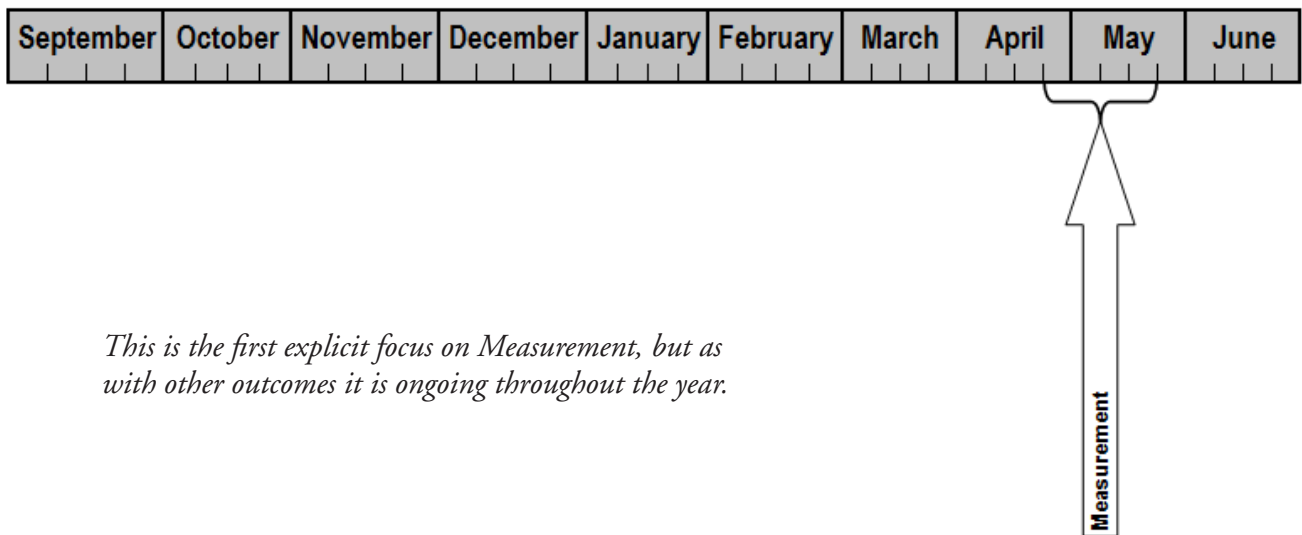


# Measurement

**Suggested Time: 4 Weeks**



*This is the first explicit focus on Measurement, but as with other outcomes it is ongoing throughout the year.*

# Unit Overview

## Focus and Context

Students are given the opportunity to work with units of time (seconds, minutes, hours, days, weeks, months, years) in a problem solving context. Students will move from previous work relating the number of days to a week and months to a year, to also include seconds to a minute, minutes to an hour, and days to a month. In Grade 3, students explore the passage of time using both standard and non-standard units in relation to everyday activities. They also learn about measuring and recording length, width, height, and perimeter of 2-D shapes and 3-D objects using personal referents and the standard units of centimetre and metre. Students are introduced to measuring and recording mass in the standard units of gram and kilogram using balance scales. Through investigations, students discover the relationship between centimetre and metre, and gram and kilogram. Students will estimate, measure, compare, and order objects using both non-standard and standard units. It is important that students are familiar with and understand the actual attribute they are using to compare a measure.

Estimation in measurement is a skill that is worked on throughout this unit. In Grade 2, students engaged in estimation activities that focused on the use, and understanding of, non-standard units. In Grade 3, students will develop an understanding of personal referents and their value for estimation in everyday life. Using their personal referents, students will estimate measures before finding the actual measurements using standard units. Engage students in activities that promote precise measurement and comparison of objects to develop predicting and problem solving skills as they estimate and measure.

## Math Connects

The concept of measurement provides students with meaningful opportunities for hands-on learning activities that enable connections to everyday life as they explore questions related to their home and school environment. Exploring measurement, and learning how to measure common objects, will support students in understanding, organizing, and describing the world around them. The activities in this unit also involve other mathematical concepts such as comparing and ordering numbers, addition and subtraction, data analysis, geometry, etc. Measurement can also provide connections to other curriculum areas such as charting the growth of a plant in science, or determining distance using scale in social studies. Over time as their understanding deepens, students should realize that measurement can be used to solve increasingly complex problems.

## Process Standards Key

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[ME]	Mental Mathematics and Estimation	[T]	Technology
		[V]	Visualization

## Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Shape and Space (Measurement)	3SS1 Relate the passage of time to common activities, using nonstandard and standard units (minutes, hours, days, weeks, months, years).	[CN, ME, R]
Shape and Space (Measurement)	3SS2 Relate the number of seconds to a minute, the number of minutes to an hour and the number of days to a month in a problem-solving context.	[C, CN, PS, R, V]
Shape and Space (Measurement)	3SS3 Demonstrate an understanding of measuring length (cm, m) by: <ul style="list-style-type: none"> <li>selecting and justifying referents for the units cm and m</li> <li>modelling and describing the relationship between the units cm and m</li> <li>estimating length, using referents</li> <li>measuring and recording length, width and height.</li> </ul>	[C, CN, ME, PS, R, V]
Shape and Space (Measurement)	3SS4 Demonstrate an understanding of measuring mass (g, kg) by: <ul style="list-style-type: none"> <li>selecting and justifying referents for the units g and kg</li> <li>modelling and describing the relationship between the units g and kg</li> <li>estimating mass, using referents</li> <li>measuring and recording mass.</li> </ul>	[C, CN, ME, PS, R, V]
Shape and Space (Measurement)	3SS5 Demonstrate an understanding of perimeter of regular and irregular shapes by: <ul style="list-style-type: none"> <li>estimating perimeter, using referents for cm or m</li> <li>measuring and recording perimeter (cm, m)</li> <li>constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter.</li> </ul>	[C, ME, PS, R, V]

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS1 Relate the passage of time to common activities, using nonstandard and standard units (minutes, hours, days, weeks, months, years).**

[CN, ME, R]

**Achievement Indicators:**

*3SS1.1 Select and use a nonstandard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice.*

*3SS1.2 Identify activities that can or cannot be accomplished in minutes, hours, days, weeks, months and years.*

## Elaborations—Strategies for Learning and Teaching

Time, as a unit of measurement, presents a unique challenge to students in that it cannot be seen. Students need the opportunity to explore and discuss daily activities that involve the passage of time and to make connections to their real world experiences. Through the use of non-standard units (e.g., pendulum swings, TV shows, sand-timers, recesses) or the standard units (minutes, hours, days, weeks, months and years) students will understand that time, as a measurement, is about the duration of an event from beginning to end.

You may wish to use the book *A Second is a Hiccup* by Hazel Hutchins as an introduction to this unit. The book provides real world connections to the passage of time.

Prior to the introduction of standard units it is essential that students choose non-standard units that measure the passage of time in a uniform and appropriate manner (e.g., hand claps do not ensure uniformity of time from person to person). Students could be asked to select an appropriate non-standard unit to estimate how long it would take them to do activities such as walking down the hall and back or going to a movie. Ask students to give reasons for their choice.

It is useful to note the duration of long and short events throughout the day to develop a sense of the various standard units of time. Do this by engaging students in daily conversations whereby they need to select an appropriate unit of measurement for activities such as brushing teeth, riding to school, reading a story, extracurricular activities, sleeping, summer vacation, building a highway. Some questions that could be asked of students are:

- Would it take hours or minutes to tie your shoes?
- Can a house be built in days, weeks, or months?
- Do we measure the growth of trees by days or years?

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 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Journal*

Ask students to describe something they do that takes a second, a minute, an hour, a day, a week, a month, or a year.

(3SS1.2)

*Performance*

Estimating Time - Working with a partner, ask students to select an activity from the estimating time sheet and estimate how long it will take in seconds or minutes to complete the activity. Ask them to write their estimate on a recording sheet. Next, they will have their partner time how long it takes them to complete the activity and record the actual time in seconds or minutes. They continue to take turns repeating steps one and two.

Names _____		
Estimating Time		
Activity	My Estimate	Actual Time
Tie Your Shoe		
Write your whole name		
Do 10 sit-ups		

(3SS1.2)

## Resources/Notes

*Math Makes Sense 3***Launch:** Eat Your Veggies

TG pp. 2 - 3

**Lesson 1:** Measuring the Passage of Time**3SS1**

TG pp. 4 – 6

**Children's Literature**  
(not provided):Hutchins, Hazel. *A Second is a Hiccup*

ISBN 9780439831062

*Math Makes Sense 3***Lesson 2:** Exploring Units of Time**3SS1**

TG pp. 7 – 10

**Additional Activity:** Just a minute

TG pp. v and 59

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS1 Continued****Achievement Indicator:**

*3SS1.3 Provide personal referents for minutes and hours.*

**3SS2 Relate the number of seconds to a minute, the number of minutes to an hour and the number of days to a month in a problem-solving context.**

[C, CN, PS, R, V]

**Achievement Indicator:**

*3SS2.1 Determine the number of days in any given month, using a calendar.*

## Elaborations—Strategies for Learning and Teaching

The following class activities would enable students to get a sense for the length of a minute:

- How many times can you write your name in a minute?
- How high can you count in a minute?
- How many hand claps can you do in a minute?
- How high can you count in two minutes?

To further develop the sense of minute, ask students to relate the above activities to 2 minutes, 5 minutes, 10 minutes

A referent is simply an object that can be used to help estimate a measurement. Brainstorm, with students, activities that students engage in for about an hour to help them establish their personal referent for one hour (e.g., math class, lunchtime, television shows, and extracurricular activities).

By the end of Grade 2, students have been introduced to the number of days in a week and months in a year. In Grade 3, students will engage in activities that further develop the relationship between the units of time measurement prior to learning to tell time on a digital or analog clock in Grade 4.

Using a calendar throughout the school year strengthens the students' sense of time. Each month brings a new calendar to explore.

- It is worthwhile for students to be exposed to the jingle as some may find it easy to remember: Thirty days hath September, April, June and November. All the rest have 31, etc.
- Students might enjoy the “Knuckle Method” for remembering the number of days in each month:

Make a fist showing four knuckles; start by pointing to the first knuckle and saying, “January.” The space between knuckles is February; the second knuckle is March, and so on. After saying, “July,” go back to the beginning making August land on the first knuckle and continue until year end. The months that land on the knuckles each have 31 days.

*(continued)*

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 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Student–Teacher Dialogue*

- Show the student a calendar for the year and ask them to identify ways in which months are the same and ways in which they differ.  
(3SS2.1)

*Performance*

- Ask pairs of students to predict how many weeks there are in a year. Ask them to use a calendar for the year to check their prediction.  
(3SS2.1)

## Resources/Notes

*Math Makes Sense 3***Lesson 2 (Cont'd):** Exploring Units of Time

3SS1

TG pp. 7 – 10

*Math Makes Sense 3***Lesson 3:** Exploring the Calendar

3SS2

TG pp. 11 – 14

*Lesson 3 does not address seconds to minutes and minutes to an hour. It was briefly introduced in lesson 2 and additional activities have been provided in 3SS2.2*

Strand: Shape and Space (Measurement)

Outcomes

*Students will be expected to*

**3SS2 Continued**

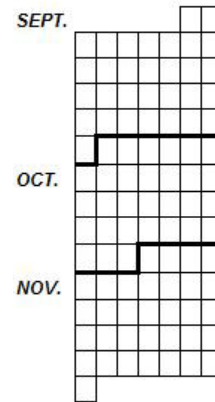
**Achievement Indicator:**

*3SS2.1 Continued*

Elaborations—Strategies for Learning and Teaching

- Consider calendar patterns :
  - Are there months that need only 4 lines?
  - Does every month have the same number of Mondays?
  
- It might be useful to have a full calendar that shows all twelve months on display in the classroom.

• At the end of each month, cut out around the calendar outline of a commercial calendar making sure to cut out all the empty boxes. Place that month's calendar so it fits like puzzle pieces with the previous month's calendar. This helps students make the connection between months and why different months start on different days.



- Students may be interested to know that a year is a little more than 365 days. To make up for this lost time, every four years we have a leap year which has 366 days. We add this extra day in February which then has 29 days.

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General Outcome: Use Direct and Indirect Measurement to Solve Problems

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Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to work in pairs. Tell them that Stacey was born February 29, 1992. Ask the students to determine how many birthdays Stacey has had. When would she celebrate her birthday? Ask them to write a letter outlining how unfair it is to be born on February 29th, and what they might suggest be done to change the situation. (3SS2.1)

Resources/Notes

*Math Makes Sense 3*

**Lesson 3 (Cont'd):** Exploring the Calendar

3SS2

TG pp. 11 – 14

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS2 Continued****Achievement Indicators:**

*3SS2.2 Solve a given problem involving the number of seconds in a minute, minutes in an hour or days in a given month.*

*3SS2.3 Create a calendar that includes days of the week, dates and personal events.*

## Elaborations—Strategies for Learning and Teaching

Before engaging in problem solving activities students need to consolidate their understanding of number of seconds in a minute, and minutes in an hour.

- Direct students' attention to the clock. How many big numbers are on the clock? Ask students to point to the hour hand, tell them that when one hour hand moves from one number to the next, one hour has passed, or sixty minutes. Ask students to point to the minute hand, tell them that when the minute hand moves from one tick mark to the next, one minute has passed, or sixty seconds.
- Count the seconds it takes for the minute hand to do one complete revolution around an analog clock.
- Challenge students to guess how long one minute is by having them place their heads on their desks. When they think one minute is up, they should raise their hand without looking up. At the end of one minute identify those students who raised their hands closest to the sixty-second mark. Repeat activity - ask students to quietly sit up when they think one minute has passed.

The following problem solving activities would allow students to use their knowledge of standard time units:

- It took John 100 seconds to brush his teeth. Is this greater or less than 2 minutes? How do you know?
- If it takes 185 minutes to drive to your grandparent's house, about how many hours will it take to get there? How do you know?
- Suzy read a chapter book beginning the first day of February and ending on the last day of March. How many days did it take her to read the book? Show your thinking in pictures, numbers or words.

Give each student a copy of a blank calendar. Model how to fill in the month, year, days of the week, and dates. Include important events that are happening in school for that month. Ask students to glue the calendar on construction paper and decorate it with illustrations pertaining to that month. Let students take their calendar home for scheduling personal activities.

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General Outcome: Use Direct and Indirect Measurement to Solve Problems

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Suggested Assessment Strategies

*Portfolio*

- Provide a calendar for the year. Ask students to figure out how many school days each month have had or will have. How many Friday the 13ths will there be in the year? On what days do the birthdays of friends and family fall? etc. Ask students to write about their findings for their portfolios. (3SS2.2)

*Student–Teacher Dialogue*

- Show the student a calendar for the year. Ask them to point out today's date and to find out what date it will be in six weeks. (3SS2.2)

Resources/Notes

*Math Makes Sense 3*

**Lesson 3 (Cont'd):** Exploring the Calendar

3SS2

TG pp. 11 – 14

Strand: Shape and Space (Measurement)

Outcomes

*Students will be expected to*

**3SS3 Demonstrate an understanding of measuring length (cm, m) by:**

- selecting and justifying referents for the units cm and m
- modelling and describing the relationship between the units cm and m
- estimating length, using referents
- measuring and recording length, width and height.

[C, CN, ME, PS, R, V]

Elaborations—Strategies for Learning and Teaching

Working with standard units is integral to students' understanding of a measurement program. Students can start using standard units to measure length when they realize that non-standard units mean different things to different people. They need to develop a familiarity with standard units and explore the relationship between them.

According to Van de Walle (2006), estimation activities help students focus on the attribute being measured, provide intrinsic motivation, and help develop familiarity with the measuring unit.

The book *Measuring Penny* by Loreen Leedy can be used to bridge the gap between the use of non-standard and standard units of measure. (This book uses Imperial measurements on some pages. Please modify to reflect the Metric system). Before reading, ask students: What is measurement? How do we measure things? How would you measure if you didn't have a ruler? After reading, ask students: What are some forms of measurement? (Height, length, time, mass, etc.) What are two parts of any measurement? (A number and a unit of measure, e.g., 12 cm, 26 g, 4 min., etc.)

Brainstorm examples of non-standard and standard units.

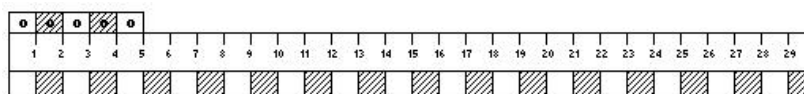
Working in pairs, students can measure such body parts as an arm, leg, hand, foot, finger, etc. using both a non-standard (paperclip, pencil, multilink, water bottle, etc.) and standard form (cm ruler) of measurement. They can record and compare their findings with their partners on a chart such as the one below.

Measuring Body Parts		Name _____
Non-Standard Unit _____		Standard Unit <u>cm</u>
Body Part	Non-Standard Measurement	Standard Measurement
arm	<u>25</u> multilinks	<u>45</u> cm
foot	_____	_____ cm
finger	_____	_____ cm

**Achievement Indicator:**

*3SS3.1 Determine and record the length and width of a given 2-D shape.*

Once the gap is bridged between non-standard and standard units, it is important to begin measuring with tools that are clear and those that will not confuse students. It can be helpful to ask students to use rulers that show only numbered centimetres and not millimetres. Lining up small cubes from your base ten materials along the ruler, will demonstrate that the stripes or numbers on the ruler correspond to the number of small cubes.



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 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to write or draw something that would explain why a sneaker is not a good referent for measuring length. (3SS3)

*Journal*

- Why is it important to learn about standard forms of measurement as well as non-standard forms of measurement? Write about a time when you used each. (3SS3)

*Student - Teacher Dialogue*

- Using a standard 30 cm ruler, ask the student to measure a common object that is shorter than the ruler such as a pencil, glue stick, eraser, etc. (3SS3.1)
- Using a standard 30cm ruler, ask the student to determine the measurement of something that is longer than the ruler such as a desktop, chart paper, width of a door, bookcase, etc. (3SS3.1)

## Resources/Notes

*Math Makes Sense 3*

**Lesson 4:** Using a Ruler  
**3SS3**

TG pp. 15 - 18

**Children's Literature (provided):**  
 Leedy, Loreen. *Measuring Penny*

*(This book uses Imperial measurements on some pages. Please modify to reflect the metric system)*

Strand: Shape and Space (Measurement)

Outcomes

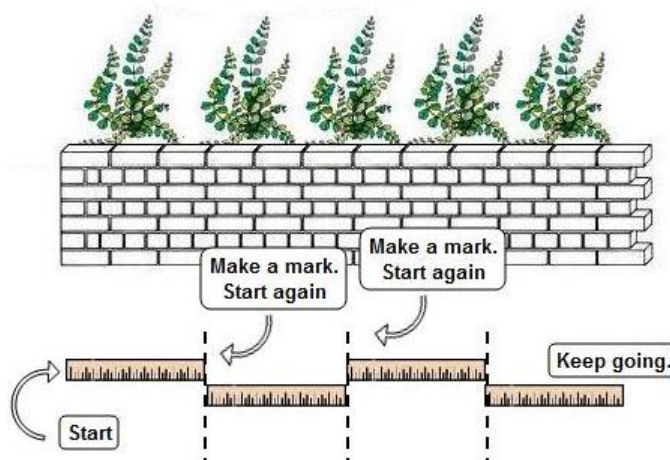
*Students will be expected to*

**3SS3 Continued**

Elaborations—Strategies for Learning and Teaching

When introducing the ruler, it is important for students to line up the 0 mark with the end of the object being measured.

It is also important to observe how students use a ruler to measure an object that is longer than the ruler. Show students how to measure something that is longer than a ruler by marking, recording, and starting again.



Adapted from *Math to Know: A Mathematics Handbook*, Mary C. Cavangh (2003), p.353

**Achievement Indicators:**

*3SS3.2 Determine and record the length, width or height of a given 3-D object.*

Using a centimetre ruler, ask the students to measure the length, width or height of some objects in the classroom (e.g., a lunch box, their desk, cereal box, etc). Students can record their measurements on a chart using both the number and the measurement unit, e.g., 3 cm or 3 centimetres.

Object	Length	Width	Height
Cereal box	15 cm	7 cm	30 cm

*3SS3.3 Draw a line segment of a given length, using a ruler.*

Provide opportunities for students to use their rulers in a free-draw activity prior to giving specific lengths. Ask them to draw a triangle, rectangle, house, etc. using straight lines. Once they establish comfort with the ruler, ask for lines of given lengths.

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General Outcome: Use Direct and Indirect Measurement to Solve Problems

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Suggested Assessment Strategies

Resources/Notes

*Math Makes Sense 3*

**Lesson 4 (Cont'd):** Using a Ruler

**3SS3**

TG pp. 15 - 18

SB p. 148

*\*Questions 6 and 7 make reference to students measuring objects starting at places other than 0. This is optional as it goes beyond the Grade 3 curriculum outcome for measurement.*

**Other Resources (provided):**

*Math to Know: A Mathematics Handbook*, Mary C. Cavanagh (2003), Thompson Nelson

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS3 Continued****Achievement Indicators:**

*3SS3.4 Provide a personal referent for one centimetre, and explain the choice.*

*3SS3.5 Estimate the length of an object, using personal referents.*

*3SS3.6 Sketch a line segment of a given length without using a ruler.*

## Elaborations—Strategies for Learning and Teaching

Brainstorm a list of items found in the classroom that students believe to be one centimetre. Using the small cube from your base-ten materials, determine which items on the list are closest to 1 cm. Invite students to think about how they could tell if something is about 1 cm long if they did not have a ruler. Ask them to look at their hands to see if they notice anything that is close to 1 cm. Identify that the width of their finger is a personal referent for 1 cm.

Working in pairs, ask students to take part in a cm scavenger hunt. Ask them to find items in the room that are close to given cm lengths using their personal referent as a measurement

"cm" Scavenger Hunt	
Personal Referent _____	
Length	Item
2cm	
7cm	
10cm	
25cm	
your choice _____	

Using a ruler, ask students to draw a line segment of a given length, e.g., 3 cm. Then without using their ruler, ask them to sketch a line segment of the same length. Ask them to attempt a line segment of 6 cm, 10 cm, 20 cm, etc. Discuss how the use of their personal referent could help them with this activity.

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General Outcome: Use Direct and Indirect Measurement to Solve Problems

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Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to find and record five items in the room that are between 10 cm and 25 cm long. Next, give other instructions such as: Find five items in the room that are shorter than your pencil, etc. (3SS3.5)

Resources/Notes

*Math Makes Sense 3*

**Lesson 5:** Estimating and Measuring with Centimetres

**3SS3**

TG pp. 19 – 22

**Game:** Button to Button

TG p.23

**Additional Activity:**

Measuring Pennies

TG: p. v and 60

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS3 Continued****Achievement Indicators:**

*3SS3.7 Provide a personal referent for one metre, and explain the choice.*

*3SS3.8 Match a given standard unit to a given referent.*

*3SS3.9 Show that 100 cm is equivalent to 1 m by using concrete materials.*

## Elaborations—Strategies for Learning and Teaching

Brainstorm a list of items found in the classroom that students believe to be one metre. Using a metre stick, determine which items on the list are closest to 1 m. Invite students to think about how they could tell if something is about 1 m long if they did not have a metre stick. Ask them to look around to see if they notice anything that is close to 1 m. Identify that the height of a doorknob from the floor can be a personal referent for 1 m.

Using objects from the classroom as referents, ask students to identify whether the object is an appropriate referent for centimetre or metre (e.g., pencil, garbage can, teacher desk, glue stick, etc.).

Working in groups with base ten materials, first ask students to explore how many small cubes would line up along a rod. Next, ask students to explore how many small cubes would line up along a metre stick. Finally, ask them to explore how many rods would line up along a metre stick. Record and present their findings to the class. Discuss as a whole group to consolidate their understanding of the equivalence of 100 cm to 1 m.

## General Outcome: Use Direct and Indirect Measurement to Solve Problems

## Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to find and record five items in the room that are between 1 m and 5 m long.  
Next, ask them to find five items in the room that are longer than their desk. (3SS3.8)

*Presentation*

- Prior to this activity, read the book *Long Jump* by Bernadette Kelly (available with the Grade 2 math program). Ask small groups of students to predict who has the longest stride and to give reasons for their selection on the recording sheet. Ask them to estimate the length of each person's stride. Measure the stride of each person in the group using a meter stick or cm measuring tape. Ask students to record their estimates and actual measures on a table. Using the results of the stride activity, ask students to predict who will have the longest jump and give reasons why on the recording sheet.

Ask students to estimate the length of each person's long jump. Students will measure the actual long jump distances and record them on the table. You may ask students to present the results.

Stride and Jump cm/m				
	Stride		Jump	
	Estimate	Actual	Estimate	Actual
Name				
Name				

(3SS3.8)

*Student – Teacher Dialogue*

- Ask the student to show, without using a ruler, how they could find out which is wider, the door or the window. (3SS3.7)
- Tell the student that a bald eagle was measured to be 109 cm long from beak to tail. Ask him/her to estimate and show how long that would be. They can then check the estimate by measuring. (3SS3.9)

## Resources/Notes

*Math Makes Sense 3***Lesson 6:** Estimating and Measuring with Metres**3SS3**

TG pp. 24 - 27

**Children's Literature:***Long Jump* by Bernadette Kelly

(provided with Grade 2 implementation)

## Strand: Shape and Space (Measurement)

## Outcomes

**Problem Solving Strategy:**  
**Draw a Picture**

## Elaborations—Strategies for Learning and Teaching

Previously, students have been introduced to the strategies of ‘Use a Pattern’, ‘Make an Organized List’, ‘Solve a Simpler Problem’, ‘Work Backward’, ‘Guess and Check’, ‘Make a Chart’ and ‘Use a Model’.

Strategy Focus: Draw a Picture - In addition to the other strategies, consider having students draw a picture of the problem before attempting to solve it. This can be beneficial to visual learners. Although students may think that drawing a picture to solve a problem is easy, the thought that goes into creating a picture is important to the success of the investigation and is helpful in presenting the solution.

Communication should be intertwined with problem solving throughout all areas of mathematics. Invite children to talk about their work as they investigate the process of how to find solutions to the problem. As students reflect on and explain, and justify their reasoning, they may revise their answers, thus lead to and confirm their own understanding. This allows opportunities for meaningful assessment.

Problem solving that incorporates real life situations helps students to make meaningful connections. Consider the following task that encourages students to use the strategy ‘Draw a Picture’.

Rachel walked 54 m to the park and realized that she forgot her coat. She returned to her house to get her coat and then decided to go to her friend’s house which was only 23 m away. After playing with her friend for 45 minutes, Rachel went home. How many metres did Rachel walk altogether?

General Outcome: Use Direct and Indirect Measurement to Solve Problems

Suggested Assessment Strategies

Resources/Notes

*Paper and Pencil*

*Math Makes Sense 3*

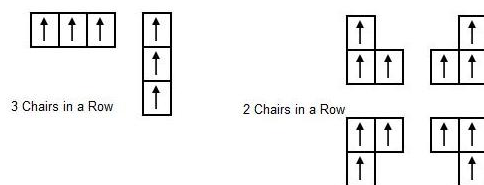
**Lesson 7: Strategies Toolkit**

**3SS3**

TG pp. 28 - 29

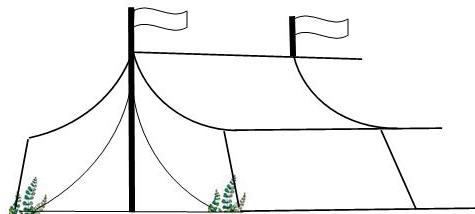
- Present the following contexts to students and encourage them to draw a picture to find the answers:
  - My new bedroom is 9 m long and 7 m wide. I want a new hockey player border around the walls. How much border do I need?
  - The caterpillar is trying to crawl up a tree. It takes 2 minutes to climb one meter but it falls back 25 cm each time it reaches one meter. How long will it take the caterpillar to crawl to the top of a 3 m tree? (You may wish to provide a number line for this problem).
  - Every bike slot in a bicycle rack was filled. Donna’s bike was in the middle. There were 6 bikes to the right of Donna’s. How many bicycles were in the bicycle rack?
  - Mr. Martin asked Sheldon to set up 3 folding chairs in the back of the room for 3 visitors coming to their class. How many different arrangements of the 3 chairs could Sheldon make with each chair either beside another chair or in front of another chair?

Answer:



There are 6 possible arrangements for the chairs. (The arrows show the direction the chairs are facing).

- A large circus tent has 7 poles from one end to the other end. The poles are 25 m apart. How long is the tent? Finish the picture.



## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS5 Demonstrate an understanding of perimeter of regular and irregular shapes by:**

- **estimating perimeter, using referents for cm or m**
- **measuring and recording perimeter (cm, m)**
- **constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter.**

[C, ME, PS, R, V]

**Achievement Indicator:**

*3SS5.1 Measure and record the perimeter of a given regular shape, and explain the strategy used.*

## Elaborations—Strategies for Learning and Teaching

The focus now is on measuring in centimetres.

An understanding that perimeter is not distinct from linear measurement will be key to students' success when exploring perimeter. Students will need to understand that perimeter is the same as measuring linear distance that is not in a straight line.

Using any regular shaped object such as a picture frame, book, or a sheet of paper, ask students how they might determine the total “distance around” the given object.

After discussion of student suggestions, model how you could find perimeter using a piece of string by fitting it around the object, cutting it, then determining its length using a ruler or meter stick. Demonstrate how to record the perimeter using the number and standard unit of measure, e.g., 36 cm.

Provide students with various regular polygons such as squares, rectangles and triangles and some string. Invite them to determine and record the perimeter of the given shape using the string and their rulers.

Once students are comfortable finding “distance around” using a piece of string, demonstrate how each side of a given object can be measured and recorded individually using a cm ruler. Show how adding the recorded measurements will give you the perimeter of the given shape.

General Outcome: Use Direct and Indirect Measurement to Solve Problems

### Suggested Assessment Strategies

#### Performance

- Rolling for Rectangles - Students roll a pair of number cubes, using one number for the length, and the other for the width of a rectangle. Next, they form the rectangle on cm grid paper to find and record the perimeter of the rectangle. They score 1 point for each centimetre of perimeter. For example, if the perimeter is 24 cm, the score is 24 points. Students record the score and then total the points on the chart. They continue taking turns. The winner is the first player to have more than 100 points.

Rolling for Rectangles		
Name _____		
Perimeter	Score	Total
$6 + 6 + 6 + 6 =$	24	24
$3 + 5 + 3 + 5 =$	16	24 +16 40
$- + - + - + - =$	—	

(3SS5.1)

### Resources/Notes

*Math Makes Sense 3*

**Lesson 8:** Measuring Perimeter in Centimetres

3SS5

TG pp. 30 – 33

**Additional Activity:**

Blob Perimeters

TG: p. v and 61

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS5 Continued****Achievement Indicators:**

*3SS5.2 Measure and record the perimeter of a given irregular shape, and explain the strategy used.*

*3SS5.3 Construct a shape for a given perimeter (cm, m).*

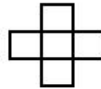
*3SS5.4 Estimate the perimeter of a given shape (cm, m), using personal referents.*

## Elaborations—Strategies for Learning and Teaching

Pentominoes may be used to illustrate this concept. Pentominoes are shapes each made up of five squares, all of which must have at least one side matching up with the side of another.



perimeter = 10 units



perimeter = 12 units



perimeter = 12 units

In addition to irregular shaped objects with straight sides, it is important to expose students to other irregular shapes such as their handprint. Working with a partner, ask students to trace around their closed hand. Using string they can outline their handprint, then cut the string to determine the perimeter of their handprint by measuring it with their ruler.

Challenge students to find someone with a handprint of the same perimeter.

Discuss with students that when constructing shapes for perimeter, they must remember that their shapes should have all square corners and be completely enclosed.

Demonstrate how this would be done using only horizontal and vertical lines, they are not to make diagonal lines through the grid squares.

Using cm grid paper, ask students to create a shape of a given perimeter.

Provide students with a playing card and ask them how they could find the card's perimeter using the width of their finger. Invite students to estimate the card's perimeter, then using a ruler find the actual perimeter and compare it to their estimate.

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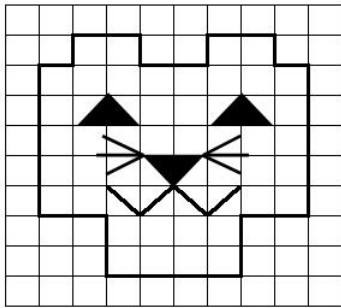
 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to determine the perimeter of a picture drawn on cm grid paper such as the one seen here.



(3SS5.2)

*Performance*

- Using cm grid paper, ask students to create three different shapes for a given perimeter. They must follow three rules:
  - Stay on the lines when you draw.
  - You must be able to cut your shape out and have it all in one piece.
  - Each shape must have a perimeter of the given length. E.g., 30 cm.
 Record the perimeter on each shape.

(3SS5.3)

## Resources/Notes

*Math Makes Sense 3***Lesson 8 (Cont'd):** Measuring Perimeter in Centimetres

3SS5

TG pp. 30 – 33

Strand: Shape and Space (Measurement)

Outcomes

*Students will be expected to*

**3SS5 Continued**

**Achievement Indicators:**

*3SS5.1 Continued*

*3SS5.2 Continued*

*3SS5.3 Continued*

*3SS5.4 Continued*

*3SS5.5 Continued*

Elaborations—Strategies for Learning and Teaching

Students have had experiences measuring using centimetres. The focus now is on metres.

Metres are used to determine the perimeter of large shapes or regions such as a window, door, or room.

Discuss with students possible strategies for determining the perimeter of the classroom. Using a metre stick and/or measuring tape demonstrate how to measure the length of each side of the room. Record the measurements as you go. Ask students what number sentence could be used to find the perimeter.

Large irregular shapes can be represented using a scale on cm grid paper (1 cm = 1 m).

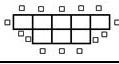
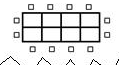
Prior to the use of the above scale for determining perimeter in metres, you may wish to use tape to outline a large irregular shape on your classroom floor (remember to use only square corners). As a group, determine the shape's perimeter in meters. (This activity could also be used in a measurement center).

Using the 1 cm = 1 m scale and cm grid paper, ask students to design 2 different floor plans for their new bedroom with a perimeter of 26 m. Remind them that their bedrooms must have square corners.

Brainstorm a list of possible referents for a meter. If students experience difficulty with this, you may suggest that a wrapping paper roll, or their arm span, is approximately 1 meter. Invite students to select a referent from the list to determine the perimeter of a given shape such as a bulletin board, a bookshelf, or a table.

Read and discuss the book *Spaghetti and Meatballs for All* by Marilyn Burns. Review Mrs. Comfort's problem in terms of perimeter. Put students in pairs. Give each pair 8 square tiles to represent tables, and 32 small cubes (from your base ten materials) to represent chairs. Ask students to make various table arrangements with the manipulatives, telling them that at least one side of each tile must touch another tile. Ask them to draw their arrangements on a recording sheet such as the one below. With each arrangement, students must record the number of guests seated, and the perimeter.

Challenge students to find the arrangements that can seat the greatest and least amount of guests. The scale and unit of measurement for recording perimeter in this activity is 1 tile side = 1 metre.

Number of Guests Seated	Table Arrangement Sketch	Perimeter
14		14 m
12		12 m

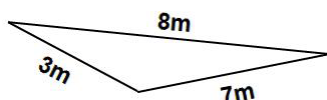
## General Outcome: Use Direct and Indirect Measurement to Solve Problems

## Suggested Assessment Strategies

*Performance*

- Shapes in the Sand - Sam and Judy were at the beach and each decided to make a shape in the sand. They measured the side lengths of each shape, and printed the lengths in the sand.

Sam drew this triangle.



Judy drew a square with each side 4 m long.

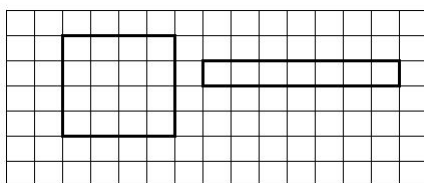
Ask students whose drawing has the greatest perimeter? Use pictures, words and numbers to explain.

(3SS5.1)

- Using a geoboard, ask students to create a rectangle with a perimeter of 14 units. Ask them to create a second rectangle of 14 units but in a different shape. (3SS5.5)

*Student-Teacher Dialogue*

- Present the student with two grid paper representations, one showing a long, skinny rectangle, and the other showing a square but both with a perimeter of 16 cm. Ask the question: Do you think it is possible for these two shapes to have the same perimeter? Ask them to explain their response.



(3SS5.5)

## Resources/Notes

*Math Makes Sense 3*

**Lesson 9:** Measuring Perimeter in Metres

3SS5

TG pp. 34 - 36

**Additional Activity:**

Art - Mosaic Design

TG pp. 35

*Math Makes Sense 3*

**Lesson 10:** Exploring Shapes with Equal Perimeters

3SS5

TG pp. 37 - 38

**Children's Literature (provided):**

Burns, Marilyn. *Spaghetti and Meatballs for All*

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS4 Demonstrate an understanding of measuring mass (g, kg) by:**

- selecting and justifying referents for the units g and kg
- modelling and describing the relationship between the units g and kg
- estimating mass, using referents
- measuring and recording mass.

[C, CN, ME, PS, R, V]

**Achievement Indicators:**

*3SS4.1 Provide a personal referent for one kilogram, and explain the choice.*

*3SS4.2 Estimate the mass of a given object, using personal referents.*

## Elaborations—Strategies for Learning and Teaching

Mass measures the amount of matter contained in an object. When introducing the concept, note that the terms ‘mass’ and ‘weight’ are similar, but they are not the same. ‘Weight’ measures how heavy an object is (measured with a scale), while ‘mass’ measures the amount of matter in an object (measured with a balance). Students should be exposed to the correct term ‘mass’. Gravity influences ‘weight’ but not ‘mass’. If you were on another planet, your weight would change but not your mass.

As with all measurement units, it is important that students have a personal reference for gram and kilogram.

Students should recognize which mass unit (gram or kilogram) is appropriate for measuring the mass of a specific item. It is helpful for students to investigate how everyday items are measured (e.g., food items). Include items which are small and dense as well as those which are large and porous.

It would be beneficial for students to have an opportunity to make a kg mass of their own. Provide students with materials (sand, pennies, flour, sugar, small cubes from base ten materials) to fill a container until it exactly balances with a 1 kg mass on a balance scale. Using this kg container they can now compare its mass to items in the classroom to help them find a personal referent for 1 kg.

The most conceptual way for students to compare the mass of two objects is to hold one in each hand, extend their arms, and experience the relative downward pull on each, effectively communicating to the student which object is closest to 1 kg.

This activity can be modelled, or completed, in groups or centers.

Once students have established a personal referent for 1 kg, they can now use their referent to estimate whether an object is heavier or lighter than 1 kg.

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General Outcome: Use Direct and Indirect Measurement to Solve Problems

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Suggested Assessment Strategies

*Paper and Pencil*

- Ask students to list five items that would be measured in grams rather than kilograms. (3SS4.1, 3SS4.2)
- Ask students to list five items they believe to be heavier than 2 kg but lighter than 10 kg. (3SS4.1, 3SS4.2)
- Ask students to draw a picture of an object that they believe to have a mass of about 5 kg. (3SS4.2)

*Student – Teacher Dialogue*

- Ask the student which seems like a more reasonable estimate for the mass of a cat – 6 kg or 6 g? Ask them to explain their choice. (3SS4.2)

Resources/Notes

*Math Makes Sense 3*

**Lesson 11:** Exploring Mass: The Kilogram

3SS4

TG pp. 39 - 40

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS4 Continued****Achievement Indicators:**

*3SS4.3 Provide a personal referent for one gram, and explain the choice.*

*3SS4.4 Match a given standard unit to a given referent.*

*3SS4.5 Explain the relationship between 1000 g and 1 kg, using a model.*

*3SS4.6 Determine and record the mass of a given 3-D object.*

*3SS4.7 Measure, using a scale, and record, using the units g and kg, the mass of given everyday objects*

## Elaborations—Strategies for Learning and Teaching

Students have explored mass using kilograms. The focus is now on measuring mass in grams.

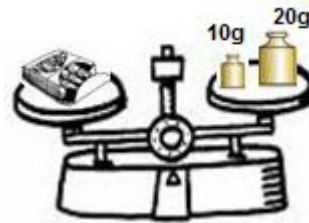
Using their understanding of kilogram, ask students to brainstorm items that may have a mass of 1 gram by using the small cube as a reference. You may wish to provide students with an item such as a raisin, bean seed, jelly bean, paper clip, etc., to conceptualize the sense of how a gram feels.

Using objects from the classroom as referents, ask students to identify whether the object is an appropriate reference for grams or kilograms (e.g. a counter, a raisin, a paper clip, a textbook, a sneaker, a lunch box, etc.)

Using food items of various benchmark masses (e.g., 2 bags of 500 g, 4 boxes or 250 g, or you may wish to have a pre-counted bag of 1000 jellybeans) model how 1000 g is equal to 1 kg using a balance scale.

Once students have established a personal referent for 1 g, they can now use their referent to estimate the mass of common objects such as an eraser, an apple, a juice box, a novel, etc.

Model how a balance scale and standard masses can be used to determine the mass of everyday objects. Provide a variety of objects for students to use as they explore measuring mass.



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 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Journal*

- Provide students with the following prompts:  
 Could you eat 1 kg of cantaloupe? 1 kg of popcorn? Explain your thinking.  
 If sliced meat sells for \$3.50/g, is it expensive? Explain your thinking.  
 (3SS4.4)

*Performance*

- Grocery Flyer Collage - Using grocery store flyers ask students to cut, paste, and sort items that are sold in grams and kilograms onto construction paper or bristol board creating a collage of the items chosen. (3SS4.4)
- Let's Go Shopping - Using grocery flyers, ask students to select at least 3 items totalling as close to 1000 g or 1 kg as possible. They can cut and paste their selected items on a paper bag. Ask students to record their thinking on the other side of the bag. (3SS4.4)
- Lightest to Heaviest - Ask students to choose 5 objects of varying masses. Ask them to use their best estimate to draw the objects in order from lightest to heaviest on a chart as seen below. Students use a balance scale and standard masses of g and kg, to determine the actual mass of all 5 objects. They then write the actual mass of each object and draw them again in the correct order from lightest to heaviest on the chart.

	Lightest → Heaviest				
My Estimate	1.	2.	3.	4.	5.
Actual Mass	1. Mass ____	2. Mass ____	3. Mass ____	4. Mass ____	5. Mass ____

(3SS4.6, 3SS4.7)

## Resources/Notes

*Math Makes Sense 3***Lesson 12:** Exploring Mass: The Gram

3SS4

TG pp. 41 – 43

**Additional Activity:**

How Many Grams

TG: p. v and 62

## Strand: Shape and Space (Measurement)

## Outcomes

*Students will be expected to*

**3SS4 Continued****Achievement Indicators:**

*3SS4.8 Provide examples of 3-D objects that have a mass of approximately 1 g, 100 g and 1 kg.*

*3SS4.9 Determine the mass of two given similar objects with different masses, and explain the results.*

*3SS4.10 Determine the mass of an object, change its shape, re-measure its mass, and explain the results.*

## Elaborations—Strategies for Learning and Teaching

With the mass of a gram being so small, it is important to provide students with opportunities to work with masses of varying benchmark sizes in an effort to develop a conceptual understanding for working with grams and kilograms. (A shoelace has a mass of 1 g, a nickel has a mass of about 5 g, a rod has a mass of about 10 g, or 10 rods could be used to show 100 g, etc.).

Determine and record the mass of two similar items such as a ping pong ball and a golf ball. Ask students to explain why two objects that appear to be so similar can have different masses. (A ping pong ball is made of lighter material, is hollow, and intended to move short distances, whereas a golf ball is made of heavier material, is solid, and intended to travel long distances.).

Using manipulatives such as modelling clay or multilink cubes, ask students to create shapes and then measure their mass. Then ask them to change the shape of their creation using the exact same material and measure its mass again. This activity can be done individually, in partners, or used in a center.

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 General Outcome: Use Direct and Indirect Measurement to Solve Problems
 

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## Suggested Assessment Strategies

*Student–Teacher Dialogue*

- Display a set of five objects of similar size, and a sixth target object. Ask students to sort them into groups with masses less than and greater than the target. (This assessment may also be done with a pan balance). (3SS4.9)
- Ask students to explain why the mass of an object does not change if you change its shape. (3SS4.10)
- Ask students to find a small but heavy item. Then ask them to find a large but lighter item. Ask them to check to see if the small object is heavier than the large object, using a pan balance. (3SS4.9)

*Journal*

- Provide students with the following prompt: Given two objects, why can you not tell which is heavier only by looking at it? Give an example of objects to support your answer. (3SS4.9)
- Provide students with the following prompt: Do bigger objects always have greater mass than smaller objects? Explain your thinking. E.g., a pillow and a book bag that is full. (3SS4.9)

## Resources/Notes

*Math Makes Sense 3*

**Lesson 12 (Cont'd):** Exploring Mass: The Gram

3SS4

TG pp. 41 – 43

