# Mathematics – Stage 1 – Unit 3



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## Unit description and duration

This two-week unit introduces students to measurement using uniform informal units. Students are provided opportunities to:

* compare, order and match using informal units of measure
* estimate whether a measurement is reasonable
* consider how the selection of measuring unit affects accuracy
* explore conservation of length, area, volume, and mass.

[Mathematics K–10 Syllabus](https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-k-10) © 2022 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.

### Student prior learning

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

* making direct comparisons with measurement, for example, hefting and superimposing
* using everyday language to compare, such as lighter-heavier, longer-shorter, wider-thinner, bigger-smaller, farther-nearer
* using mathematical language of length, area, mass, and volume through play with informal units such as craft sticks, blocks, clay, water, sand
* recognising and sorting objects by length, area, mass, and volume
* exploring properties of common shapes such as squares and rectangles through play.

## 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: How can we measure length?**](#Lesson_1)  70 minutes  Choice of measuring unit affects accuracy. | **Representing whole numbers A**   * Use counting sequences of ones with two-digit numbers and beyond * Continue and create number patterns   **Geometric measure A**   * Measure the lengths of objects using uniform informal units * Compare lengths using uniform informal units | * [Making Longer, Making Shorter](https://nrich.maths.org/5590) * Craft sticks, toothpicks, paperclips, blocks, interlocking cubes * Roll of paper * String (2 pieces of equal length) * Writing materials |
| [**Lesson 2: Choosing units of measurement**](#_Lesson_2:_Choosing)  **70 minutes**  **Consistent units of measurement are needed for comparison.** | **Representing whole numbers A**   * Represent the structure of groups of ten in whole numbers * Represent numbers on a line   **Geometric measure B**   * Compare and order lengths, using appropriate uniform informal units | * Craft sticks, toothpicks, paperclips, string * Large quantity of coloured blocks * Writing materials |
| [**Lesson 3: How can we measure area?**](#_Lesson_3:_What)  **75 minutes**  **Informal units can be used to order, compare and match area.** | **Representing whole numbers A**   * Represent numbers on a line   **Representing whole numbers B**   * Use counting sequences of ones and tens flexibly   **Two-dimensional spatial structure A**   * Indirectly compare area * Measure areas using uniform informal units | * [Resource 1: Shoeprints](#_Resource_1:_Shoeprints) * Small blocks or paperclips * Large number of blocks |
| [**Lesson 4: Area of rectangles**](#_Lesson_4:_Area)  **75 minutes**  **Area can be the same even if shapes are different.** | **Representing whole numbers B**   * Form, regroup and rename three-digit numbers   **Forming groups B**   * Represent and explain multiplication as the combining of equal groups   **Two-dimensional spatial structure A**   * Recognise and classify shapes using obvious features * Indirectly compare area * Measure areas using uniform informal units   **Two-dimensional spatial structure B**   * Compare rectangular areas using uniform square units of an appropriate size in rows and columns   **Statistics and probability Data A**   * Represent data with objects and drawings and describe the displays | * [How many rectangles? – Stage 1 (2:45)](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources/how-many-rectangles-s1) from [Stage 1 Thinking mathematically](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources.main-education--category---catalogue---key-learning-area---mathematics---thinking-mathematically.nameAsc.1.grid#catalogue_auto) * [Different Sizes](https://nrich.maths.org/8117) from [NRICH](https://nrich.maths.org/) * Coloured paper squares (large) * Large number of craft sticks * Small interlocking blocks or MAB blocks * Square tiles or pattern blocks * Squared grid paper |
| [**Lesson 5: Let’s use our measuring skills!**](#_Lesson_5:_Let's)  **70 minutes**  **Lengths and areas can be compared by referring to the unit of measurement selected.** | **Representing whole numbers A**   * Represent the structure of groups of ten in whole numbers   **Forming groups B**   * Represent and explain multiplication as the combining of equal groups   **Geometric measure A**   * Measure the length of objects using uniform informal units   **Geometric measure B**   * Compare and order lengths using appropriate informal units   **Two-dimensional spatial structure B**   * Compare rectangular areas using uniform square units of an appropriate size in rows and columns   **Statistics and Probability Data A**   * Represent data with objects and drawings and describe the displays | * Chalk (2 different colours) * Grid paper * Square tiles * String * Sticky notes * Student measure of 10 from Lesson 2 |
| [**Lesson 6: Baby bear’s cup**](#_Lesson_6:_Baby)  **65 minutes**  **Objects can look different but still have the same internal volume.** | **Representing whole numbers A**   * Use counting sequences of ones with two-digit numbers and beyond   **Representing whole numbers B**   * Use counting sequence of ones and tens flexibly   **Three-dimensional spatial structure A**   * Measure and compare the internal volumes (capacities) of containers by filling | * [Goldilocks and the three bears – Stage 1 (8:04)](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources/goldilocks-and-the-three-bears-s1) from [Stage 1 Thinking mathematically](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources.main-education--category---catalogue---key-learning-area---mathematics---thinking-mathematically.nameAsc.1.grid#catalogue_auto) * Cups of glasses (different sizes) * Lentils, sand, blocks, rice * Mini whiteboards and markers * Small measuring scoops |
| [**Lesson 7: My marble box**](#_Lesson_7:_My)  60 **minutes**  **Container shape makes a difference to how efficiently units can be packed.** | **Representing whole numbers A**   * Represent the structure of groups of ten in whole numbers   **Three-dimensional spatial structure B**   * Compare containers based on internal volume (capacity) by filling and packing | * [Two-digit Targets](https://nrich.maths.org/6343) adapted from [NRICH](https://nrich.maths.org/). * Cardboard * Counters * Cubes, marbles - 30 per group * Number cards (0 to 9) * Paper clips |
| [**Lesson 8: Heavier, lighter or the same?**](#_Lesson_8:_Heavier,)  **70 minutes**  Objects can be compared, ordered and matched by their mass. | **Representing whole numbers A**   * Represent numbers on a line   **Non-spatial measurement A**   * Investigate mass using an equal-arm balance | * Blocks * Equal-arm balances * Modelling clay * Rubber balls * Sticky notes (labelled 1 to 10) |

## Lesson 1: How can we measure length?

**Core concept**: Choice of measuring unit affects accuracy.

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:   * measuring allows us to compare and order lengths * estimating can be used to decide if a measurement of length is reasonable * choice of measuring unit affects accuracy when measuring length * objects can appear to be different lengths depending on how they are positioned * numbers can be counted forwards and backwards by ones or in larger groups. | Students can:   * use words to describe length * estimate how long an object is and check by measuring * identify a unit of measurement to compare lengths of objects * reason whether an object has been measured accurately by avoiding spaces, overlaps and measuring in a straight line * count forwards and backwards by ones from a given number * skip count forwards and backwards in twos from a given number |

**Note:** Learning intentions throughout this unit are structured to illustrate the connectedness of measurement concepts.

### Daily number sense: One more, one less – 10 minutes

1. Build student understanding of counting forwards and backwards and skip counting by exploring increasing and decreasing lengths of blocks.
2. Model measuring classroom objects such as pencil cases or books with blocks. Ask students:

* How many blocks long is this?
* If it was one block longer, how many blocks would that be?
* If it was one block shorter, how many blocks would that be?

1. Skip count forwards or backwards in twos from a block measurement.

### Why do we measure things? – 5 minutes

1. Discuss different types of measurement by asking students what they have seen being measured and why things are measured. Answers could include to:

* get to school on time (measurement of time)
* buy the right amount of food (measurements of volume and mass)
* buy the right size shoes for our feet (measurement of length)
* buy furniture that fits in our house (measurements of area, length, and height)
* know what clothes to wear when we go out (measurement of temperature)
* know how much money to bring to school for a canteen treat (measurement of money)
* take the right amount of medicine (measurement of volume).

### Using my hand to measure! – 10 minutes

1. Tell students that they are going to think about how to measure length and complete the following 2-minute challenges:

* What can you see that is smaller than your hand?
* Look at an object a little way from you, estimate how many hands long it is and then check with your hand.
* What can you find in the classroom that is longer than 3 hands but shorter than 4 hands? Choose an object and check.
* What words do we use to describe how long something is? For example, short, long, shorter, longest.

### How do we measure? – 30 minutes

1. In groups on the floor, give students a pile of mixed informal units, for example, craft sticks, toothpicks, paperclips, or blocks. Students make as many different lines as possible in 5 minutes using only one material in each line. Compare lines using vocabulary such as short, shorter than, shortest, long, longer than, longest, the same, almost as long, about twice as long and so on. Look for examples where students have laid units end to end with no spaces and where there are no overlaps. Discuss how this improves accuracy of measurement.
2. Students choose an informal unit and record the measurements of 2 objects. Support students to reflect by asking:

* What did you measure and how many units long was it?
* Which object was longest?
* Did you check your measurements by putting the objects side by side?
* Why did you choose that unit to measure with?
* Would you choose that unit to measure with again? Why? Why not?
* How did you record measurements that were not exactly whole units, for example, 3 and a bit, nearly 4 and so on?

1. Choose a volunteer student. Tell the class that this person is going to be in the middle of a line of 5 students standing in height order. Decide which students would need to stand on each side and in what order. Use vocabulary of short, shorter, shortest, tall, taller, tallest.
2. Have students lie down and ask what words could be used to describe them now. For example, would students choose the same vocabulary, or would they use long, longer, longest? Ask students if they think they are taller, shorter or the same standing up or lying down. Ask students how they could check their ideas using informal units.

**Note:** During this unit, measure the heights of students on a roll of paper for observations now, and comparisons later in the year.

1. To reinforce the conservation of length concept, show students 2 equal pieces of string, one lying straight and one curled in a spiral. Ask students what they think about the lengths of the pieces of string. Some may think the curled-up piece of string is shorter. Make both pieces of string straight to prove they are the same length.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students use vocabulary to compare and order lengths? **(MA1-GM-02)** * Can students select and use appropriate uniform informal units to measure lengths? **(MAO-WM-01, MA1-GM-02)** * Can students apply visual estimation to the measurement of objects? **(MAO-WM-01, MA1-GM-02)** * Do students understand the need to start measuring from the edge and place units end to end without spaces or overlaps? **(MA1-GM-02)** * Can students count informal units to measure lengths or distances and include left-over parts? **(MA1-GM-02)**   What to collect:   * observations of students selecting units to measure objects and describing what they estimated and found **(MAO-WM-01, MA1-GM-02)** | Students cannot accurately measure with uniform informal units or do not understand that height is a length.   * Students measure small objects with interlocking cubes to avoid overlapping or spaces. * Show students 2 identical objects, laying one on its side and one upright. Superimpose or measure both objects with interlocking cubes to prove they are the same. | Students can already measure and compare using uniform informal units. Students investigate the length problem [Making Longer, Making Shorter](https://nrich.maths.org/5590) with blocks, including working backwards to find shorter lengths and using repeated addition to make longer lengths. |

### Consolidation: Discuss and connect the mathematics – 15 minutes

This activity has been adapted from Sullivan and Lilburn (2004).

1. Tara measured a table and said it was 10 sticks long. Michael measured the same table and said it was 12 sticks long. Support students to think about how this might have happened by asking:

* Could there have been differences between the sticks?
* Did both students start measuring from the same place?
* What would happen if there were spaces between the sticks or the sticks overlapped?
* What could happen if the sticks were not in a straight line?

1. Make a poster with ideas from students about what is important to remember when measuring length.

## 

## Lesson 2: Choosing units of measurement

**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:   * measuring allows us to compare and order lengths * estimating can be used to decide if a measurement of length is reasonable * choice of a measuring unit affects accuracy when measuring length * finding groups of tens and units can help us measure longer objects effectively. | Students can:   * visually estimate if a measurement is reasonable * compare and order lengths using the same informal unit * make and use a tape measure calibrated with informal units to compare lengths of objects * use 10 as a reference to count quantities between 11 and 20. |

### Daily number sense: How many blocks? – 15 minutes

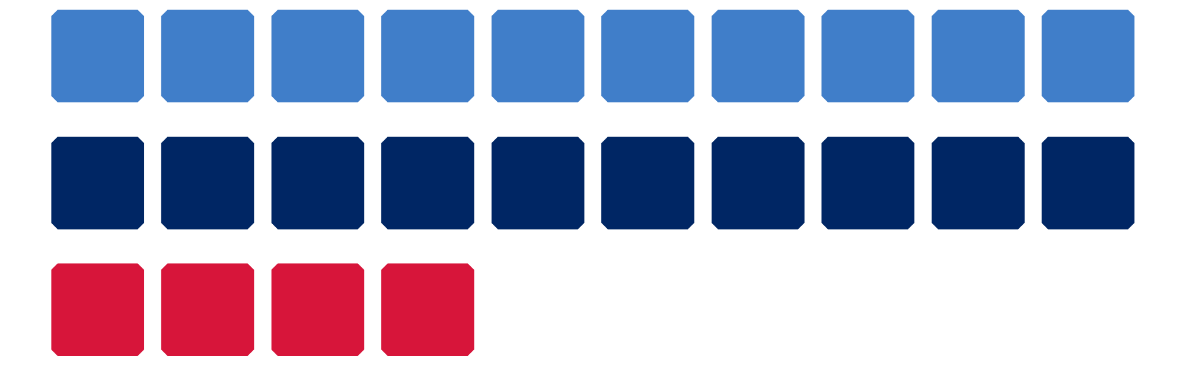
1. Build student understanding of using 10 as a reference number by organising coloured blocks to measure objects.
2. Pre-select classroom objects to measure that will be between 11 and 20 blocks in length. Prior to each measurement, ask students to estimate how many blocks long the object will be. Measure using one colour for the first 10 blocks and another colour for the remainder. This will demonstrate using 10 as a reference number to make counting larger numbers easier. See Figure 1 as a reference.
3. Pre-select classroom objects to measure that will be between 11 and 20 blocks in length. Prior to each measurement, ask students to estimate how many blocks long the object will be. Measure using one colour for the first 10 blocks and another colour for the remainder. This will demonstrate using 10 as a reference number to make counting larger numbers easier. See Figure 1.

Figure 1 – Count 14 using 10 as a reference



1. Repeat this process with an object between 20 and 30 blocks long. Use one colour for the first 10 blocks, a second colour for the next 10, and another for remaining units.
2. Align groups of 10 blocks and then units vertically to demonstrate partitioning of numbers into tens and units. See Figure 2.

Figure 2 – Partitioning using vertical alignment



1. In pairs, have students choose objects that will be over 11 blocks long and estimate how many blocks long they think the objects will be. Measure using blocks in groups of 10 and then ones. Model partitioning using 10 as shown above. Compare final measurements to estimates each time.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students make reasonable predictions? **(MA1-GM-01)** * Can students use 10 as a reference number when counting quantities between 11 and 20? **(MA1-RWN-02)** * Can students partition 2-digit numbers to show tens and units? **(MA1-RWN-02)**   What to collect:   * observations and images of students predicting and measuring objects with blocks, using 10 as a reference number **(MA1-RWN-02)** | Students cannot work with numbers between 11 and 20. Students measure objects between 5 and 9 blocks long and use 5 as a reference. | Students can work with large numbers of blocks. Students think about how they will organise counting when they have 10 lots of 10 blocks and some left over. |

### How long is my shoe? – 25 minutes

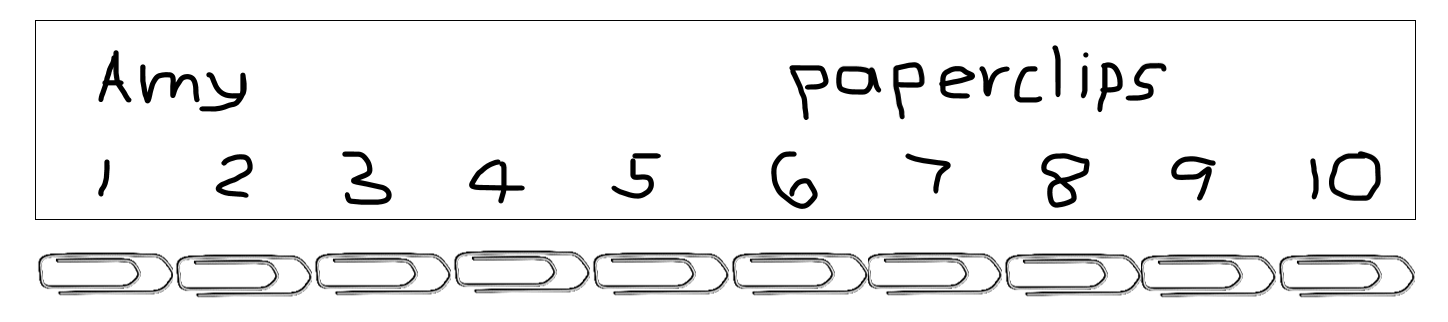
This activity has been adapted from [Learning & Teaching with Learning Trajectories](https://www.learningtrajectories.org/) (Clements and Sarama 2019).

1. Length riddle: Students take off a shoe and look at the bottom. Ask if they can see anything in the classroom that is about the same length. Students then find objects that are about the same length as 2 of their shoes, 5 of their shoes, less than one shoe, and so on. Ask if everyone's results will be the same and think about why or why not. Emphasise that as everyone's shoes are different lengths, all their measurements will be different too.
2. Explain that students will measure and compare shoe lengths. Discuss how to get accurate measurements that can be compared and how this means agreeing on a sensible, consistent unit of informal measurement, for example, small blocks or paperclips. Model placing units next to a shoe, using the same starting and finishing points, and making sure there are no overlaps or spaces.
3. As students find their shoe length, record on a number line with student names and ask students what they notice. This could include thinking about who has the shortest or longest shoe and what is the most common shoe length.

### What else can we measure with? – 20 minutes

1. Ask students if they can see any objects that cannot be measured with squares or blocks such as large, tall, and curved objects. Discuss what other ways there are to measure objects apart from single units. Students could suggest solutions such as a card that measures 5 blocks at a time or maybe they have seen someone using a tape measure or ruler. Tell students they are going to make their own measure of 10 from a material of choice, for example, card or string, and a chosen unit of measurement such as blocks, craft sticks, paperclips and so on. Label and name the measure. See **Figure 3**.

**Figure 3 – Measure of 10**



1. Once students have a measure of 10 calibrated with an informal unit of measurement, they record estimates and measure objects in the classroom that cannot be moved. Students use ‘[Talk moves](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/numeracy/talk-moves)’ in pairs to discuss which estimates were most accurate, which units of measurement were most useful and whether they would choose a different unit to measure an object if they did it again.
2. Ask students if anyone can compare their measurements. The answer should be yes for students who chose the same unit of measure and no for others. For example, 3 students who used toothpicks to make their measure of 10 can compare their measurements, but only one student used paperclips so those measurements cannot be compared. Discuss why.

**Note:** Teacher collects named measures of 10 and keeps for [Lesson 5](#_Lesson_5:_Let's) number sense activity.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students make reasonable estimates? **(MA1-GM-01)** * Can students use informal units of measurement to record, compare and order shoe lengths? **(MA1-RWN-01, MA1-GM-01)** * Can students make and use a tape measure calibrated with informal units? **(MAO-WM-01, MA1-GM-02)**   What to collect:   * recordings of estimates and measurements **(MA1-GM-01)** * observations and images of students demonstrating measuring and comparing shoe lengths using a number line **(MA1-RWN-01, MA1-GM-01)** | Students do not have the spatial skills to make reasonable predictions or are not using uniform informal units accurately when measuring their shoe.   * Students work with small objects, 5 or less blocks long, to build visual estimation skills. * Measure at least the first half of the shoe with the student, modelling no overlaps, no spaces and measuring in a straight line. Student continues to place units independently to the end of the shoe and then counts units. | Students predict and accurately measure the length of several different sized objects. Students estimate the length and height of an object and measure. They then compare the length with the height, making observations, such as the length is more than twice the height. |

### Discussing and connecting the mathematics – 10 minutes

1. As a class, clarify and add to the length poster from [Lesson 1](#_Lesson_1:_How). Revisit what is important when measuring and comparing lengths. This will be compared to future posters on area, volume, and mass. The posters should be used to build connections about what is important when measuring anything and how length, area, volume, and mass relate to each other.

## Lesson 3: How can we measure area?

**Core concept:** Informal units can be used to order, compare and match area.

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: * measuring allows us to compare, order and match areas * estimating can be used to decide if a measurement of area is reasonable * choice of measuring unit affects accuracy when measuring area * counting in tens develops understanding of place value. | Students can:   * compare areas of 2 surfaces that cannot be moved * choose an informal unit to accurately measure area * estimate which of 2 similar shapes has the larger area and check using an informal unit of measure * organise area measurements on a number line to make comparisons * estimate and check by counting in groups of 10 and adding left-over parts * count forwards and backwards in tens from a given number. |

### Daily number sense: How big is that pile? – 15 minutes

1. Build student understanding of place value by counting in groups of 10 using large numbers of blocks.
2. Show students a pile of between 20 and 50 blocks. In advance, ensure the answer is off the decade. Have students estimate how many blocks there are and then check by counting into groups of 10 and adding on left-over blocks.
3. From the answer, for example 37, students count forwards by tens into three-digit numbers and then backwards by tens.
4. Return to the original answer and ask students to suggest the next multiple of 10. Count forwards and backwards on the decade from the answer.
5. Repeat in small groups with a different number of blocks between 20 and 50.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students find a quantity by counting blocks in groups of 10 and adding on left-over blocks? **(MA1-RWN-01)** * Do students refer to estimates to decide if their answer is reasonable? **(MA1-RWN-01)** * Can students count forwards and backwards by tens on and off the decade? **(MA1-RWN-01)**   What to collect:   * observations of students demonstrating the use of groups of 10 to find answers and counting forwards and backwards off the decade **(MA1-RWN-01)** | Students cannot work with number of blocks independently or count forwards or backwards by 10 off the decade.   * Model estimating and counting a second pile of blocks between 20 and 50. * Student works with a number of blocks between 10 and 20 as in the previous number sense activity. * Students use a [hundreds chart](https://toytheater.com/hundreds-chart/) to find the next number. | Students can already count by tens on and off the decade. Students use the answer to count forwards and backwards by twos, threes and fives. Students then count by numbers of their choice. |

### Predicting and covering – 10 minutes

1. Tell students that they are going to think about how to measure area. Explain that area is the surface an object takes up.

**Area:** The amount of surface inside a closed flat (2D) shape.

1. Ask students to predict which classroom objects their hand will completely cover. Test predictions. Repeat for classroom objects their hands will not completely cover.
2. Ask students to choose 2 similar objects to measure by covering with hands, predict which will be bigger and then check.
3. Give each student a piece of A4 paper. Students predict which objects they could completely cover with the paper and then test their predictions. In pairs, students find things they could completely cover with 2 pieces of paper. Students make a list or take photos of objects that can be covered with one and two pieces of paper.
4. Ask a few students to describe objects they measured using language of area, for example, this picture is bigger than 2 pieces of paper, that pencil case was much smaller than one piece of paper.
5. Make a list of words that can be used to describe area, for example, big, narrow, wide, small, larger, smallest and so on.

### Shoeprints – 35 minutes

This activity has been adapted from [Teaching Measurement Early Stage One: Shoeprints [DOC 765KB]](https://schoolsnsw.sharepoint.com/:w:/r/sites/A43LZFM2/_layouts/15/Doc.aspx?sourcedoc=%7BB15C70B9-38C9-410F-96CE-CDEE9AC1241F%7D&file=Shoe%20prints-%20Exploring%20area%20through%20superimposing.docx&action=default&mobileredirect=true).

1. Revise that area is the measurement of surface inside a 2D shape.
2. Display [Resource 1: Shoeprints](#_Resource_2:_Shoeprints) (see Figure 4) and discuss with students what they notice, what they wonder and what mathematics they see.

Figure 4 – Shoeprints



1. In pairs, students take off one shoe each, directly compare the bottom of their shoe with their partner’s shoe (shoe print) and discuss which has the largest area. As a class, students suggest what unit of measurement they could use to compare everyone’s shoe prints. Spend a few minutes discussing advantages and disadvantages of suggestions. Select a unit that everyone will use, for example, small blocks or paperclips. Ask students what they will need to remember when they are measuring and comparing area of shoes. Discuss how measuring area is the same and different to measuring length.
2. Trace around the shoe on paper. Model estimating how many units of measurement will be needed by making one line of units in the middle of the tracing, discussing how many units are in one row and how many there might be altogether. Model measuring part of the area by placing informal units over the shoe with no overlaps or spaces and think about left-over parts. For example, this looks like about a half and a half so they can count as one; here is almost a full unit and here is a tiny bit of a unit so that could make one too.
3. Students independently estimate, trace, measure and record the area of their shoe print.
4. In groups, students discuss how they could organise results to make comparisons. They could choose to use a number line as in [Lesson 2](#_Lesson_2:_Choosing), or make a list from smallest to largest, and so on. Students organise results and make observations about their shoe area compared to others, largest area, smallest area and so on.
5. As a class, revisit the shoe lengths found in [Lesson 2](#_Lesson_2:_Choosing). Did the student who had the longest shoe have the largest shoeprint area? Did the student who had the shortest shoe have the smallest shoeprint area?

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students predict which of 2 similar shapes has the larger area and check using an informal unit of measurement? **(MA1-2DS-02)** * Can students use an informal unit to measure the bottom of their shoe, and include left-over parts of units in their answer? **(MA1-2DS-02)** * Can students organise measurements of shoe areas to make comparisons? **(MA1-RWN-01)**   What to collect:   * observations and images of students measuring using informal units and including left-over parts in their answer **(MAO-WM-01, MA1-2DS-02)** * observations and images of students organising and comparing shoe areas **(MAO-WM-01, MA1-RWN-01)** | Students cannot work out how to include left-over parts in final measurements. Model language of part-part-whole with students. | Students can find the area of their shoeprint. Using the measurement of their shoe as a unit, for example 15 blocks, students estimate areas of large objects in the classroom. Then students work out how to find the actual measurement. Compare answers to estimates each time. |

### Discuss and connect the mathematics – 15 minutes

1. Ask students:

* What were they measuring today?
* What is area?
* Are there other objects that they could use the tracing method for to compare areas?
* Are there objects they cannot use grid paper to measure the area of? What are they and why?

1. Ask students if there is anything the same about how they measure length and area and if there is anything different. Make an area poster with student responses and display it next to the length poster.

## Lesson 4: Area of rectangles

**Core concept:** Area can be the same even if shapes are different.

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:   * measuring allows us to compare, order and match areas * estimating can be used to decide if a measurement of area is reasonable * choice of measuring unit affects accuracy when measuring area * area can be the same even if shapes look different * groups of units can be organised to find a measurement. | Students can:   * estimate, measure, and record area using uniform informal units * explain why different rectangles can have the same area * understand that the size of the unit used makes a difference to the number of units needed * form arrays of equal rows and equal columns to create rectangles * systematically group in tens and hundreds to count three-digit numbers. |

### Daily number sense: Counting big numbers! – 10 minutes

1. Build understanding of counting and representing large sets of objects by systematically grouping in tens and hundreds.
2. Show students a big pile of craft sticks (between 200 and 300 so that you can represent 100 twice). Tell them there are more than 100 sticks and ask them to estimate how many hundreds there are. Ask if they have a good idea for a way to count them. Students may recall that the previous number sense activity used grouping in tens. Use the activity as an example if it is not suggested. When you reach 10 or more groups of 10, count them 10 by 10. When you reach 100, ask students if there is a new way they could group the sticks counted so far. Bundle 10 groups of 10 into one group of 100. Keep counting until you find another hundred. When it looks like there are less than 100 sticks left, count by tens and ones to find the answer.
3. Ask students how many hundreds, tens, and ones there are.
4. Ask students if the answer is closer to 300 or 400 and to explain how they can tell.

### How many rectangles? – 25 minutes

1. As a class, watch the video, [How many rectangles? – Stage 1 (2:45)](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources/how-many-rectangles-s1) from [Stage1 Thinking mathematically resource](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources.main-education--category---catalogue---key-learning-area---mathematics---thinking-mathematically.nameAsc.1.grid#catalogue_auto).
2. Make the 2 rectangles from the video with tiles and then ask if there is another rectangle that can be made using 12 squares. This rectangle will be 12 squares long and one square high. Describe it and think about how it is the same and different to the first 2 rectangles.
3. Challenge students to make as many different rectangles as they can using 12 squares. Use squared grid paper or tiles to record rectangles. Ask students how they will know if they have found all the rectangles. If students make rectangles with the same dimensions but in different orientations, it may be difficult to decide whether they are different. If working with paper, they can cut, rotate, and superimpose to check. Tile models can be built on top of each other to check.
4. Explain that shapes, like rectangles, can look different but have the same area. Ask how they can describe different rectangles.

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

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * What is the same? * What is different? * What are you wondering? | * All the rectangles have 12 squares. * Some are long and some are fat. * This rectangle has 2 layers of 6 and I know that 2 lots of 6 makes 12. * That one is the longest and it only has one row of tiles. * I wonder if the rectangle that has 3 groups of 4 columns is the same as the rectangle that has 4 groups of 3 columns. * I wonder how many of the layers have the same number of squares as dots on dice. |

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Do students recognise arrays when they are making rectangles? **(MA1-FG-01, MA1-2DS-01)** * Can students use understanding of area to explain why rectangles in different orientations are the same? **(MA1-2DS-02)**   What to collect:   * observations of students making, manipulating, and describing rectangles **(MA1-FG-01, MA1-2DS-01)** | Students cannot recognise arrays.   * Teacher models separating a rectangle of 12 squares into 2 rows of 6. Students mirror the teacher example. * Students use interlocking cubes in blocks of colour to show different combinations of rows. | Students understand arrays and quickly prove they have made all possible rectangles with 12 squares.   * Give students the activity [Different Sizes](https://nrich.maths.org/8117) from [NRICH](https://nrich.maths.org) to investigate different areas of rectangles exploring criteria of sides, area, doubling and halving. * Students make or draw irregular shapes with 12 squares to further their understanding of conservation of area. |

### Measuring area with informal units – 25 minutes

1. Select a rectangular object such as the top of a desk or a book cover and discuss how to use square tiles to measure the area. Students estimate, measure, and record the area of the object, ensuring there are no gaps or overlaps. Discuss measurement methods and compare results by asking:

* Did you encounter any challenges and if so, how did you overcome them? For example, counting left-over parts of tiles.
* Did anyone use arrays to find an area?
* Did everybody get the same result?
* What are some possible reasons for differences in results?

1. Using the same object, introduce using a second informal square unit such as small interlocking blocks or MAB blocks. Ask students if they think the area will be bigger, smaller or the same, and why. Estimate and measure using the second informal unit with no gaps or overlaps. Decide how to measure parts of squares at the edges. Ask students to describe the difference between their 2 measurements and how this relates to the 2 units of measurement used. Support students to recognise that a smaller unit of measure will result in a bigger answer.

This table details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students estimate, accurately measure and record area using uniform informal units in rows and columns? **(MA1-FG-01, MA1-2DS-02)** * Can students identify left-over parts of units when measuring area and include them in a final measurement? **(MAO-WM-01, MA1-2DS-02)** * Do students understand that the size of unit used makes a difference to the number of units needed? **(MA1-2DS-02)**   What to collect:   * samples of recordings of rectangles **(MA1-2DS-02)** * observations of discussions of methods and units used **(MAO-WM-01, MA1-2DS-02)** | Students cannot work out how to include left-over parts in final measurements. Model language of part-part-whole with students. | Students understand and apply all concepts and skills. Students close their eyes and throw 2 counters on a number chart to get 2 numbers, for example, 43 and 69. They then apply skills and concepts to find as many objects as possible that have an area of between 43 and 69 units, within 10 minutes. |

### Consolidation: What unit of measure should I choose? – 15 minutes

1. Ask students if square tiles or pattern blocks would be an appropriate unit for measuring a larger area, such as a rug or desktop. Students should decide that this unit of measurement is too small and choose a more appropriate consistent unit, such as newspaper or coloured paper squares. Measure some larger areas in small groups, compare results and explain differences.
2. Return to the area poster, clarify ideas, and add new ideas.

## 

## Lesson 5: Let's use our measuring skills!

**Core concept:** Lengths and areas can be compared by referring to the unit of measurement selected.

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:   * lengths and areas can be compared, ordered and matched by grouping units * estimating can be used to decide if a measurement of length or area is reasonable * choice of measuring unit affects accuracy when measuring length and area * measurements can be used to find patterns and make connections. | Students can:   * select a unit to make a calibrated measure of 10 * use a calibrated measure to compare straight and irregular curved routes * use estimation to decide if an answer is reasonable * investigate length and area comparisons using drawings, numerals and words, and refer to the unit of measurement selected. |

### Daily number sense: Shorter or more fun? – 25 minutes

1. Build understanding of large numbers by measuring straight lines and curve lines using a measure of 10 units.
2. Go outside to play the measuring game, ‘Shorter or more fun?’
3. Using chalk, students mark one spot as home and another spot as school and then draw the shortest straight path between them. Give students their measure of 10 from [Lesson 2](#_Lesson_2:_Choosing) so they can use it iteratively to find the length of the path.

**Iteratively**: Repeatedly.

1. Discuss with students that sometimes they don't come straight to school. They might have to drive around a roundabout, or they might get a hot chocolate on the way. Explain that this means the route might have corners, curves or a circle in it; it might even look like a curved line. Students draw a curved path between the same 2 points as before but in a different colour.
2. Estimate and measure this route. Some students will realise at this point, that if they made a straight, inflexible measure in [Lesson 2](#_Lesson_2:_Choosing), it won’t work for a curved route. They will need to quickly choose a flexible material such as string and make a new calibrated measure of 10. Students can choose how to record their measurements as they work, for example, skip counting in tens and adding the remainder at the end; or using tally marks to record how many tens and how many left over. Many measurements will be over 100 units. Where this happens, support students to systematically put 10 measures together to make 100 as in [Lesson 4](#_Daily_number_sense:): Daily number sense.
3. Compare the 2 routes, for example the fun route is more than twice as long as the straight route.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students use their calibrated measure of 10 iteratively to measure paths? **(MA1-GM-02)** * Do students remember to add the left-over part to reach an accurate final measurement? **(MA1-GM-02)** * Do students use estimation to consider whether a final measurement is reasonable? **(MAO-WM-01, MA1-GM-02)**   What to collect:   * observations of students estimating and measuring **(MAO-WM-01, MA1-GM-02)** | Students are unable to use their measure accurately. Teacher models the first section of each path with no overlaps or spaces. Student completes the measurement. | Students find and compare measurements of both paths accurately.   * Students predict whether a calibrated measure of 20 units will make measuring a path easier or harder and then test their prediction. Students compare the measurements and look for patterns, for example, halving. * Students make up number questions about their routes. For example, if the short route takes 5 minutes and the fun route is 3 times longer, how long will the long route take? |

### How many rectangles: Same and different? – 35 minutes

1. Explain that students are going to investigate rectangles again but this time using 24 squares. Students are going to be ‘measurement detectives’ and investigate the lengths and areas of the rectangles they find. In small groups, students make or draw rectangles using square tiles or grid paper and choose how to organise them to think about them. Ask questions to support investigations:

* How many rectangles can you find?
* How do you know you have found all the rectangles?
* How can you order your rectangles so you can compare them?
* How are your rectangles the same?
* How are your rectangles different?
* How can you use arrays to make your rectangles?
* What different arrays can you see in your rectangles?
* Which rectangle has the shortest and longest sides? Why?
* Can you see any patterns between the sides of the rectangles and the areas of the rectangles?

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Do students use arrays to create rectangles? **(MA1-FG-01, MA1-2DS-02)** * Can students choose how to record area and length of rectangles? **(MAO-WM-01, MA1-GM-01, MA1-2DS-01)** * Are students using data to look for patterns and make connections about area and length? **(MAO-WM-01, MA1-DATA-02)**   What to collect:   * observations of students collecting data on different rectangles using drawings and numbers to discuss connections and patterns between length and area **(MAO-WM-01, MA1-FG-01, MA1-GM-01, MA1-2DS-02, MA1-DATA-02)** | Students cannot use arrays to make rectangles. Work with students to make small rectangles, for example, two-by-one or three-by-one. Increase array numbers until the student is working with 24 squares. | Students answer all questions correctly.   * Students work with random odd numbers of squares to investigate if they can make them into rectangles with no squares left over. Note: All odd numbers will work if there are 2 or more squares left over. * Students investigate different sized squares beginning with a one-by-one square. Look for patterns in the number of tiles used as squares increase in size. Students focus on connections between length of sides and area. Look for connections with rectangle lengths and areas. |

### Discuss and connect the mathematics: Length and area – 10 minutes

1. Return to area and length posters. Think about connections between length and area.

## 

## Lesson 6: Baby bear’s cup

**Core concept:** Objects can look different but still have the same internal volume (capacity).

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:   * measuring allows us to compare, order and match internal volumes (capacities) * estimating can be used to decide if a measurement of internal volume is reasonable * choice of measuring unit affects accuracy when measuring internal volume * internal volume can be the same even if containers are different shapes * place value can be used to find the numbers before and after a number and the next multiple of ten for a number. | Students can:   * explain why different shaped containers can have the same internal volume (capacity) * estimate and measure how many scoops of a chosen unit a container will hold * identify the number before and after a given two-digit number * identify the next multiple of 10 for a given two-digit number. |

### Daily number sense: Number of the day – 15 minutes

1. Build student understanding of place value by thinking about a two-digit number in multiple ways.
2. Show students the number 77. Students answer questions verbally or on mini whiteboards:

* What number comes before?
* What number comes after?
* What is 10 more? Can you keep counting forwards in tens?
* What is 10 less? Can you keep counting backwards in tens?
* How many more to the next multiple of 10? What is 10 less and 10 more than that?
* How many tens and how many ones are there in 77?

1. In pairs, students randomly choose a two-digit number and ask each other the same questions.

### Baby bear’s cup – 40 minutes

This activity has been adapted from NZ Maths [Goldilocks and the three bears – Stage 1 (8:04)](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources/goldilocks-and-the-three-bears-s1) at [Stage 1 Thinking Mathematically](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources.main-education--category---catalogue---key-learning-area---mathematics---thinking-mathematically.nameAsc.1.grid" \l "catalogue_auto).

1. Ask students if they can remember what kinds of measurements they have learned about so far – area and length. Explain that they are going to explore how to measure internal volume (capacity). Internal volume is the space inside something. Students identify objects that have a small internal space and a large internal space using vocabulary such as big, small, full, almost empty. Discuss how it might be possible to measure these spaces or internal volumes. Ask what units it might be sensible to measure with and why.

**Note:** Internal volume (capacity) refers to the amount a container can hold and is only used in relation to containers. It generally refers to liquid measurement, that is, the amount of liquid is equal to the internal volume of a container. When working with students in Stage 1 it is recommended that the terms ‘capacity’ and ‘internal volume’ be used interchangeably.

1. Ask if students can remember any stories where there were different sized containers, such as bowls. Revise that, in the story *Goldilocks and the Three Bears*, the bears had different sized bowls for their porridge. Discuss how it might be possible to measure these spaces or internal volumes. Ask what units it might be sensible to measure with and why.
2. As a class, watch the [Stage 1 Thinking mathematically](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources.main-education--category---catalogue---key-learning-area---mathematics---thinking-mathematically.nameAsc.1.grid#catalogue_auto) video [Goldilocks and the three bears – Stage 1 (8:04)](https://education.nsw.gov.au/teaching-and-learning/curriculum/mathematics/mathematics-curriculum-resources-k-12/mathematics-k-6-resources/goldilocks-and-the-three-bears-s1).
3. Discuss the important things that the mathematicians in the video did to get an accurate measurement. Ask students why they used lentils for measurement and what would change if blocks had been used instead. Draw students’ attention to the spaces between units and how this would affect a measurement. Compare scoops of lentils and then scoops of blocks if students need concrete materials to visualise this. Ask students if the mathematicians filled containers right to the top or left space and how this affects accuracy of measurement. See if students noticed the mathematicians checking how lentils were level with the top of the cup.
4. Provide groups of students with cups or glasses of different sizes, small scoops, and choices of measuring units, for example, sand, rice, blocks. Groups choose one cup to be baby bear’s cup, and then have 10 minutes to select a measuring unit and scoop and find another cup or glass that can hold the same amount. For each cup investigated, students estimate, record a measurement, and see how close their estimate was. Students compare and order measurements once they have investigated 2 or more cups.
5. Come back together as a class. Ask:

* What unit of measure did you choose to work with? Why? How well did it work?
* Did any groups find an exact match to baby bear’s cup?
* If you didn’t find an exact match, which cup was closest in internal volume (capacity) and how could you tell?

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students estimate and measure how much a container will hold by iteratively filling with a smaller container? **(MAO-WM-01, MA1-3DS-02)** * Do students understand that spaces between units will lead to an inaccurate measurement? **(MA1-3DS-02)** * Can students compare internal volumes of two or more containers? **(MA1-3DS-02)** * Can students recognise and explain why containers of different shapes can have the same internal volume? **(MAO-WM-01, MA1-3DS-02)**   What to collect:   * observations of student investigations demonstrating understanding of capacity through measuring and comparing **(MAO-WM-01, MA1-3DS-02)** | Students cannot measure accurately.   * Choose a container and have the student measure its internal volume. Model filling the scoop and container to the top and levelling off. Show students how to keep a record of scoops used. * Work with smaller containers. | Students complete activity accurately. Students select a variety of containers and label where they think each would be half full. They cannot use a ruler. They can use a unit of measurement and a scoop to check their estimation. |

### Consolidation and meaningful practice: Sandy’s container – 10 minutes

1. Show students a cup of rice and explain that Sandy filled a container somewhere in the classroom using 5 cups of rice. Ask students to describe and identify what containers Sandy could have filled.
2. Discuss the important things to remember when measuring internal volume. Record ideas and vocabulary on a poster or anchor chart.

## 

## Lesson 7: My marble box

**Core concept:** Container shape makes a difference to how efficiently units can be packed.

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:   * measuring allows us to compare, order and match volumes * estimating can be used to decide if a measurement of volume is reasonable * choice of measuring unit affects accuracy when measuring volume * volume can be the same even if containers are different shapes * two-digit numbers can be partitioned to make different quantities. | Students can:   * make and use a container to hold a given number of objects * estimate how many of a unit will be needed to fill a box by comparing it to other units of measure * recognise that different shaped boxes can hold the same number of marbles * understand that using smaller units of measure will mean that more units are needed * manipulate two-digit numbers to make smaller or larger quantities. |

### Daily number sense: Two-digit targets! – 15 minutes

This activity has been adapted from [Two-digit targets](https://nrich.maths.org/6343) by NRICH.

1. Build student understanding of place value and properties of numbers by completing [Two-digit targets](https://nrich.maths.org/6343).
2. Give small groups a set of number cards from zero to nine. Students arrange their cards to make the following two-digit numbers:

* the largest even number (98)
* the largest odd number (97)
* the smallest odd number (13)
* the largest multiple of 5 (95)
* the number closest to 50 (49 or 51 – ask students why both answers are correct).

1. Students repeat the activity but this time they can only use each digit once. One possible set of solutions is:

* the largest even number (92)
* the largest odd number (75)
* the smallest odd number (13)
* the largest multiple of 5 (60)
* the number closest to 50 (48)

1. Discuss different solutions, decide which is closest and justify why.

### Warm-up! – 5 minutes

1. Revise that in [Lesson 6](#_Lesson_6:_Baby) students investigated volume by filling the space inside cups. Explain that in this lesson, students will investigate volume by making and packing other containers.
2. Two-minute challenge: find something that will hold 6 cubes, so they don't move around too much. Compare different objects chosen.

### Keep those marbles safe! – 30 minutes

1. Tell students they are going to be given 30 marbles, and they need to store the marbles in a container, so they don’t roll around all over the place. In small groups, students make a container out of card and tape that will hold exactly 30 marbles with as little space left over as possible. This container could be a box, but there are many other possibilities.
2. As a class, compare containers and talk about how they are the same (volume) and different (shape).
3. Provide students with a variety of informal units of measure, for example, paperclips, counters and so on. Then use the empty marble container to investigate packing other informal units of measure. For each, estimate and then record a measurement. Encourage students to compare each new informal unit with a marble to help predict how many more or less of the new unit of measure they will need. For example, 5 of these counters are about the same as one marble, so there should be about 5 times more counters than marbles. This block is twice the size of the marbles so my box might fit 15 blocks instead of 30. Fill the marble container with the new unit of measure and check predictions.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students make and use a container to hold a given number of informal units? **(MAO-WM-01, MA1-3DS-02)** * Can students estimate internal volume (capacity) by referring to number and type of uniform informal unit used? **(MAO-WM-01, MA1-3DS-02)** * Can students identify different shaped marble boxes holding 30 marbles? **(MA1-3DS-02)** * Do students understand that the size of the unit used makes a difference to the number of units needed? **(MAO-WM-01, MA1-3DS-02)**   What to collect:   * observations of marble container investigations where students are demonstrating working mathematically with volume skills. **(MAO-WM-01, MA1-3DS-02)** | Students have poor fine motor skills and cannot make a container. Provide students with a variety of containers to investigate and find one that holds 30 marbles. | Students complete all activities quickly and accurately. Students use their thirty-marble containers to work out dimensions for containers that will hold 60 marbles and 90 marbles. |

### Connect and discuss the mathematics: Volume, length and area – 10 minutes

1. Add to or clarify the class volume poster. Discuss what is the same and different about measuring volume compared to measuring length and area.

## Lesson 8: Heavier, lighter or the same?

**Core concept:** Objects can be compared, ordered and matched by their 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:   * measuring allows us to compare, order and match mass * estimating can be used to decide if a measurement of mass is reasonable * choice of measuring unit affects accuracy when measuring mass * mass remains the same even if the object changes shape * a number can be identified by its properties. | Students can:   * describe objects using vocabulary of mass, for example, heavier than, lighter, the same as * use an equal-arm balance to compare the mass of 2 objects * use a consistent unit to measure mass so that several objects can be compared and ordered * explain that a ball of clay can be made into 2 different shapes but still have the same mass * ask logical questions about a secret number to work out what it is. |

### Daily number sense: Celebrity numbers – 10 minutes

1. Build student understanding of number properties by choosing a mystery number and having students ask questions in a logical sequence to work out what it is.
2. Model how to play Celebrity numbers. Have mixed up sticky notes labelled one to ten. Take one out without looking and stick to your forehead. Ask the students questions that only have yes or no answers until there are enough clues to guess what the number is. For each answer, indicate on a number line which numbers the answer could still be. For example:

* Am I bigger than 5? No. Look at the number line. The answer could be 1, 2, 3 or 4.
* Am I an even number? Yes. Look at the number line. The answer could only be 2 or 4 now.
* Am I 4? No. Look at the number line. There is only one possibility left now.
* Am I 2? Yes.

1. Some students will need to keep playing a modelled version to apply logical thinking with properties. Others who demonstrate understanding could make their own sticky notes with two-digit numbers to play with. They can add questions that give clues to larger numbers, for example:

* Am I bigger than 50 but less than 75?
* Can you skip count by 5 to get exactly to me?
* Can you skip count by 10 to get exactly to me?

### Two-minute mass challenges – 10 minutes

1. Explain that in this lesson students will explore mass as a measurement. Students have 2 to 3 minutes to complete each challenge to recall previous understanding and vocabulary of mass:

* Challenge 1: What can you find that is bigger and lighter than a rubber ball? Encourage hefting.
* Challenge 2: Lin carried a big, full bucket quite easily. What might have been in it?

1. Make a list of words used to talk about mass, for example heavier, heaviest, lighter, lightest. Ask students if any of their words have connections to words they used to describe area, length and volume.

### Measuring with an equal-arm balance demonstration – 15 minutes

1. Show students an equal-arm balance. Discuss:

* How can an equal-arm balance help us to measure?
* What does it measure?
* How does it work?

1. Clarify that an equal arm balance shows if objects weigh the same or if one object is heavier or lighter. Put objects of the same weight on each side of the balance and ask students what they can see.
2. Show students 2 different sized balls of modelling clay. Ask students if they think they are the same or if one ball is heavier than the other. Demonstrate hefting and record which ball seems heavier.
3. Ask students to predict what will happen to the equal-arm balance when the balls are placed on either side. Place the balls on each side and discuss what happens.
4. Discuss how to make the equal-arm balance even. Students may suggest taking some clay off the heavier side and adding it to the other or adding new clay to the lighter ball. Try suggestions and get closer each time until the equal-arm balance is even.
5. Change the shape of the clay on one side and then put it back on the scale. Ask if the scale is still balanced. Prompt students to explain their thinking. Repeat with the clay on the other side. Talk about how mass remains the same even if an object changes shape.

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

|  |  |
| --- | --- |
| Prompts | Anticipated student responses |
| * What do you notice? * Are the 2 sides of the balance even? * What do you think has happened when one side of the balance goes down? * What will happen if we make one ball of clay a different shape? | * The balance has stayed level so my objects must be the same mass. * One side is higher so that ball of clay must be lighter. * That side went down so it might be heavier. * The ball is thinner now so it won't weigh as much, and one side of the scale will go down. * The scale stayed balanced even when we changed the shape of a ball so it must still weigh the same. |

### Which ball is heaviest? – 10 minutes

1. In groups, give students equal-arm balances that already have a ball of clay on one side. Give students another ball of clay that is heavier or lighter than the ball on the balance. Students heft balls and record predictions about what will happen when they place both balls on the balance. Place balls and refer to predictions. Ask groups to make the equal-arm balance show equivalence – the same on both sides.

### How can we compare all our clay balls? – 15 minutes

1. Give the groups different sized balls of clay and ask the class how they can measure their balls so that they can compare and order mass. If they do not suggest using a consistent unit of measurement for the other side of their scale, ask them to remember how they measured length of shoes in [Lesson 2](#_Lesson_2:_Choosing) and volume of cups in [Lesson 6](#_Lesson_6:_Baby) as a prompt. Decide on a consistent unit of measure. Place the ball on one side and the selected unit, for example, blocks, one by one on the other side until the balance is level. Record the number of blocks needed.
2. As a class, discuss results. Ask if any ball was not an exact number of the measuring unit and what they did if this happened. Order quantities to identify the lightest and heaviest clay balls.

The table below details assessment opportunities and differentiation ideas.

|  |  |  |
| --- | --- | --- |
| Assessment opportunities | Too hard? | Too easy? |
| What to look for:   * Can students use hefting to describe objects using vocabulary of mass, for example heavier than, lighter, the same as? **(MA1-NSM-01)** * Can students use an equal-arm balance to compare the mass of 2 objects? **(MA1-NSM-01)** * Do students understand that mass remains the same even if the object changes shape? **(MA1-NSM-01)** * Can students use a consistent unit to measure mass to compare and order objects? **(MA1-NSM-01)**   What to collect:   * observations of students using an equal-arm balance correctly to compare and order masses. **(MAO-WM-01, MA1-NSM-01)** | Students do not understand conservation of mass or cannot use a consistent unit to measure.   * Students are given 2 balls of clay with equal mass and prove they are equal by placing on the equal-arm balance. Remove one ball and make it into a sausage shape. Place back on the scale to show the 2 masses are still the same. * Student puts big blocks and little blocks together and discusses with the teacher why they cannot be used in the same measurement. Use the equal-arm balance to prove they are not the same mass. | Students can find equivalence using clay and units.   * Students place a book on one side of a balance and find 2 objects for the other side so the equal-arm balance is level. What might the 2 objects be? * Students place five 20c pieces on one side of the balance and find out what money amounts could be placed on the other side to make both sides equivalent. Students think about how to prove they have found all possible answers.   These activities have been adapted from Sullivan and Lilburn (2004). |

### Discuss and connect the mathematics: How do we measure? – 10 minutes

1. As a class, make a poster about the important things to remember when measuring mass. Compare this poster to the area, volume, and length posters. Ask students:

* What are the most important things to remember when measuring quantities of anything?
* What do they have to do so that they can compare, order and match quantities?

## Resource 1: Shoeprints



## 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).

|  |  |  |
| --- | --- | --- |
| Focus area and outcomes | Content groups and content points | Lessons |
| **Representing whole numbers A**  **MAO-WM-01**  **MA1-RWN-01**  **MA1-RWN-02** | **Use counting sequences of ones with two-digit numbers and beyond**   * identify the number before and after a given two-digit number (CPr5)   **Continue and create number patterns**   * count forwards and backwards by twos from any starting point (CPr6-CPr7, MuS2)   **Represent numbers on a line**   * sequence numbers and arrange them on a line by considering the order and size of those numbers (CPr5)   **Represent the structure of groups of ten in whole numbers**   * use 10 as a reference in forming numbers from 11-20 (CPr7) * count large sets of objects by systematically counting in tens (CPr7) * partition two-digit numbers to show quantity values (NPV4) * estimate, to the nearest ten, the number of objects in a collection and check by counting in groups of ten (Reasons about quantity) (CPr7, NPV6) | **1–3, 5–8** |
| **Representing whole numbers B**  **MAO-WM-01**  **MA1-RWN-01**  **MA1-RWN-02** | **Use counting sequences of ones and tens flexibly**   * count forwards and backwards by tens, on and off the decade, with two- and three-digit numbers (CPr7)   **Form, regroup and rename three-digit numbers**   * count and represent large sets of objects by systematically grouping in tens and hundreds (CPr7, NPV5) * identify the nearest hundred to a number | **3 and 4** |
| **Forming groups B**  **MAO-WM-01**  **MA1-FG-01** | **Represent and explain multiplication as the combining of equal groups**   * form arrays of equal rows and equal columns (MuS5) | **4 and 5** |
| **Geometric measure A**  **MAO-WM-01**  **MA1-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 measures 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)   **Length: 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 and 5** |
| **Geometric measure B**  **MAO-WM-01**  **MA1-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 | **2 and 5** |
| **Two-dimensional spatial structure A**  **MAO-WM-01**  **MA1-2DS-01**  **MA1-2DS-02** | **2D shapes: Recognise and classify shapes using obvious features**   * identify shapes presented in different orientations (UGP2)   **Area: Indirectly compare area**   * predict which of two similar shapes has the larger area and check by covering (UuM4)   **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 units 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) | **3 and 4** |
| **Two-dimensional spatial structure B**  **MAO-WM-01**  **MA1-2DS-02** | **Area: 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 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 * record comparisons of area using drawings, numerals and words, and by referring to the uniform informal unit used | **4 and 5** |
| **Three-dimensional spatial structure A**  **MAO-WM-01**  **MA1-3DS-02** | **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) * **Volume: Measure the internal volume (capacity) of containers by packing** * explain that if there are gaps when packing and stacking, this will affect the accuracy of measuring the internal volume | **6 and 7** |
| **Three-dimensional spatial structure B**  **MAO-WM-01**  **MA1-3DS-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) | **6 and 7** |
| **Non-spatial measure A**  **MAO-WM-01**  **MA1-NSM-01** | **Mass: Investigate mass using an equal-arm balance**   * place objects on either side of an equal-arm balance to obtain a level balance * use an equal-arm balance to compare the masses of two objects and record which is heavier or lighter (UuM2) * predict the action of an equal-arm balance before placing particular objects in each pan * compare and order the masses of two or more objects by hefting, and check using an equal-arm balance (UuM2) | **8** |
| **Data A**  **MAO-WM-01**  **MA1-DATA-02** | **Represent data with objects and drawings and describe the displays**   * use concrete materials or pictures of objects such as symbols to create data displays where one object or picture represents one data value (IRD2) * describe information presented in one-to-one data displays (IRD2) | **4 and 5** |

## References

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

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