



San Diego Unified School District

Instructional Module to Enhance the Teaching of

HARCOURT

Math

California Edition

Grade 5

Module 8 – Reorganized

Measurement: Area, Perimeter, and Volume

— WORK IN PROGRESS —

San Diego City Schools
Instruction and Curriculum Division
MATHEMATICS CURRICULUM MAP – GRADE 5

MODULE 8 – GEOMETRY: AREA, PERIMETER, AND VOLUME

Modules represent individual units of study that lead to essential learnings

THREADS THROUGHOUT THE YEAR:

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.

Students will:

- 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.

These are essential learnings that represent bigger ideas/concepts:

- *Students understand that measurement involves comparing an item with a measurement unit that has the same attribute: length with length; area with area; volume with volume.*
- *Perimeter, area and volume formulas provide a way of measuring these attributes using only measurements of length.*
- *Students derive formulas for finding the area of rectangles and triangles and then use those polygons to derive formulas for finding the area of other polygons and the surface area of rectangular prisms.*

These are essential questions that learners ask themselves in order to achieve the essential learnings:

- How do I identify and use the relationships between area and perimeter to solve problems?
- How do I use my understanding of the area of a rectangle to derive the formulas for the area of a triangle and a parallelogram?
- How do I make 2-dimensional patterns (nets) that can be folded into 3-dimensional solid figures?
- How do I use my understanding of finding the area of a rectangle to understand and find the surface area of rectangular prisms?
- How do I explain and show relationships between perimeter, area and volume?
- How do I use cubes to derive, model, and explain the formula for finding the volume of a rectangular prism?
- How do I identify and use the appropriate units of measure for perimeter, area and volume (units, square units and cubic units)?

Resources: Van de Walle, Chapter 19 (pp. 316-340); *Mathematics Source Book* (pp. 27-36)

**Measurement: Area/Perimeter/Volume
Chapters 28 and 29**

Key Mathematical Concepts:

- Know that perimeter is a linear measure that uses units of length to measure the distance around a polygon and understand how to figure the perimeter.
- Identify and use the relationships between area and perimeter to solve problems.
- Use understanding of the area of a rectangle to derive the formula for the area of a triangle.
- Use understanding about the area of a rectangle to derive the formula for the area of a parallelogram.
- Identify two-dimensional nets for three-dimensional solids.
- Understand that the surface area of a rectangular prism is the sum of the areas of all faces and know how to compute surface area.
- Understand how to find the volume of a rectangular prism and that cubic units are used to measure the amount of space the prism occupies.
- Identify and use appropriate units of measure for perimeter, area, and volume.

<p>Chapter 28: <u>Perimeter and Area</u></p> <p>Lesson 1: Perimeter Lesson 2: Relate Perimeter and Area Lesson 3: Area of Triangles Lesson 4: Area of parallelograms Lesson 5: Problem Solving Strategy: <i>Solve a Simpler Problem</i></p>	<p>Chapter 29: <u>Surface Area and Volume</u></p> <p>Lesson 1: Nets For Solid Figures Lesson 2: Surface Area Lesson 3: Algebra: Volume Lesson 4: Measure Perimeter, Area, Volume</p>
	<p align="center">Note: Review “Module Notes” for an explanation about the suggested order of the lessons and rationale for omitting some lessons.</p>

MODULE 8 NOTES

- Chapter 27 is moved to Module 10 because measurement is practiced in the geometry lessons.
- Lesson 28.1 and 28.3 are combined in Lesson 1 to review perimeter and area.
- Lesson 28.2 is omitted because circumference is not a fifth grade standard.
- Lesson 29.5 is omitted to provide time for assessment of geometry concepts.
- This module does not contain lessons for: Day 10, 11, or 12

Area/Perimeter/Volume

<u>Day 1</u> CHAPTER 28: Perimeter and Area Lesson 28.1 and 28.3 Perimeter and Area	<u>Day 2</u> Lesson 28.4 Relate Perimeter and Area	<u>Day 3</u> Lesson 28.5 Area of Triangles	<u>Day 4</u> Lesson 28.6 Area of Parallelograms	<u>Day 5</u> Lesson 28.7 Problem Solving: Compare the Area of Triangles & Parallelograms
<u>Day 6</u> Chapter 29: Surface Area and Volume Lesson 29.1 Nets of Solid Figures	<u>Day 7</u> Lesson 29.2 Surface Area	<u>Day 8</u> Lesson 29.3 Algebra: Volume	<u>Day 9</u> Lesson 29.4 Measure Perimeter, Area, and Volume	<u>Day 10</u> Review/ Assessment of Geometry Concepts

Note: Review “Module Notes” for an explanation about the suggested order of the lesson.

DAY 1
 Unit 8: Measurement
 Chapter 28: Perimeter and Area
 LESSON 28.1 & 28.3, pp. 524 -529

MATERIALS:	Grid paper
LESSON FOCUS:	Perimeter and Area
CALIFORNIA STANDARDS:	<p>Measurement and Geometry</p> <p>1.4: Differentiate between, and use appropriate units of measures for 2- and 3-dimensional objects (e.g., Find perimeter, area, and volume).</p> <p>AF 1.2: Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.</p>
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Review perimeter and area and use the correct units used to measure them (linear and square). • Understand polygons are closed plane figures formed by line segments and regular polygons have equal sides.
<p>LAUNCH: Introduce students to concepts.</p>	<ul style="list-style-type: none"> • Introduce measurement concepts by having students tell you what they already know about perimeter and area. Chart responses. • Place a color tile on the overhead and ask students: <p>PERIMETER:</p> <ul style="list-style-type: none"> • <i>What do we call the distance around the edge or boundary of a space? (perimeter)</i> • <i>What measurement units might we use to describe the perimeter?</i> • As students provide examples, brainstorm things that would actually be measured using those units. Include all grade appropriate linear measurements in the discussion. <p>AREA:</p> <ul style="list-style-type: none"> • Refer back to the color tile on the overhead. • Ask students how they might describe how much space is covered by the tile. <p><u>Note:</u> The big idea here is that you can't measure area with linear units. The area of a space is measured with square units.</p> <ul style="list-style-type: none"> • Discuss the difference between an inch and a square inch; a foot and a square foot; a meter and a square meter, etc. • Compare a line segment 1" long with the space covered by the tile. <p>*Note: Perimeter can be thought of as the measure of the length of the boundary of a straight-sided figure.</p>

<p>Grid paper</p>	<p>Problem of the Day (28.1), P. 524A</p> <p>A. Ask students to draw all of the possible rectangles that could be enclosed by the fencing. (perimeter)</p> <p>B. Extend the discussion by asking what is the area of each rectangle? Encourage the strategy of counting the squares to determine area.</p> <ul style="list-style-type: none"> • Students use grid paper to find all of the different rectangles that are possible. • Students label each rectangle with the perimeter and area (square units). • Remind students that each square represents 1 square foot and each edge of a square is one linear foot.
<p>EXPLORE: Work with the concept. Focus on students “doing” mathematics.</p> <p>Grid paper</p>	<p>Learn, P. 529: Making Plans.</p> <ul style="list-style-type: none"> • Write problem on board/overhead. • Discuss possible strategies to solve, including those for finding the perimeter. <p>Teach, P. 529; Guided Instruction questions to guide discussion.</p> <ul style="list-style-type: none"> • Highlight both area and perimeter of the shapes.
<p>PRACTICE: Focus on Communication and Representation.</p>	<p>Check, P. 524 #1 – 5</p> <p>Check, P. 529 # 1 – 3</p> <p>Practice & Problem Solving, P. 525 #14 – 22. Discuss solutions.</p> <p>Practice & Problem Solving, P. 529 #18 – 20. Discuss solutions.</p>
<p>SUMMARIZE: Connect purpose to activities.</p>	<ul style="list-style-type: none"> • Discuss the difference between perimeter and area and the units used to measure each. <p>ASSESS, P. 529: DISCUSS</p>
<p>HOMEWORK:</p>	<p>Practice & Problem Solving, P. 525: # 10 – 13</p> <p>Practice & Problem Solving, P. 529: # 8, 12, 15, 21</p>

ROUTINE:

Pose problems with a constant perimeter and challenge students to find rectangles with different areas. Cut out some of the rectangles and post them under the headings:

“Most Area”

“Least Area”

Challenge students to find the rectangles with the greatest and least areas. Ask students to generalize/describe the kinds of shapes with the greatest and least area.

DAY 2
 Unit 8: Measurement
 Module 6: Chapter 28: Perimeter and Area
 LESSON 28.4, pp. 530 -531

MATERIALS:	Color Tiles, Cm. Grid Paper
LESSON FOCUS:	Relate Perimeter and Area
CALIFORNIA STANDARDS:	Measurement and Geometry 1.4: Differentiate between, and use appropriate units of measures for 2- and 3-dimensional objects (e.g., Find perimeter, area, and volume.)
PURPOSE OF LESSON:	<ul style="list-style-type: none"> Understand that polygons (rectangles) that have the same area can have different perimeters and polygons (rectangles) that have the same perimeter can have different areas.
LAUNCH: Introduce students to concepts. Grid paper	Explore, P. 530. Write Sharon & Brad problem on board/overhead. TEACH, P. 530, Guided Instruction Questions in to discuss generalizations about rectangles that have the same perimeter. Try It, bottom P. 530. <ul style="list-style-type: none"> Ask students to consider if shapes that have the same area can have different perimeters? Why? Why not? Explain/show/justify your thinking. Do Career Connection, P. 530A to investigate the above question.
EXPLORE: Work with the concept. Focus on students “doing” mathematics. Color tiles	Connect, P. 531 top SE. <ul style="list-style-type: none"> Students find all the possible rectangles they can make with 24 tiles. Students record their work in a table (see page 531). Discuss Reasoning & Math Idea, top P. 531 SE, after completing the chart.
PRACTICE: Focus on Communication and Representation.	Practice, P. 531 #14 – 17. <ul style="list-style-type: none"> Share & discuss. Practice, P. 531: #s 1, 2, 6, 7
SUMMARIZE: Connect purpose to activities.	<ul style="list-style-type: none"> Ask students to suggest possible dimensions for a rectangle with an area of 100 square inches, without drawing or modeling. List student suggestions on board/overhead. 1 x 100, 2 x 50, 4 x 25, 5 x 20, 10 x 10. Ask students if the rectangles will they all have the same perimeter, and have them explain their thinking. Ask which shape do they think will have the greatest/least perimeter and why.

HOMEWORK:**Practice, P. 531: #, 5, 8, 9**
Mixed Review, P. 531**ROUTINES:**

Ask students to find all the rectangular arrays for a given number of one-inch tiles. (Grid paper may be used.)

Connect this activity to previous factor work. Find the rectangles with the least and greatest perimeters. Post shapes under the headings:

"Greatest Perimeter"

"Least Perimeter"

Ask students to generalize/describe the kinds of rectangles with the greatest and least perimeters.

DAY 3
Unit 8: Measurement
Module 6: Chapter 28: Perimeter and Area
LESSON 28.5, pp. 532 -535

MATERIALS:	Grid paper, TR 32
LESSON FOCUS:	Area of Triangles
CALIFORNIA STANDARDS:	Measurement and Geometry 1.1: Derive and use the formula for the area of a triangle and of a parallelogram by comparing it with the formula for the area of a rectangle. 1.4: Differentiate between, and use appropriate units of measures for 2- and 3-dimensional objects (e.g. find perimeter, area, and volume).
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Use rectangles to find the area of triangles. • Understand that a diagonal of a rectangle divides it into 2 congruent triangles. • Understand congruent triangles have the same area. • Understand that to find the height of a triangle, measure the length of the line segment perpendicular to the base.
LAUNCH: Introduce students to concepts. Grid paper	<ul style="list-style-type: none"> • Ask students to draw a triangle on grid paper with a base of 5 units and a height of 10 units, to match Step 1, SE, P. 532. • Discuss how they could find the area. (50 square cm.) (count, etc.) • Cut the rectangle into two triangles as shown in diagram and discuss how they can help you find the area of a triangle. (The area is half.) • Introduce new vocabulary: base and height for triangles. <p>Learn, P. 532: Surf the Wind. Discuss problem with students. Teach, P. 532: Guided Instruction questions to guide discussion of Activity 1.</p>
EXPLORE: Work with the concept. Focus on students “doing” mathematics.	<p>Other Triangles, P. 533: Activity 2: Steps 1, 2, & 3</p> <ul style="list-style-type: none"> • At this point, <u>do not</u> emphasize the formula. Focus on the relationship between the triangles and the rectangle. • See bullets, top margin, TE P. 533, to guide discussion. <p>Check P. 533</p> <ul style="list-style-type: none"> • Discuss # 1. • Students use grid paper to draw triangles #s 2, 3, & 4. • Students enclose each triangle in a rectangle to find the area. <p>Connect using base and height to find area to the use of the formula.</p>
PRACTICE: Focus on Communication and Representation.	<p>Practice & Problem Solving, P. 534 – 535 # 18 – 20; 22.</p> <ul style="list-style-type: none"> • Discuss.

SUMMARIZE: Connect purpose to activities.	Practice & Problem Solving, P. 534 #21. <ul style="list-style-type: none">• Students discuss error with partner and how to correct it. Practice & Problem Solving, P. 535 #23. <ul style="list-style-type: none">• Discuss
HOMEWORK:	Practice & Problem Solving, P. 534, #8 – 13, 15, 16

ROUTINES:

Connect both of these routines to real world applications.

Examples:

When would we want to maximize the perimeter?

(Seating more people around a limited number of tables; display space in a museum where you want more wall space per square foot of space.)

When would we want to minimize the perimeter?

(To keep down the cost of walls in housing; to keep down the amount of fencing needed to enclose a space.)

DAY 4
Unit 8: Measurement
Chapter 28: Perimeter and Area
LESSON 28.6, pp. 536-539

MATERIALS:	Cm. grid paper
LESSON FOCUS:	Area of parallelograms
CALIFORNIA STANDARDS:	Measurement and Geometry 1.1: Derive and use the formula for the area of a triangle and parallelogram by comparing it with the formula for area of a rectangle. 1.4: Differentiate between, and use appropriate units of measures for, two- and three-dimensional objects.
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • Use knowledge of rectangles to find the area of a parallelogram. • Understand parallelograms can be transformed to a rectangle to find its area.
LAUNCH: Introduce students to concepts.	<p>Learn, P. 536: Catch the Sun.</p> <ul style="list-style-type: none"> • Students use grid paper to draw a parallelogram (as in Activity) with a base of 11 and a height of 5 cm. • Model on board/overhead. <p>NOTE: Remind students that a parallelogram is a quadrilateral with two pairs of parallel sides. Squares and rectangles are also parallelograms. This lesson will focus on parallelograms with no <u>right angles</u>.</p> <ul style="list-style-type: none"> • Ask students how they can use what they've learned about triangles and rectangles to find the area of this parallelogram. • Allow students time to work and then share strategies. • Guide the class through steps 2 and 3 in the activity. • Discuss what students notice (base and height), about the area of the rectangle, and the area of the parallelogram and why. (What dimensions are the same about both shapes?) • Ask students to work with their partner to draw another parallelogram. • Cut and slide to form a rectangle and find the area. • Discuss bullet at bottom of SE P. 536. <p>Use a Formula, P. 537.</p> <ul style="list-style-type: none"> • Connect activity to the Math Idea on P. 537. • See bullets top margin, TE P. 537 to guide discussion. • Include Reasoning question.

<p>EXPLORE: Work with the concept. Focus on students “doing” mathematics.</p>	<p>Check, P. 537. For problems 2, 3, and 4, draw each parallelogram.</p> <ul style="list-style-type: none"> • Write the base and height for each. Use the formula to find the area. • (Check the area by cutting a right triangle and sliding it to form a rectangle.) <p>Check, P. 537 #5 – 7.</p> <ul style="list-style-type: none"> • Draw models on grid paper. • Share & discuss.
<p>PRACTICE: Focus on Communication and Representation.</p>	<p>Practice & Problem Solving, P. 538-539 # 20 – 28.</p> <ul style="list-style-type: none"> • Share & discuss.
<p>SUMMARIZE: Connect purpose to activities.</p>	<p>ASSESS, TE P. 539: DISCUSS.</p>
<p>HOMEWORK:</p>	<p>Practice & Problem Solving, P. 538: # 13 – 15, 17, 18 Mixed Review, P. 539</p>

ROUTINES:

DAY 5
Unit 8: Measurement
Chapter 28: Perimeter and Area
LESSON 28.7, pp. 540 -541

MATERIALS:	Grid paper, straight edge
LESSON FOCUS:	Solve a Simpler Problem
CALIFORNIA STANDARDS:	Measurement and Geometry 3.2: Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems. AF 1.2: Use a letter to represent an unknown number; write and evaluate simple algebraic expressions in one variable by substitution.
PURPOSE OF LESSON:	Deepen understanding of the formulas for the area of triangles and parallelograms by comparing them; review base, height, and congruent.
LAUNCH: Introduce students to concepts. Grid paper	Problem, P. 540. • Review with students. Teach, P. 540. Guided Instruction questions to guide discussion. • Ask students to sketch the drawing (to scale) of the house, SE P. 540. • Highlight the decomposition into different shapes in the SOLVE section.
EXPLORE: Work with the concept. Focus on students “doing” mathematics.	Problem Solving Practice, P. 541 #1 – 4. Students work with partners. Share and discuss responses. Highlight concepts of area and perimeter and their connections in the discussion.
PRACTICE: Focus on Communication and Representation.	Mixed Strategy Practice, P. 541 #5 – 10. Discuss solutions and thinking.
SUMMARIZE: Connect purpose to activities.	• ASSESS, TE P. 541: WRITE. • Writing In Mathematics, P. 536B: Students explain how the areas of a triangle and a parallelogram with the same base and height (dimensions) compare.
HOMEWORK:	Thinker’s Corner, P. 539

ROUTINES:

DAY 6
Unit 8: Measurement
Chapter 29: Surface Area and Volume
LESSON 29.1 pp. 546 -547

MATERIALS:	One-inch grid paper, scissors, tape, copies for each student of TR 60, 62, 65, 66.								
LESSON FOCUS:	Nets for Solid Figures								
CALIFORNIA STANDARDS:	Measurement and Geometry 1.2: Construct a cube and rectangular box from two-dimensional patterns and use these patterns to compute the surface area for these objects. 2.3 Visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids.								
PURPOSE OF LESSON:	<ul style="list-style-type: none"> • To learn to recognize a two-dimensional pattern for a three-dimensional solid. (net) • Understand prisms and pyramids are examples of 3-D solids. 								
LAUNCH: Introduce students to concepts.	Problem of the Day, P. 546A, TR 29.1 <ul style="list-style-type: none"> • Have students cut out nets to check. • Define net as a 2-D pattern that can be folded into a 3-D shape. (See top of p. 546). 								
EXPLORE: Work with the concept. Focus on students “doing” mathematics.	Learn, P. 546: Boxed In: <ul style="list-style-type: none"> • Write net definition on board/overhead. • Discuss. • Students follow steps of Activity, p. 546, and make net. • Students also make nets for Examples A & B. Teach, P. 546; <ul style="list-style-type: none"> • Guided Instruction Questions to guide discussion. Check What You Know, P. 545, #1 – 4. <ul style="list-style-type: none"> • Discuss. • Then, # 5-9: <ul style="list-style-type: none"> • Begin a chart with the following headings: <table style="margin-left: 20px; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Name of Shape</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Number of Faces</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Shape of Faces</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Shape of Base/s</u></th> </tr> </thead> <tbody> <tr> <td style="height: 20px;"> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Complete the chart for the cube. • Students construct: Rectangular Prism (TR 60), Triangular Prism (TR62), Square Pyramid (TR 65), and Triangular Prism (TR 66) similar to the one in Example A. • Discuss attributes of each solid and refer to data on the chart. 	<u>Name of Shape</u>	<u>Number of Faces</u>	<u>Shape of Faces</u>	<u>Shape of Base/s</u>				
<u>Name of Shape</u>	<u>Number of Faces</u>	<u>Shape of Faces</u>	<u>Shape of Base/s</u>						

