RICH MATHEMATICAL TASK BOOKLET

MEASUREMENT

YEAR 0

Teacher Booklet

Task 1

George is sorting the coloured pencils.

What coloured pencil is the longest pencil?

What coloured pencil is the shortest pencil?

Choose a coloured pencil. Put it in the middle of your book.

Can you draw a pencil that would be longer?
Can you draw a pencil that would be shorter?

Teacher Notes

Have a set of pencils for each group to explore. If you are short on resources, do the first two questions as a whole group.

As students decide on the longest/shortest pencil prompt them to justify their idea. How do you know it is the longest/shortest pencil?

Notice students who ensure the pencils accruately lined up to ensure they can compare the pencils. Highlight this to the group.

For some learners, this language may be new, so model the use of correct measurement terminology when comparing the pencils.

For the second part of the activity, encourage each group to choose a coloured pencil. Notice the students who are directly comparing the when drawing.

Use the word length explicitly to describe the comparison. Also support students in their explanation (e.g. the blue pencil is longer than the red pencil).

Shareback

Select students to share who have drawn their coloured pencils and can accurately use the language of shorter, and longer.

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume.
When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these.
Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C.
There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used.

Connect

Using one set of coloured pencils. Lay two pencils out and make a statement (e.g. the blue pencil is the longest and the green is the shortest). Now add another pencil into the line and ask the students if the blue pencil is still the longest? Why? Why not?

If possible, add in two pencils that are the same size. Facilitate a discussion around the mathematical language of the same.

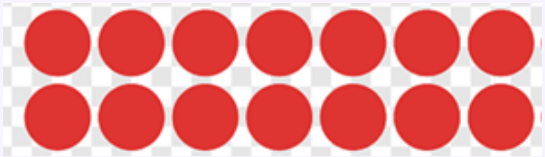
Continue to compare pencils encouraging students mathematical explanations.

Suggested Learning Outcomes

Compare the length of a liner using non-standard units.

Use measurement language to describe the comparison of length.

Independent Tasks



Use number sentences to represent this pattern in as many ways as you can.

Curriculum Links

6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Mathematical Language

Length, unit of measure, measurement count, longest, shortest, same.

Anticipations

Solutions, Misconceptions

Task 2

Talia wants to take her dog on a long walk.

Can you use the equipment to measure which path in the park is the longest or are they all the same?

Record your measurement unit and measurement count.

Choose a different set of equipment to measure the paths.

Record your measurement unit and measurement count.

Teacher Notes

Before the launch, have a set of objects from the classroom and ask the students to put them in a line from the shortest to the longest.

Have lengths of string the students can use to measure with and then compare.

Use the word length explicitly to describe the linear measurement. Also support students to give the unit of measure in their explanation (e.g., “the length was five centi-cubes long”).

Facilitate students to attend to measurement concepts including that they need to use the same unit of measure, ensure there are no gaps and repeat the unit of measure to the end of the length.

For the independent activity, have stations set up and classroom objects for students to directly compare.

Shareback

Select students to share who have drawn on measurement concepts including ensuring they are starting and ending their measure correctly. Highlight this to all students.

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume.

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Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C.

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Connect

Model to the students how to measure using multilink cubes or with another material. Discuss with the students how the measure can be so many cubes long but only one length of string.

Suggested Learning Outcomes

Compare the length of a liner using non-standard units.

Use non-standard units to measure length.

Count whole numbers of units to describe the measurement.

Use measurement language to describe the comparison of length.

Independent Tasks

Compare these obects and put them in order from smallest to longest.

Curriculum Links

6 months
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Mathematical Language

Length, unit of measure, measurement count, longest, shortest, same.

Anticipations

Solutions, Misconceptions

Task 3

There has been too much rain and parts of the roads have washed away. We need your help to measure the road and find the bridges to help people get home.

NOTE: this resource is in a separate file

Use the equipment to measure each part of the road that has washed away. Record the unit of measurement and the measurement count.

Now go to the storage shed and use the measurement unit to find the bridge that will fit for the part of the road that washed away.

Work with your partner until the road is fixed and you can drive the car home.

Teacher Notes

Have sets of objects that the students can use to measure (e.g., centi-cubes, multilink, rods, match sticks), ensure that there is enough objects in the set that they can cover the entire length to be measured. Have a box for the storage shed with the bridge parts in this.

Put the bridge parts in the storage shed away from the maps so that the students must first measure the washed away road and then use this measurement to find the correct bridge length rather than using direct comparison.

When measuring the washed away road, students may either cover the entire length to be measured with the objects or choose to use one or two and repetitively place these to measure.

Use the word length explicitly to describe the linear measurement. Also support students to give the unit of measure in their explanation (e.g., “the length was 3 rods long”).

Big Ideas

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Teacher Notes

Facilitate students to attend to measurement concepts including that they need to use the same unit of measure, ensure there are no gaps and repeat the unit of measure to the end of the length.

For the independent task, have sets of objects that the students can use to measure (e.g., centi-cubes, multilink, rods, match-sticks), ensure that there is enough objects in the set that they can cover the entire length to be measured.

Shareback

Select students to show how they measured and draw attention to the measurement concepts that they used including using the same unit of repeat, ensuring that there are no gaps and using iteration accurately.

Connect

Model measuring one of the washed away roads with a set of equipment but leave gaps between the measurement unit. Ask the students to discuss the following questions:

What was different about how I measured?
Who measured more precisely?
Can you help me fix my measurement mistakes?

Suggested Learning Outcomes

Compare the length of a liner using non-standard units.

Use non-standard units to measure length.

Count whole numbers of units to describe the measurement.

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Mathematical Language

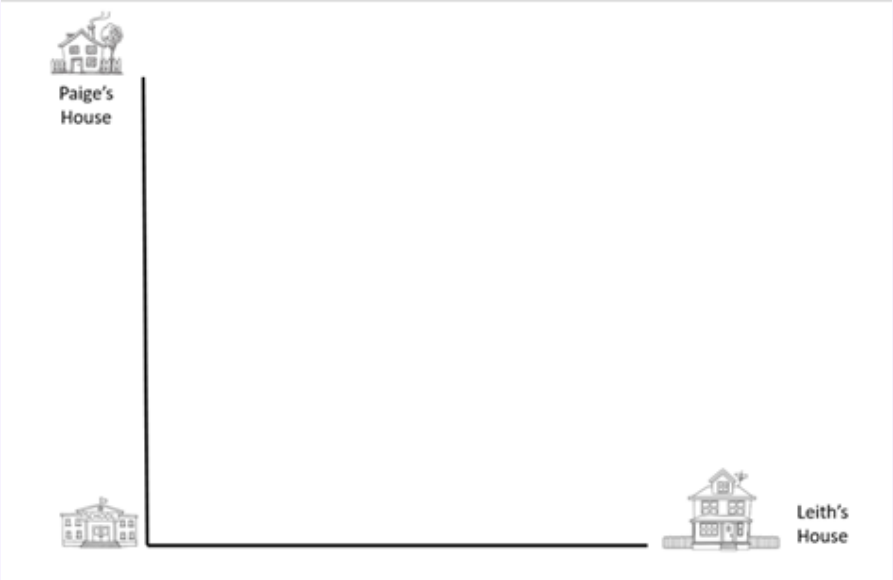
Length, unit of measure, measurement count, compare, longest, shortest, same.

Independent Tasks

Puawai and Leith both think that they have the longest walk from home to school.

Use the equipment to measure their walk home and see who does have the longest walk.

Record your measurement unit and measurement count.

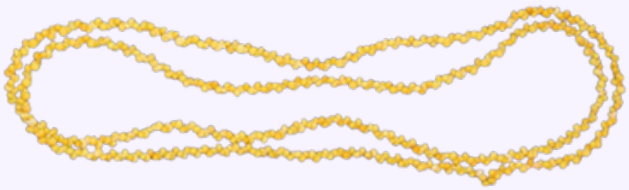


Anticipations

Solutions, Misconceptions

Task 4

Teuila has some kahoa hihi for her family reunion. She wants to keep the longest one to give to her Nena.



Use the measurement unit to work out which is the longest kahoa hihi. Can you measure it with one measurement unit?

Record the measurement unit and measurement count.

Teacher Notes

For the task, have three lengths of string (between 15 – 20 centimetres in length if using cubes or 20 – 30 centimetres if using longer rods) for each student to measure and then either centi-cubes, multilink cubes or rods to use as the unit of measure.

Allow students to measure using either a set that will cover the entire length or a single unit.

If students choose to use a single unit then facilitate them to notice how they can keep track of where the cube ended (using a finger or pen mark) so they know where to move it next.

Use the word length explicitly to describe the linear measurement. Also support students to give the unit of measure in their explanation (e.g., "the length was 18 centi-cubes long").

Support the students to use grouping to record their measurement counts.

For the independent task, have sets of objects that the students can use to measure to cover the entire length (e.g., centi-cube or multilink).

Big Ideas

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Shareback

Select students to share who could measure using one measurement unit while ensuring that there are no gaps (using a finger or pen mark each time) and using iteration accurately. If no students measured using one measurement unit, then model this as something previous students have done.

Connect

Introduce a fourth piece of string which is a different length. Ask the students to estimate how long the string is and then measure using their measurement unit and compare the results.

Suggested Learning Outcomes

Compare the length of a liner using non-standard units.

Use non-standard units to measure length.

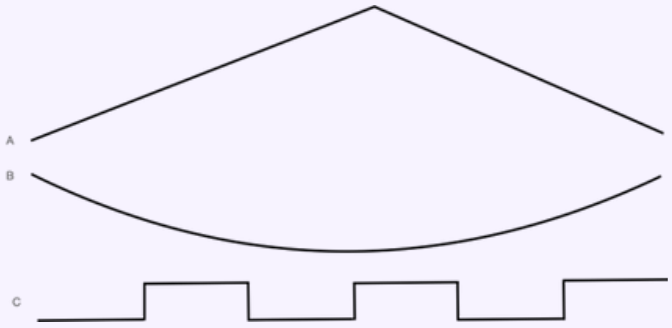
Count whole numbers of units to describe the measurement.

Use measurement language to describe the comparison of length.

Independent Tasks

Ailine and Emme are making skipping ropes. They want to give the longest one to their oldest brother.

Measure the skipping ropes and see which is the longest.



Record your measurement unit and measurement count.

Curriculum Links

6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
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Mathematical Language

Length, unit of measure, repeat, gap.

Anticipations

Solutions, Misconceptions

Task 5

How wide do you think the classroom is?

Use part of your body as a unit of measurement and measure the width. Record your result.

Teacher Notes

During the launch, ensure that students understand that the width is the straight distance from one side (point of the room) to the other.

Use the word length explicitly to describe the linear measurement. Also support students to give the unit of measure in their explanation (e.g., "the length was 18 feet long").

Facilitate students to attend to measurement concepts including that they need to use the same unit of measure, ensure there are no gaps and repeat the unit of measure to the end of the length.

For the independent activity, have stations set up where students can compare and order different objects from within the classroom. They may like to record their ideas in their books.

Shareback

Record and display the results for each student including the unit of measure they used (body part) and the measurement count. Ask the students to discuss why they got a different measurement count for different body parts or between different students.

Connect

Ask students to estimate and then measure the width again using a metre ruler. Ask them to discuss why their results are similar when using the metre ruler.

Big Ideas

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Suggested Learning Outcomes

Compare the length of a liner using non-standard units.

Use non-standard units to measure length.

Count whole numbers of units to describe the measurement.

Use measurement language to describe the comparison of length.

Independent Tasks

Explore these items.

What is the longest?
What is the shortest?

Can you put them in order from shortest to longest?
How do you know?

Curriculum Links

6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Mathematical Language

Length, width, unit of measure, measurement count, longest, shortest, same.

Anticipations

Solutions, Misconceptions

Task 6

What picture book has the biggest surface space?
What picture book has the smallest surface space?

Teacher Notes

Before the launch, informally discuss with students the area of different spaces around the school. For example, which takes up the larger amount of space, the field or the courts? Which room has the largest amount of floor space?

During the launch, introduce students to the term area and explain that the area is the amount of space inside a 2D shape (the surface).

Hold up two books (a big book and a reader). Ask the students what book has the biggest surface area.

Have a selection of books for each group to order in smallest area to largest area (or smallest surface space to largest surface space).

For the independent activity, allow the students to use their foot measure to compare items within the classroom. How long is the window? How tall is the desk etc.

Shareback

Notice groups that have directly compared by placing the objects on top of each other. Select these groups to share back supporting them with their explanations if needed.

Connect

Have two books that are similar in area. Demonstrate to the students that you could compare these by placing squares of paper on the books, convering the space.

Big Ideas

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Suggested Learning Outcomes

Compare the surface area of two or more objects.

Use measurement language to describe the comparison.

Independent Tasks

How big is your foot?

Draw around your foot and use this to measure and compare objects around the room.

How long is the window?
How tall is the desk?

Curriculum Links

6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Mathematical Language

Length, width, unit of measure, measurement count, longest, shortest, same.

Anticipations

Solutions, Misconceptions

Task 7

Look at these balloons I have collected. I need you to work out which balloon takes up the most space.

Teacher Notes

During the launch, blow up a balloon and facilitate the students to discuss what is happening with the balloon and the amount of space as it is blown up.

Have students use their hands to show the amount of space taken up inside the balloons. This is supporting them to re-represent the space. Use the word volume explicitly to describe the space taken up.

Students should order the balloons from smallest to largest or vice versa. Monitor for the use of hands to illustrate the space taken up inside.

For the independent task, have a stations or collections of different sized boxes or containers, or pictures of boxes and containers for the students to compare..

Shareback

Select students to share who identify that the bigger the balloon, the more space inside it (volume), and that this would take up more space within another container.

Connect

Use a series of pictures of balls (including bigger, smaller and ones which are the same). Ask the students to discuss which ball has the most volume, the least volume, and the same volume. Directly compare these objects.

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume.

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Curriculum Links

6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Suggested Learning Outcomes

Compare and order the volume of objects.

Explain volume as the space inside an object/container.

Mathematical Language

Space, volume, most, least, same.

Independent Tasks

Compare these objects.

What one is the biggest?

What one is the smallest?

Which boxes are the same size?

Can you draw the containers and label these?

Anticipations

Solutions, Misconceptions

Task 8

Georgia would like to choose a box to decorate for her treasures. She would like the box with the biggest volume.

Can you use the material to work out which box has the biggest volume?

Teacher Notes

Have small boxes (e.g., tea bag boxes, shoe boxes or smaller). Provide students with cubes or blocks that are the same size to use as the measurement unit.

Monitor for students using vocabulary which includes space, volume, and more than, less than and the same as.

Notice students who use grouping or counting on to find the number of measurement units. If these are not used, model how to use them.

Expect students to represent their solutions using drawing and numbers.

Make comparisons between the measurement count and size of the measurement unit. Discuss with the students that the bigger the measurement unit the more space it takes and therefore less would fit in the same size box.

For the independent task, have a range of small boxes and measuring material available for the students to use.

Shareback

Select students to share who measure the volume of the boxes in a systematic way by layering the bottom first and then filling the rest of the box and ensuring that there are as little spaces as possible. Also focus attention on students who use grouping or counting on solutions to find the measurement unit count.

Big Ideas

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Curriculum Links

6 months
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First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Connect

Model measuring the volume of the box but leave obvious gaps and use two different sizes of cubes. Ask students for suggestions to develop instructions on how to compare volume. Record these and display.

Suggested Learning Outcomes

Compare the volume of a container using non-standard units.

Count whole numbers of units to describe the measurement.

Independent Tasks

If you were going to make yourself a treasure box, which one would you choose and why?

Mathematical Language

Space, volume, more than, less than, same, measurement unit, measurement count.

Anticipations

Solutions, Misconceptions

Task 9

Teremoana has made some donuts. Her little brother wonders which is the biggest donut. What would you tell him?

Teacher Notes

For the launch, use two identical cakes (e.g, playdough or modelling clay). Cut one of the cakes into pieces and ask the children to talk about if there is more, or less cake, bigger, smaller, same? If needed, put the pieces back together to show that the volume has not changed.

Use pictures of a doughnut or a food relevant to your students. Have the same picture with the whole donut and the same donut cut into halves, quarters, irregular size pieces.

Have playdough available, if needed give students balls to model the donut physically.

Monitor for students using vocabulary which includes space, volume, and more than, less than and the same as.

For the independent task, have pictures of different and the same size objects (e.g., cakes, melons, sandcastles).

Shareback

Select students to share solution strategies where they have recognised that the volume of a 3-dimensional object stays the same however they are arranged and rearranged.

Connect

Give students playdough or modelling clay and ask students to make shapes that take up the same space (volume), more space (volume), or less space (volume).

Big Ideas

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Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

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Suggested Learning Outcomes

Compare the objects.

Explain that when an object is subdivided the volume remains the same (conservation).

Independent Tasks

Look at the pictures. Compare the objects.

Which object has the biggest volume - holds more?
Which object has the smallest volume - holds less?

Do any objects have the same volume?

Mathematical Language

Perimeter, length, unit of measure, measurement count, ruler.

Anticipations

Solutions, Misconceptions

Task 10

Choose two containers and pick them up.

What do you notice about their volume?
Which has the greater volume?

What do you notice about their mass?
Which is heavier and which is lighter?

Teacher Notes

Have a variety of bottles and containers some which are the same so students can swap and explore these as they work.

Have students hold 2 containers (small bottles, buckets) one of which is full of some matter (soil, sand, beans) and with eyes closed, discuss and make comparisons between the 2 containers describing the mass.

Facilitate students to understand that two containers can have the same volume (take up the same amount of space) but that they have different amounts of matter in them so a different mass.

Make sure that the word mass is used for matter in a container. Expect students to use a range of measurement language to describe the mass.

For the independent task, have a range of containers or objects with different mass for the students to compare.

Shareback

Select students to share using a range of measurement language to describe what they notice.

Encourage students to reason with their peers statements by asking do you agree or disagree that this object is heavier than that? etc. Why?

Big Ideas

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Connect

Have variety of pictures of containers with different amounts of matter. Discuss and match:

The containers that hold the same (volume) or hold different amounts.

The containers that are may be heavier and lighter (mass).

Mathematical Language

Mass, same, different, heavier, lighter, less mass, more mass, massive.

Suggested Learning Outcomes

Compare and order the mass of objects.

Use measurement language to describe the comparison of mass.Estimate

Independent Tasks

Pick up two objects, one in each hand.

Compare the objects.
What object is lighter, what object is heavier?

Put the objects in order from heaviest to lighter.

Anticipations

Solutions, Misconceptions

Task 11

Use the balance scale to weigh the objects

Can you find some objects that have the same mass?

Can you find some objects that have less mass?

Can you find some objects that have more mass?

Teacher Notes

To launch the task show students a picture of an empty seesaw and pictures of different aged children and adults. Ask students to describe how they could be arranged so that the seesaw is balanced, or heavier or lighter on each end.

For the task, use either equal-arm balances (or two plastic bags on two ends of a coat hanger held by a hook.

If students use the term 'weight' press them to say mass when talking about the matter inside a container.

Model to students how to represent their ideas such as the mass of 2 books is more than 3 pencils using < > or =

For the independent task, have a range of books and objects with balance scales for the students to use.

Shareback

Select students to share using a range of measurement language to describe what they notice.

Connect

Have pictures of different tinned food (e.g., fruit, soup, baked beans). Ask the students to select tins so that the mass would be the same and would balance. Record with the number under the pictures in a number sentence (e.g., 3 = 3). Ask students to find examples that would have greater or less mass on each side. Record as number sentences using < and >

Big Ideas

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6 months
Directly compare two objects by an attribute (e.g., length, mass (weight), capacity)

First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Suggested Learning Outcomes

Compare and order the mass of objects.

Use measurement language to describe the comparison of mass.

Independent Tasks

Explore these objects.

A book is on one side of the balance scale and two objects are on the other side so the scale is level. What might the two objects be?

Find other solutions using these object and scales.

Mathematical Language

Mass, same, different, heavier, lighter, less mass, more mass, massive.

Anticipations

Solutions, Misconceptions

Task 12

Cooper noticed that the blocks are all different sizes.

What block is tallest?

What block is shortest?

What block might be the heaviest?

What block looks like it takes up the most space?

Teacher Notes

Before launching the task, initate a discussion with the students to brainstorm everything they know about measurement. This may build a word wall. Prompt or expect students to say “something can be longer or shorter etc”. Discuss with the students the idea that all of this vocabulary may be used in todays lesson.

Ensure that each group has a group of blocks to compare. Try and give the groups the same collections of blocks to allow for similar comparisons.

Ask each question individually and expect students to use measurement langauge when discussing their responsese.

For the independent task, select one or more of the assessment tasks as the independent activity.

Shareback

Select students to share using a range of measurement language to describe what they notice when comparing.

Connect

Highlight to the students that a block may be longer in length, but smaller in surface area. Or that one of the blocks might be wider in length, but lighter in mass (e.g a hollow block verses a solid block).

Big Ideas

There are a range of attributes that we can measure including length, mass, time, area, angle, and volume.

When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these.

There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used.

Curriculum Links

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First year
Compare the length, mass (weight), volume, or capacity of objects directly or indirectly (e.g., by comparing each of them another object, used repeatedly)

Suggested Learning Outcomes

Compare and order objects based on different attributes; length, mass, weight.

Use measurement language to describe the comparison of the objects.

Independent Tasks

Assessment Task One : Comparing Lines

Assessment Task Two: Which box is biggest?

Mathematical Language

Mass, same, different, heavier, lighter, less mass, more mass, massive, longer, shorter, taller, bigger, smaller, same.

Anticipations

Solutions, Misconceptions

Assessment Task 1 - Measurement - Year 0

Use something in the classroom to measure the lines below. Write what you choose to use to measure and show how you measured each line and the measurement count. Label the lines from shortest to longest.

Assessment Task 2 - Measurement - Year 0

Which one of these boxes is the biggest? Which one is the smallest? Describe how you measured it and how you know.

(Teacher notes: Give students 3 small boxes and centi-cubes or multi-link. Take photos of students' way of measuring)