CCGPS Frameworks Student Edition

Mathematics

Second Grade Unit Three
Understanding Measurement, Length, and Time

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

Unit 3: Understanding Measurement, Length, and Time

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OVERVIEW

In this unit students will:

- Know the following customary for measuring length: inch, foot, yard
- Recognize the need for standard units of measure
- Use rulers and other measurement tools with the understanding that linear measure involves an iteration of units.
- Recognize that the smaller the unit is, the more iterations they need to cover a given length.
- Know the following metric units for measuring length: centimeter and meter
- Compare the relationship of one unit of measurement to another, within the same system
- Check by measuring to determine if estimates are accurate for length
- Determine the appropriate tool for measuring length; inch ruler and yardstick, centimeter ruler, and meter stick
- Tell time to the nearest five minutes
- Understand the relationship of hours and days
- Understand the importance and usefulness of reasonable estimations
- Connect the whole-number units on rulers, yardsticks, meter sticks and measuring tapes to number lines showing whole-number units starting at 0
- Use these measuring tools to model different representations for whole-number sums and differences less than or equal to 100 using the numbers 0 to 100.
- Be able to represent the length of several objects by making a line plot

Second graders are transitioning from measuring lengths with informal or nonstandard units to measuring with these standard units: inches, feet, centimeters, and meters. The measure of length is a count of how many units are needed to match the length of the object or distance being measured. Students have to understand what a length unit is and how it is used to find a measurement. They need many experiences measuring lengths with appropriate tools so they can become very familiar with the standard units and estimate lengths. Use language that reflects the approximate nature of measurement, such as the length of the room is about 26 feet.

Chapter 8 in *Teaching Student Centered Mathematics* by John A. Van de Walle focuses on measurement. Revisiting/Reading this chapter provides information about measurement and how young children learn measurement skills.

Have students measure the same length with different-sized units then discuss what they noticed. Ask questions to guide the discussion so students will see the relationship between the size of the units and measurement, i.e. the measurement made with the smaller unit is more than the measurement made with the larger unit and vice versa.

Insist that students always estimate lengths before the measure. Estimation helps them focus on the attribute to be measured, the length units, and the process. After they find measurements,

have students discuss the estimates, their procedures for finding the measurements and the differences between their estimates and the measurements.

STANDARDS FOR MATHEMATICAL CONTENT

Measure and estimate lengths in standard units.

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Relate addition and subtraction to length.

MCC2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.

MCC.2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

Work with time and money.

MCC.2.MD.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

Represent and Interpret Data.

MCC2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a **line plot**, where the horizontal scale is marked off in whole-number units.

MCC2.MD.10 Draw a picture graph and a bar graph (with single- unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems[1] using information presented in a bar graph.

STANDARDS FOR MATHEMATICAL PRACTICE

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Students are expected to:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson*****

ENDURING UNDERSTANDINGS

- Measurement is a consistent duration and distance.
- The length of objects can be measured using customary units (inch, foot, yard).
- The length of objects can be measured using Metric units (centimeter, meter).
- The length of time can be measured using standard units (seconds, minutes, hours, and days).
- An analog clock can be used to tell time to the nearest five minutes.
- Relationships of one unit to another may be compared by measuring an object with each unit. For example: something that measures 17 inches could also be expressed as 1 foot 5 inches.
- A reasonable estimate is one that is close to the actual measurement.
- An inch or centimeter would be a good unit to measure small items such as the length of a pencil.
- A yard or meter would be an appropriate unit to use when measuring the length of a large item, such as the classroom.
- A ruler, yardstick, and a meter stick are special types of number lines (they show fractions, too).
- A ruler, yardstick, and a meter stick are tools used for linear measurement.
- Line plots are useful tools for collecting data because they show the number of things along a numeric scale.
- A number line has evenly spaced points corresponding to the numbers.

ESSENTIAL QUESTIONS

- How can we decide on appropriate units of measurement (i.e. inch, foot, yard, centimeter, meter, seconds, minutes, hours, days)?
- Why is it important for us to know how to measure different objects using different tools of measurement?
- How can we tell if an estimate is reasonable?
- How does using a different unit change our measurement?
- Why do we need to be able to estimate a measurement or value?
- Why is it important for us to know how to measure different units of measurement?
- How can counting by five help us to determine time in an hour?
- What does telling time to the nearest five minutes mean?
- How can we determine the number of hours in a day?
- How does a line plot help me share my data?
- How can using a number line help us when we are solving math problems?
- Why is it important to be able to organize and graph data?
- How do you know what type of graph to use?

CONCEPTS/SKILLS TO MAINTAIN

It is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

In Grade 1, instructional time focused on four critical areas:

- Developing understanding of addition, subtraction, and strategies for addition and subtraction within 20;
- Developing understanding of whole number relationships and place value, including grouping in tens and ones;
- Developing understanding of linear measurement and measuring lengths as iterating length units; and
- Reasoning about attributes of, and composing and decomposing geometric shapes.

Routine topics such as counting, time, money, positional words, patterns, and tallying should be addressed on an ongoing basis through the use of calendars, centers, and games. Organizing and graphing data as stated in MCC.MD.10 should be incorporated in activities throughout the year. Students should be able to draw a picture graph and a bar graph to represent a data set with up to four categories as well as solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Specifically, it is expected that students will have prior knowledge/experience related to the concepts and skills identified below. It may be necessary to pre-assess in order to determine if time needs to be spent on conceptual activities that help students develop a deeper understanding of these ideas.

- Fluency with single digit addition/subtraction facts to 20
- Duration and sequence of events
- Fact families
- Fractions: halves, fourths
- Tally marks
- Picture graphs, bar graphs
- Estimation: to the nearest ten
- Telling time to the nearest hours and half-hours
- Measurement – estimating, comparing, and ordering
- Basic geometric figures and spatial relationships

SELECTED TERMS AND SYMBOLS

The following terms and symbols are often misunderstood. These concepts are not an inclusive list and should not be taught in isolation. However, due to evidence of frequent difficulty and misunderstanding associated with these concepts, instructors should pay particular attention to them and how their students are able to explain and apply them.

The terms below are for teacher **reference only and are not to be memorized by the students**. Teachers should present these concepts to students with models and real life examples. Students should understand the concepts involved and be able to recognize and/or demonstrate them with words, models, pictures, or numbers.

- **analog clock**
- **bar graph**
- **centimeter**
- **digital clock**
- **estimate**
- **foot**
- **hour**
- **inch**
- **line plot**
- **measuring tape**
- **meter**
- **meter stick**
- **minute**
- **number line diagram**
- **penny**

- **picture graph**
- **ruler**
- **standard unit**
- **yardstick**

STRATEGIES FOR TEACHING AND LEARNING

(Information adapted from North Carolina DPI Instructional Support Tools)

Measure and estimate lengths in standard units.

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Instructional Strategies

Second graders are transitioning from measuring lengths with informal or nonstandard units to measuring with these standard units: inches, feet, centimeters, and meters. The measure of length is a count of how many units are needed to match the length of the object or distance being measured. Students have to understand what a length unit is and how it is used to find a measurement. They need many experiences measuring lengths with appropriate tools so they can become very familiar with the standard units and estimate lengths. Use language that reflects the approximate nature of measurement, such as the length of the room is about 26 feet.

In order for students to have a better understanding of the relationships between units, they need to use measuring devices in class. The number of units needs to relate to the size of the unit. They need to discover that there are 12 inches in 1 foot and 3 feet in 1 yard. Allow students to use rulers and yardsticks to discover these relationships among these units of measurements. Using 12-inch rulers and yardstick, students can see that three of the 12-inch rulers, which is the same as 3 feet since each ruler is 1 foot in length, are equivalent to one yardstick. Have students record the relationships in a two column table or t-charts. A similar strategy can be used with rulers marked with centimeters and a meter stick to discover the relationships between centimeters and meters. Present word problems as a source of students' understanding of the relationships units of measurement.

Have students measure the same length with different-sized units then discuss what they noticed. Ask questions to guide the discussion so students will see the relationship between the size of the units and measurement, i.e. the measurement made with the smaller unit is more than the measurement made with the larger unit and vice versa.

Insist that students always estimate lengths before they measure. Estimation helps them focus on the attribute to be measured, the length units, and the process. After they find measurements, have students discuss the estimates, their procedures for finding the measurements and the differences between their estimates and the measurements.

Relate addition and subtraction to length.
MCC2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.

MCC.2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

Instructional Strategies
Connect the whole-number units on rulers, yardsticks, meter sticks and measuring tapes to number lines showing whole-number units starting at 0. Use these measuring tools to model different representations for whole-number sums and differences less than or equal to 100 using the numbers 0 to 100.
Use the meter stick to view units of ten (10 cm) and hundred (100 cm), and to skip count by 5s and 10s.
Provide one- and two-step word problems that include different lengths measurement made with the same unit (inches, feet, centimeters, and meters). Students add and subtract within 100 to solve problems for these situations: adding to, taking from, putting together, taking apart, and comparing, and with unknowns in all positions. Students use drawings and write equations with a symbol for the unknown to solve the problems.
Have students represent their addition and subtraction within 100 on a number line. They can use notebook or grid paper to make their own number lines. First they mark and label a line on paper with whole-number units that are equally spaced and relevant to the addition or subtraction problem. Then they show the addition or subtraction using curved lines segments above the number line and between the numbers marked on the number line. For 49 + 5, they start at 49 on the line and draw a curve to 50, then continue drawing curves to 54. Drawing the curves or making the ―hops‖ between the numbers will help students focus on a space as the length of a unit and the sum or difference as a length.

Work with time and money.
MCC.2.MD.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

Instructional Strategies
Second graders expand their work with telling time from analog and digital clocks to the nearest hour or half-hour in Grade 1 to telling time to the nearest five minutes using a.m. and p.m.
As students continue to practice telling time (orally and in writing) using both analog and digital clocks they should also be encouraged to use the terms a.m. and p.m. Teachers should help

students make the connection between skip counting by 5s (CCGPS.2.NBT.2) and telling time on an analog clock.

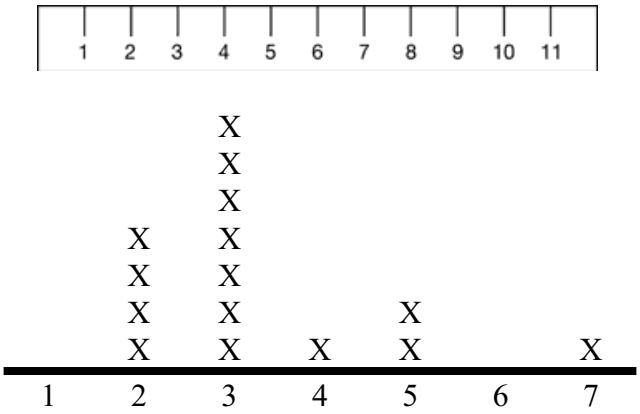
Represent and Interpret Data.
MCC2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.

MCC2.MD.10 Draw a picture graph and a bar graph (with single- unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Instructional Strategies

Standard MCC2.MD.9 calls for students to represent the length of several objects by making a line plot. Students should round their lengths to the nearest whole unit.

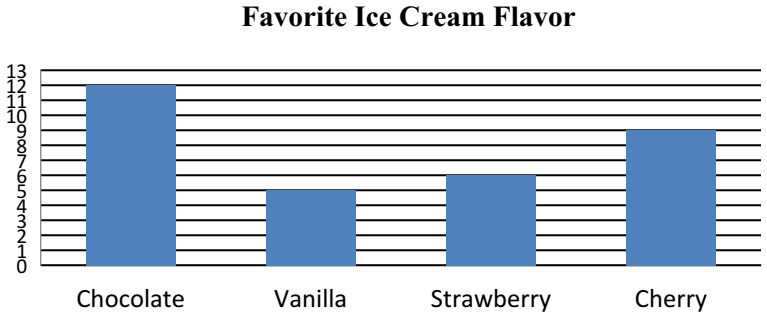
Example: Measure objects in your desk to the nearest inch, display data collected on a line plot. How many objects measured 2 inches? 3 inches? Which length had the most number of objects? How do you know?

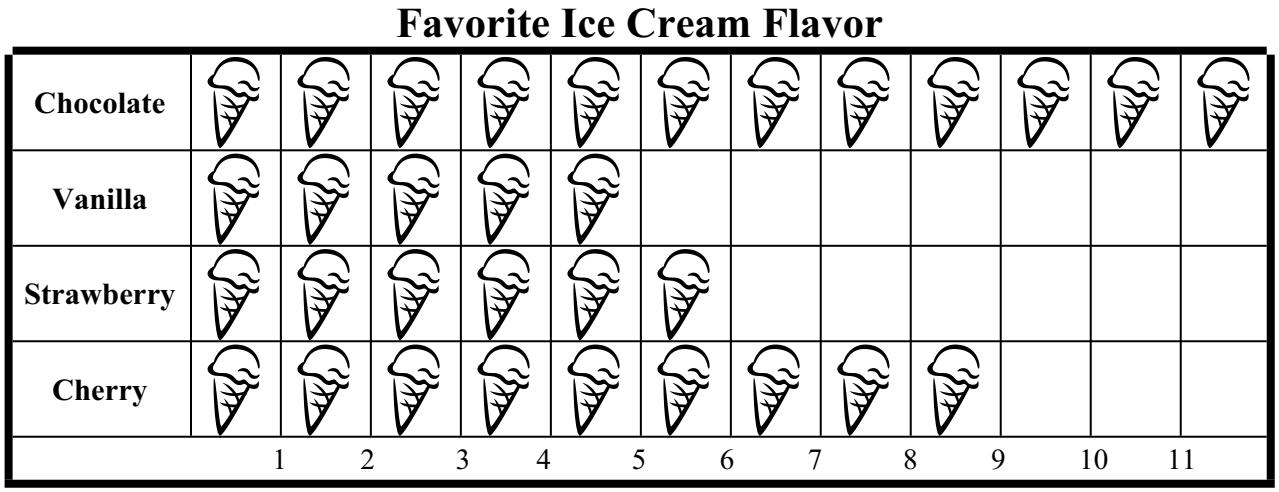


At first students should create real object and picture graphs so each row or bar consists of countable parts. These graphs show items in a category and do not have a numerical scale. For example, a real object graph could show the students' shoes (one shoe per student) lined end to end in horizontal or vertical rows by their color. Students would simply count to find how many shoes are in each row or bar. The graphs should be limited to 2 to 4 rows or bars. Students would then move to making horizontal or vertical bar graphs with two to four categories and a single-unit scale.

Flavor	Number of People
Chocolate	12
Vanilla	5
Strawberry	6
Cherry	9

Students display their data using a picture graph or bar graph using a single unit scale.





As students continue to develop their use of reading and interpreting data it is highly suggested to incorporate these standards into daily routines. It is not merely the making or filling out of the graph but the connections made from the date represented that builds and strengthens mathematical reasoning.

EVIDENCE OF LEARNING

By the conclusion of this unit, students should be able to demonstrate the following:

- Standard units for measuring length (inch, foot, yard, centimeter, and meter).
- Measuring items with two different units makes it possible to determine the relationship of the two different units.
- Estimated lengths should be reasonably close to the actual measurement.
- Appropriate tools should be used to measure length.

- Tell time to nearest 5 minutes and using a.m. and p.m.
- Create, read, and interpret a line plot graph.
- Use a number line to help solve problems using addition and subtraction.
- Use addition and subtraction within 100 to solve word problems about length.
- Represent lengths on a number line.

TASKS

The following tasks represent the level of depth, rigor, and complexity expected of all second grade students. These tasks or a task of similar depth and rigor should be used to demonstrate evidence of learning. It is important that all elements of a task be addressed throughout the learning process so that students understand what is expected of them.

Scaffolding Task	Constructing Task	Practice Task	Performance Task
Tasks that build up to the task constructing task.	Constructing understanding through deep/rich contextualized problem solving tasks.	Games/activities	Summative assessment for the unit.

Task Name	Task Type/ *Grouping Strategy*	Content Addressed
Measuring Pets	Scaffolding Task Large group, small group	Linear Measurement
My Big Feet	Scaffolding Task Large group, small group	Linear Measurement
Snails and Lizards	Constructing Task *Large Group, Small Groups*	Linear Measurement
Measurement Scavenger Hunt	Constructing Task *Large Group, Partners*	Linear Measurement
Measurement Line Plot	Constructing Task *Small Groups*	Linear Measurement, Graphing
Kangaroo Jumps	Constructing Task *Large Group, Small Groups*	Linear Measurement
Giant Measurements	Practice Task *Small Groups*	Linear Measurement
I Spy	Constructing Task *Small Groups*	Linear Measurement
Solving Problems on a Number Line	Constructing Task *Small Groups*	Linear Measurement
Time, Time and More Time	Constructing Task *Small Groups*	Telling Time

Missed Bedtime	Performance Task *Whole Group/Partners*	AM and PM, duration of time, problem solving
Performance Task: Measurement Olympics	Performance Task *Partners*	Linear Measurement & Time
Performance Task: Lizards, Lizards, Everywhere!	Performance Task *Individual*	Linear Measurement, Graphing

As this unit has no Culminating Task, you may pair/modify tasks to include all unit standards in combination.

Scaffolding Task: Measuring Pets

(Approximately 1-2 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measure measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

It is important to recognize this is the first time students are using standard units of measure; therefore the first few tasks address non-standard and standard units of measure. We are building the understanding that measurement is a consistent distance or duration. **It is highly recommended that you follow these tasks in the order presented, so that students recognize the need for a consistent unit of measure and the importance of using standard units of measure.**

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 226)

"For most attributes that are measured in elementary schools, it is possible to have physical models of the units of measure. Time and temperature are exceptions. Unit models can be found for both informal units and standard units. For length, for example, drinking straws (informal) or tagboard strips 1 foot long (standard) might be used as units.

The most easily understood use of unit models is actually to use as many copies of the unit as are needed to fill or match the attribute measured. The length of the room could be measured with giant footprints by placing tagboard copies of the footprint end to end, completely "covering" the length of the room. It is somewhat more difficult to use a single copy of a unit in an iteration process. For the footprint example, one footprint could be placed down and then moved to take the space of the second footprint, and so on. However, not only is this more difficult for younger children, but it also obscures the meaning of measurement- to see how many units will fill the length."

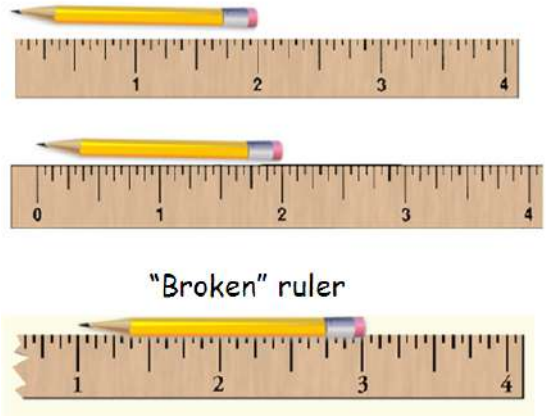
This standard associated with this task calls for students to measure the length of objects in both customary (inches and feet) and metric (centimeters and meters). Students should have ample experiences choosing objects, identifying the appropriate tool and unit, and then measuring the object. The teacher should allow students to determine which tools and units to use.
Foundational understandings to help with measure concepts:

- Understand that larger units can be subdivided into equivalent units (partition).
- Understand that the same unit can be repeated to determine the measure (iteration).
- Understand the relationship between the size of a unit and the number of units needed (compensatory principle).
- Understand the measuring of two-dimensional space (area) using non-standard units.

When some students see standard rulers with numbers on the markings, they believe that the numbers *are counting the marks instead of the units or spaces between the marks*. Have students use informal or standard length units to make their own rulers by marking each whole unit with a number in the middle. They will see that the ruler is a representation of a row of units and focus on the spaces.

Some students might think that they can only measure lengths with a ruler starting at the left edge. Provide situations where the ruler does not start at zero. For example, a ruler is broken and the first inch number that can be seen is 2. If a pencil is measured and it is 9 inches on this ruler, the students must subtract 2 inches from the 9 inches to adjust for where the measurement started.

Students are first introduced to standard linear measurement in second grade; therefore they will need many experiences to learn how to use the ruler correctly. It is important to show students how to accurately use the ruler when it begins at 0, as well as when it begins at the end of the ruler. It is important to expose students to both types and give them practice with both types of rulers. Research tells us that students see rulers with hash marks as counting numbers instead of the units (or spaces) between the marks. This is what will be helpful as they are exposed to experiences like the "broken" ruler. It is important for students to develop an understanding of length (measure) even when the starting point varies. Students should begin to understand that a ruler is a representation of a consistent row of units.



ESSENTIAL QUESTIONS

- Why is it important for us to know how to measure different objects using different tools of measurement?
- Why is it important for us to know how to measure different units of measurement?

MATERIALS

- *Measuring Penny* by Loreen Leedy or similar book
- Colored construction paper
- Scissors
- Glue
- Rulers
- Nonstandard units of measurement found in the classroom

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I
Gather students together and discuss the different sizes of dogs and other pets of the students. Ask the students to compare the sizes of different breeds (Jack Russell versus Greyhound). *Are all dog noses/tails/ears the same length? How would you compare the dogs' sizes/lengths? Which dogs do you think have the longest/shortest noses/tails/ears? Will the dog with the longest tail have the longest nose?* It is important to include discussions about the difference in length and height.

Tell the students the book, *Measuring Penny*, is about a girl who wants to measure her dog Penny and compare it to other dogs in the park. Read the book aloud to the students. *Please note*

that the book discusses elapsed time and other concepts not appropriate for this task. The nose, tail, ears, paw prints, height, and how far dogs can jump are all measurements taken in the book.

After reading the book, ask the students to give examples of other nonstandard units that could be used to measure the dogs (based on items found in the classroom). Students are expected to say things like erasers, pencils, paper clips, etc. Another example would be measuring a dog's height by the number of hands tall, like what is done when measuring horses. Assign students a partner or let them choose a partner. Distribute the student task sheet of rectangles and squares, scissors, rulers, and glue to the students. Instruct the students to work with their partners to cut out 10 to 15 rectangles, some of which may be squares! *The various sizes will be beneficial when the students begin comparing the sizes/lengths of their dog's measurements with the measurements. This way the class can still discuss which body part is the longest/shortest/widest/thinnest.* Use the cut-out shapes to create a "measure dog." The students should name their new pet. Remind the students to include a body, nose, tail, legs, and ears. Be sure that the squares and rectangles touch and then glue the "measure dog" to a solid sheet of construction paper.

Part II
Once each student has created their "measure dog", have them choose nonstandard units found at their desks and in the classroom to measure their dog's height and the lengths of its body parts. These nonstandard units could include paperclips, crayons, erasers, etc. Have the students record these measurements on a chart.

Have some students share their dog's nonstandard measurements. Choose a specific body part, like the tail, and ask several students for their lengths. Record these on the board. The nonstandard units should vary. Ask the students about comparing these measurements. *Is it easy to compare paperclips to erasers? How do you know which length is longer when they are measured with different materials? Can two pencils actually be longer than ten paper clips?* Ask the students if there is a better way to measure lengths if they want to compare them. The students should suggest that they all need to use the same unit, a standard unit—i.e. an inch. (The students may suggest other units like centimeters and feet.)

Ask the students to use their ruler to re-measure their "measure dog" lengths to the nearest inch. Have them record these measurements on the same sheet of paper as their nonstandard measurements. Ask the students to share their new results with their neighbor. Record the standard unit measurements of the same students' lengths next to the nonstandard measurements on the board. Ask the students about comparing the standard unit measurements. *Is it easier to compare the lengths now that they are all in inches? Now can you tell me which is longer/shorter? When all the measurements were in a standard unit, did any of the lengths surprise you? Were there any lengths that you thought would have been shorter/longer?* Ask similar comparison questions for other body parts.

Part III
Review length and measurement and why standard units are important for comparison. Have students share their explanations. Students should mention that it is hard to compare lengths when they use different standards of measurement. Some expected students responses are: we need to use the same units of measure so we can know how long everyone's dog is; we need to use the same units of measure (standard units) so we can compare. Students can demonstrate what they know by accurately giving a measurement with a nonstandard unit and also measure their dogs with rulers (standard units) correctly. Possible student suggested examples: it is difficult to compare 10 erasers and 3 pencils. Instead it is much easier to tell that 10 inches is bigger than 9 inches.

FORMATIVE ASSESSMENT QUESTIONS

- How would you compare the dogs' sizes/lengths?
- Do you think all the dogs will have the same noses/tails/ears?
- Is it easy to compare paperclips to erasers?
- How do you know which length is longer when they are measured with different materials?
- Can two pencils actually be longer than ten paper clips?
- Is it easier to compare the lengths now that they are all in inches?
- When all the measurements were in a standard unit, did you discover anything?
- Were there any lengths that you thought would have been shorter/longer? Why?

DIFFERENTIATION

Extension

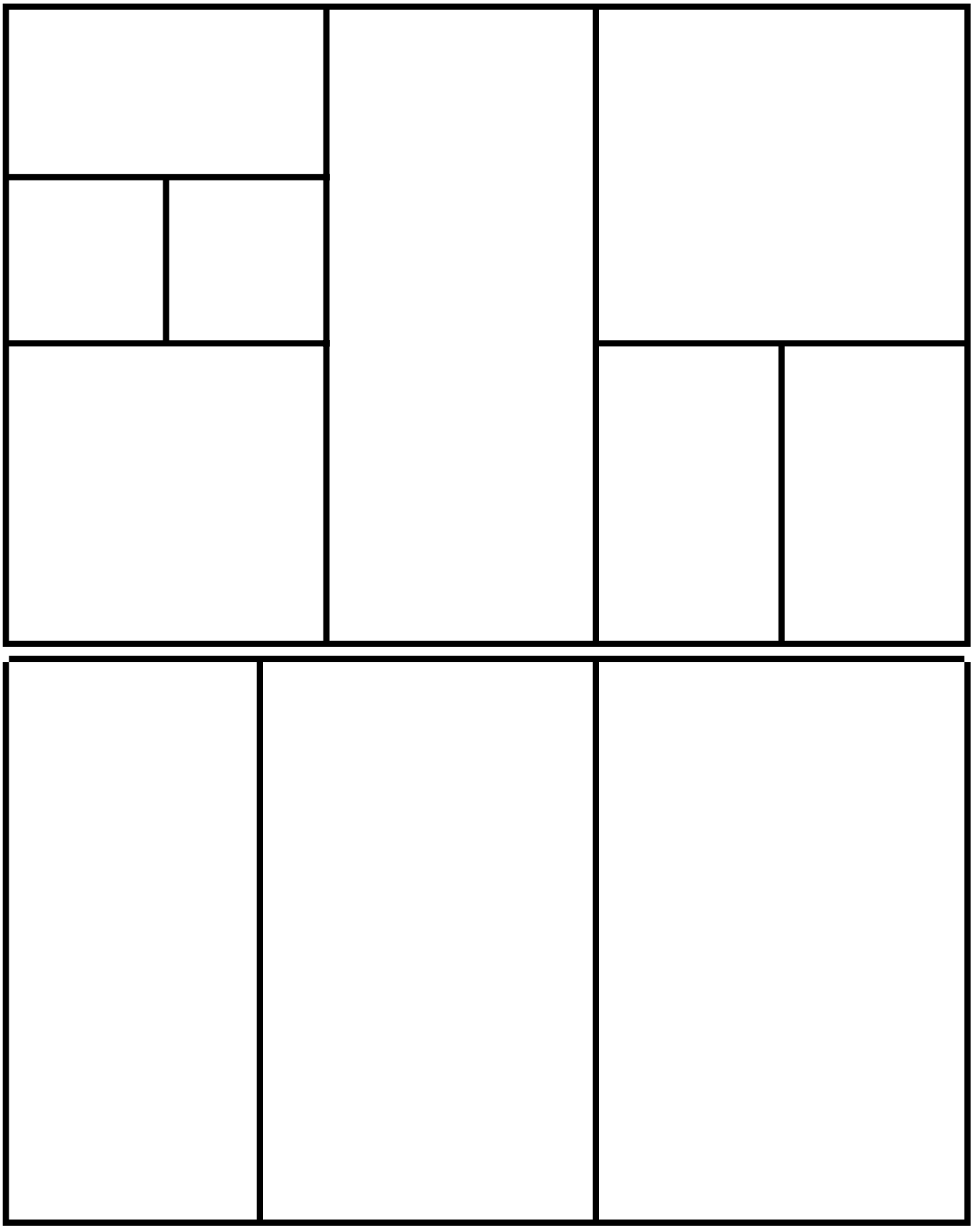
- Working in pairs, use different size dog bones and let students measure with those as the two different non-standard units and compare measurements. Have students construct viable arguments to support why their unit of measurement was the best choice critique the reasoning of others.

Intervention

- This lesson is very hands on and tactile. Allowing time for struggling students to make connections with the mathematics of the lesson is crucial. Involve these students in the discussion as much as possible, paying close attention to them as they work through the activity.
- See also activities 8.1, 8.2, 8.3 in *Teaching Student Centered Mathematics* by John A. Van de Walle.

Measuring Pets

Name _____



Measuring Pets

Name: _____

Body Part	Nonstandard Unit: _____ Measure	Inches Measure

Scaffolding Task: My Big Feet

Approximately 1 Day (This task was adapted from "How Big is a Foot?", http://illuminations.nctm.org)

STANDARDS FOR MATHEMATICAL CONTENT

MCCMD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
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5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

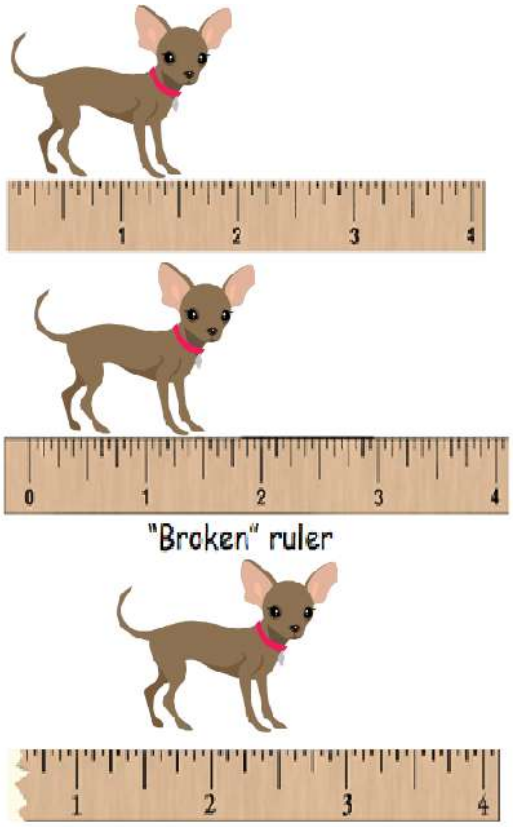
BACKGROUND KNOWLEDGE

It is important to recognize this is the first time students are using standard units of measure; therefore the first few tasks address non-standard and standard units of measure. We are building the understanding that measurement is a consistent distance or duration. **It is highly recommended that you follow these tasks in the order presented, so that students recognize the need for a consistent unit of measure and the importance of using standard units of measure.**

***For additional background, see Measuring Pets task.**

Students are first introduced to standard linear measurement in second grade; therefore they will need many experiences to learn how to use the ruler correctly. It is important to show students how to accurately use the ruler when it begins at 0, as well as when it begins at the end of the ruler. It is important to expose students to both types and give them practice with both types of rulers. Research tells us that students see rulers with hash marks as counting numbers instead of

the units (or spaces) between the marks. This is what will be helpful as they are exposed to experiences like the "broken" ruler. It is important for students to develop an understanding of length (measure) even when the starting point varies. Students should begin to understand that a ruler is a representation of a consistent row of units.



ESSENTIAL QUESTIONS

- Why do we need to be able to estimate a measurement or value?
- Why is it important for us to know how to measure different units of measurement?

MATERIALS

- *How Big Is a Foot?* by Rolf Myller or similar book
- Butcher paper: about 6' x 3' piece for each group
- Pencils or markers
- Rulers
- Making Beds activity sheet (one per student)

GROUPING

Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Tell students the story of the king who wants his carpenter to make a bed for his queen, but it's a challenge to make sure the bed is the right size and to figure what to measure it with.

Create a list of questions the apprentice would have to answer in order to be able to make the bed. Discuss the things that have to happen in order to measure a bed.

For example:

- Is it for an adult or a child?
- Is it for 1 person or 2 people?
- Is the person big or small?
- Do they sleep diagonally or vertically? (The bed has to be longer than the person is tall and wider the person is, etc.).
- What would you estimate is the length and the width of your bed at home, what would you use to find this out? How did you come up with your estimate?
- What other questions would you want to ask?

Read the book, *How Big Is a Foot?* or similar book to the students. Tell students that they will have the chance to explore some of the things that happened in the story with their classmates. Ask students to explain why the bed created by the apprentice was not what the King expected.

Part II

To begin, divide students into groups of 4. (If this is not possible, groups of 3-5 will work). Within the group, roles should be assigned for the following tasks. Roles can be combined based on the number of group members.

- The Foot (the person whose foot will be traced)
- Tracer (this person will trace The Foot's foot).
- Recorder
- Speaker (will report results to the class).
- Measurer (this person will measure the finished bed in both The Foot's feet and with a ruler).
- Checker (checks the group's work to make sure that there is agreement with the results found).

After assigning roles, the groups should:

- Trace the Foot's foot end-to-end on the butcher paper to make two sides of a bed that is 6 footprints long and 3 footprints wide. Modeling this for the students may be helpful, or have a pre-made sample of what you would like the finished product to look like.
- After all groups finish tracing their "beds" hang them up in the front of the room so that a comparison discussion can take place.

Discuss individual students' responses to the tasks. In particular, ask the students:

- "Why do you think a standard unit of measure was invented?" Student responses might include the idea that a standard unit of measurement is more reliable than everyone using their own footprint to measure length. "What problems do you think measuring with a nonstandard unit would cause?"

Part III

After the class has had a discussion using the nonstandard units, have students work in pairs to create a bed using a 12 inch ruler. This is a good time to demonstrate how to appropriately measure. Expose students to rulers that begin at zero and rulers that leave a small space before zero. This is not to mislead students, but rather to keep them from creating misconceptions that all rulers begin at the edge. See the Background Knowledge portion for further explanation.

Each group will create a bed that is 6 feet long and 3 feet wide. Once each has created their bed, hang all the beds at the front of the room to compare.

FORMATIVE ASSESSMENT QUESTIONS

- How do we line up our rulers to measure correctly?
- Why is it important for us to know how to measure different objects using different tools of measurement?
- How can we tell if an estimate is reasonable?
- Why do we need to be able to estimate a measurement or value?
- Why is it important for us to know how to measure different units of measurement?
- Is there a time when you could use a nonstandard unit of measure?

DIFFERENTIATION

Extension

- Students could create a bed using yardsticks to measure without given dimensions. How many yards long should the bed be? How many yards wide?
- Students could calculate the number of inches long a bed with a length of six feet would be? How many inches wide would a bed be that is 3 feet wide?

Intervention

- Have students use multiple copies of a foot to measure. Some students struggle with keeping the ending point while they move their unit of measurement. This causes inaccurate measuring. If students have multiple copies, or multiple rulers, they would be able to hold one in place while they moved the other.

Constructing Task: Snails and Lizards

(Approximately 2-3 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information adapted from Mathematics Common Core State Standards and Model Curriculum, Ohio Department of Education Teaching)

Students should have experience measuring the length of the same object using different tools (ruler with inches, ruler with centimeters, a yardstick, or meter stick). This will help students learn which tool is more appropriate for measuring a given object. They describe the relationship between the size of the measurement unit and the number of units needed to measure something. For instance, a student might say, “The longer the unit, the fewer I need.”

Estimation helps develop familiarity with the specific unit of measure being used. To measure the length of a shoe, knowledge of an inch or a centimeter is important so that one can approximate the length in inches or centimeters. Students should begin practicing estimation with items which are familiar to them (length of desk, pencil, favorite book, etc.).

Some useful benchmarks for measurement are:

- First joint to the tip of a thumb is about an inch
- Length from your elbow to your wrist is about a foot
- If your arm is held out perpendicular to your body, the length from your nose to the tip of your fingers is about a yard

ESSENTIAL QUESTIONS

- How can we decide on appropriate units of measurement (i.e. inch, foot, yard)?
- Why is it important for us to know how to measure different units of measurement?
- How do I know if an estimate is reasonable?
- Why do we need to be able to estimate a measurement or value?

MATERIALS

- *Twelve Snails to One Lizard* by Susan Highower or similar book
- Class set of twelve-inch rulers
- 6-8 yard sticks
- Ribbon for making snakes, iguanas, and snails (it is recommended to not use yarn as it stretches and can complicate the lesson as the students measure items)

GROUPING

Large Group, Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Read *Twelve Snails to One Lizard* by Susan Hightower or similar book to the class. Have the children measure items such as the ones in the story using a nonstandard type of measurement unit like the student's feet. For example, have everyone measure the length of the classroom using their feet (or review from prior tasks where this was discussed). Ask questions such as "Did all of you get the same measurement? Why or why not? Can you explain why this happened? Is there a way to measure our classroom and not get so many difference answers? Is there a tool we can use besides our own feet?" At this point, you would want to refer back to the previous task, *My Big Foot.* Discuss the story and identify the problem and solution.

Part II

Students measure the distance across the room and record their measurements. They will hopefully ask which measurement to use for this distance. Invite student discussion on the appropriate unit (foot and yard) to use and why. Help to guide the discussion of why inch would not be the best unit for this measurement. After measurements are completed, groups will share

their findings. Let students discuss/argue rationale for foot and yard as better choices for measurement of the classroom.

Part III
Use ribbon to make snakes that are exactly thirty six inches long (one yard), iguanas that are twelve inches long (1 foot) and snails that are exactly one inch long. Teacher should make yard sticks available or have a measuring table where students could use pre-marked place on table to measure and cut their ribbon. The group will create one of each animal and explain the relationship of the three. This may be done through a journaling activity or chart that the group creates. The teacher should be sure to provide conversations about the standard measurement vocabulary of inch, foot and yard.

Please note: Encourage the groups to show how many snails it takes to equal one snake to avoid inaccurate measurements.

Students should answer questions (using math journal) such as:

- Which is the smallest unit of measurement? Largest?
- How many snails does it take to equal the length of an iguana? How many iguanas does it take to equal the length of a snake?

Part IV
(This portion should be done on the next day to allow the student to fully comprehend the unit comparisons)

As a class, generate a list of items that the students think are one inch, one foot and one yard in length. Then give each student a twelve inch ruler and divide class into groups of three students. Students should locate an item that is approximately one inch long, an item that is one foot long and an item that is one yard long. (All three students must work together to measure a yard by putting their three twelve inch rulers together). Then have students find items that are shorter and/or longer than one inch, one foot, and one yard. Bring students back together and discuss the items they located in these measurements. Facilitate discussion on comparisons of the items and their measurements.

Part V
Students should choose one item that is longer than their snake or 1 yard. Measure the object and record the measurements. The measurements should be done to nearest whole unit. At this point students are not using fractional notation so they should only be using whole units, however, this does not mean that discussion of fractional parts should be prohibited. Descriptions should include at least 2 ways to record the measurement. For example: yards and inches, feet and inches, or all inches.

FORMATIVE ASSESSMENT QUESTIONS

- Did all of you get the same measurement? Why or why not?
- Can you explain why this happened?

- Is there a way to measure our classroom and not get so many difference answers?
- Is there a tool we can use besides our own feet?
- How do we determine the smallest unit of measure? How do you know?

DIFFERENTIATION

Extension

- Have students measure other items and make comparisons. Write about the comparisons in their math journal using comparison symbols >, <, =.

Intervention

- Provide students with a piece of adding machine tape that is one inch, one foot, and one yard, so they can visually see the difference in each unit of measurement. Then have them use the inch piece to determine how many inches it takes to make a foot. Do the same for how many feet are in a yard. By using adding machine tape, students can see the measurements more clearly. They may choose to mark it on the paper in different colors or cut the paper.

Name_____

Snakes and Lizards

Measurement	1 inch	1 foot	1 yard
Approximately			
Longer			
Shorter			

Constructing Task: Measurement Scavenger Hunt

(Approximately 2 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

Students should begin to understand that a ruler is a representation of a consistent row of units. Students should have experience measuring the length of the same object using different tools (ruler with inches, ruler with centimeters, a yardstick, or meter stick). This will help students learn which tool is more appropriate for measuring a given object. They describe the relationship between the size of the measurement unit and the number of units needed to measure something. For instance, a student might say, “The longer the unit, the fewer I need.” Multiple opportunities to explore provide the foundation for relating metric units to customary units, as well as relating within customary (inches to feet to yards) and within metric (centimeters to meters). . The more students work with a specific unit of measure, the better they become at choosing the appropriate tool when measuring.

Estimation helps develop familiarity with the specific unit of measure being used. To measure the length of a shoe, knowledge of an inch or a centimeter is important so that one can

approximate the length in inches or centimeters. Students should begin practicing estimation with items which are familiar to them (length of desk, pencil, favorite book, etc.).
For additional information on measurement read chapter 8 in ***Teaching Student Centered Mathematics*** by John A. Van de Walle.

Using the table for this task is optional because students need to learn to independently draw and record their work for three reasons:

- Standard of Mathematical Practice 2: Reason abstractly and quantitatively
- Standard of Mathematical Practice 3: Construct viable arguments and critique the reasoning of others.
- Standard of Mathematical Practice 4: Model with Mathematics

ESSENTIAL QUESTIONS

- How can we decide on appropriate units of measurement (i.e. inch, foot, yard, centimeter, meter)?
- Why is it important for me to know how to measure different objects using different units of measurement?

MATERIALS

- Ribbons (it is recommended to not use yarn as it stretches and can complicate the lesson as the students measure items)
- Rulers with inches and centimeters markers
- Scissors
- *Inch by Inch* by Leo Lionni or similar book
- *Optional: measuring tapes*

GROUPING

Large Group, Partner

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Gather students together and ask questions such as: Where have you seen a worm? What did it look like? Does anyone know what an inch worm is? What does it look like? How long is it? What is an inch? Can anyone show me something that is about one inch long, wide, or thick? What are some ways to measure length? Make a chart or list on the board with student responses. Tell students that you are going to read a story about an inch worm who likes to measure different things. Read a book like *Inch by Inch* by Leo Lionni.

Part II
Students will work with a partner to cut ribbons into the following lengths: 5 inches, 5 centimeters, 10 inches, 10 centimeters. Students will measure various objects in room and record in a math journal (sample recording table is provided)

****Having the students create their recording sheet would better provide them practice with the standards for mathematical practice. See Background Knowledge for further explanation.****

Strings	Equal to	Less than	Greater Than	Not Equal/but close
String 1 (5 cm.)				
String 2 (5 in.)				
String 3 (10 cm.)				
String 4 (10 in.)				

Allow the children to estimate, measure, and record data for each string with their partner. As the groups are working, look to see that the children are correctly measuring and recording. *After they have completed their chart students will need to reflect on how they measured and estimated.* Students should use math vocabulary in their writing about this activity. Partners will then share findings with the class by creating a poster with their strings, measurements, and recording chart and present it to the class.

Teachers can create a chart similar to one shown on the right to show all of the information described above.

Part III
Have each student estimate the length and/or height of body parts. This information should be recorded in inches and centimeters on individual student task sheets.

- Thumb
- Index finger
- Arm
- Hand
- Foot
- Leg
- Head (Circumference and the height)
- Body (length)

Students should work in pairs to measure their body parts using ribbon. This will allow students to accurately measure round items (such as your head) and the use the ruler to measure the ribbon. Students record their data on their task sheet. After students have measured, bring them together as a class. Have students record their findings on a large class chart. Discuss results of student findings. Students then graph data from one interesting example. Closure should include review the concepts of inch and foot, centimeter and meter, and the relationships. The teacher could close this task by holding up different objects and asking students to estimate the object's length in both systems of measurement.

FORMATIVE ASSESSMENT QUESTIONS

- What unit of measurement are you using? Why?
- When you measure using a ruler or tape measure, how do you place the item so you can get the most accurate measurement?

DIFFERENTIATION

Extension

- Use the web site and choose the level of difficulty http://onlineintervention.funbrain.com/measure/index.html
- Have students create a scavenger hunt within your classroom and have students guess what they can find that is of a particular length.
- Have students find and measure objects that are of a certain length.
- Home activity: Measure, graph, and compare someone at home.

Intervention

- Have students only measure items that can be measured using the ruler. This will keep students from having to use the ribbon.
    - Thumb
    - Index finger
    - Arm
    - Hand
    - Foot
    - Leg
    - Body (length)

Name _____

Measurement Scavenger Hunt

Body Part	Estimate (inches)	Actual Measurement (inches)	Estimate (centimeters)	Actual Measurement (centimeters)
Thumb				
Index finger				
Arm				
Hand				
Foot				
Leg				
Body (length)				

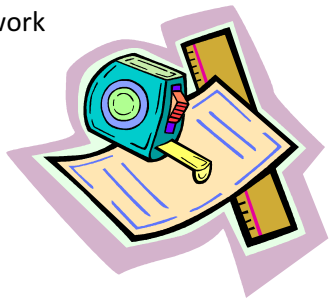
What is different about your measurements and your partner's?

_____

_____

_____

_____



Constructing Task: Measurement Line Plot

(Approximately 1 Day)

STANDARDS FOR MATHMATICAL CONTENT

CCGPS.2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

CCGPS.2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 321)

"Bar graphs or picture graphs are useful for illustrating categories of data that have no numeric ordering- for example, colors or TV shows. When data are grouped along a continuous scale, they should be ordered along a number line. Examples of such information include temperatures that occur over time, height or weight over age, and percentages of test takers scoring in different intervals along the scale of possible scores."

Line plots are useful tools for collecting quantitative data because they show the number of things along a numeric scale. They are made by simply drawing a number line then placing an X above the corresponding value on the line that represents each piece of data. Line plots are essentially bar graphs with a potential bar for each value on the number line. This standard calls for students to represent the length of several objects by making a line plot. Students should round their lengths to the nearest whole unit.

ESSENTIAL QUESTION

- How does a line plot help me share data?

MATERIALS

- Ruler
- Paper

GROUPING

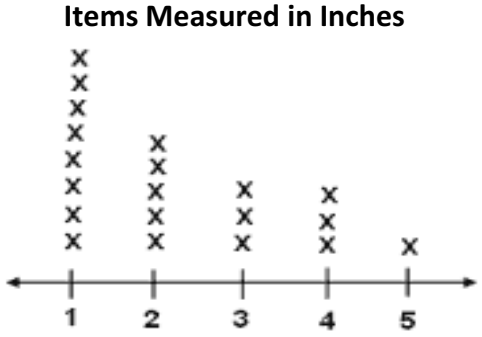
Small Group or Partners

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Gather the students on the classroom rug and discuss previous lessons on measuring. Ask a child to remind the class about using a ruler and the correct way to measure items. For this task the students will be measuring 10 items that are smaller than their ruler. Pair up the students and have them go about the classroom and measure 10 items that are smaller than their ruler. **For this task they will be measuring each of the 10 items in inches *and* in centimeters so they can create two separate line plots.** They should record the item and its measurement on paper or in their math journal.

After the groups have made their list of 10 items, have them all join you back on the classroom rug. Randomly call on some groups to give you some examples of items they measured. List these items on chart paper and record their measurement both in centimeters and in inches. After listing some ask them if they know how to graph these measurements. Accept both yes and no responses and any ideas they have. After getting some ideas from the students, share with them what a line plot graph is and its purpose.
As a group, model how to create a line plot graph using their inch measurements. See graphic below for help. To make a line plot, a number line is drawn and an X is made above the corresponding value on the line for every corresponding data element. After graphing the inch measurements lead the students back to their partners to create their separate line plot graph using their centimeter measurements.
After the students have created their centimeter line plot graphs, give them time to share their graphs with another group. Let them list the similarities and differences in their graphs in their math journals.

Sample Line Plot Graph:



FORMATIVE ASSESSMENT QUESTIONS

- What numbers did you use on your line plot graph? Why?
- What can you tell me about the information on your graph?

DIFFERENTIATION

Extension

- Let some students measure using centimeters. This might lead them to make their line plot graph quite large in terms of the measurements.
- Have students find items larger than a foot.

Intervention

- Give the students a recording sheet that already has a number line on it so that they can label the numbers and put the X for each measurement.

Constructing Task: Kangaroo Jumps

(Approximately 2 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.

MCC2.MD.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, page 322)

Students should begin to understand that a ruler is a representation of a consistent row of units. Students should have experience measuring the length of the same object using different tools (ruler with inches, ruler with centimeters, a yardstick, or meter stick). This will help students learn which tool is more appropriate for measuring a given object. They describe the relationship between the size of the measurement unit and the number of units needed to measure something. For instance, a student might say, "The longer the unit, the fewer I need." Multiple opportunities

to explore provide the foundation for relating metric units to customary units, as well as relating within customary (inches to feet to yards) and within metric (centimeters to meters). The more students work with a specific unit of measure, the better they become at choosing the appropriate tool when measuring.

Estimation helps develop familiarity with the specific unit of measure being used. To measure the length of a shoe, knowledge of an inch or a centimeter is important so that one can approximate the length in inches or centimeters. Students should begin practicing estimation with items which are familiar to them (length of desk, pencil, favorite book, etc.).

For additional information on measurement see chapter 8 in Teaching Student Centered Mathematics by John A. Van de Walle.

One way to organize the data collected within this task is to use a bar graph or a line plot. Bar graphs are widely used and many students find them easy to read. One type of graph that students may have less exposure to is a line plot graph.

"*Line plots* are useful *counts* of things along a numeric scale. To make a line plot, a number line is drawn and an X is made above the corresponding value on the line for every corresponding data element. One advantage of a line plot is that every piece of data is shown on the graph. It is also a very easy type of graph for students to make. It is essentially a bar graph with a potential bar for every possible value. A simple example is shown in Figure 11.6." Van de Walle, *Teaching Student Centered Mathematics, K-3 pg 322*

ESSENTIAL QUESTIONS

- How can we decide on appropriate units of measurement (i.e. inch, foot, yard)?
- Why is it important for me to know how to measure different objects using different tools of measurement?
- Why is it important to be able to organize and graph data?

MATERIALS

- Rulers with inches and feet, centimeters and meter
- Student task sheet

GROUPING

Large Group, Small Groups (four)

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

Gather students together in your classroom meeting area. Brainstorm a list of ways we get from place to place without a vehicle. Some examples are: run, walk, hop, jump etc. Then concentrate student's attention to a discussion on the word jump. Create a word web of animals that jump. If kangaroo is not an animal they share, then lead them to name this animal. Explain to them, "Today we will do some jumping like the kangaroo!" Have someone demonstrate a kangaroo jump.

Explain to the students they are going to measure their jumps from a standing position five times. Place the students in groups of four. Ask children to record their information on the task sheet chart. They will need to decide on the unit of measurement (centimeters, inches, feet, or meter) and fill that in on the task sheet. Students will come up with the rules for the jumping. (Do they start with toes on the starting line? Are they going to measure to the heel or the toes of the foot once they have landed? Will there be a practice jump or will the first jump count?)The distance jumped can be marked with a piece of chalk or tape. Children will record their information on the task sheet. Students should estimate jump distance before measuring the distance.

Students might start out using a unit of measurement and then decide they want to change their unit. They might come to ask you, as the teacher, if this is ok. You can use this at your closing of the lesson letting that group share why they asked that and what they changed to for the task. You can allow them to change the unit BUT they need to be questioned about how they will record that data on the graph. (Watch them discuss this as you might see them convert the measurements or start all over). Either choice is another great thing to discuss at closing.

**You might want to *tell* them what to do if they come to this problem...it is imperative that you allow this mathematical discussion to take place between them as a group and you simply listen and watch.

As indicated by the Mathematical Practice Standards, this type of mathematical discourse should be the goal of every task.

Students order their jumps from longest to shortest on the back of the task sheet. After students have completed their chart, lead them in a discussion about how measuring in various units is different, which is more practical for this experiment, why they think this way, and how many inches are in a foot, centimeters are in a meter?

Part II
Students will work together in their group to create a line plot to display the information from their jumps**.** After groups have created their graphs demonstrating their data for their jumps, they should create 3-5 questions that can be answered using the line plot. The teacher may ask students to trade graphs with another group and answer questions created. Student's graph and questions should be presented to the class. Guide students in discussion about comparisons between graphs.

FORMATIVE ASSESSMENT QUESTIONS

- How do I know if an estimate is close to the actual measurement?
- Why do we need to be able to estimate a measurement or value?
- How do you organize the data from your jumps?
- How do you use a line plot? What can you tell using your line plot.

DIFFERENTIATION

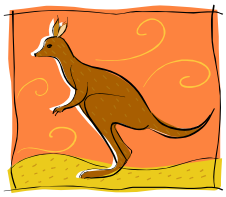
Extension

- Challenge students to add up all the jumps together to see how far the group jumped. Challenge them to tell how many inches it would be all together, and how many feet it would be.
- As a group create two line plots, one of the longest jump everyone did and another one the use the longer from each person.

Intervention

- Students can lay rulers in a line to measure the jumps if they are having a difficult time measuring lengths that are larger than one foot.
- Students can also use measuring tapes to help them measure distances longer than a foot.

Kangaroo Jumps!



Name _____

Jump #	Unit _____	Estimate before jumping	Estimate after jumping	Actual Measurement of jump
1				
2				
3				
4				
5				

Create 3 number sentences using your data.

1._____

2._____

3._____

Write three statements about your data.

4._____

5._____

6._____

Practice Task: Giant Measurements

(Approximately 2-3 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 228-230)

"Length is usually the first attribute students learn to measure. Be aware, however, that length measurement is not immediately understood by young children. At the kindergarten level, children should begin with direct comparisons of two or more lengths.

It is important to compare lengths that are not in straight lines. One way to do this is with string or rope. Students can wrap string around objects in a search for things that are, for example, as long around as the distance from the floor to their belly button or as long as the distance around one's head or waist. Body measures are always fun.

The temptation is to carefully explain to students how to use these units to measure and then send them off to practice measuring. This approach will shift students' attention to the procedure

(following your instruction) and away from developing an understanding of measurement using units."

ESSENTIAL QUESTIONS

- How can I determine appropriate tools of measurement?
- Why is it important for me to know how to measure different objects using different tools of measurement?

MATERIALS

- *Jim and the Beanstalk* by Raymond Briggs or similar book
- Butcher paper
- Index cards
- Crayons, markers, colored pencils
- Ribbon
- Measurement tools

GROUPING

Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I
Read a book like *Jim and the Beanstalk* by Raymond Briggs to the class. Discuss giants, the concept of size for humans and for giants, and how they might be different. As a class, make a chart of estimations on what the giant's height might be, how big his waist might be, and how long the length of his foot might be. It would be helpful to refer back to body measurements portion of the ***Measurement Scavenger Hunt*** task. Estimations of the giant's measurements could be done in both inches and centimeters so children could see that the number of centimeters would be much larger than the number of inches.

Part II
Students will work in groups of 3-4 to create the different giant body parts based on feet and yard measurements. Students should use butcher paper to create giant's body parts.

Use these measurements for giant:

- Head- 2 feet across
- Neck-1 foot across
- Body/Torso-1 yard long
- Arms-2 yards long
- Legs-3 yards, 5 inches long

- Hands (with fingers) - 1 foot long
- Feet (with toes) – 2 feet, 1 inch long

Once all groups have cut, colored and decorated their giant body parts, piece them together to create a class giant. Allow groups to check other groups' measurements.

FORMATIVE ASSESSMENT QUESTIONS

- Is it possible to record all of our giant's measurements in one unit? *Some parts have been measured in feet, while others were measured in yards.*
- Would it be possible to use just one of the units?

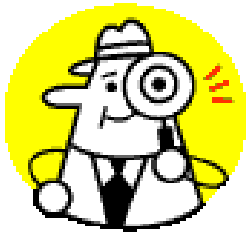
DIFFERENTIATION

Extension

- Give students different measurements and have them construct giants in groups. Students could make a giant's foot from construction paper and discover how many foot lengths it takes to go to various locations in the school and graph the results. They could then compare the giant's foot to their foot in an organized table.
- Have the students write their observations about the size of the giant in their journal. Encourage them to list comparisons between the size of the giant and themselves, items in the classroom, etc.

Intervention

- Students could use modified measurements that aren't as large. Perhaps their measurements are of the sizes no larger than 2 feet.



Constructing Task: I Spy

(Approximately 2 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson. *****

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 225-226)

"The first and most critical goal is for students to understand the attribute they are going to measure. When students compare objects on the basis of some measureable attribute, that attribute becomes the focus of the activity. For example, is the capacity of one box more than, less than, or about the same as the capacity of another? No measurement is required, but some manner of comparing one volume to the other must be devised. The attribute of "capacity" (how much a container can hold) is inescapable.

Many attributes can be compared directly, such as placing one length directly in line with another. In the case of volume or capacity, some indirect method is probably required, such as filling one box with beans and then pouring the beans into another box. Using a string to

compare the height of a wastebasket to the distance around is another example of an indirect comparison. The string is the intermediary. It is impossible to compare these two lengths directly."

ESSENTIAL QUESTIONS

- Why is it important for me to know how to measure different objects using different units of measurement?
- Why do we need to be able to estimate a measurement or value?
- How does using a different unit change our measurement?

MATERIALS

- Measurement tools – rulers, yardsticks, meter sticks
- chalk
- *I Spy* student task
- Measurement cards
- Class set of construction paper

GROUPING

Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I
Gather students together on the class meeting area. The teacher will ask a question like, "What in this room is 10 inches long?" In cooperative groups students need to agree on an object they think is 10 inches long. They may remember some items from previous tasks, encourage this discourse. Take time to allow groups to share what object they predicted. Then measure it to see what the actual length is and discuss the difference in each group's prediction and the actual measurement. The students complete the "I Spy" task chart for various measurements collaboratively with group members. They will put a (+) or (-) amount in the difference column to show if the object is more (+) or less (-) than the estimate. If the estimation and actual measurement are the same, put a zero in the difference column. Use the data to figure out which group made the most accurate object-estimates.

Part II
Students will work together to cut out all the Measurement Cards. As a small group they will be placing their measurement cards in order but they will be allowed to decide if they will be placing their cards in order from largest to smallest or smallest to largest. As a small group they will work to create each of the lengths. This can be done by marking their measurements using chalk on the sidewalk. Each group should use the appropriate measurement tools to measure out each length; they should not work towards converting the measurement cards into the same unit.

Exposing the students to a variety of units will help them to decide which measurement tool is needed and it will create an opportunity for discussing how different units affect the length. Students should paste their measurement cards in order onto construction paper, making sure to label their paper either "largest to smallest" or "smallest to largest".

FORMATIVE ASSESSMENT QUESTIONS

- How did you choose that item as an estimate for the measurement?
- Was your estimate close? How close?
- How did you use what you know to help you estimate the lengths?
- When you put the cards in order, how did you organize them?
- How do you know they are in the correct order?

DIFFERENTIATION

Extension

- Students can create their own list of measurement cards to order.

Intervention

- Students can work in partner groups to order cards.

Name: _____

I Spy

Measurement	Object	Actual Measurement	More or less than actual measurement
5 inches			
5 centimeters			
5 feet			
10 inches			
10 centimeters			
10 feet			
1 foot			
1 yard			
1 meter			
1 inch			
1 centimeter			

Measurement Cards

18 inches	5 inches	2 yards, 4 inches
25 inches	6 feet,7 inches	8 feet, 3 inches
3 feet, 2 inches	5 feet	1 foot
50 inches	10 inches	1 yard, 6 inches

Constructing Task: Solving Problems on Number Line

Approximately 1 Days from www.k-5mathteachingresources.com

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.

MCC2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, …, and represent whole-number sums and differences within 100 on a number line diagram.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

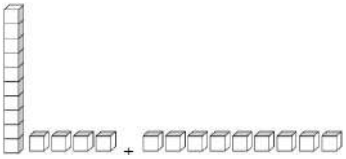
(Information adapted from Mathematics Common Core State Standards and Model Curriculum, Ohio Department of Education Teaching)

This standard applies the concept of length to solve addition and subtraction word problems with numbers within 100. Students should use the same unit in these problems.

Example: In P.E. class, Kate jumped 14 inches. Mary jumped 23 inches. How much farther did Mary jump than Kate? Write an equation and then solve the problem.

Student 1

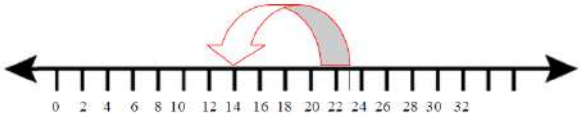
My equation is 14 + ___ = 23 since I am trying to find out the difference between Kate and Mary's jumps. I used place value blocks and counted out 14. Then I added blocks until I got to 23. I needed to add 9 blocks. Mary jumped 9 more



inches than Kate.

Student 2

My equation is 23 – 14 = ___. I drew a number line. I started at 23. I moved back to 14 and counted how far I moved. I moved back 9 spots. Mary jumped 9 more inches than Kate.



ESSENTIAL QUESTIONS

- Why is it important for us to know how to measure different objects using different tools of measurement?
- How can using a number line help us when we are solving math problems?

MATERIALS

- Measurement Problems Sheet
- Ruler
- Empty Number Lines
- Websites for Empty Number Lines
  - http://www.helpingwithmath.com/resources/oth_number_lines.htm
  - http://www.helpingwithmath.com/resources/oth_number_lines02.htm
  - http://www.math-salamanders.com/blank-number-lines.html

GROUPING

Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Using the number line and referencing the ruler as a number line itself, the students should work in groups to solve the math problems. The problems for this task should be cut apart and given to pairs to solve. As the students solve these problems the teacher should be taking note of how the students are solving the problems on the number line and the strategies they use so these can be shared at the closing of the lesson. The students should also write a problem for another group to solve. It should be explained to them that after they write the problem they should also solve their own problem to make sure they know the correct answer. These problems provide the students with some real life examples of problems that use units of measure as their context.

FORMATIVE ASSESSMENT QUESTIONS

- What range of numbers did you use on your number line? Why?

- How do you know you solved the problem correctly? Explain to me how you labeled the number line.

DIFFERENTIATION

Extension

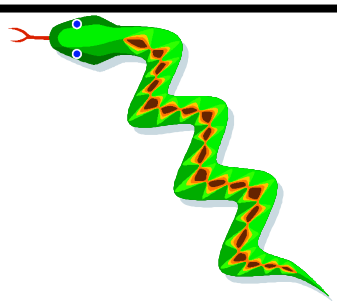
- Students could create their own multistep story problems.

Intervention

- Revisit "Where Am I on the Number Line?" from Unit 1 and "Roll Away" from Unit 2.

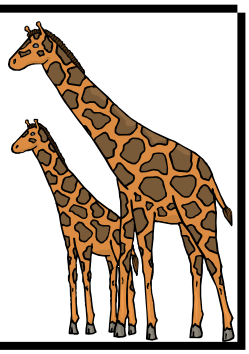
(Information adapted from k-5 Math Teaching Resources, www.k-5mathteachingresources.com)

A snake was 35 inches long. Now it is 57 inches long. How much did the snake grow?



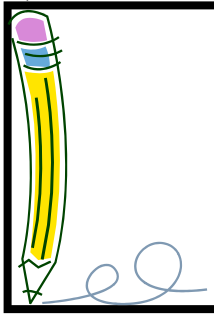
A ribbon was 50 cm long. After I cut some off 37 cm was left. How much did I cut off?

A baby giraffe was 61 inches tall. Another young giraffe was 98 inches tall. How much shorter was the baby giraffe?



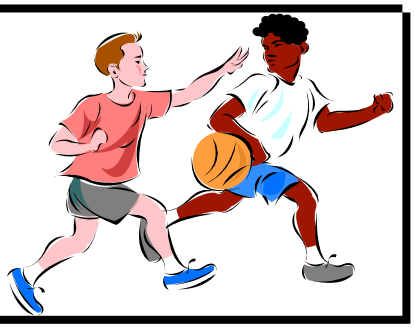
A beaver is 15 inches long. It grows 23 inches. How long is the beaver now?

(Information adapted from k-5 Math Teaching Resources, www.k-5mathteachingresources.com)



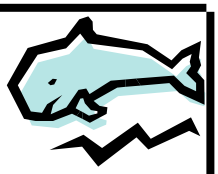
I have 3 pencils. The pencils are 17 cm, 12 cm, and 9 cm long. What is the total length of all pencils?

Ben is 48 cm tall. Mike is 13 cm taller than Ben. How tall is Mike?



A building is 60 meters tall. A tree near the building is 12 meters tall. How much taller is the building than the tree?

A whale is 78 feet long. A rhinoceros is 13 feet long. What is the difference in length between the whale and the rhinoceros?



Constructing Task: Time, Time, and More Time!

(Approximately 3 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 243)

"Young children's problems with clock reading may be due to the curriculum. Children are usually taught first to read clacks to the hour, then the half and quarter hours, and finally to 5- and 1-minute intervals. In the early stages of this sequence, children are shown clocks set exactly to the hour or half hour. Many children who can read a clock at 7:00 or 2:30 have no idea what time it is at 6:58 or 2:33.

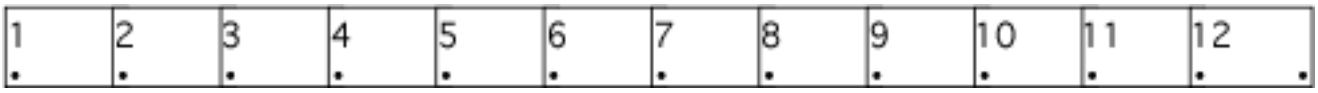
Digital clocks permit students to read times easily but do not relate times very well. To know that a digital reading of 7:58 is nearly 8 o'clock, the child must know that there are 60 minutes in an hour, that 58 is close to 60, and that 2 minutes is not a very long time. These concepts have not been developed by most first-grade and many second-grade children. The analog clock (with hands) shows "close to" times without the need for understanding big numbers or even how many minutes in an hour.

Furthermore, the standard approach to clock reading ignores the distinctly different actions and functions of the two hands. The little hand indicates broad, approximate time (nearest hour), and the big hand indicates time (minutes) before or after an hour. When we look at the hour hand, we focus on where it is pointing. With the minute hand, the focus is on the distance that it has gone around the clock or the distance yet to go for the hand to get back to the top."

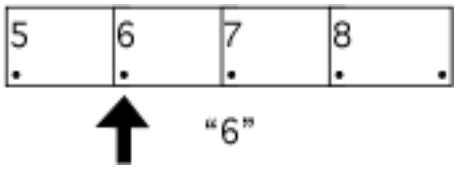
Students were first introduced to telling time in first grade. In this unit, students will build on their understanding of time by moving from telling time at the hour and half hour to telling time to the 5 minute mark. The number line is a useful way to help students understand the movement of the hands of the clock. Also, connecting the number line and the clock is helpful in developing student's number sense.

In ***Teaching Student Centered Mathematics*** by John A. Van de Walle there are many suggestions for teaching time, see pages 242-244.

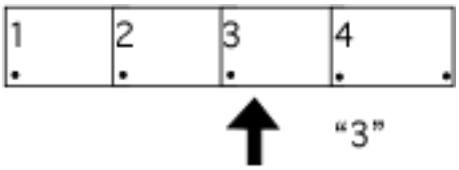
THE NUMBER-LINE CLOCK



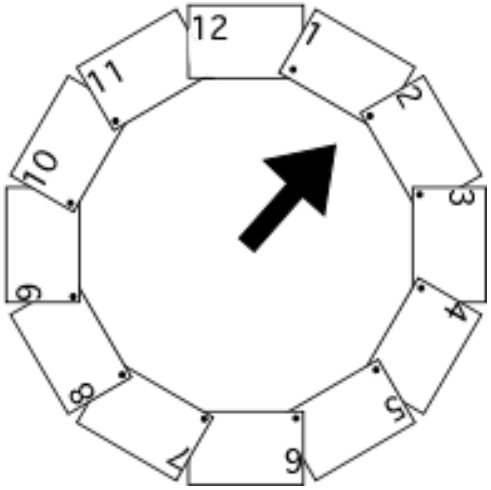
A number line clock is made up of 12 rectangles of tagboard. Punch a hole in the lower right and lower left hand corner of each card. Write the numerals 1 – 12 in black marker, one per card, in the top upper left hand corners. Use brass fastners to assemble the twelve cards to form a flexible number line.
Introduce the number line in a horizontal position by laying it on the floor, setting it in a chalk tray, or attaching it to a bulletin board. Make an arrow the same color as the numerals (black). Make the arrow short and wide. Place the arrow so it is below the line, but pointing to a specific numeral. Have students identify the numbers in order and out of order.



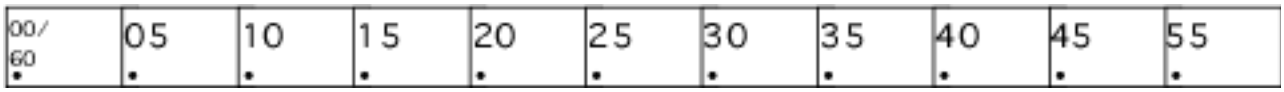
Now place the arrow between two numerals on the line. Students need to develop the understnding that the arrow continues to indicate the lesser value until the arrow arrives at the next numeral in the line.



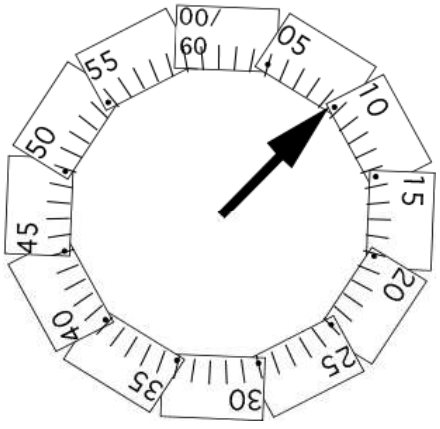
After students become proficient with the horizontal number line, connect the two ends together and arrange the numeral cards in a circlular shape. Place the "clock" on the floor or a bulletin board.



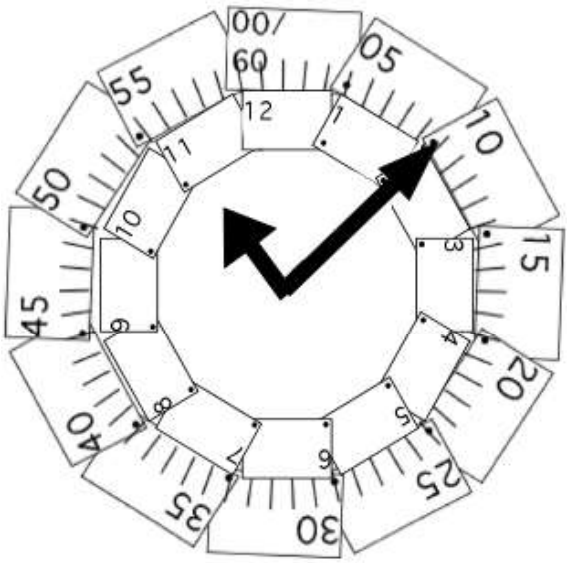
Place the arrow in the center of the circle and have the students practice reading the numeral that the arrow points toward.



Extend clock time to mintues by cutting out 12 more cards, slightly larger in length than the first set. Construct the number line using the same method as the hour number cards. Write the numerals 5 – 60/00 in a red marker in the top left corenr . Cut a longer and narrower arrow out of red construction paper. Move the arrow along the number line. First have students practice counting by 5s as you move the arrow. You can then add line segments on each card to represent minutes. One segment under the numeral, and 4 more equally spaced out on each card. Practice moving the arrow to any numeral or minute interval segment.



When students become proficient with this skill, connect the ends to make a circuler shape and practice reading the minute numerals with the long arrow in the middle of the circle.

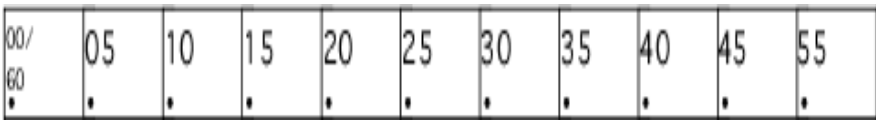


11:10

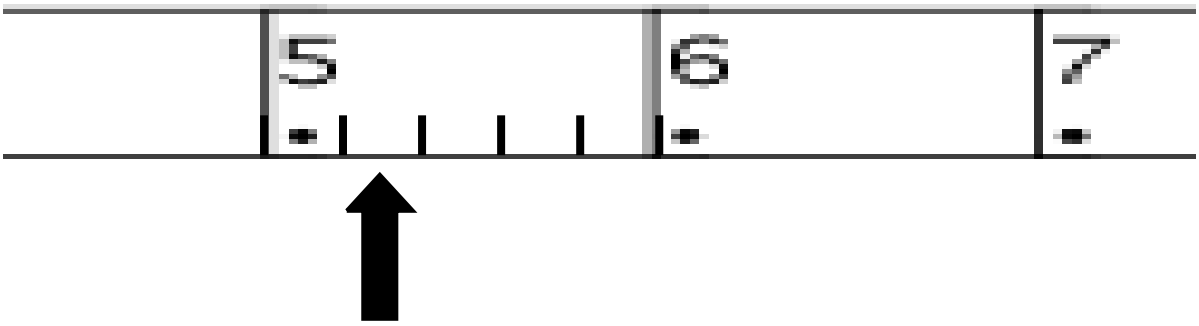
When students have had many experiences with each "clock", place the 00/60 – 55 minute clock around the outside of the 1- 12 hour clock. Use both hands to read the hour and the minute time. Also provide opportunities for students to practice moving the hands to a "digitally-printed" time on the board or flashcard: 5:35, 10:25, etc.

An Important Thought about Hours and Minutes

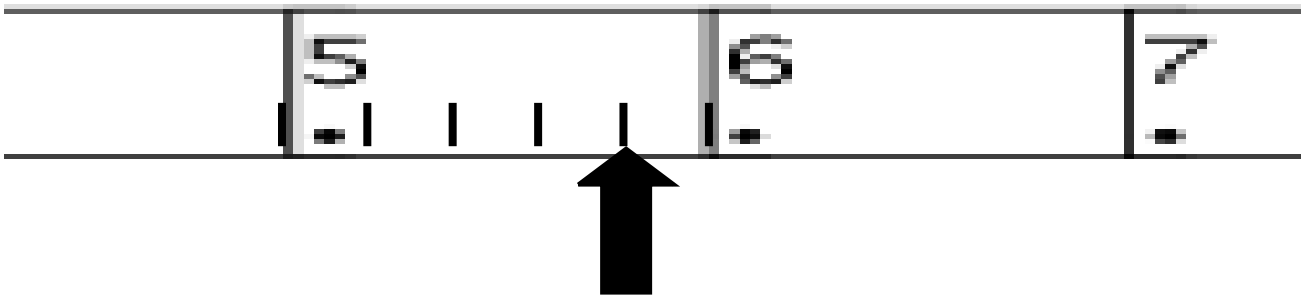
Students rarely understand that all of the sixty "minute marks" actually occur in the space of one hour traveled by the hour hand. Use the diagram below to explore this idea.



Teachers have also used clocks with only an hour hand to help students understand this concept.



Look at the arrow on the "5 o'clock segment. The hour hand has traveled 1/5 of the distance to 6:00. One-fith of 60 minutes is 12 minutes. The time is 5:12.



This hour hand has traveled almost 4/5 of the hour's distance. The time is approximately 5:45. The time is between 5:36 and 5:48.

**In 2nd Grade, students are only working to master telling time to the nearest five minutes, students are not expected to master telling time to the nearest minute or use fractional notation in reference to time. This is just content information for the teacher.

ESSENTIAL QUESTIONS

- How can counting by five help me to determine time in an hour?
- What does telling time to the nearest five minutes mean?
- How can I determine the number of hours in a day?

MATERIALS

- *The Grouchy Lady Bug* by Eric Carle or similar book
- Zippered plastic bags for time memory game storage
- Time Memory cards
- Class set of Judy Clocks
- How Long Is a Minute? task sheet
- *The Grouchy Ladybug* clock task sheet
- Brass fasteners needed for *The Grouchy Ladybug* clocks

GROUPING

Small Groups

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

This task is designed to take a few days. Students need daily experience with reading a clock and problem solving situations involving time.

Part I
Gather students together for reading of Eric Carle's *The Grouchy Ladybug* or similar book. Write the times from ***The Grouchy Ladybug*** on a large class chart and review the story. Give each child (or partners) the ladybug clock task sheet and assign each child a time from the story. Instruct them to record the activity that happened at that time. Students will cut out an analog and a digital clock, record the correct time and then write a sentence to describe what was happening in the story at that time on a large white sheet of construction paper. As the story is read a second time, each student should read his or her time aloud, lining up the sheets across the front of the room to retell the story. It would be helpful to have the class in a circle for this part of the task, so everyone can see all the pages. These pages can be put together to create a class book along with an illustration of each activity.

Part II
(Activity found from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 244)
Use two real clocks, one with only an hour hand and one with two hands. (Break off the minute hand from an old clock.) Cover the two-handed clock. Periodically during the day, direct attention to the one-handed clock. Discuss the time in approximate language. Have students predict where the minute hand should be. Uncover the other clock and check. This could be added into your classroom procedures.
Once students are familiar with predicting where the minute hand should be, then review time after the hour in 5-minute intervals. Review counting by 5's around the clock. Instead of predicting that the minute hand is pointing at the 4, encourage students to say it is about 20 minutes after the hour. As skills develop, suggest that students always look first at the little or hour hand to learn approximately what time it is and then focus on the minute hand for precision.

Part III
Students will create a time match game. The teacher should prepare 5 or more pages of the pre-made set of clock cards for the children to program with different times. Each pair of students should have the same number of digital clock cards as analog clock cards. Stress the importance of programming each pair of cards with the same time (preferably with times other than on the hour or half hour.) It is important to check the clock cards before students begin playing the match game.

Student Directions

- You and a partner will use the stack of clocks to play a memory game.
- Lay all the cards face down on the floor in an array.

- Player number 1 turns over two cards and will say the time shown on each card as it is turned over. An appropriate statement might be, "The analog clock shows 5:20. The digital clock shows 8:10."
- If both cards revealed by the first player match then the cards are picked up by the player and two more cards may be turned over.
- If the cards turned over do not match then the cards are turned face down and it becomes the second player's turn.
- Continue the game until all cards have been picked up.
- The person with the most sets of cards at the end of the game wins.

FORMATIVE ASSESSMENT QUESTIONS

- What time is it on this clock? How do you know?
- Explain to me how to tell time.
- The hour hand is in between two numbers on a clock, how do I know what time it is?

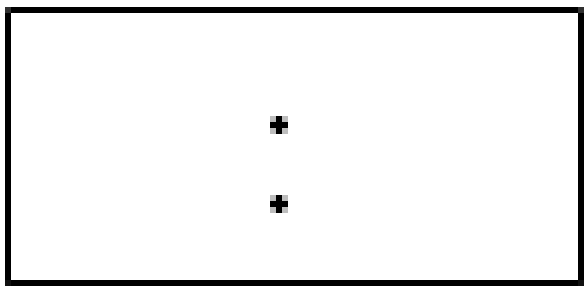
DIFFERENTIATION

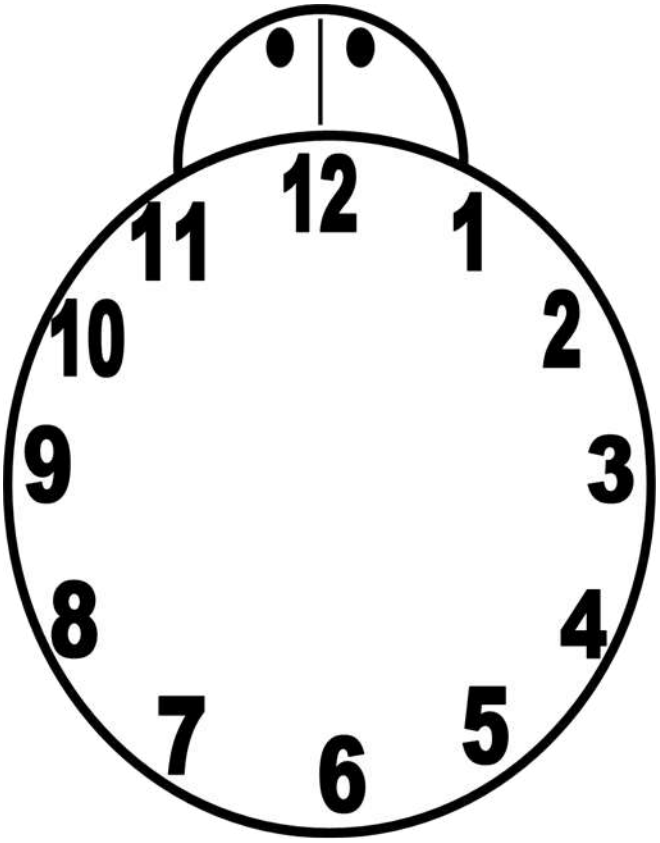
Extension

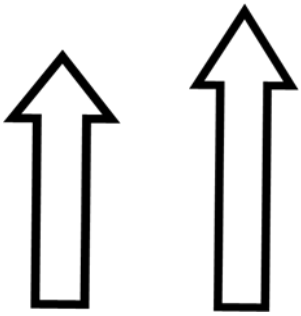
- Students can use clock times to create a story about a day on the farm, at the beach or somewhere else. This can also be link to writing by creating a story of taking on another animal/character's point of view, such as the ladybug.

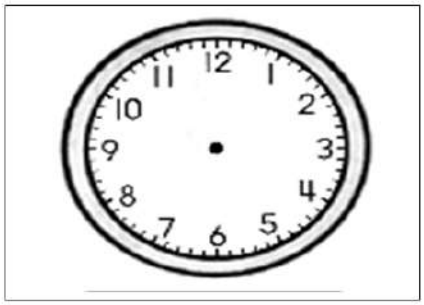
Intervention

- Have students add the one minute increments around their "Grouchy Ladybug" clock, this will allow students to count one by one.
- Allow students to use Judy Clocks or other commercially made clocks to model the time that is on the analog clock, so they can see the hands clearly. These clocks are great because they show how the hour hand and minute hand work together. They will also be able to see that when the minute hand is pointing to a number, they count by 5s to locate the minute. Students could also model the time that is on the digital clock using the Judy clock, so they will know what the analog clock will look like.
- A website that provides a CRCT computerized format of analog clocks is located at http://www.fi.edu/time/journey/JustInTIme/min-quiz.html .This quiz could be used as quick assessment of telling time.
- More telling time activities with lesson plans and games are located at http://www.fi.edu/time/journey/JustInTime/contents.html. This site offers practice on telling time to the hour, half hour, and five minute intervals.

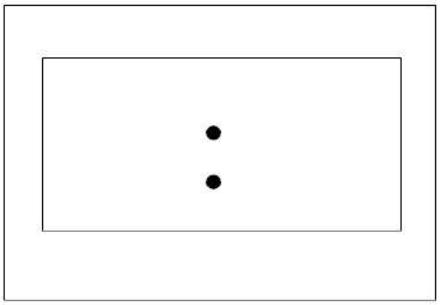




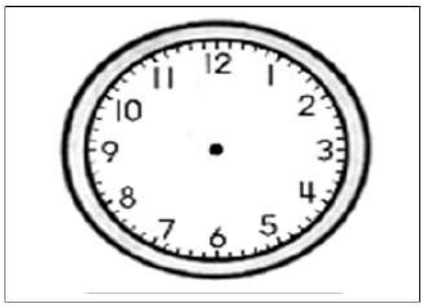




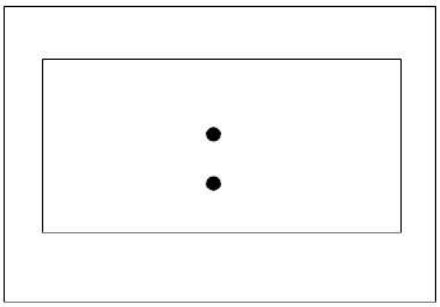
Analog Clock



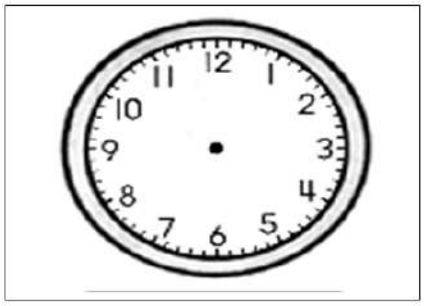
Digital Clock



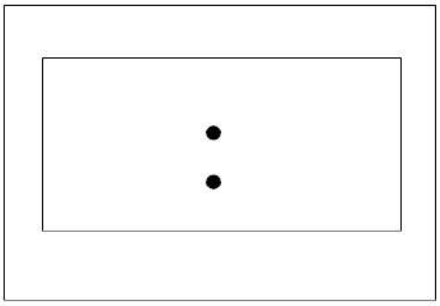
Analog Clock



Digital Clock



Analog Clock



Digital Clock

Performance Task: Missed Bedtime

Approximately 1-2 days

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

Students will need to have an understanding of the duration of time, the differences between AM and PM, and have had experiences solving problems for this task. Students should understand the importance of explaining their thinking and be able to express all of their thoughts on their task sheet through pictures, diagrams, words, and numbers.

ESSENTIAL QUESTIONS

- How do we show our thinking with pictures and words?

MATERIALS

- "Time for Bed!" Student Task Sheet
- *It's About Time!* By Stuart J. Murphy, or another similar book about time

GROUPING

Large group, individual

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Gather students together in a common area. Read *It's About Time!* by Stuart J. Murphy or another similar book about time. Discuss and model scenarios from the story by asking students to identify a time during the day (am or pm), show it on an analog clock and write it on the board as they would see it on a digital clock, and name an event that would occur during that time.

Present the following problem on a Smartboard, chart paper, document cam or overhead projector:

Julie was very grumpy at school because she had little sleep last night. She told her teacher that she went to bed long after her bed time of 8p.m. What time could Julie have gone to bed? Show the time on an analog clock and explain why you think it is the time Julie went to bed.

Discuss how this problem can be solved (using a clock, making a chart, drawing a number line, etc.) Discuss different plans for solving the problems. Allow students to share strategies such as draw a diagram, make a list, guess and check, find a pattern, create a chart, work backwards, etc.

Have students work with a partner to carry out a plan. The teacher should ask student pairs about their plan including if the plans make sense, etc. Ask questions such as: What led you to choose this particular plan? How do you know your plan makes sense? Tell me about these numbers, what do they represent? Hours, minutes, seconds, or something else?

Observe students as they work. Have the students record strategies and solutions on their paper. They should use pictures, words, and numbers to explain the solutions and justify their thinking.

After ample work time, have students share their ideas. Discuss the similar plans and the unique plans. This is an open-ended question and will have different combinations of responses. Include discussion of how each solution works.

FORMATIVE ASSESSMENT QUESTIONS

- What is your plan to solve this problem?
- How did drawing pictures help you solve this problem?
- Can you write a number sentence or use words to communicate your thinking?
- What do the numbers represent in this problem?
- What did you have to know in order to solve this problem?

DIFFERENTIATION

Extension

- Present this problem to the students:

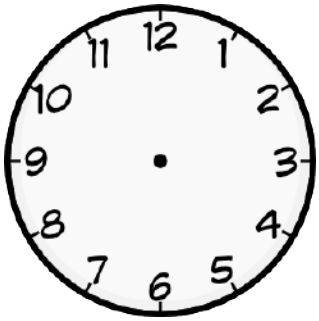
  Julie was very grumpy at school because she had little sleep last night. She told her teacher that she went to bed long after her bed time. What time do you think is her

bedtime? Why? What time could Julie have gone to bed? Show the time on an analog clock and explain why you think it is the time Julie went to bed.

Intervention

- Provide students with this problem that attaches a unit to the problem:

  Julie was very grumpy at school because she had little sleep last night. She told her teacher that she went to bed long after her bed time of 8p.m. What time could Julie have gone to bed? Show the time on an analog clock and explain why you think it is the time Julie went to bed.



Name:_____ **Date:**_____

Missed Bedtime

Julie was very grumpy at school because she did not get enough sleep last night. She told her teacher that she went to bed long after her bed time of 8p.m. What time could Julie have gone to bed? Show the time on an analog clock and explain why you think it is the time Julie went to bed.

Performance Task: Measurement Olympics

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

MCC.2.MD3 Estimate lengths using units of inches, feet, centimeters, and meters.

MCC2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

MCC2.MD.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information adapted from Mathematics Common Core State Standards and Model Curriculum, Ohio Department of Education Teaching)

These standards call for students to estimate the lengths of objects using inches, feet, centimeters, and meters. Students should make estimates after seeing a benchmark unit, such as the length of one inch, before making their estimate.
Example: Look at your ruler to see how long one inch is. Now, estimate the length of this paper in inches.

This task will encourage students to tell (orally and in writing) and write time after reading analog and digital clocks. Time should be to 5 minute intervals, and students should also use the

terms a.m. and p.m. Teachers should help students make the connection between skip counting by 5s (CCGPS.2.NBT.2) and telling time on an analog clock.

ESSENTIAL QUESTIONS

- Why is it important for us to know how to measure different objects using different tools of measurement?
- How do we read a clock to determine the time (hours and minutes)?

MATERIALS

- Rulers
- Cotton Balls
- Second Timers
- Internet Access (Optional)
- Recording Sheet
- Olympic Game Directions (Laminated- Optional)
- Elastic from a material store
- M&Ms or connecting cubes

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Divide the class into partners. The teacher may need to adjust activities according to the student ability levels. Discuss the events with the students as a whole class. Explain that prior to finding the true measurements, students must record their estimate. Below is a description of each event. Have the directions cards and the materials at each station as the Olympics start!
ENJOY THE OLYMPICS!

Cotton Ball Shot Put
Teacher should provide a starting line for students to throw the cotton ball and rulers

- Place feet on starting line. Throw the Cotton Ball Shot. (ONLY ONE THROW!)
- Estimate the distance (using inches) that you "put" the shot. Record that number on the recording sheet.
- Measure the actual distance from the starting line to the position of the cotton ball. Record that amount on the recording sheet.
- What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Big Foot Contest

- Look at the members that are in your group. Select the person who you believe has the largest foot.
- Make an estimate about how long you think their foot is (using centimeters/inches.)
- Record your estimate on your recording sheet.
- Measure the foot of the person selected in your group (using centimeters.)
- What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Length Layout

Teacher should provide a small package of M&Ms or connecting cubes to each student and a foot long ruler

- Select connecting cubes bag or open the pack of M&Ms.
- Estimate how many M&Ms you believe it would take to make one foot laying them one beside the other. Record your estimate on the recording sheet.
- Lay the M&Ms out next to the ruler. Get as close to 12 inches as possible.
- Count to see how many M&Ms it took. Record the number as the actual measurement.
- What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Time Barrier

(Information adapted from k-5 Math Teaching Resources, www.k-5mathteachingresources.com)

1. Work with a partner. Sit side by side with a divider standing between you.
2. Player 1: Make different times on each clock on your grid without letting your partner see your work.
3. Player 1: Give clear instructions to your partner on how to complete the clocks to match your grid. For example, you might say, "Write 3 o'clock on the clock in the center of your grid."
4. Remove the divider and look at the two completed grids to see how closely they match.
5. Give yourself points for the clocks that match.

The Big Stretch

Provide students with a piece of elastic or a stretchy plastic animal from a discount store. The elastic can be cut into various lengths and students can choose the elastic they want to measure. You will also need to provide a ruler with inches in this area. The elastic should not be more than 8 inches long.

- Pick one piece of elastic (this is the piece you will be working with for this race.)
- Stretch the elastic as far as you can. Estimate how long you think the elastic is when it is stretched. Record that number as your estimate.

- Stretch the elastic again and have a friend measure the elastic as it is stretched using inches. Record that measurement as the actual measurement.
- What is the difference between the estimate and actual measurement? Find the difference between the two, that will be your score for the event.

After each student has finished each race, add the score up. The person in the class with the **LOWEST** score is the winner, because that means their estimates and actual measurements were close. If you want to have teams total their scores together and award the team with the lowest score, this is an option as well.

FORMATIVE ASSESSMENT QUESTIONS

- At what events do you feel you were good?
- Which event did you struggle with the most?
- What do you think you could have improved upon?
- What tools are you good at using?
- How close were your measurement estimations?
- How could you improve if you did the events again?

Cotton Ball Shot Put

Materials:

- Starting line
- Cotton Ball
- Ruler
- Recording Sheet

1. Place feet on starting line – Throw the "Cotton Ball Shot." (ONLY ONE THROW!)

2. Estimate the distance (using inches) that you put the "shot" – Record that number on the recording sheet.

3. Measure the distance from the starting line to the position of the cotton ball. Record that amount on the recording sheet.

4. What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Big Foot Contest

Materials:

- Centimeter Ruler
- Recording Sheet

1. Look the members that are in your group. Select the person who you believe has the largest foot.

2. Make an estimate about how long you think their foot is (using centimeters).

3. Record your estimate on your recording sheet.

4. Measure the foot of the person selected in your group (using centimeters).

5. What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Length Layout

Materials:

- Small package of M&M's Candy or connecting cubes
- Foot Ruler

1. Open the pack of M&M's.

2. Estimate how many M&M's you believe it would take to make one foot laying them one beside the other. Record your estimate on the recording sheet.

3. Lay the M&M's out next to the ruler. Get as close to 12 inches as possible.

4. Count to see how many M&M's it took. Record the number as the actual measurement.

5. What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Time Barrier

Materials:

- Instructional clocks with hands that move
- Time Barrier Grid sheet

1. Work with a partner. Sit side by side with a divider standing between you.

2. Player 1: Make different times on each clock on your grid without letting your partner see your work.

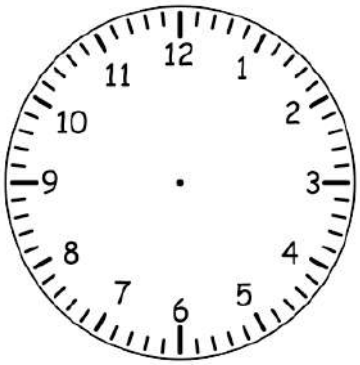
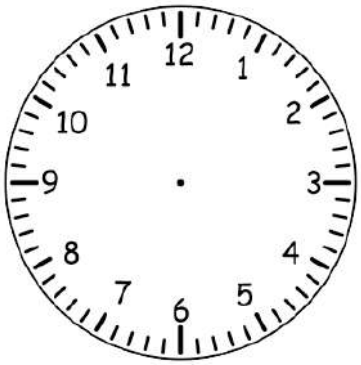
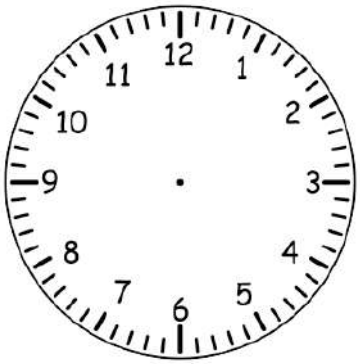
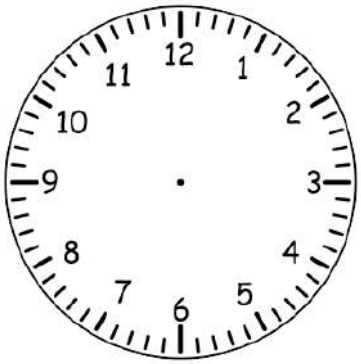
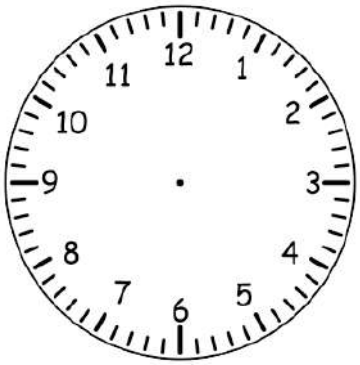
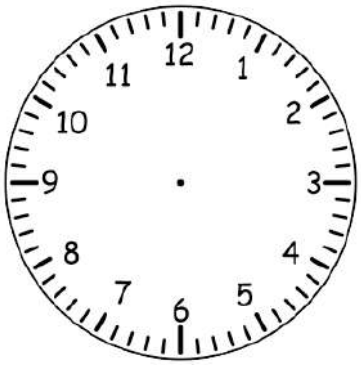
3. Player 1: Give clear instructions to your partner on how to complete the clocks to match your grid. For example, you might say, "Write 3 o'clock on the clock in the center of your grid."

4. Remove the divider and look at the two completed grids to see how closely they match.

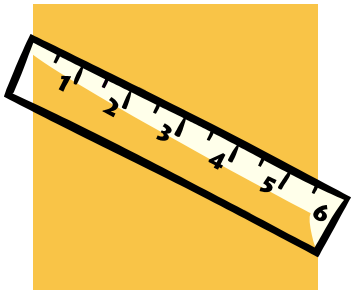
5. Give yourself points for the clocks that match.

Name_____

Time Barrier Grid

 :	 :
 :	 :
 :	 :

The Big Stretch



Materials:

- Pieces of elastic cut various lengths or stretchy animals
- Ruler with inches

1. Pick one piece of elastic (or animal.) This is the piece you will be working with for this "race".

2. Stretch the elastic as far as you can. Estimate how long you think the elastic is when it is stretched. Record that number as your estimate.

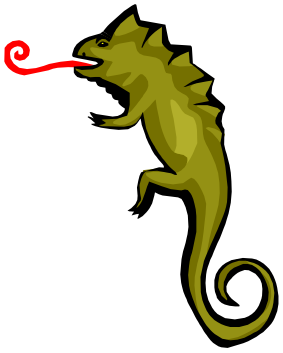
3. Stretch the elastic again and have a friend measure the elastic as it is stretched using inches. Record that measurement as the actual measurement.

4. What is the difference between the estimate and actual measurement? Subtract the lowest number from the highest number. That will be your score for the event.

Name: _____

Measurement Olympics Recording Sheet

Olympic Game	Estimate	Actual	Difference (Score)
Cotton Ball Shot Put			
Big Foot Contest			
Length Layout			
All Right Relay			
Time Barrier			
The Big Stretch			
 Individual Olympic Score!			



Performance Task: Lizards, Lizards, Everywhere!

STANDARDS FOR MATHEMATICAL CONTENT

MCC.2.MD.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC.2.MD.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

***Mathematical Practices 1 and 6 should be evident in EVERY lesson. ***

BACKGROUND KNOWLEDGE

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 323, 325)

"Line graphs and line plots do show trends or tendencies that cannot be shown in bar graphs, and students should be encouraged to use them when appropriate."

"When data are depicted on a number line, such as in a line plot or histogram, the idea of data that are spread out or grouped together takes on a numeric meaning as well. For example, in a measure of the heights of boys and girls in inches, we might notice that girls' heights are spread over a wider range than the boys'. The boys' heights may cluster around a particular height."

ESSENTIAL QUESTIONS

- Why is it important to be able to organize and graph data?
- How do you know what type of graph to use?
- Why is it important for us to know how to measure different objects using different tools of measurement?

MATERIALS

- Lizards Recording Sheet
- Centimeter Ruler
- Paper

GROUPING

Individual

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

This is a culminating task for the standards in the unit of measuring and using a line plot graph. The students will be given a recording sheet that has graphics of lizards on it. Using a centimeter ruler the students will measure each lizard in centimeters. After measuring each lizard in centimeters, the students will then use that data to create a line plot graph that displays the lizard population at the zoo.

Students will be required to create the line plot graph, labeling all parts of the graph and also add sentences about the graph they created.

FORMATIVE ASSESSMENT QUESTIONS

- Can you show me how you measured this (teacher points) lizard with your ruler?
- Explain to me how to use a ruler.
- How do you build a line plot graph?
- Where do the numbers on the number line of a line plot graph come from?
- What do you notice about your line plot graph?
- What do you think might challenge others when creating a line plot graph?

Name: _____

Performance Task: Lizards, Lizards, Everywhere!

The zoo has many new lizards. Please help collect some data on their lizard population.

Measure the lizards to the nearest whole centimeter. Create a line plot to display the data. Write sentences about what you notice about your line plot.