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## **MATH MINI LESSON – LENGTH MEASUREMENT**

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### **INTRODUCTION TO OUR PEERS:**

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This lesson focuses on units of length measurement that students will encounter and engage with frequently throughout their lives. An understanding of these units, as well as their relationships to each other, will supply students with skills that will be directly beneficial to them. The overall intention of this lesson is to stimulate and motivate students' mathematical thinking by providing them with an authentic and personally relevant learning experience.

The first part of the lesson will introduce the basic units of length measurement, with emphasis falling on the Metric system, the most widely used system of standardized measurement in the world. Following this will be our first student challenge, a short explorative activity where students come up with their own unit of measurement before measuring objects using their units. A discussion around the success of their units will follow, which will segway into a conversation about standard vs. non-standard units of length measurement.

The second challenge for children will involve them taking part in a scavenger hunt, where they will practice their skills in estimating and measuring various objects or lengths using standardized units of measurement. In doing so, they will gain familiarity in the basic standard units of length measurement and their relation to one another. This challenge for children, along with the first, can be modified to take place in an outdoor greenspace (see the 'Greenspace Adaptation' below).

We hope that by the end of this lesson students will feel more comfortable in their understanding and applications of units of length measurement in a way that will benefit them academically and otherwise.

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## **LESSON DETAILS**

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### **GRADE:**

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### **ANTICIPATED TIMELINE:**

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45 minutes

### **LEARNING OBJECTIVE:**

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By the end of this lesson, students will be able to identify and describe common standard and non-standard units of length measurement, and will develop their abilities to apply them, with justification, in real-world contexts

### BIG IDEA:

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Standard units are used to describe, measure, and compare attributes of objects' shapes

### CONTENT

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Measurement, using standard units (linear, mass, and capacity)

### CURRICULAR COMPETENCIES

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#### *Reasoning and analyzing:*

- Use reasoning to explore and make connections
- Estimate reasonably

#### *Understanding and Solving:*

- Develop, demonstrate, and apply mathematical understanding through play, inquiry, and problem solving

#### *Communicating and Representing:*

- Communicate mathematical thinking in many ways
- Use mathematical vocabulary and language to contribute to mathematical discussions
- Explain and justify mathematical ideas and decisions

#### *Connecting and Reflecting:*

- Reflect on mathematical thinking
- Connect mathematical concepts to each other and to other areas and personal interests
- Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts

### FIRST PEOPLES PRINCIPLES OF LEARNING

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- Learning is holistic, reflexive, reflective, experiential, and relational (focus on connectedness, on reciprocal relationships, and a sense of place)
- Learning is embedded in memory, history, and story.

### MATERIALS REQUIRED

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- Measuring tapes
- Rulers
- Writing utensils
- Calculators for conversions

- ‘Measurement Scavenger Hunt’ handout and ‘Create Your Own Unit of Measurement’ handout

## KEY TERMS

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- Length
- Measurement
- Standard unit
- Non-standard unit
- Metric units (meter, centimeter, millimeter, kilometer)
- Imperial units (foot, yard, inch)

## PRIOR KNOWLEDGE NEEDED:

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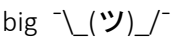
- How to use a ruler/measuring tape/the use of technology in exploring mathematics
- Terms related to measurement such as length, width, and height
- How to estimate reasonably
- Direct linear measurement, and a familiarity with standard metric units and their relation to each other
- Place value to hundredths or thousandths
- Basic attributes of 2D and 3D objects
- Addition and subtraction concepts
- Meaning of equality and inequality

## LESSON PROGRESSION

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### 1) MATH CHAT ABOUT LENGTH AND MEASUREMENT UNITS:

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- **What is length?**
  - “The distance from one end of something to another”
  - “The greatest of side/dimension of a 2D or 3D shape”
- **Introduce and discuss the concept of non-standard units of length (hand, cubit, or step)**
  - We could agree on pretty much anything to use as a unit of measurement if we wanted to.
  - We might use ‘steps’ to measure the length of a soccer field or distance on a map
  - We use body parts like our hands and arms to measure length, as in to say it is this big 
  - What makes non-standard units helpful?
    - Easy to visualize and comprehend
    - Universal (maybe)
  - What might make them not so effective?
    - non-uniform/inconsistent, can lead to confusion
    - **Question:** Can you think of something you could use as a unit to measure length? Did you think of something that was consistently the same size? If not, can you see a problem with your unit?

- **Next, discuss Standard Units (cm, m, km)**
  - In Canada, we use the Metric system as a way to quantify the length (or distance, width, or height of something). This system is also the most common system of units used around the world (its official name is the “International system of units”, or SI for short).
  - There are other standard systems of measurement, including the Imperial system. This system, prevalent in the everyday lives of Canadians (Canada changed from the Imperial system to the Metric System in the 1970s and The United States still uses the Imperial system) uses units such as the inch, yard, mile, or foot. Although not the official system of measurement in Canada, the Imperial system is still useful to learn about.
  - Standardized units are accurate and specific (i.e. the table is 10 meters long, instead of just “big”; each unit has an agreed upon specific length that is always the same)
  
- **What makes standard units helpful?**
  - They make communicating and following instructions easier
  - Can make consistent conversions between other systems and cultures
  - Necessary for jobs where it is important for measurements to be accurate (ie. construction, architecture, aviation, etc.)
  - The Metric system takes advantage of the base 10 number system/place value and powers of 10, thus making the conversion between units very easy.
  - If looking at these Metric units on a scale from left to right, the unit immediately to the right of another is 10x smaller, and to the left is 10x bigger.
  - This system uses prefixes applied to the term ‘meter’ to explain different units (i.e. kilo, hecto, deka, deci, centi, milli).
  - With standardized systems such as the Metric system, we can measure really long things, as well as really small things effectively, with the same system; there are units that are appropriate for most things we will need to try and measure throughout our lives

\*\*\*See Appendix #1 for chart showing relationships between kilometers, centimeters, and millimeters\*\*\*

## 2) KEY QUESTIONS TO ASK STUDENTS

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- What are standard units of measurement? What are non-standard units?
- Why is it helpful to use standard units? When might non-standard units be used?
- What is length? How does it differ from something like width?
- What are some of the Metric units of measurement? Imperial? Other?
- What 4 Metric units do we commonly use to measure and talk about length?

## 3) ACTIVITY CHALLENGES FOR STUDENTS

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### Challenge 1: Create Your Own Unit of Measurement

In the first hands-on section of our lesson, students will come up with their own unit of length measurement. Including this creative, improvisational element to the lesson will illustrate the fact that units of measurement are simply quantities that people create in order to communicate with each other (i.e. they are not fundamental to math in the way that addition, subtraction, multiplication, or division are). Students will be instructed to go around the classroom and measure whatever they want - objects,

distances between things, people, etc. - using their unique units of length measurement. They will fill out a worksheet (see appendix) that identifies and describes their unit of measurement, documents 3 things they measured (including their estimations before measuring), and asks them to explain whether or not they thought their unit of measurement worked well and why it did/didn't. After their exploration, students will be led in a discussion where they share their findings and thoughts on their units of measurement. Then, they will be asked questions intended to lead them into the next stage of our lesson which focuses on the practicality of having a variety of standardized units (for example: "What types of objects do you think your unit would be helpful/unhelpful in measuring?", "Do you foresee any problems with your unit of measurement?", and "Why might it be problematic for everyone in the class to have different units of measurement?", etc.).

\*\*\*Please see Appendix # 2 for handout\*\*\*

### Challenge 2: Measurement Scavenger Hunt

Using a ruler and/or measuring tape, students will estimate and measure the length of different objects in the classroom. This activity is meant to familiarize students with the standard units typically found on a ruler, while getting them out of their desk and moving around the school or school grounds. Because this activity asks you to find items that are of a certain length, estimation skills are naturally built into it. Students have to look around and ask what would be reasonably close to 15 mm (for example) and then test their hypothesis. This challenge can be done individually, in groups, competitively or non-competitively.

\*\*\*Please see the Appendix# 3 for handout\*\*\*

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## OPPORTUNITES TO DIFFERENTIATE, PERSONALIZE, OR EXTEND

The complexity of the measurements required for the scavenger hunt can be adapted to meet the needs of advanced or struggling students. For students who are less confident taking measurements, an option is to mark the specific spot on the ruler they are reading from with an arrow or sticker. Limit the number of measurements they have to take if necessary. Consider partnering students with an experienced peer as well.

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## EXTENSION ACTIVITY

Have students convert their unit of measurement into the unit of measurement created by a classmate/classmates, or have students practice converting units they have measured during challenge 2 into other units (metric or otherwise).

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## EXTENSION QUESTIONS

- What are some examples where Canadians might use non-metric units to describe distance?
- Can you measure any other dimensions of the objects whose length you've measured?
- Do you know the names for those dimensions?
- What other standard units of measurement can you think of that weren't mentioned in today's lesson? (i.e. light years, etc.)
- What would be the most reasonable unit to measure the length of an old cedar tree? What would be the most reasonable unit to measure the distance between Victoria and Nanaimo?

- What would be the most reasonable unit to measure the length of an eagle feather?

### FOLLOW UP ACTIVITIES

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- 1) Have students complete 'Measurement Scavenger Hunt 2' and/or the 'Green Space Adaptation'  
\*\*\*Please see Appendix #4 and #5 for both activities\*\*\*
- 2) Once students become familiar with metric (and other) units of measurement, one subsequent lesson could be designed that further explore the relation of units to each other. For example, an activity that follows this lesson could involve using the data contained on the worksheets from this lesson to convert into other units of measurement.

### CROSS CURRICULAR CONNECTIONS

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PHE: students can perform various track and field/athletic movements and have them measure the results. For example, students could measure each other's running stride, how far they can jump, or how far they can throw an object

Art: students can create their own street scene, beach scene, or house using measurement to explore proportion, uniformity, and other related concepts

Social Studies/Indigenous Cultures: students can explore how different cultures in the past, specifically Indigenous cultures, created and utilized units of length measurement

Science: students can explore units of measurement in the natural environment by studying and comparing units of measurement used to quantify properties of certain plants, animals, or micro-organisms. Students could create graphs based on data collected

### ASSESSMENT

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Following the *triangulation model* of assessment, and with a focus on formative assessment (as this is intended to be a largely introductory lesson) we will derive assessment information from students based on conversations, observations, and products. Group discussions are a big part of our lesson plan, and these will help teachers assess student understanding to further guide them in their instruction (formative assessment), as well as what students have learned at the closing of the lesson (summative assessment). Observing students as they discuss ideas with classmates, explore their surroundings during both student challenges, and complete their worksheets will provide more opportunity for assessment. Finally, the completed worksheets will serve as valuable products for assessment that will give teachers a good idea of what students have learned during this lesson, as well as providing teachers with more evidence on which to base subsequent lessons.

APPENDICES

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## Appendix #1

<b>Kilometer</b>	<b>Meter</b>	<b>Centimeter</b>	<b>Millimeter</b>
<b>1</b>	1000	100,000	1,000,000
$\frac{1}{1000}$	<b>1</b>	100	1000
$\frac{1}{100,000}$	$\frac{1}{100}$	<b>1</b>	10

## Appendix # 2

**Activity 1: Create Your Own Unit Of Measurement!**

My Unit of Length Measurement:

**Data:**

Object #1:

Estimation and Measurement:

Object #2:

Estimation and Measurement:

Object #3:

Estimation and Measurement:

**Question:** Do you think your unit of measurement worked well? Why/why not?



## Appendix # 3

**Measurement Scavenger Hunt**

<b>Find an object that is 1 cm in length</b>	<b>Find an object that is 5 cm in length</b>	<b>Find an object that is half a meter in length</b>
<b>Find an object or part of an object that is 1 metre in length</b>	<b>Find an object that is longer than your arm</b>	<b>Find an object that is 10 cm long</b>
<b>Find an object that is longer than your friend</b>	<b>Find an object that is 1 ft in length</b>	<b>Find an object that is 15mm in length</b>
<b>Find an object that is 5 inches in length</b>	<b>Find an object that is 7 cm and 2 mm in length</b>	<b>Find an object that is <math>\frac{1}{4}</math> inch in length</b>
<b>Find an object that is 2 feet in length</b>	<b>Find something that is longer than the classroom</b>	<b>Estimate the length of an object longer than your arm in cm, now record its length cm</b>

## Appendix # 4

## Measurement Scavenger Hunt 2

<b>Length</b>	<b>Estimate (cm or in)</b>	<b>Centimeters (cm)</b>	<b>Inches (in)</b>
The bookshelf			
The whiteboard			
A window			
A pencil			
The top of your desk			
An eraser			
A book			
Something in class longer than you			
Something in the class shorter than you			
The classroom			
The height of the building			
Your hand			

## Appendix #5

**Green Space Adaptation:**

If done outside or in a nature space, this lesson could lend itself well to the First People's Principles of Learning: "Learning is holistic, reflexive, reflective, experiential, and relational (focus on connectedness, on reciprocal relationships, and a sense of place)"

Once outside and boundaries are established, allow your students (in groups or individually) some time to explore and find a spot they feel a connection to, or a spot they feel calm in. When everyone has found their spot, have students measure and record its distance from objects in the environment that emphasize our reciprocal relationship with nature. Students can use measuring tapes, or non-standard units like steps, feet, or the length of their body from head to toe.

Question examples:

Measure the length of distance from:

- 1) Where you are to any source of freshwater
- 2) Where you are to a particular tree
- 3) Where you are to a spot that would provide shelter or a home for an animal.

References:

Math Antics - Intro to the Metric System: <https://www.youtube.com/watch?v=ZNX-a-5jGeM&t=82s>

Math Antics - Units of Distance:  
<https://www.youtube.com/watch?v=cKbmLv-FRo>