Overarching Understandings:
Some attributes of objects are measurable and can be quantified using unit amounts. Length, area, volume, weight/mass, and capacity are attributes that provide different ways of describing the size of an object. Time is also a measurable attribute. Time is the duration of an event from beginning to end. Time can be measured in seconds, minutes and hours. A given measurement can be represented in equivalent ways. Some attributes of two-dimensional figures (perimeter and area) are measurable and can be quantified using unit amounts. A pattern is a sequence or a relationship that repeats or evolves in a predictable way. A rule describes what that predictable process will look like.

Essential Questions:
- How are units in the same system of measurement related?
- How do we compare measures of time?
- How are hours, minutes, and seconds related?
- How are grams, milligrams and kilograms related?
- How are pounds and ounces related?
- How are liters and milliliters related?
- How are centimeters, meters and kilometers related?
- What is perimeter?
- What is area?
- How are area and perimeter related?
- How can you find the area of a rectangle?
- How can you find the perimeter of a rectangle?
- How do a patterns/sequences repeat or evolve?
- How can you describe the process by which a pattern repeats or evolves?

Common Core State Standards:
4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurements, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4ft snake as 48 in.
4.MD.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
4.MD.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems.
4.OA.5 Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule “Add 3” and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate this way.
### Key Vocabulary:
- Perimeter
- Area
- Length
- Width
- Capacity
- Quart
- Gallon
- Cup
- Pint
- Fluid ounce
- Pound
- Ton
- Millimeter
- Centimeter
- Meter
- Kilometer
- Mass
- Gram
- Milligram
- Kilogram
- Milliliter
- Liter
- Repeating Pattern
- Rule

### Sentence Frames:
- _____ hours/minutes is the same as _____ minutes/seconds, because……
- _____ kilograms is the same as _____ grams, because…
- _____ pounds is the same as _____ ounces, because…
- _____ liters is the same as _____ milliliters, because…
- _____ kilometers/meters is the same as _____ meters/centimeters, because…..

I found the perimeter of this shape by…

I found the area of this shape by…

### Suggested Materials:

### Number Talks:*
*Number Talks are used to build number sense, develop fluency, and make sense of problems.*

Problem Solving
# FOURTH GRADE

## Unit 7

### Measurement and Patterns

15 days

14 lessons

1 Assessment Day

## Suggested Order of Lessons

### Objective 1: Students will solve problems by using measurement equivalents. (4.MD.1, 4.MD.2)

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Source</th>
<th>Title</th>
<th>Page Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enVision 2.0</td>
<td>13-1 Equivalence with Customary Units of Length</td>
<td>ENV TE p.679</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SDUSD</td>
<td>Converting Units of Measure</td>
<td>Unit p.10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SDUSD</td>
<td>Measurement Equivalents</td>
<td>Unit p.12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>enVision 2.0</td>
<td>13-2 Equivalence with Customary Units of Capacity</td>
<td>ENV TE p.685</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>enVision 2.0</td>
<td>13-3 Equivalence with Customary Units of Weight</td>
<td>ENV TE p.691</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>enVision 2.0</td>
<td>13-4 Equivalence with Metric Units of Length</td>
<td>ENV TE p.697</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>enVision 2.0</td>
<td>3-5 Equivalence with Metric Units of Capacity and Mass</td>
<td>ENV TE p.703</td>
<td></td>
</tr>
</tbody>
</table>

### Objective 2: Students will solve problems involving area and perimeter by using various models and formulas. (4.MD.3)

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Source</th>
<th>Title</th>
<th>Page Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>EngageNY</td>
<td>Lesson 1- Investigate and Use the Formulas for Area and Perimeter of Rectangles</td>
<td>Unit p.16</td>
<td>Problems 1 &amp; 2 (Perimeter) Do perimeter problems only in Problem Set</td>
</tr>
<tr>
<td>9</td>
<td>EngageNY</td>
<td>Lesson 1- Investigate and Use the Formulas for Area and Perimeter of Rectangles</td>
<td>Unit p.16</td>
<td>Problem 3 (Area) Have students finish the Area problems in Problem Set</td>
</tr>
<tr>
<td>10</td>
<td>enVision 2.0</td>
<td>13-6 Solve Perimeter and Area Problems</td>
<td>ENV TE p.709</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>SDUSD</td>
<td>Problem Solving with Area and Perimeter</td>
<td>Unit p.22</td>
<td>Adapted from EngageNY Lesson 1 “Investigate and Use the Formulas for Area and Perimeter of Rectangles.”</td>
</tr>
</tbody>
</table>
### Objective 3: Students will generate and analyze patterns based on a given rule. (4.OA.5)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>enVision 2.0</td>
<td>14-2 Patterns: Number Rules</td>
<td>ENV TE p. 739</td>
</tr>
<tr>
<td>13</td>
<td>enVision 2.0</td>
<td>14-3 Patterns: Repeating Shapes</td>
<td>ENV TE p. 745</td>
</tr>
<tr>
<td>14</td>
<td>enVision 2.0</td>
<td>14-4 Look for and Use Structure</td>
<td>ENV TE p. 751</td>
</tr>
<tr>
<td>14</td>
<td>Assessment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
enVision 2.0 Lesson 14-1 was not included in the suggested order of lessons because the concept it addresses is explored thoroughly and coherently in the subsequent 3 lessons in Objective 3.
SDUSD Math Lesson Map

The structure of math lessons should follow the Launch, Explore, Summarize format. This structure allows students to explore mathematical concepts with rigor (fluency, concept development, and application) to develop understanding in ways that make sense. Some rich tasks may take multiple days for students to explore. In these cases, each day should still follow the Launch, Explore, Summarize format.

**Number Talks**
15 minutes

Number Talks are a chance for students to come together to practice fluency and share their mathematical thinking by engaging in conversations and discussions around problem solving and number sense activities.

**LAUNCH** (5–10 minutes)

The teacher sets the stage for learning by ensuring the purpose and the rationale of the lesson are clear by connecting the purpose to prior learning, posing the problem(s), and introducing the Explore task for students. During this time the teacher is identifying the tools and materials available, reviewing academic vocabulary, and setting the expectations for the lesson.

The students are actively engaged in a short task or discussion to activate prior knowledge in preparation of the Explore task. Students may be using tools and/or manipulatives to make sense of the mathematical concept.  

**EXPLORE** (15–20 minutes)

The teacher provides opportunities and support for students to develop conceptual understanding by providing meaningful explorations and tasks that promote active student engagement.

The teacher monitors the development of student understanding by conferring with students and asking students questions in order to understand and stimulate their thinking. The teacher uses this information to plan for the Summarize and, if needed, to call the students together for a mid-Explore scaffold to focus or propel student thinking.

The students are actively engaged in constructing meaning of the mathematical concept being taught. Students engage in private reasoning time before working with partners or groups. Students use multiple representations to solve rich tasks and communicate their mathematical understanding.

**SUMMARIZE** (15–20 minutes)

The teacher provides opportunities to make public the learning that was accomplished by the students by sharing evidence of what was learned, and providing opportunities for students to analyze, compare, discuss, extend, connect, consolidate, and record thinking strategies. A summary of the learning is articulated and connected to the purpose of the lesson.

The students are actively engaged as a community of learners, discussing, justifying, and challenging various solutions to the Explore task. The students are able to articulate the learning/understanding of the mathematical concept being taught either orally or in writing. Students can engage in this discussion whether or not they have completed the task.

**FORMATIVE ASSESSMENT**

The teacher determines what students are learning and are struggling with by conferring with students and by examining student work throughout the lesson. This formative assessment informs ongoing adjustments in the lesson and next steps for the class and each student.

The students are actively engaged in showing their learning accomplishments related to the mathematical concept of the lesson.

**PRACTICE, REFLECT, and APPLY** (10–15 minutes)

This time is saved for after the Summarize so students can use what they have learned to access additional tasks. The opportunities that teachers provide are responsive to student needs.

The students may have the opportunity to revise their work, reflect on their learning, show what they know with an exit slip, extend their learning with a similar or extension problem, or practice with centers or games.

The teacher confers with individual students or small groups.

INDIVIDUAL, PAIRS, OR SMALL GROUP
SDUSD Mathematics Units

We understand that for deep and sustainable change in mathematics to take place, teachers, students, and leaders must grapple with what the rich mathematics asked for by Common Core State Standards—Mathematics looks like in the classroom, in pedagogical practice, in student work, in curriculum, and in assessments. It is our goal that teachers and site leaders work collaboratively toward a shared vision of math instruction that develops mathematically proficient students as defined by the CCSS—Mathematics. It is our hope that these units provide a common instructional foundation for this collaboration.

The SDUSD Mathematics Units are designed to support teachers and students as we shift from a more directive style of teaching mathematics toward a more inquiry-based style. In problem-based learning, students develop the habits of mind and interaction of mathematicians through engaging in mathematical discourse, connecting representations, asking genuine questions, and justifying and generalizing ideas. These mathematical habits reflect the shifts in pedagogy required to support the Common Core Standards for Mathematical Practice.

The SDUSD math units are compiled with multiple sources to ensure students have a variety of mathematical experiences aligned to the CCSS. All lessons should follow the structure of Launch, Explore, and Summarize. The following document will guide teachers in planning for daily lessons, by helping them understand the structures of each of the sources.

Structure for enVision 2.0 Lessons

Use Step 1 Develop: Problem-Based Learning is the Launch, Explore, and Summarize for every enVision 2.0 Lesson.

Launch: (Before)

Start with the Solve-and-Share problem. Pose the problem to the students making sure the problem is understood. This does not mean you explain how to do the problem, rather you ensure that students understand what the problem is about. Establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore: (During)

Students engage in solving the problem using a variety of strategies and tools. Use the suggested guiding questions to check in briefly with students as needed, in order to understand and push student thinking. You may want to use the “Extension for Early Finishers” as needed.

Summarize: (After)

Select student work for the class to analyze and discuss. If needed, use the Sample Student Work provided for each lesson in enVision 2.0.

Practice, Reflect, Apply: (Select Problems from Workbook Pages, Reteach, Games, Intervention Activity)

During this time, students may revise their work from the Explore time or you may use pieces of Step 2 Develop: Visual Learning and Step 3 Assess and Differentiate. Note: The Quick-Check component is now a few select problems that are highlighted with a pink checkmark in the Teacher’s Edition. This time provides an excellent opportunity to pull small groups of students that may need additional support.
Structure for Engage NY Lessons

Launch/Explore: (Concept Development)

The Concept Development constitutes the major portion of instructional time when new learning is introduced. During this time, the lessons move through a deliberate progression on material, from concrete to pictorial to abstract. Your word choice may be slightly different from that in the vignettes, and you should use what works from the suggested talking points to meet your students’ needs.

Summarize: (Student Debrief)

The student debrief piece helps develop students’ metacognition by helping them make connections between parts of the lesson, concepts, strategies, and tools on their own. The goal is for students to see and hear multiple perspectives from their classmates and mentally construct a multifaceted image of the concepts being learned. Through questions that help make these connections explicit, and dialogue that directly engages students in the Standards for Mathematical Practice, they articulate those observations so the lesson’s objective becomes eminently clear to them.

Practice, Reflect, Apply: (Problem Set/Exit Ticket)

The Problem Set often includes fluency pertaining to the Concept Development, as well as conceptual and application word problems. The primary goal of the Problem Set is for students to apply the conceptual understandings learned during the lesson.

Exit Tickets are quick assessments that contain specific questions to provide a quick glimpse of the day’s major learning. The purpose of the Exit Ticket is twofold: to teach students to grow accustomed to being individually accountable for the work they have done, and to provide you with valuable evidence of the efficacy of that day’s work which is indispensible for planning purposes. This time provides an excellent opportunity to pull small groups of students that may need additional support.
Structure for Georgia Standards Lessons

The Georgia Standards tasks have been included in the units to provide students opportunities for rich, engaging, real-world mathematical experiences. These tasks allow students to develop conceptual understanding over time and may take more than one math lesson to complete. The extra time for these lessons has been allotted for in the units. When planning for a Georgia Task, it is suggested that you start by doing the mathematics the students will be engaging in before presenting it to the students.

Launch:

You may need to activate prior knowledge for some of the tasks that will be presented by showing images, letting students engage in partner talk about real-life situations, or using the suggested activity from the background knowledge component. Pose the task to the students making sure the task is understood. This does not mean that you explain how to do the problem, rather you ensure that students understand what the problem is about. You establish clear expectations as to whether students will work individually, in pairs, or in small groups. This includes making sure students know which representations and tools they might be using or if they will have a choice of materials.

Explore:

Students will engage in working on the task using a variety of strategies and tools. You may use the Essential Questions or Formative Assessment questions provided in the lesson as needed in order to understand and prompt student thinking.

Summarize:

Select student work for the class to analyze and discuss. Use partnerships and whole-class collaborative conversations to help students make sense of each others’ work. The Formative Assessment questions may also be used during this time to facilitate the conversation.

Practice, Reflect, Apply:

At this time, provide students time to reflect and revise their work from the Explore after they have engaged in the conversation in the Summarize portion of the lesson. This time provides an excellent opportunity to pull small groups of students that may need additional support.
Common Core Approach to Assessment

Assessments provide ongoing opportunities for students to show their learning accomplishments in addition to offering students a pathway to monitor their progress, celebrate successes, examine mistakes, uncover misconceptions, and engage in self-reflection and analysis. A central goal of assessments is to make students aware of their strengths and weaknesses and to give them opportunities to try again, do better and, in doing so, enjoy the experience of seeing their hard work pay off as their skill and understanding increases. Furthermore, the data collected as a result of assessments represent invaluable tools in the hands of teachers and provides specific data about student understanding that can inform instructional decisions.

For each Topic in enVision 2.0 the following assessments are available:

In the Student Workbook:
- Topic Assessment
- Performance Assessment

Online Teacher's Edition:
- Additional topic assessment Black-line Master
- Additional performance assessment Black-line Master

Online Student Assessment
- Teacher can modify the number of items on an assessment
- Teacher can rearrange order of problems

All of the assessment items for enVision 2.0 are aligned to the types of problems students may encounter on state testing. We have found enVision 2.0 has an excessive amount of items suggested for each topic. To avoid over-assessing, we recommend that school sites work collaboratively in grade-level teams to determine how to best use all the assessment resources available to evaluate student understanding and reduce the amount of items assessed. The SDUSD math units have grouped related topics together within a unit. Sites may choose to only give an assessment at the end of each unit, consisting of items from multiple topics, rather than using multiple days to assess each topic individually.
<table>
<thead>
<tr>
<th>LESSON FOCUS</th>
<th>Converting Units of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIALS</td>
<td>Recording Sheet, access to internet or other resource for measurement information</td>
</tr>
<tr>
<td>LAUNCH</td>
<td>Gather students in an open space. Give students a recording sheet or explain another way they need to display the information. 1. Say, &quot;Today you are going to become an expert with converting units of measure.&quot; 2. Pass out the conversion chart and ask students, “What do you notice about this chart?” Have students turn and talk to a partner about what they notice. Listen in on student conversations and facilitate a brief (5 minute) whole group discussion. Record student ideas. 3. Say, &quot;You can use the internet (or another resource you have) to help you complete the conversion chart.&quot;</td>
</tr>
<tr>
<td>EXPLORE</td>
<td>Give partners/small groups a recording sheet and access to the internet or other resources. 1. Students work with their partner or small groups to research and complete the conversion chart/recording sheet. 2. Students fill in the conversion chart/recording sheet. Mid-way through students explore time, stop students and ask them to think about any patterns they are noticing on their conversion chart. 3. Students will save the chart to use in Lesson 3.</td>
</tr>
<tr>
<td>SUMMARIZE</td>
<td>Refocus the class by sitting in a large circle for a whole class discussion. Select a conversion chart to project or post for the whole class to see. Pose the question: What patterns do you notice on the conversion chart? Give students time to think privately. Have students talk to a partner about the patterns they notice. Listen in on student conversations. Facilitate a whole class discussions focusing on patterns/equivalencies in units of measure. Record what the class notices. Let students know they will be using their conversion charts tomorrow, to continue to think about measurement.</td>
</tr>
</tbody>
</table>
Name ___________________________________________ Date _____________

<table>
<thead>
<tr>
<th>Metric Units of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
</tr>
<tr>
<td>1 centimeter (cm) = _______ millimeters (mm)</td>
</tr>
<tr>
<td>1 meter (m) = _______ cm = _______ mm</td>
</tr>
<tr>
<td>1 kilometer (km) = _______ m = _______ cm = _______ mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass (weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gram (g) = _______ milligrams (mg)</td>
</tr>
<tr>
<td>1 kilogram (kg) = _______ g = _______ mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liquid Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 liter (l) = _______ milliliters (ml)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customary Units of Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
</tr>
<tr>
<td>1 foot (ft) = _______ inches (in.)</td>
</tr>
<tr>
<td>1 yard (yd) = _______ ft = _______ in.</td>
</tr>
<tr>
<td>1 mile (mi) = _______ yd = _______ ft = _______ in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mass (weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pound (lb) = _______ ounces (oz)</td>
</tr>
<tr>
<td>1 ton (t) = _______ lb = _______ oz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liquid Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pint (pt) = _______ cups (c)</td>
</tr>
<tr>
<td>1 quart (qt) = _______ pt = _______ c</td>
</tr>
<tr>
<td>1 gallon (gal) = _______ qt = _______ pt = _______ c</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute (min.) = _______ seconds (sec.)</td>
</tr>
<tr>
<td>1 hour (hr.) = _______ min. = _______ sec.</td>
</tr>
<tr>
<td>1 day = _______ hr. = _______ min. = _______ sec.</td>
</tr>
</tbody>
</table>
LESSON FOCUS | Measurement Equivalents
---|---
MATERIALS | conversion chart from Day 1, calculators, conversion chart worksheet, blank paper

LAUNCH
Gather students in an open space.
Students should have their own conversion chart from Lesson 2
Display the following table:

<table>
<thead>
<tr>
<th>Pounds</th>
<th>Ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

4. Pose the question: "What goes in the blank spaces? How do you know?" "What tool could you use to think about it?" (Encourage students to use their conversion chart from yesterday.)
5. Pose the question "Looking at the table, what might be the rule for converting pounds to ounces and how do you know?"
6. Give students private reasoning time. Have students briefly explain their ideas about the rule to a partner.
7. Facilitate a group discussion and establish as a class that one rule that makes sense for pounds to ounces could be "multiply the number of pounds by 16". As a class justify why that rule makes sense.
8. Ask, "How could we determine how many ounces are in 15 pounds?"
9. Ask, "What would we need to do if we wanted to determine the number of ounces in any number of pounds?"
10. EXPLORE
Give partners/small groups recording sheets, a calculator, paper, and their Conversion Charts from Lesson 2.

4. Students use their conversion chart and the calculator to fill in the conversion tables and find the rules on their recording sheet.
5. Students will save the recording sheets to use as a reference for future lessons.
6. Students will need paper to create tables for other conversions.

SUMMARIZE
Refocus the class by sitting in a large circle for a whole class discussion.

Select a conversion table that students worked to complete and project it or post it for the whole class to see.

1. Pose the question: How did you determine the rule for converting these measurements?
2. Give students private reasoning time. Have students talk to a partner about their thinking. Listen in on student conversations.
3. Facilitate a whole class discussions focusing on the multiplicative thinking involved in determining a rule.
4. Pose the question: “What is important to think about when you are converting measurements from one unit to another?”
5. Record what the class notices.

Let students know they will be using their conversion tables as well as their conversion charts as a resource to help them problem solve in upcoming lessons. Be sure they keep their charts in a safe place.
Conversion Table

<table>
<thead>
<tr>
<th>Pounds</th>
<th>Ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
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<td>4</td>
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<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
The rule for converting feet to inches is ________________

The rule for converting yards to feet is ________________

The rule for converting quarts to pints is ________________

The rule for converting gallons to quarts is ________________

Use your conversion chart to create tables and to find the rules for:
- centimeters to millimeters
- meters to centimeters
- kilometers to meters
- kilograms to grams
- liters to milliliters
- minutes to seconds
- hours to minutes
- days to hours
Objective: Investigate and use the formulas for area and perimeter of rectangles.

Concept Development (35 minutes)

Materials: (T) Grid paper (with ability to project or enlarge grid paper), chart paper (S) Grid paper, personal white board

Problem 1: Review and compare perimeter and area of a rectangle.

T: Draw a rectangle on your grid paper that is four units wide and seven units long.
S: (Draw rectangle on grid paper.)
T: (Monitor to see that the students have drawn the rectangle correctly.) Tell your partner what you notice about your rectangle.
S: The opposite sides are the same length. → It has four right angles. → The area of the rectangle is 28 square units. → The perimeter of the rectangle is 22 units.
T: Place the point of your pencil on one of the corners of the rectangle. Now, trace around the outside of the rectangle until you get back to where you started. What do we call the measurement of the distance around a rectangle?
S: The perimeter.
T: Trace the perimeter again. This time, count the units as you trace them. What is the perimeter of the rectangle?
S: 22 units.
T: When we know the measurements of the length and width of a rectangle, is there a quicker way to determine the perimeter than to count the units while tracing?
S: We could add the measurements of all four sides of the rectangle.
T: Take your pencil and count all of the squares within your rectangle. These squares represent the area of the rectangle. How do I find the area of the rectangle?
S: You count the squares. → You can multiply the length times the width of the rectangle. → Four units times 7 units is 28 square units.

Problem 2: Use the formula $2 \times (l + w)$ to solve for perimeter and to find an unknown side length of a rectangle.

T: Draw a rectangle on your graph paper that is 3 units wide and 9 units long. (Draw and display the rectangle.) Watch as I label the length and width of the rectangle. Now, label the length and width of your rectangle. How can I find the perimeter?
S: Add up the lengths of all of the sides. $3 + 9 + 3 + 9 = 24$. The perimeter is
You could also add $3 + 3 + 9 + 9$. The answer is still 24 units. The order doesn’t matter when you are adding.

T: Use your pencil to trace along one width and one length. Along how many units did you trace?
S: 12 units.

T: How does 12 relate to the length and width of the rectangle?
S: It’s the sum of the length and width.

T: How does the sum of the length and width relate to finding the perimeter of the rectangle?
S: It’s halfway around. I can double the length and double the width to find the perimeter instead of adding all the sides ($2l + 2w$). I could also add the length and the width and double that sum, $2 \times (l + w)$. Both of those work since the opposite sides are equal.

T: You have just mentioned many formulas, like counting along the sides of the rectangle or adding sides or doubling, to find the perimeter. Let’s create a chart to keep track of the formulas for finding the perimeter of a rectangle. Talk to your partner about the most efficient way to find the perimeter.

S: If I draw the shape on grid paper, I can just count along the edge. I am good at adding, so I will add all four sides. It is faster to double the sum of the length and width. It’s only two steps.

T: We can write the formula as $P = 2 \times (l + w)$ on our chart, meaning we add the length and width first and then multiply that sum by 2. What is the length plus width of this rectangle?
S: 3 plus 9 equals 12. 12 units.
T: 12 units doubled, or 12 units times 2, equals?
S: 24 units.

T: Now, draw a rectangle that is 2 units wide and 4 units long. Find the perimeter by using the formula I just mentioned. Then, solve for the perimeter using a different formula to check your work.
S: 2 + 4 = 6 and 6 × 2 = 12. The perimeter is 12 units. Another way is double 2, double 4, and then add the doubles together. 4 plus 8 is 12 Both formulas give us the same answer.

Repeat with a rectangle that is 5 units wide and 6 units long.

Instruct students to sketch a rectangle with a width of 5 units and a perimeter of 26 units on their personal white boards, not using graph paper.

T: Label the width as 5 units. Label the length as an unknown of $x$ units. How can we determine the length? Discuss your ideas with a partner.
S: If I know that the width is 5, I can label the opposite side as 5 units since they are the same. If the perimeter is 26, I can take away the widths to find the sum of the other two sides. 26 – 10 = 16. If the sum of the remaining two sides is 16, I know that each side must be 8 since I know that they are equal and that $8 + 8 = 16$, so $x = 8$ (shows sketch to demonstrate her thinking).
Problem 3: Use the area formula \((l \times w)\) to solve for area and to solve for the unknown side length of a rectangle.

T: Look back at the rectangle with the width of 3 units and the length of 9 units. How can we find the area of the rectangle?

S: We can count all of the squares. \(\rightarrow\) We could also count the number of squares in one row and then skip-count that number for all of the rows. \(\rightarrow\) That’s just multiplying the number of rows by the number in each row. \(\rightarrow\) A quicker way is to multiply the length times the width. Nine rows of each is like an array. Can just multiply 9 \(\times\) 3.

Discuss how to find the area for the 2 \(\times\) 4 rectangle and the 5 \(\times\) 6 rectangle drawn earlier in the lesson. Encourage students to multiply length times width to solve. Ask students to tell how the area of each rectangle needs to be labeled and why.

T: We discussed a formula for finding the perimeter of a rectangle. We just discovered a formula for finding the area of a rectangle. If we use \(A\) for area, \(l\) for length, and \(w\) for width, how could we write the formula?

S: \(A = l \times w\).

T: (Sketch a rectangle on the board, and label the area as 50 square centimeters.) If we know that the area of a rectangle is 50 square centimeters and that the length of the rectangle is 10 centimeters, how can we determine the measurement of the width of the rectangle?

S: I can use the area formula. 50 square centimeters is equal to \(l\) centimeters times the width. \(10\) times 5
equals 50, so the width is 5 centimeters. → The area formula says $50 = 10 \times \_\_\_. I can solve that with division! So, 50 square centimeters divided by 10 centimeters is 5 centimeter Repeat for $A = 32$ square m, $l = 8$ m and for $A = 63$ square cm, $w = 7$ cm.

**Problem Set (10 minutes)**

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. Some problems do not specify a method for solving. This is an intentional reduction of scaffolding that invokes **MP.5**, Use Appropriate Tools Strategically. Students should solve these problems using the RDW approach used for Application Problems.

For some classes, it may be appropriate to modify the assignment by specifying which problems students should work on first. With this option, let the purposeful sequencing of the Problem Set guide your selections so that problems continue to be scaffolded. Balance word problems with other problem types to ensure a range of practice. Consider assigning incomplete problems for homework or at another time during the day.

**Student Debrief (10 minutes)**

**Lesson Objective:** Investigate and use the formulas for area and perimeter of rectangles.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- What is a **formula** for solving for perimeter? What formula is most efficient?
- Compare the units used to measure perimeter and the units used to measure area (length units and square units).
- What was challenging about solving Problems 6(a) and 6(b)? How did the process of solving Problems 4 and 5 help you to figure out how to solve Problems 6(a) and 6(b)?
- The perimeters of the rectangles in Problems 2(a) and 2(b) are the same. Why are the areas different?
- The areas of the rectangles in Problems 6(a) and 6(b) are the same. Why are the perimeters different?
- How did you find the answer for the length of the unknown side, $x$, in Problems 4(a) and 4(b)?
- What was your strategy for finding the length of the unknown side, $x$, in Problems 5(a) and 5(b)? Discuss with your partner.
- What significant math vocabulary did we use today to communicate precisely?
Name ___________________________________________ Date ________________

1. Determine the perimeter and area of rectangles A and B.

   Rectangle A  \( A = \) ___________  \( P = \) ___________

   Rectangle B  \( A = \) ___________  \( P = \) ___________

2. Determine the perimeter and area of each rectangle.
   a. \( 6 \text{ cm} \)

   b. \( 5 \text{ cm} \)

   \( P = \) ________  \( A = \) ________

   \( 3 \text{ cm} \)

   \( 8 \text{ cm} \)

   \( P = \) ________  \( A = \) ________
3. Given the rectangle's area, find the unknown side length.

   a. \[ \text{8 cm} \]
      \[ \text{80 square cm} \]
      \[ x \]
      \[ x = \__ \__ \__ \__ \]

   b. \[ \text{7 cm} \]
      \[ \text{49 square cm} \]
      \[ x \text{ cm} \]
      \[ x = \__ \__ \__ \__ \]

4. Given the rectangle's perimeter, find the unknown side length.

   a. \[ P = 120 \text{ cm} \]
      \[ \text{20 cm} \]
      \[ x \text{ cm} \]
      \[ x = \__ \__ \__ \__ \__ \]

   b. \[ P = 1,000 \text{ m} \]
      \[ x \text{ m} \]
      \[ 250 \text{ m} \]
      \[ x = \__ \__ \__ \__ \__ \__ \]

5. Each of the following rectangles has whole number side lengths. Given the area and perimeter, find the length and width.

   c. \[ P = 20 \text{ cm} \]
      \[ \text{24 square cm} \]
      \[ l = \__ \__ \__ \__ \]

   b. \[ P = 28 \text{ m} \]
      \[ \text{24 square m} \]
      \[ w = \__ \text{ cm} \]
      \[ l = \__ \__ \__ \__ \]
## Fourth Grade Unit 7
### Lesson 11

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Present the following problem to students: The rectangular projection screen in the school auditorium is 5 times as long and 5 times as wide as the rectangular screen in the library. The screen in the library is 4 feet long with a perimeter of 14 feet. What is the perimeter of the screen in the auditorium?

Ask: What is happening in this problem?
Give students private reasoning time. Have students briefly discuss what is happening in the problem with a partner.
Facilitate a whole class discussion that clarifies what is happening in the problem (i.e., There are two different sized screens, one is in the library and one is in the auditorium. The auditorium screen is bigger than the library screen.)

Chart class ideas

Ask: What are the quantities (numbers) in this problem and what do they represent?
Give students private reasoning time. Have students briefly discuss the quantities (numbers) in the problem and what they represent.
Facilitate a whole class discussion that clarifies the quantities in the problem and what they represent. (i.e., 5 represents how many times larger the auditorium screen is than the library screen, 4 ft represents the length of the library screen, 14 represents the perimeter of the library screen.)

Chart Class ideas

Ask: How could you draw a model or a visual representation of what we know about this situation so far?
Give students private time to sketch out a quick visual representation of the information they know so far.
Observe student models and select one to put before the class to analyze.
Post or project the student model
Ask: How does this model match the problem?

Finally
Ask: What is the problem asking us to find out?
Clarify with the class what the problem is asking to find out. (The perimeter of the screen in the auditorium)
### EXPLORE

Give individuals/partners/small groups a problem sheet. Let students know that their job is to solve this problem, and any other problems they may have time for, by using a clear visual representation that shows their thinking.

7. Students work individually, with their partner or in small groups to solve the problems in the problem sheet. They record their thinking clearly using a visual representation.

8. Check in with students as they work to get a sense of the ideas you will bring forth to the whole group in the summarize portion of the lesson.

Note students will *not* have time to work on all of the problems during the explore time. When most students have had a chance to grapple with problem number 1 on their own, call students back together to discuss and summarize that problem.

### SUMMARIZE

Refocus the class by sitting in a large circle for a whole class discussion.

Select a model to present to the whole class that represents problem number 1. Pose the question: How does this representation match the problem? Give students time to think privately. Have students talk to a partner about how the visual representation matches the problem situation. Listen in on student conversations. Facilitate a whole class discussions focusing on how the representation matches the problem.

Ask: What is the problem asking us to find out? Where do you see that information in the representation? Give students time to think privately. Have students talk to a partner about how the visual representation matches the problem situation. Listen in on student conversations. Facilitate a whole class discussions focusing on how the representation matches the problem and answers the question in the problem.

Ask: How did the big ideas of area and perimeter help you solve this problem? Ask: How did using a visual representation help you solve this problem?

### PRACTICE, REFLECT, APPLY

Students work on solving the remaining 3 problems individually, in partnerships or small groups.

Remind students to use a visual representation that matches the situation to help them reason through the problems.
Solve the following problems. Show your work clearly using a visual representation.

1. The rectangular projection screen in the school auditorium is 5 times as long and 5 times as wide as the rectangular screen in the library. The screen in the library is 4 feet long with a perimeter of 14 feet. What is the perimeter of the screen in the auditorium?

2. The width of David’s rectangular tent is 5 feet. The length is twice the width. David’s rectangular air mattress measures 3 feet by 6 feet. If David puts the air mattress in the tent, how many square feet of floor space will be available for the rest of his things?
3. Jackson’s rectangular bedroom has an area of 90 square feet. The area of his bedroom is 9 times that of his rectangular closet. If the closet is 2 feet wide, what is its length?

4. The length of a rectangular deck is 4 times its width. If the deck’s perimeter is 30 feet, what is the deck’s area?