



San Diego Unified School District

Instructional Module to Enhance the Teaching of

HARCOURT

Math

California Edition

Grade 4

Module 8 – Revised

Unit 7: Measurement, Algebra,
and Graphing

— WORK IN PROGRESS —



San Diego City Schools
Instruction and Curriculum Division
MATHEMATICS CURRICULUM MAP – GRADE 4

MODULE 8 – MEASUREMENT, ALGEBRA, AND GRAPHING

Modules represent individual units of study that lead to the essential learnings

<p>THREADS THROUGHOUT THE YEAR:</p> <p><i>The threads represent ongoing learning opportunities in which students should be actively engaged throughout all units of inquiry during the entire school year. These items should not be isolated to any one particular unit of inquiry.</i></p> <p>Students will:</p> <ul style="list-style-type: none"> • Develop understanding of numbers and the number system and use their understanding to solve problems and recognize reasonable results. • Develop understanding of and fluency in basic computation and procedural skills. • Use mathematical reasoning to solve problems. • Communicate their mathematical thinking by using words, numbers, symbols, graphs and charts and translate between different representations. • Use equations and variables to express generalizations of patterns and relationships. • Develop logical thinking to analyze evidence and build arguments to support or refute a hypothesis. • Make connections among mathematical ideas and between other disciplines. • Develop and use strategies, skills, and concepts to solve problems. • Use appropriate tools, including technology, as vehicles to learn mathematical concepts. 		
<p>These are essential learnings that represent bigger ideas/concepts:</p> <ul style="list-style-type: none"> • Students understand that measurement involves comparing an item with a measurement unit that has the same attribute: length with length, area with area. • Students use their understanding of base-ten and decimals to convert between metric units. 	<p>These are essential learnings that represent bigger ideas/concepts:</p> <ul style="list-style-type: none"> • Students understand that a negative number is the opposite of a positive number in relation to zero. • Students use ordered pairs to locate and describe locations on a coordinate grid. 	<p>These are essential learnings that represent bigger ideas/concepts:</p> <ul style="list-style-type: none"> • Students understand that functions are rules that determine how members of one set affect members of another set. • They represent functions in context, words, graphs, tables and equations.
<p>These are essential questions that learners ask themselves in order to achieve the essential learnings:</p> <ul style="list-style-type: none"> • How do I choose the appropriate tool and unit of length to use when measuring? • How do I use my understanding of measurement “benchmarks” as a strategy for estimating and comparing different customary and metric units of measure? • How do I explain and show the relationship between customary linear units? • How do I use multiplication and division and my understanding of the relationship between customary units of length to convert between units? • How do I use my understanding of multiplication and division patterns of powers of ten to convert between 	<p>These are essential questions that learners ask themselves in order to achieve the essential learnings:</p> <ul style="list-style-type: none"> • How do I use thermometers and number lines to understand, compare and order positive and negative numbers in relation to zero? • How do I find and name the parts of a coordinate grid, and graph points on it? • How do I locate ordered pairs on a grid and connect the point with the length of horizontal and vertical line segments? 	<p>These are essential questions that learners ask themselves in order to achieve the essential learnings:</p> <ul style="list-style-type: none"> • How do I find, write and use rules to determine the values in an input/output* function table? • How do I represent rules for input/output function tables using equations and variables? • How do I translate an equation into an input/output function table and use the ordered pairs to graph the equation? • How do I analyze the points on a graph to identify and explain the relationships shown on the graph?

metric units of length?	*Presented in previous grade(s)	*Presented in previous grade(s)
<p>Resources: Van de Walle: Chapter 19 (pp. 316-322 & 331-335); <i>Mathematics Source Book: Measurement</i> (pp. 27-36)</p>	<p>Resources: Van de Walle: Chapter 24 (pp. 457-459); <i>Mathematics Source Book: Negative Numbers</i> (pp. 109-114)</p>	<p>Resources: Van de Walle: Chapter 22 & 23 (pp. 420-427 & 436-438); <i>Mathematics Source Book: Algebra and Functions</i> (pp 79-81)</p>

UNIT 7: Measurement, Algebra, and Graphing
MODULE 8 – 4 Weeks of Instruction

Key Mathematical Concepts:

- Know how to estimate and accurately measure length, capacity and weight; choose the correct customary units.
- Develop and use efficient strategies to convert units within systems of measurement and know how to compare measurements.
- Understand and use measurement “benchmarks” as a strategy for estimating and comparing different units of measure.
- Know that all measurement is approximate.
- Understand how to locate, name, compare and order negative numbers using tools such as thermometers and number lines.
- Understand that positive numbers are greater than negative numbers and know how to use a number line to compare and order positive and negative numbers in relation to zero.
- Understand how to locate and plot points on a coordinate grid and use the values from a function table to plot ordered pairs.
- Know how to find the vertical and horizontal distance between two points on a coordinate grid.
- Know how to find and name the x axis and y axis on a coordinate grid.
- Understand that a rule or function is a prescription for determining a second number when the first is given and use rules to determine the values in an input/output tables.
- Understand how to use an equation to determine ordered pairs that can be graphed.
- Understand that points of a linear relationship can be plotted on a grid and connected with a straight line.

<p>Chapter 21: <u>Customary Measurement</u></p> <p>Lesson 21.1: Choose the Appropriate Unit</p> <p>Lesson 21.2: Measure Fractional Parts</p> <p>Lesson 21.3: Algebra: Change Linear Units</p> <p>Lesson 21.4: Hands On: Capacity</p> <p>Lesson 21.5: Hands On: Weight</p> <p>Lesson 21.6: Problem Solving Strategy: Compare Strategies</p>	<p>Chapter 22: <u>Metric Measurement</u></p> <p>Lesson 22.1: Linear Measure</p> <p>Lesson 22.2: Algebra: Change Linear Units</p> <p>Lesson 22.3: Hands On: Capacity</p> <p>Lesson 22.4: Hands On: Mass</p> <p>Lesson 22.5: Problem Solving Strategy: Draw a Diagram</p>
<p>Chapter 23: <u>Algebra: Explore Negative Numbers</u></p> <p>Lesson 23.1: Temperature: Fahrenheit</p> <p>Lesson 23.2: Temperature: Celsius</p> <p>Lesson 23.3: Negative Numbers</p> <p>Lesson 23.4: Problem Solving Skill: Make Generalizations</p>	<p>Chapter 24: <u>Explore the Coordinate Grid</u></p> <p>Lesson 24.1: Use a Coordinate Grid</p> <p>Lesson 24.2: Length on the Coordinate Grid</p> <p>Lesson 24.3: Use an Equation</p> <p>Lesson 24.4: Graph an Equation</p> <p>Lesson 24.5: Problem Solving Skill: Identify Relationships</p>

MODULE 8 NOTES: Chapters 21-22

Chapter 24: Explore the Coordinate Grid: All lessons in this chapter are important, and none should be skipped.

The following lessons do not directly address Grade 4 Standards, but understanding of the lesson concepts is assumed. These lesson concepts could be addressed indirectly on state assessments.

- Lesson 21.2: Measure Fractional Parts
- Lesson 21.3: Algebra: Change Linear Units
- Lesson 22.1: Linear Measure
- Lesson 22.2: Algebra: Change Linear Units

The following lessons are optional if additional instructional time is needed for developing understanding of concepts in the unit.

- Lesson 21.6: Problem Solving Strategy: Compare Strategies
- Lesson 22.5: Problem Solving Strategy: Draw a Diagram

MEASUREMENT, ALGEBRA, AND GRAPHING

Harcourt Mathematics

Unit 7: 4 Weeks of Instruction

<p>Day 1 CHAPTER 21 <i>Customary Measurement</i> Lesson 21.1: Choose the Appropriate Unit</p>	<p>Day 2 Lesson 21.2: Measure Fractional Parts</p>	<p>Day 3 Lesson 21.3: Algebra: Change Linear Units</p>	<p>Day 4 Lesson 21.4: Hands On: Capacity</p>	<p>Day 5 Lesson 21.5: Hands On: Weight</p>
<p>Day 6 Lesson 21.6: Problem Solving Strategy: Compare Strategies</p>	<p>Day 7 CHAPTER 22 <i>Metric Measurement</i> Lesson 22.1: Metric Linear Measure</p>	<p>Day 8 Lesson 22.2: Algebra: Change Linear Units</p>	<p>Day 9 Lesson 22.3: Hands On: Capacity</p>	<p>Day 10 Lesson 22.4: Hands On: Mass</p>
<p>Day 11 Lesson 22.5: Problem Solving Strategy: Draw a Diagram</p>	<p>Day 12 CHAPTER 23: <i>Algebra: Explore Negative Numbers</i> Lesson 23.1: Temperature: Fahrenheit</p>	<p>Day 13 Lesson 23.2: Temperature: Celsius</p>	<p>Day 14 Lesson 23.3: Negative Numbers Day 1 of a 2-Day Lesson</p>	<p>Day 15 Lesson 23.3: Negative Numbers Day 2 of a 2-Day Lesson</p>
<p>Day 16 CHAPTER 24 Explore the Coordinate Grid Lesson 24.1: Use a Coordinate Grid</p>	<p>Day 17 Lesson 24.2: Use a Coordinate Grid</p>	<p>Day 18 Lesson 24.3: Use an Equation Day 1 of a 2-Day Lesson</p>	<p>Day 19 Lesson 24.3: Use an Equation Day 2 of a 2-Day Lesson</p>	<p>Day 20 Lesson 24.4: Graph an Equation</p>
<p>Day 21 Lesson 24.5: Problem Solving Skill: Identify Relationships</p>				

DAY 1
 Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
 Chapter 21
 LESSON 21.1, Pp. 404-405

MATERIALS:	<ul style="list-style-type: none"> • *Transparency 21.1; Three 1" x 12" strips of construction paper (2 of one color, 1 of another) per student; • Rulers or yardsticks for students to share; 1-inch masking tape.
LESSON FOCUS:	Choose the Appropriate Unit
CALIFORNIA STANDARDS:	<p>Mathematical Reasoning 1.1, 2.3, 2.4, 3.3 1.0: Make decisions about how to approach problems. 3.2: Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems. Number Sense 3.0</p>
PURPOSE OF LESSON:	<p>Measure length and distance using customary units. Understand relationship between linear units of inches, feet and yards.</p>
<p>LAUNCH/EXPLORE: Introduce students to concepts/Work with the concept. Focus on students "doing mathematics." *Transparency 21.1 For each student – three 1" x 12" strips of construction paper (2 of one color & 1 of another); rulers or yardsticks for students to share; 1-inch masking tape.</p>	<ul style="list-style-type: none"> • Give each student three construction paper strips (2 of one color, 1 of another). <p>Questions:</p> <ul style="list-style-type: none"> • Ask students to estimate the length of one of their strips. Discuss. <p>Directions: Students make a mark at each end and label the ends 0 and 12.</p> <div style="text-align: center; border: 1px solid black; width: 200px; margin: 10px auto; padding: 5px;"> 0 12 </div> <p>Model:</p> <ul style="list-style-type: none"> • Fold strip in half. Make a small line at the top of the midpoint. How should you label the midpoint? Discuss and label "6." • Continue by folding strip in half again (2 folds), make the lines; label (3 and 9). • Students use ruler to mark the other inches and label them with numbers. • Discuss how to mark and label the half inches. • Using rulers, continue marking half inches between all inches. • Review naming each half-inch if needed. • Students mark the other two strips the same way, using their 1-12 strip as a model, labeling the second color strip with inches 13-24, and the last strip with 25-36. Explain that the middle foot (strip) is a different color to make it easier to measure and estimate. • Students place their paper strips on the tape in order, creating a measuring tape. <ul style="list-style-type: none"> • Ask students questions about their measuring tapes to acquaint them with the measurements: <ul style="list-style-type: none"> • Discuss: <i>How many inches in 1 1/2 feet? In 2 1/2 feet?</i> • <i>Which is longer, 2 feet or 25 inches?</i> • Continue with similar questions. <p>Learn, P. 404: Measure Up.</p> <ul style="list-style-type: none"> • Read and discuss with students. • Highlight meaning of Linear.

	<ul style="list-style-type: none"> • Ask students to give examples of things that are measured with each unit of measure. • Students work in pairs: Use tapes or benchmark measures, to measure items in the room and record measurements. (model making a table to record measurements.) • Share/record/discuss results. • Identify items that would best be measured with a ruler, yardstick, or tape measure. <p>Note: Save tape measures for use in next lessons.</p>
PRACTICE: Focus on Communication and Representation.	<p>Practice & Problem Solving, P. 405: #s 8 –10: Do with students.</p> <p>Practice & Problem Solving, P. 405: #s 20-23:</p> <ul style="list-style-type: none"> • Students work with partners. Discuss/share responses.
SUMMARIZE: Connect purpose to activities.	<ul style="list-style-type: none"> • Students explain how to decide which measuring tool to use to measure items, e.g., short or long items, distances, round objects, etc. • List several things to measure using each instrument: ruler, yardstick, tape measure (36"), and distance from one city to another.
HOMEWORK:	<p>Practice & Problem Solving, P. 405: #s 11-16</p> <p>Mixed Review and Test Prep, #s 25-29.</p>

ROUTINES:**Sum, Difference, Product, or Quotient?**

What is the answer to an addition problem called?

What is the answer to a subtraction problem called? Multiplication problems? Division problems?

Go around class giving such problems as $3 \times 4 = ?$ (The answer is the: Sum? Difference? Product? Quotient?)

Continue with:

$$9 - 7 = ? \quad 25 + 37 = ? \quad 1/2 + 1/2 = ? \quad 0.5 - 0.3 = ? \quad 3/4 - 1/4 = ?$$

Students respond in turn with the "**name**" of the answer, e.g., product, difference, etc.

Students act as leaders in small groups to continue the practice.

Vary by saying the words: *sum, difference, product, quotient*, and have students give a matching problem, e.g., **Sum: $3 + 9 = 12$.**

DAY 2
Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
Chapter 21
LESSON 21.2, Pp. 406-409

MATERIALS:	<ul style="list-style-type: none"> • Students' tape measures from Lesson 21.1; • Rulers – 1 per student.
LESSON FOCUS:	Measure Fractional Parts
CALIFORNIA STANDARDS:	<p>Mathematical Reasoning 1.0, 2.3, 2.4, 3.2 1.1: Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns. 2.5: Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy. Number Sense 2.0, 3.4</p>
PURPOSE OF LESSON:	Measure length, using linear units, to the nearest fraction of a unit.
<p>LAUNCH: Introduce students to concepts.</p> <p>Students' tape measures from Lesson 21.1; rulers – 1 per student.</p>	<p>Quick Review, P. 406. Do with students. (optional)</p> <p>Discussion Questions:</p> <ul style="list-style-type: none"> • Discuss/share/model measuring an object that cannot be measured to the exact inch. Example: A pencil that is 6 – 7 inches long or a shoe. • Ask students how they would measure something that is between a whole inch and half an inch. (halfway between wholes & halves is fourths) • Discuss quarter inches – explore with rulers. Students make one-quarter inch marks on the first 12 inches of their tapes. Use rulers as model. • Discuss where the marks are made and label them $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, etc. • Ask questions such as: Which is longer: $2\frac{3}{4}$ inches or $2\frac{1}{2}$ inches? <p>Review Leaf Lesson, Examples A & B, SE P. 406.</p> <ul style="list-style-type: none"> • Students find objects to measure to the nearest quarter inch. Measure and record measurements. Discuss. • Continue the investigation by having students make $\frac{1}{8}$-inch marks on the first <u>three inches</u> of their tapes. Measure several items to nearest eighth of an inch.
<p>EXPLORE: Work with the concept. Focus on students "doing mathematics." Tape measures</p>	<p>Practice & Problem Solving, P. 408 #s 8 – 11 and discuss.</p> <p>Estimates and Measures, P. 407. Do Steps 1 & 2. Students use their tapes to measure and record the lengths of 5 items to the nearest fractional part of an inch.</p>
<p>PRACTICE: Focus on Communication and Representation.</p>	<p>Practice & Problem Solving, Pp. 408-409: #s 18-21, 24, 26, 27:</p> <ul style="list-style-type: none"> • Students work with partners. • Discuss solutions and compare strategies.

SUMMARIZE: Connect purpose to activities.	ASSESS, P. 409: DISCUSS. <ul style="list-style-type: none">• Students explain how to measure to the nearest $\frac{1}{8}$ inch.• Students draw and label line segments to the nearest 1 _ inches, 1 _ inches, and $1 \frac{1}{8}$ inches. Share.
HOMEWORK:	Practice & Problem Solving, P. 408: #s 22 – 23 Mixed Review and Test Prep: #s 29-37.

ROUTINES:**Watch Those Zeros!**

Review mentally multiplying by ten.

Write the following problems, one at a time, and go around class asking for products:

$24 \times 10 = ?$

$341 \times 10 = ?$

$430 \times 10 = ?$

$1,000 \times 10 =$

$30 \times 10 = ?$

$943 \times 10 = ?$

$100 \times 10 = ?$

$20,000 \times 10 =$

Discuss and record strategies for solving.

DAY 3
Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
Chapter 21
LESSON 21.3, Pp. 410-411

MATERIALS:	<ul style="list-style-type: none"> • Transparency 21.3 • Student made paper yardsticks.
LESSON FOCUS:	Algebra: Change Linear Units
CALIFORNIA STANDARDS:	<p>Algebra and Functions</p> <p>1.0: Use and interpret variables, mathematical symbols, and properties to write and simplify expressions and sentences.</p> <p>1.1: Use letters, boxes, or other symbols to stand for any number in simple expressions or equations.</p> <p>Mathematical Reasoning 1.0, 1.1, 2.3, 3.0, 3.2</p> <p>Number Sense 2.0</p>
PURPOSE OF LESSON:	Understand how to change linear units of measure by multiplying or dividing.
<p>LAUNCH/EXPLORE: Introduce students to concepts/Work with the concept. Focus on students “doing mathematics.”</p> <p>Transparency 21.3</p>	<p>Number of the Day, P. 410A. <i>How many nickels are there in \$1.00? How can you find out?</i></p> <ul style="list-style-type: none"> • Discuss, explain solution, and share strategies. • Remind students to write the dollar sign and decimal point correctly. • <i>How many nickels are in \$2.00?</i> • Share equations. In \$20.00? In \$200.00? Discuss/explain process. • Share, and discuss while doing the following problems: • Students write an equation for each problem that is not solved mentally. • Ask students to examine their yardsticks. • Ask how many feet in 1 yard; 2 yards; 10 yards. Record. • <i>How many feet are in 36 yards?</i> • Students share their equations for solving this problem. • Encourage students to use mental math to find the number of feet in 360 yards. Explain/show how to write the equation. Discuss students' equations. Ask if they notice a rule or pattern (multiply by 3) for changing yards to feet. Students may now be ready to generalize that you multiply when converting larger units to smaller units. • Do with a partner: <i>How many feet in 48 yards?</i> Write the equation. Explain solution. <i>How many feet in 480 yards? In 4,800 yards?</i> • Ask students to consider their yardsticks again & tell how many yards are in 6 feet; 9 feet; 12 feet (highlight the pattern). • <i>Twenty-four feet is how many yards?</i> Discuss/explain process for going from smaller units to larger units (divide). • <i>Two-hundred forty feet is how many yards?</i> Discuss/explain process.

PRACTICE: Focus on Communication and Representation.	Check, P. 411: #1, 3, and 4: Do with students. Practice & Problem Solving, P. 411 #19-22. Students work with partners. Discuss.
SUMMARIZE: Connect purpose to activities.	<ul style="list-style-type: none"> • ASSESS, P. 411: DISCUSS. Students explain how to convert smaller units to larger ones and larger units to smaller ones. • Students make up a problem in which they find how many feet are in a number of yards. Discuss students' problems.
HOMEWORK:	Practice & Problem Solving, P. 411: Do #10-11, 14-17 Mixed Review and Test Prep: #s 23-27

ROUTINES:**Find the Factors!**

Say the "product."

Students provide different combinations of factors (omitting 1) for each product, e.g.:

Say 42: Response: 7 and 6 (or other factors equaling 42, e.g., 7, 2, and 3)

Say 100: Response: 10 and 10 (or 2, 5, and 10, or 25 and 4 etc.)

Students giving more than two factors must explain (show) their work to the class. Continue to see if there are any other ways to make the product.

Include prime numbers in this task.

DAY 4
 Unit 7: MEASUREMENT, ALGEBRA, AND GRAPHING
 Chapter 21
 LESSON 21.4, Pp. 412-413

MATERIALS:	<ul style="list-style-type: none"> • Liquid containers with various capacities: larger than 1 quart and a one cup container for each group and teacher; • one pint, quart, and gallon container so each group has one and teacher has a set; • water. <p>(Alternative: If conditions are not amenable to class using water, have one large container of water (colored, if possible) and transparent containers. Ask volunteers to take turns pouring it as needed throughout the lesson.);</p> <ul style="list-style-type: none"> • Transparency 21.4; • Routine: Performance Assessment 4.7A: Class Party – 1 copy per student. 															
LESSON FOCUS:	Hands On: Capacity Understanding the relationship between cups, pints, quarts & gallons.															
CALIFORNIA STANDARDS:	Algebra and Function 1.1 1.0: Use and interpret variables, mathematical symbols, and properties to write an d simplify expressions and sentences. Mathematical Reasoning 1.0, 1.1, 3.0 3.2: Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.															
PURPOSE OF LESSON:	Find the capacity of containers using customary units.															
LAUNCH: Introduce students to concepts. Transparency 21.4 Each group: 1 large container and a container of water.	<p>Explore students' prior knowledge of capacity: Discuss: Familiar liquid measures: containers of milk/soda, buying gasoline, different size sodas at convenience stores, etc.</p> <p>Explore, P. 412. Prepare students by reading together.</p> <ul style="list-style-type: none"> • Give each group 1 container of <u>each size</u>. Students line up the containers by size and estimate how many of each will fill the next, e.g. the # of cups in a pint, quart, gallon; the # of pints in a quart, gallon. • Students make table and record estimates. (columns for: container, estimates, and actual measurement) <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th></th> <th>Number of cups</th> <th>Number of cups</th> </tr> <tr> <th>Container</th> <th>Estimate</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Pint</td> <td></td> <td>2</td> </tr> <tr> <td>Quart</td> <td></td> <td></td> </tr> <tr> <td>Gallon</td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Find the number of cups and the number of pints that fill a quart, etc. • Ask questions that can be answered using the data in their table. Note: Students may ask about the markings on the cup measure. 8 fluid ounces = 1 cup; 16 fluid ounces = 1 pint. 		Number of cups	Number of cups	Container	Estimate	Actual	Pint		2	Quart			Gallon		
	Number of cups	Number of cups														
Container	Estimate	Actual														
Pint		2														
Quart																
Gallon																

