Grade 2 Mathematics, Quarter 2, Unit 2.1

Recognize and Apply Standard Units of Measurement

Overview

Number of instructional days: 6 (1 day = 45 minutes)

Content to be learned

- Understand the need for standard units of measure.
- Measure the length of an object using appropriate tools.
- Measure the same object twice using different units of measurement.
- Estimate length using units of inches, feet, centimeters, and meters.
- Recognize that the smaller the unit, the more equal-sized units are needed to cover a given length.

Mathematical practices to be integrated

Use appropriate tools strategically.

- Understand and become familiar with tools that are available.
- Select appropriate tools to measure a particular object.
- Use estimation to help solve a problem.

Attend to precision.

- Specify units of measure.
- Communicate precisely about the unit of measure chosen and why it was chosen.

Essential questions

- Why do you need to have standard units of measure?
- How would you determine which tool to use to measure a ____?
- What is your estimate of the length of this object? Explain your thinking.
- How can you measure an object using two different units? How do the two measurement differ? Why?
- How is the size of the unit of measure related to the number of units needed to measure an object?

Written Curriculum

Common Core State Standards for Mathematical Content

Measurement and Data	2.MD

Measure and estimate lengths in standard units.

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

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.

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

Common Core Standards for Mathematical Practice

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Clarifying the Standards

Prior Learning

In grade 1, students compared the lengths of two objects indirectly by using a third object. Students expressed the length of an object as a whole number using length units. They used nonstandard units of measure.

Current Learning

In grade 2, students measure and estimate lengths in standard units of measurement using tools such as rulers, yardsticks, metersticks, and measuring tapes. This is their first experience with standard units of measure. Students measure the same object twice using different units of measurement. They understand that the smaller the unit, the more units it takes to measure the object.

Future Learning

In grade 3, students will measure the lengths of objects using rulers marked with halves and fourths of an inch. They will show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

Additional Findings

According to Principles and Standards for School Mathematics, "Learning how to choose an appropriate unit is a major part of understanding measurement." (p. 45)

In the *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics*, "Children develop an understanding of the meaning and processes of measurement … they understand linear measure as an iteration of units and use rulers, and other measurement tools with that understanding." (p.14) In addition, "They understand the need for equal-length units, the use of standard units of measure (centimeters, inch), and the inverse relationship between the size of a unit and the number of units used in a particular measurement." (p. 14)

Grade 2 Mathematics, Quarter 2, Unit 2.2

Measure and Compare Lengths of Objects

Overview

Number of instructional days: 6 (1 day = 45 minutes)

Content to be learned

- Measure to determine how much longer one object is than another using standard units.
- Solve word problems involving adding and subtracting lengths that are given in the same units.
- Represent whole number sums and differences using a number line.

Mathematical practices to be integrated

Model with mathematics**.**

- Write an addition or subtraction equation to describe a situation.
- Identify important amounts in a word problem using a number line.
- Use drawings to solve addition and subtraction word problems involving length.
- Interpret results and reflect on whether they make sense.

Use appropriate tools strategically.

- Become familiar with tools for standard units of measure.
- Select tools that can be used to solve problems involving length.
- Solve an addition or subtraction problem using the appropriate tool (e.g., rulers, number lines).

Attend to precision.

- Carefully specify units of measure.
- Accurately represent a situation by labeling a diagram.

Essential questions

- How can you determine how much longer Object A is than Object B? Show your mathematical thinking.
- How would you draw and label a number line to solve a provided word problem? Show your solution.
- How can you use a number line to represent sums/differences?

Written Curriculum

Common Core State Standards for Mathematical Content

Measurement and Data	2.MD

Measure and estimate lengths in standard units.

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.

2.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.

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.

Common Core Standards for Mathematical Practice

4 Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use

them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Clarifying the Standards

Prior Learning

In grade 1, students compared the lengths of two objects indirectly by using a third object (e.g., paper clips). Students expressed the length of an object as a whole number using length units. They used nonstandard units of measure.

Current Learning

In grade 2, students use addition and subtraction within 100 to solve word problems involving lengths in the same units. They also compare the length of two objects, expressing the length difference in terms of a standard length unit. Students represent whole numbers as lengths starting at 0 on a number line with equally spaced points and represent whole number sums and differences within 100.

Future Learning

In grade 3, students' measuring will become more precise by including fractions. They will progress from linear measurement to geometric measurement (area and perimeter). Students will understand concepts of area. They will relate area to multiplication and division.

Additional Findings

In *Principles and Standards for School Mathematics,* "The study of measurement is important … because of the practicality and pervasiveness of measurement in so many aspects of every day life." In addition, "Measurement lends itself especially well to the use of concrete materials. In fact, it is unlikely that children can gain a deep understanding of measurement without handling materials, making comparisons physically, and measuring with tools." (p. 44)

Grade 2 Mathematics, Quarter 2, Unit 2.3

Composing and Decomposing, and Comparing Numbers Using Place Value

Overview

Number of instructional days: 14 (1 day = 45 minutes)

Content to be learned

- Understand that 100 is 10 tens.
- Read and write numbers to 1,000.
- Recognize that 100, 200, … 900 are that many hundreds, 0 tens, and 0 ones.
- Use place value to represent three-digit numbers.
- Compare two 3-digit numbers using place value.
- Represent the results of comparing two 3-digit numbers using symbols <, >, or =.
- Add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

Mathematical practices to be integrated

Reason abstractly and quantitatively.

- Make sense of quantities and their relationships in problem situation.
- Demonstrate the ability to take apart and put together numbers.
- Represent the problem, consider units involved, and attend to the meaning of the quantities.
- Know and flexibly use different properties of operations and place value.

Use appropriate tools strategically

- Solve addition and/or subtraction problems using the appropriate tools such as base-10 blocks, part/part whole mats, etc.
- Represent their thinking using graphic organizers and other tools.

Essential questions

- How can you represent 100?
- What can you tell about the value of ___ (a multiple of 100)?
- How can you show a three-digit number using concrete materials such as snap cubes or base-10 blocks?
- How can you describe the values of the digits in numbers?
- How can you compare these two numbers by creating a model and using symbols such as <, >, or =?
- What strategy did you use to solve the problem? Explain your thinking.
- How can you use place value to solve the problem?
- How do you write the number name for the number _____? (e.g., 983)
- How would you write the number 235 in expanded form?

Written Curriculum

Common Core State Standards for Mathematical Content

Number and Operations in Base Ten	2.NBT

Understand place value.

2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:

a. 100 can be thought of as a bundle of ten tens — called a "hundred."

b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).

2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

2.NBT.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

Use place value understanding and properties of operations to add and subtract.

2.NBT.5 ~~Fluently~~ add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

Common Core Standards for Mathematical Practice

2 Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that

technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

Clarifying the Standards

Prior Learning

In grade 1, students understood that the two digits of a two-digit number represent amounts of tens and ones. They learned that 10 could be thought of as a bundle of 10 ones—called a "ten." Students also learned that the numbers 11–19 are composed of a 10 and 1…or 9 ones, and the numbers 10–90 refer to 1, 2…or 9 tens (and 0 ones).

Students compared two 2-digit numbers based on the meaning of tens and ones digits, recording the results with the symbols <, =, and >. In grade 1, when given a two-digit number, students mentally found 10 more or 10 less than a number without having to count and explained the reasoning used. They subtracted multiples of 1- in the range 10–90 using concrete models and strategies based on place value, properties of operations, and the relationship between addition and subtraction. Students related the strategies used to a written method and explained their reasoning.

Current Learning

In grade 2, students learn that the three digits of a three-digit number represent amounts of hundreds, tens, and ones. While students were exposed to place value earlier in the year, they expand upon their knowledge of place value by understanding that 100 can be thought of as a bundle of 10 tens called "one hundred." Students compare two 3-digit numbers based on meanings of the hundreds, tens, and ones digits, using <, =, and > symbols to record their results of comparisons. By the end of the year, students fluently add and subtract within 1,000 and add up to four 2-digit numbers, using place value strategies, properties of operations, and/or the relationship between addition and subtraction.

Strikethroughs are addressed in Unit 4.4.

Future Learning

In grade 3, students will fluently add and subtract within 1,000. They will develop understanding of multiplication and division.

Additional Findings

Principles and Standards for School Mathematics states "Representing numbers with various physical materials should be a major part of mathematics instruction in the elementary grades." (p. 33) In addition, "Developing fluency requires a balance and connection between conceptual understanding and conceptual proficiency. On the one hand, computational methods that are over practiced without understanding are often forgotten or remembered incorrectly." (p. 35)

Grade 2 Mathematics, Quarter 2, Unit 2.4

Operations and Algebraic Thinking

Overview

Number of instructional days: 14 (1 day = 45 minutes)

Content to be learned

- Solve one- and two-step word problems involving addition and subtraction within 100 using unknowns in all positions.
- Add and subtract with 1,000 using concrete models, drawings, and strategies.
- Use place value and the properties of operations to explain why addition and subtraction strategies work.
- Understand that they add or subtract hundreds to hundreds, tens to tens, and ones to ones.
- Understand that in adding and subtracting it is sometimes necessary to compose or decompose numbers.

Mathematical practices to be integrated

Make sense of problems and persevere in solving them.

- Explain the meaning of a problem.
- Monitor and evaluate progress when solving a problem.
- Know what they are solving for.

Construct viable arguments and critique the reasoning of others.

- Justify conclusions.
- Communicate their thinking to others.
- Respond appropriately to the arguments of others.

Look for and make use of structure.

- Look for a pattern in place value to add or subtract.
- Add or subtract hundreds to hundreds, tens to tens, and ones to ones.

Essential questions

- How can you use drawings, equations, and symbols to represent the following problem? (using two representations)
- What strategies did you use to solve these problems? Show your work and explain your thinking.
- How can you use concrete models to add and subtract within 1,000?
- How can you solve for the unknown?
- What do you need to know when adding/ subtracting three-digit numbers?

Written Curriculum

Common Core State Standards for Mathematical Content

Operations and Algebraic Thinking	2.OA

Represent and solve problems involving addition and subtraction.

2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.[1]

[1] See Glossary, Table 1.

Number and Operations in Base Ten	2.NBT

Use place value understanding and properties of operations to add and subtract.

2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.

2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.[3]

[3] Explanations may be supported by drawings or objects.

Common Core Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

3 Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

7 Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Clarifying the Standards

Prior Learning

In grade 1, students used addition and subtraction within 20 to solve word problems with unknowns in all positions by employing objects, drawings, and equations. Students added within 100 using a two-digit number and a one-digit number. They subtracted multiples of 10 in the range 10–90. Students mentally found 10 more or 10 less and were able to explain their reasoning.

Current Learning

In grade 2, students solve one- and two-step word problems using addition and subtraction within 100 with unknowns in all positions. They use concrete models and strategies to add and subtract within 1,000. Students explain why the addition and subtraction strategies work. They support their explanations with drawings and objects. Students use place value when adding and subtracting; they add or subtract hundreds to hundreds, tens to tens, and ones to ones. Students learn that sometimes it is necessary to compose or decompose a number when adding or subtracting (regrouping).

Future Learning

In grade 3, students will solve two-step word problems using the four operations. They will fluently add and subtract with 1,000. The fluency focus shifts from multiplication to division.

Additional Findings

Principles and Standards for School Mathematics states, "Researches and experienced teachers alike have found that when children in the elementary grades are encouraged to develop, record, explain and critique one another's strategies for solving computational problems a number of important kinds of learning can occur." In addition, "Experience suggests that in classes focused on the development and discussion of strategies, various standard algorithms either arise naturally or can be introduced by the teacher as appropriate." (p. 35) Finally, "Developing fluency requires a balance and connection between conceptual understanding and computational fluency." (p. 35)