5. Ask if there were any challenges with the uniform informal units, for example, gaps that affect the accuracy of the measurement. Ask students if they have any ideas about more efficient units of measurement.
6. Ask students to pack each container with coloured bricks or make an insert from coloured bricks for their container that fits exactly. Identify the bricks inside as the capacity or internal volume of the container. Students count how many bricks there are in each empty container and then in the insert or bricks packed inside.
7. Work out the whole volume of the container or the space that it takes up, by adding the 2 numbers of bricks together. Record findings using drawings, numerals and words. Support students to think about volume and capacity on a [gallery walk](https://education.nsw.gov.au/teaching-and-learning/learning-from-home/teaching-at-home/expectations/contemporary-learning-and-teaching-from-home/learning-from-home--teaching-strategies/gallery-walk).
8. As a class, discuss why the insert has fewer bricks than it took to make the container. Support students to work out the difference between the volume or space that the whole container takes up and the internal volume or capacity.
9. Ask students which container has the:
* biggest internal volume (capacity)
* smallest internal volume (capacity)
* biggest volume (container and internal volume combined)
* smallest volume (container and internal volume combined).
1. Ask students what they found interesting about the results.
2. As a class discuss what types of measurement they used to investigate this problem. The answer is volume and capacity.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students select appropriate uniform informal units to estimate, measure and compare capacity? **(MAO-WM-01, MA1-3DS-02)**
* Can students identify containers of different shapes that have the same volume or capacity? **(MAO-WM-01, MA1-3DS-02)**
* Do students understand the difference between volume and capacity? **(MAO-WM-01, MA1-3DS-02)**

What to collect:* observational records **(MAO-WM-01, MA1-3DS-02)**
* work samples of containers and inserts with student recordings of volume and capacity. **(MAO-WM-01, MA1-3DS-02)**
 | Students do not understand the difference between volume and capacity.* Show students translucent geometric solids and discuss that the space they take up is their volume.
* Show students the equivalent geometric object with no top and discuss that what can fit inside is the internal volume or capacity.
 | Students understand the difference between volume and capacity.* Students make open cubes of increasing size with coloured bricks.
* They investigate patterns between increasing sizes of open cubes, volume and capacity.
 |

### Consolidation and meaningful practice: Paper clip challenge – 10 minutes

1. Ten-minute capacity challenge: Make a container from coloured bricks that holds exactly 50 paper clips.
2. Provide students with a range of cups or other small containers. Students select a cup and estimate how many lots of 50 paper clips it will hold. Check by filling with their container of paper clips until it is level with the top of the cup. Compare measurement to estimate.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students make a container that holds exactly 50 paper clips? **(MAO-WM-01, MA1-3DS-02)**
* Can they use their container to estimate and measure the capacity of a cup? **(MAO-WM-01, MA1-3DS-02)**

What to collect:* observational records **(MAO-WM-01, MA1-3DS-02)**
* **photographs of containers and videos of filling to find capacity. (MAO-WM-01, MA1-3DS-02)**
 | Students cannot make a measure calibrated to hold 50 paper clips or use it to find capacity.* Students make a container to hold 10 paper clips.
* Model how to use a measure to fill a cup until it is level with the top.
 | Students can make a measure calibrated for 50 paper clips and use it to find the capacity of a cup.* Students measure how many paper clips there are in half the cup and calculate how many will be needed to fill the whole cup to capacity.
* Students measure how many paper clips there are in a quarter of the cup and calculate how many will be needed to fill the whole cup to capacity.
 |

## Lesson 6: Multiple masses

**Core concept**: Different informal units can be used to explore conservation of mass.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* uniform informal units can be selected to estimate, measure and compare masses
* the number of units needed to measure the mass of an object will depend on the mass of the unit
* mass is conserved.
 | Students can:* select uniform informal units to estimate, measure and compare masses
* explain why different numbers of units can be used to measure the mass of an everyday object
* explain how what they know about the mass of one object can be used to measure the mass of another object.
 |

### Daily number sense: An up and down story – 10 minutes

1. Build student understanding of height as a length by solving number problems.
2. Explain that Ollie the powerful owl lives in an apartment tree with many levels. Ollie lives on the third level and he loves cooking. One day Ollie makes cupcakes and decides to share them with his friends. He pops up 12 levels and gives some to Madi the magpie. Then he realises he has missed out Walter the wattlebird 4 levels below. He flies back down, delivers a cupcake to Walter and then flies back up 9 floors to the top floor and gives a cupcake to Ruby the rosella. Ask students how many levels there are in Ollie’s apartment tree. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves), and use numbers, words and diagrams to solve the problem. Share solutions as a class.

### Combining weights – 50 minutes

1. Revise how to use an equal-arm balance using uniform informal units and everyday objects. For example, estimate how many marbles will be needed if there is a stapler on the other side of the equal-arm balance, and then check by measuring. Ask students if they can think of another unit of measurement to use and whether they will need more or less of them to equal the mass of the stapler. Test student ideas.
2. Model a mass story where students use knowledge of some masses to work out how many uniform informal units are needed for another. For example, if a pencil case is equal in mass to 20 marbles, and a book is equal in mass to 2 pencil cases, how many marbles will equal one book? Give students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) time.
3. Ask students for their ideas and how they could check. Demonstrate with concrete materials and an equal arm-balance. Ask students what other units could have been used to solve this problem.
4. Provide small groups of students with equal arm-balances, a choice of uniform informal units and everyday classroom objects. Students select appropriate units and objects. They estimate, create, record and solve three-part mass problems as per the modelled story.
5. Display the problems in a [gallery walk](https://education.nsw.gov.au/teaching-and-learning/learning-from-home/teaching-at-home/expectations/contemporary-learning-and-teaching-from-home/learning-from-home--teaching-strategies/gallery-walk).
6. As a class, ask students:
* Were there any uniform informal units or everyday objects that did not work for this activity? Why was this?
* Which uniform informal unit would have been the most efficient to work with? Why do you think this?
* Which mass story did you enjoy solving the most? Why?
1. As a class discuss what types of measurement were used to investigate this problem. The answer is mass.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students select uniform informal units to estimate, measure and compare masses? **(MAO-WM-01, MA1-NSM-01)**
* Can students explain why different numbers of units can be used to measure the mass of an everyday object? For example, a stapler has a mass the same as 5 marbles or 60 paperclips **(MAO-WM-01, MA1-NSM-01)**
* Can students explain how what they know about the mass of one object can be used to measure the mass of another object? **(MAO-WM-01, MA1-NSM-01)**

What to collect:* observational records **(MAO-WM-01, MA1-NSM-01)**
* photographs of problems from gallery walk. **(MAO-WM-01, MA1-NSM-01)**
 | Students cannot use what they know about the mass of one object to find the mass of a second object.* Students use the same uniform informal unit to measure the mass of both items.
* They record the answers and look for a relationship. For example, the pencil case weighs 20 marbles and the book weighs 40 marbles. So the book weighs twice as much as the pencil case.
 | Students use an equal arm-balance to create and solve mass problems.* Students estimate, create, record and solve four-part mass problems.
* Students use a standard water bottle that holds 600mL as one of the objects in a three-part problem.
 |

### Consolidation and meaningful practice: Up and down stories – 10 minutes

1. Revise up and down stories. In pairs, students create and record their own height as a length story. Provide concrete materials and vertical number lines. They join another group and solve each other's stories.

##

## Lesson 7: Measurement investigators!

**Core concept**: The unit of measure to use is determined by what needs to be measured.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* mass, volume, area and length can be investigated in isolation or through their connections
* units of measurement can be selected to estimate, measure, record and compare shapes and objects
* mathematical thinking can be explored and communicated through numbers, words, symbols and diagrams.
 | Students can:* choose and describe a measurement idea and/or question to investigate
* justify the selection of a unit of measure to estimate, measure, record and compare attributes
* explore and communicate measurement ideas and investigations through words, numbers, symbols and diagrams.
 |

### Daily number sense: Teacher choice – 10 minutes

1. From a class need surfaced through formative assessment data, identify a short, focused activity that targets students’ knowledge, understanding and skills. Example activities may be drawn from the following resources:
* [Thinking mathematically Stage 1](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources#catalogue_auto)
* [Universal Resources Hub](https://resources.education.nsw.gov.au/home).

### Measurement investigators! – 50 minutes

**Note:** This lesson requires a range of uniform informal units of measure. Some students may choose an investigation that requires them to work outside the classroom for part of the time.

1. Ask students what types of measurement they have used in this unit. Students [turn and talk](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves) and then share ideas with the class. The types are length, area, volume and mass. Briefly revise the activities:
* Length – [Which length would you choose?](#Lesson_2)
* Area and length – [Which one doesn’t belong?](#_Which_one_doesn’t) [How big is that?](#_How_big_is) and [Squares, rectangles and corners](#_How_do_we)
* Volume and capacity – [What can I fit inside?](#_What_can_I)
* Mass – [Multiple masses](#_Lesson_6:_Multiple).
1. Brainstorm all the uniform informal units that have been used in these activities.
2. Tell students they are going to be measurement investigators. They are going to investigate an idea and/or questions about a type of measurement or how types of measurement relate to each other. In pairs or small groups, students brainstorm ideas. They choose one idea or question to investigate, recording this and the resources they will need.

**Note:** Students will present their investigations to the class in [Lesson 8](#_Lesson_8:_Project).

1. Each group explains their proposal to another group to check aspects of content and clarity.
2. Once a group is satisfied with their proposal, they investigate their idea and/or question. Move between groups, supporting students to solve issues as they arise, and asking:
* What idea and/or question are you investigating?
* What type or types of measurement does your investigation involve? For example, area and length or mass.
* What strategies are you using to investigate?
* What units of measurement are you using? Why?
* How accurate have your estimations been so far?
* What is the prediction for the result of your investigation?
* Have there been any problems? How did you solve these?
* How will you record what you find out?
* Are there any new questions you want to find the answer to now?

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Can students choose and describe a measurement problem to investigate? **(MAO-WM-01)**
* Can students justify the selection of a unit of measure to estimate, measure, record and compare attributes? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* Can students explore and communicate measurement ideas through words, numbers, symbols and diagrams? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**

What to collect:* observational records **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* work samples of investigations. **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
 | Students cannot choose an investigation or select appropriate uniform informal units of measurement.* Support students to discuss ideas and choose an appropriate idea and unit of measurement.
* Students make the letters of their given name with square tiles and investigate area and length.

Students cannot record ideas using words, pictures and symbols.* Students take photos of the investigation process.
* Students video themselves explaining what they have found out about measurement.
 | Students complete a measurement investigation.* If students have only investigated one type of measurement, they consider how to extend their investigation into another.
* Students incorporate halves and quarters into their investigation.
 |

## Lesson 8: Project presenters!

**Core concept**: Measurement concepts can be communicated through words, symbols, numbers, diagrams and actions.

The table below contains suggested learning intentions and success criteria. These are best co-constructed with students.

|  |  |
| --- | --- |
| Learning intentions | Success criteria |
| Students are learning that:* mass, volume, area and length can be investigated in isolation or through their connections
* units of measurement can be selected to estimate, measure, record and compare shapes and objects
* mathematical understanding can be communicated through numbers, words, symbols and diagrams.
 | Students can:* justify selection of a unit of measure to estimate, measure, record and compare attributes
* explore and understand measurement concepts through investigations
* communicate understanding through words, numbers, symbols and diagrams.
 |

### Daily number sense: Teacher choice – 10 minutes

1. From a class need surfaced through formative assessment data, identify a short, focused activity that targets students’ knowledge, understanding and skills. Example activities may be drawn from the following resources:
* [Thinking Mathematically Stage 1](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources#catalogue_auto)
* [Universal Resources Hub](https://resources.education.nsw.gov.au/home).

### Project presenters! – 50 minutes

1. Each group presents the measurement investigation they completed in [Lesson 7](#Lesson_7) to the class, by:
* describing the idea or question investigated and why it was chosen
* communicating the steps undertaken to find answers and displaying how they recorded this information
* justifying their choice of strategies and units of measurement
* explaining what they have discovered about measurement
* describing problems encountered and how they solved these
* communicating new questions or ideas that they would like to explore next.
1. Students ask questions. These could be about content, strategies, clarification, choice of measurement units.
2. Ask if students can see any connections between different investigations. These could include links between concepts, content, use of strategies or measurement units.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:* Could students choose and describe a measurement idea and/or question to investigate? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* Could students justify and use selection of a unit of measure and strategies? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* Could students explore and understand measurement ideas and/or questions? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* Could students communicate understanding through words, numbers, symbols and diagrams? **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**

What to collect:* observational records **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
* video recordings of presentations with audience questions and responses. **(MAO-WM-01, MA1-GM-02, MA1-2DS-02, MA1-3DS-02, MA1-NSM-01)**
 | Students cannot communicate their understanding to the class.* Students show photos taken during the investigation and use them to explain their steps. Students and the teacher answer questions from the class together.
* Students show videos explaining what they have found out about measurement.
 | Students complete and communicate a measurement investigation showing understanding and reasoning.* Students suggest modifications and/or new ideas for each group presentation.
* Students brainstorm how to investigate number through a measurement investigation.
 |

### Consolidation and meaningful practice: Congratulations! – 10 minutes

1. Ask students if they enjoyed the investigations, what they discovered and if they have any ideas for other measurement investigations.

## Resource 1: Think about maths!



## Resource 2: Animals everywhere



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## Resource 3: Dice

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## Resource 4: Rectangles, corners and squares



## Resource 5: Squares and rectangles



## Syllabus outcomes and content

The table below outlines the [syllabus outcomes](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10) and range of relevant syllabus content covered in this unit. Content is linked to [National Numeracy Learning Progression](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) version (3).

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| Focus area and outcomes | Content groups and content points | Lessons |
| Representing whole numbers AMAO-WM-01MA1-RWN-01MA1-RWN-02 | **Represent the structure of groups of ten in whole numbers** * Partition two-digit numbers to show quantity values (NPV4)
 | **1** |
| Representing whole numbers BMAO-WM-01MA1-RWN-01MA1-RWN-02 | **Use counting sequence of ones and tens flexibly*** Identify the number before and after a given three-digit number
* Count forwards and backwards by tens, on and off the decade, with two- and three-digit numbers (CPr7)
* Identify how much more to the next multiple of ten within two- and three-digit numbers

**Form, regroup, and rename three-digit numbers*** State the quantity value of digits in numbers up to three digits (NPV5)
* Identify the nearest hundred to a number
* Recognise units of 100 (UnM5, NPV5)
* Use place value to partition and rename three-digit numbers in different ways (NPV5)
 | **2, 3, 5** |
| Combining and separating quantities AMAO-WM-01MA1-CSQ-01 | **Use advanced count-by-one strategies to solve addition and subtraction problems*** Fluently use advanced count-by one strategies including counting on and counting back to solve addition and subtraction problems involving one- and two-digit numbers (AdS3-AdS5)

**Use flexible strategies to solve addition and subtraction problems*** 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 (AdS6-AdS7)
 | **1** |
| Combining and separating quantities BMAO-WM-01MA1-CSQ-01 | **Represent and reason about additive relations*** Represent the difference between two numbers using concrete materials and diagrams (AdS6)

**Form multiples of ten when adding and subtracting two-digit numbers*** Add two-digit numbers by building to multiples of ten (AdS7)
* Use quantity values to separate tens and ones for addition (only) (AdS7-AdS8)
 | **1, 5** |
| Forming groups BMAO-WM-01MA1-FG-01 | **Represent and explain multiplication as the combining of equal groups*** Use objects, diagrams, images or actions to model multiplication as accumulating equal *groups* (MuS4)
* Solve multiplication problems using repeated addition (MuS4)
* Form arrays of equal rows and equal columns (MuS5)
* Determine and distinguish between the number of *rows/columns* and the *number in each row/column* when describing collections of objects (MuS5)
* Model the commutative property of multiplication, using an array (MuS6)
* Model division by deconstructing an array equally into a given number of rows or columns
 | **2, 4** |
| Geometric measure AMAO-WM-01MA1-GM-02 | **Length: Measure the lengths of objects using uniform informal units*** Use uniform informal units to measure lengths and distances by placing the units end to end without gaps or overlaps (UuM2)
* Select appropriate uniform informal units to measure lengths and distances (UuM3)
* Recognise and explain the relationship between the size of a unit and the number of units needed
* Count informal units to measure lengths or distances and describe the part left over (UuM4)
* Record lengths and distances by referring to the number and type of unit used (UuM4)
* Use a single informal unit repeatedly (iteratively) to measure length (UuM4)

**Compare lengths using uniform informal units*** Compare the lengths of two or more objects using appropriate uniform informal units and check by placing the objects side by side and aligning the ends (UuM2-UuM3)
* Explain why the length of an object remains constant when rearranged
* Estimate lengths, indicating the number and type of unit used and check by measuring (UuM3)
 | **1–5, 7,8** |
| Geometric measure BMAO-WM-01MA1-GM-02 | **Length: Compare and order lengths, using appropriate uniform informal units*** Make and use a tape measure calibrated in uniform informal units (UuM4)
* Compare and order two or more shapes according to their lengths using an appropriate uniform informal unit
* Compare the lengths of two or more objects that cannot be moved or aligned
* Record length comparisons using drawings, numerals and words, and by referring to the uniform informal unit used
 | **1–3, 7, 8** |
| Two-dimensional spatial structure AMAO-WM-01MA1-2DS-02 | **Area: Measure areas using uniform informal units*** Explore area using uniform informal units to cover the surface in rows or columns without gaps or overlaps (UuM5)
* Measure area by selecting and using appropriate uniform informal units
* Explain the relationship between the size of a unit and the number of units needed to measure an area
* Explain why the area remains constant when units are rearranged
* Record areas by referring to the number and type of uniform informal unit used
* Identify any parts of units left over when counting uniform informal units to measure area
* Estimate areas by referring to the number and type of uniform informal unit used and check by measuring (UuM3)
 | **1, 3, 4, 7,8** |
| Two-dimensional spatial structure BMAO-WM-01MA1-2DS-02 | **Compare rectangular areas using uniform square units of an appropriate size in rows and columns*** Cover rectangular surfaces by creating repeated rows of square tiles (UuM5)
* Use a single square to create the array structure of area in rows and columns (UuM5)
* Use the structure of repeated units to find the area of a rectangle (UuM5)
* Explain how the grid structure of rows and columns helps to find the area
* Compare the areas of two or more surfaces that cannot be moved, or superimposed, by measuring in uniform informal units (UuM4)
* Record comparisons of area using drawings, numerals and words, and by referring to the uniform informal unit used
 | **1, 3, 4, 7,8** |
| Three-dimensional spatial structure AMAO-WM-01MA1-3DS-01MA1-3DS-02 | **3D objects: Recognise familiar three-dimensional objects*** Use the term ‘three-dimensional’ to describe a range of objects (UGP2-UGP3)
* Distinguish between objects, which are *three-dimensional* *(3D)* and shapes which are *two-dimensional* *(2D)*
* Identify and name familiar three-dimensional objects, including cubes, cylinders, spheres and rectangular prisms

**Volume: Measure and compare the internal volumes (capacities) of containers by filling*** Use uniform informal units to measure how much a container will hold by counting the number of times a smaller container can be filled and emptied into the container being measured (UuM3)
* Select appropriate informal units to measure the capacities of containers
* Recognise and explain the relationship between the size of a unit and the number of units needed
* Compare the internal volumes of two or more containers using appropriate uniform informal units (UuM3)
* Recognise and explain why containers of different shapes may have the same internal volume
* Estimate how much a container holds by referring to the number and type of uniform informal unit used and check by measuring (UuM3-UuM4)

**Volume: Measure the internal volume (capacity) of containers by packing*** Pack cubic units (eg blocks) into rectangular containers so that there are no gaps
* Recognise that cubes pack better than other objects in rectangular containers
* Estimate and measure the internal volume of a container by filling the container with uniform informal units and counting the number of units used
* Explain that if there are gaps when packing and stacking, this will affect the accuracy of measuring the internal volume
 | **5, 7, 8** |
| Three-dimensional spatial structure BMAO-WM-01MA1-3DS-02 | **Volume: Compare containers based on internal volume (capacity) by filling and packing*** Make and use a device for measuring internal volume (capacity) calibrated in uniform informal units (UuM3-UuM4)
* Compare, order and record the internal volumes (capacities) of two or more containers by measuring each container in uniform informal units (UuM3-UuM4)
* Estimate internal volume (capacity) by referring to the number and type of uniform informal unit used (UuM3)

**Volume: Compare volumes using uniform informal units*** Estimate the volumes of two or more models and check by counting the number of blocks used in each model
* Compare models with different appearances, recognising when they have the same volume
* Record the results of volume comparisons using drawings, numerals and words, referring to the units used
* Explain that models made of the same number of units may have different volumes depending on the size of the units used
 | **5, 7, 8** |
| Non-spatial measure BMAO-WM-01MA1-NSM-01MA1-NSM-02 | **Mass: Compare the masses of objects using an equal-arm balance*** Use uniform informal units to measure the mass of an object by counting the number of units needed to obtain a level balance on an equal-arm balance (UuM3)
* Select an appropriate uniform informal unit to measure the mass of an object and justify the choice (UuM3)
* Explain the relationship between the mass of a unit and the number of units needed
* Compare the masses of two or more objects using the same informal units (UuM3)
* Estimate mass by referring to the number and type of uniform informal unit used and check by measuring (UuM3-UuM4)
* Recognise that mass is conserved
 | **6–8** |

## References

**Links to third-party material and websites**

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[National Numeracy Learning Progression](https://www.australiancurriculum.edu.au/resources/national-literacy-and-numeracy-learning-progressions/version-3-of-national-literacy-and-numeracy-learning-progressions/) © Australian Curriculum, Assessment and Reporting Authority (ACARA) 2010 to present, unless otherwise indicated. This material was downloaded from the [Australian Curriculum](http://www.australiancurriculum.edu.au/) website (National Numeracy Learning Progression) (accessed 30 January 2023) and was not modified. The material is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0). Version updates are tracked in the ‘Curriculum version history’ section on the ['About the Australian Curriculum'](http://australiancurriculum.edu.au/about-the-australian-curriculum) page of the Australian Curriculum website.

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### Further reading

Danielson C (2019) *Which One Doesn’t Belong?: Playing with Shapes*, Charlesbridge, Watertown, MA.

Siemon D, Warren E, Beswick K, Faragher R, Miller J, Horne M, Jazby D, Breed M (2020) *Teaching Mathematics: Foundations to Middle Years: Part 4 – Teaching Measurement and Geometry*, 3rd edn, Oxford University Press Australia and New Zealand, Sydney.