

# YuMi Deadly Maths

## Year 4 Teacher Resource: **MG – Make your own ruler**

Prepared by the YuMi Deadly Centre  
Faculty of Education, QUT



YuMi Deadly Maths Year 4 Teacher Resource: **MG – Make your own ruler**



## **ACKNOWLEDGEMENT**

We acknowledge the traditional owners and custodians of the lands in which the mathematics ideas for this resource were developed, refined and presented in professional development sessions.

## **TERMS AND CONDITIONS OF YOUR USE OF THE WORK AND RESTRICTED WAIVER OF COPYRIGHT**

Copyright and all other intellectual property rights in relation to all of the information available on this website, including teaching models and teacher resources (the Work) are owned by the Queensland University of Technology (QUT).

Except under the conditions of the restricted waiver of copyright below, no part of the Work may be reproduced or otherwise used for any purpose without receiving the prior written consent of QUT to do so.

The Work is subject to a restricted waiver of copyright to allow copies to be made, subject to the following conditions:

1. all copies shall be made without alteration or abridgement and must retain acknowledgement of the copyright;
2. the Work must not be copied for the purposes of sale or hire or otherwise be used to derive revenue; and
3. the restricted waiver of copyright is not transferable and may be withdrawn if any of these conditions are breached.

By using the Work you are deemed to have accepted these terms and conditions.

Prepared by the YuMi Deadly Centre  
Queensland University of Technology  
Kelvin Grove, Queensland, 4059

[ydc.qut.edu.au](http://ydc.qut.edu.au)

© 2014 Queensland University of Technology  
through the YuMi Deadly Centre

## Year 4 Measurement and Geometry


### Make your own ruler

<b>Learning goal</b>	Students will measure and compare lengths using an informal instrument and then identify formal and metric units of length.
<b>Content description</b>	Measurement and Geometry – Using units of measurement <ul style="list-style-type: none"><li>Use scaled instruments to measure and compare lengths, masses, capacities and temperatures <a href="#">(ACMMG084)</a></li></ul>
<b>Big idea</b>	Measurement – length – continuous vs discrete, three principles, need for a standard
<b>Resources</b>	Matchsticks, paperclips, counters, narrow strips of paper, straws, string, rulers, measuring tapes, trundle wheels

#### Reality

<b>Local knowledge</b>	Discuss different lengths, in local environment and in classroom, of objects that could be measured, e.g. height, width, length of a fence; distance, how far classroom is from the library; range of measurements, e.g. height of a tree/building/person, length of board/table, arm/finger/leg, width of desk/room.
<b>Prior experience</b>	<i>What would I use to measure the length of the classroom/the width of a pencil/the height of the door/the width of your palm/the depth of your forehead? What three principles do we need to follow when we are measuring objects? [common unit; smaller the unit – greater in number, larger the unit – fewer in number; smaller units give greater accuracy]</i>
<b>Kinaesthetic</b>	Students choose their own informal unit – e.g. matchsticks, paperclips, sharpeners; make their own measuring tape using a narrow strip of paper.  Using their personal measuring tools, students estimate, measure and record the measurement of two given objects in the classroom. Discuss results stating object that was measured, measuring tool used and number of that unit needed. Record findings on whiteboard and focus on the differences in numbers that came from using different measuring tools to establish the need to use a class standard tool.  Students choose a tool that will be used as the standard, e.g. a pencil, length of ribbon, straw, or coloured tape.

#### Abstraction

<b>Body</b>	Students estimate and measure objects with the chosen class tool, discuss the results and identify the objects that are the longest. <i>How can you tell which object is longer than another?</i> Demonstrate that the more of the common or standard units that are required, the longer the length becomes. [With a common/standard unit, the higher the number required means a longer length and conversely, the fewer required, the shorter the length.]  Discuss the reason/purpose for the development of formal scaled tools, e.g. school ruler, metre ruler, metric measuring tapes, trundle wheels. Identify formal and metric units of measurement.  <b>Identification</b>  Cut 1 cm pieces from different coloured drinking straws. Thread these pieces along a string in groups of 10 of one colour followed by 10 of another colour. This can be used to identify centimetres and groups of 10 centimetres to make up a metre.  Using 1 cm grid paper, cut 10 strips that are 10 cm in length. Tape these together to form a folding 1 m measuring strip. This should be placed on cardboard to make it more durable.   This again identifies a centimetre and a metre.
-------------	---

Attempt to cut a 1 cm piece of paper into 10 equal slices. Discuss how small they are. Find a long distance (along a road or around an oval), get students to estimate how far to make a kilometre, then use a trundle wheel to have everyone walk an actual kilometre.

### Internalisation

Students use a measuring tape to measure and record their personal body measures:

height, arm span, head circumference, leg length, around the wrist, foot, length of hand, ankle to knee, wrist to elbow, left hand, thumb, index finger

Find a reference length in your body which is approximately:

1 cm \_\_\_\_\_

10 cm \_\_\_\_\_

1 m \_\_\_\_\_

1 mm \_\_\_\_\_

Use this body measure to estimate different items around the room – measure to check how close the estimate is to the actual measurement.

### Estimation

Estimate, using a variety of techniques – internal measures, time, paces, and so on – a variety of items or lengths – don't forget perimeters! Then measure the same lengths and see how close you get.

Estimate larger distances that students may walk every day – classroom to canteen, school to shop or significant landmarks in the community and then measure these distances. Try to develop the distance of a kilometre.

### Hand

Use a range of measuring devices to measure length in standard units. A ruler is a length of wood or plastic usually marked in cm or mm or both. Simple early rulers can be made where 1 cm sections are coloured alternatively to help students focus on the count of units representing the measure of length. Marking each centimetre using numbers in each section can assist young students to move to identifying the numbers with the length. Then they can be shown that on standard rulers the numbers are at the end of each length.



Students list five of the objects they measured with informal body units, estimate the number of metric units for each, measure with a standard unit measuring device and compare the number of metric units for each object measured.

### Mind

Students visualise an object that was as long as five of their informal units; how many of their informal units were needed to equal 10 cm, and so on.

### Creativity

Students draw a template of their foot and compare it with the size of others in the class to see whose is biggest and whose is smallest.

## Mathematics

**Language/symbols** compare, difference, centimetre, metre, length

**Practice** 1. Estimate the metric measurement first and then measure the length of a variety of objects (find some interesting things) inside and outside. Complete estimates and measures of object before moving on to the next.

Object	Estimate	Metric Measure	Difference

2. Mark out a 10 m distance using a measuring tape. Determine how many of your paces equal this 10 m. Pace the following distances, make some up, and use this value to convert paces to metres:

Distance	Paces	Estimated conversion to metres
Length of room		
Width of board		
Length of veranda		
Distance around the classroom		
Distance around the building		

3. Mark out 100 m. Use a stopwatch to time how long it takes you to walk this distance. Use this time to determine how long it would take you to walk a kilometre. Find a local well-known distance that is around 1 km – check if your time matches.
4. Class table: Objects measured, personal and metric tools used. Record the results for each object and the number needed for each of the different personal tools and metric tools.

**Connections** Connect to place value and measuring capacity and mass.

### Reflection

**Validation** Students investigate the places where length and accurate measurement are required, e.g. building, dressmaking, distances between places, racetracks.

**Application/problems** Provide applications and problems for students to apply to different contexts independently. Applications for length and distance around (perimeter) should be built around the idea of a triad – there is an object, a unit of measure and the number of units. Thus, applications for length can be built around three types of problems:

- Number unknown – *measure this wall in metres.*
- Object unknown – *find an object that is 16 cm long.*
- Unit unknown – *this object is 35 units, are these units cm or mm?*

An application of length is finding perimeter; e.g. *Use an informal/standard tool to measure how much timber would be needed to edge a school garden bed.* The vocabulary and concept of perimeter, as the distance around the outside of an object, should have been built during the previous stages.

**Extension** **Flexibility.** Students measure length, width and height of many objects with informal then formal tools and compare. Measure objects where the length may be straight or curved.

**Reversing.** Students are able to construct meaning from any starting point: stories ↔ acting out/modelling with materials ↔ pictures (drawing) ↔ language ↔ symbols, in relation to the triad: object, a unit of measure and the number of units.

**Generalising.** *The informal unit selected as a measuring tool affects the result. Different informal measuring tools give different results for the same object. Hence the need for a standard measuring tool. Always start at zero when using metric measuring tools. The length of the object is the number of units from zero where the object ends.*

**Changing parameters.** Students consider measuring capacity and mass with informal and scaled instruments.

## Teacher's notes

- Some rulers do not have the zero aligned with the end of the ruler requiring students to align the zero with the edge of the object they are measuring (see figure below). This can cause measurement errors for inexperienced students. The figure on right below shows a student correctly using a ruler to measure a length of straw by aligning the zero with the end of the straw.



Zero not aligned with the end of the ruler



A student correctly aligning the zero on a ruler to measure length

- A list of objects to be measured needs to be developed so that pairs of students (with different measuring tools) are able to rotate around the objects.
- Students need to be taught the skill of visualising: closing their eyes and seeing pictures in their minds, making mental images; e.g. show a picture of a straw ruler, students look at it, remove the picture, students then close their eyes and see the picture in their mind; then make a mental picture of a different measuring tool.
- Suggestions in Local Knowledge are only a guide. It is very important that examples in Reality are taken from the local environment that have significance to the local culture and come from the students' experience of their local environment.
- Useful websites for resources: [www.rrr.edu.au](http://www.rrr.edu.au); <https://www.qcaa.qld.edu.au/3035.html>
- Explicit teaching that **aligns with students' understanding** is part of every section of the RAMR cycle and has particular emphasis in the Mathematics section. The RAMR cycle is not always linear but may necessitate revisiting the previous stage/s at any given point.
- Reflection on the concept may happen at any stage of the RAMR cycle to reinforce the concept being taught. Validation, Application, and the last two parts of Extension should not be undertaken until students have mastered the mathematical concept as students need the foundation in order to be able to validate, apply, generalise and change parameters.