Perimeter, Area and Volume
What Do Units Tell You About What Is Being Measured?
Overview

Summary of Lessons: This set of lessons was designed to develop conceptual understanding of the unique attributes of perimeter, area and volume as well as the close relationships between these concepts. In a combination of group and individual work with manipulatives, students explore how to decide what to measure, how to measure it, how to calculate the totals, and what units to use for recording the answers. Each lesson could be taught in isolation if only one of the three concepts needed to be targeted. Lessons focus on standard English measurement, but could be adapted for metric measurement.

Enduring Understanding: 4ME03, 5ME03, 6ME03
Use systematic procedures to measure, describe, and compare the perimeter and area of rectangles and the volume of rectangular prisms. Identify perimeter, area or volume as the attribute to be measured. Select and use appropriate units for perimeter, area or volume and use tools that match the unit chosen. Accurately count to determine the number of units. Use formulas to find the perimeter and area of rectangles and the volume of rectangular prisms.

Essential Questions:
• How do you identify whether perimeter or area of a rectangle is the attribute to be measured?
• What systematic procedures can be used to measure perimeter or area of a rectangle?
• Why are specific units appropriate for measuring perimeter or area of a rectangle?
• How do you identify when volume of a rectangular prism is the attribute to be measured?
• What systematic procedures can be used to measure volume of a rectangular prism?
• What are specific units appropriate for measuring volume of a rectangular prism?
• How are systematic procedures used to measure perimeter, area, and volume of rectangular figures and the units used to express those measurements related?

Prerequisites for Lesson:
• Vocabulary: foot, height, inch, length, linear units, perimeter, ruler, rectangle, square, width, square unit, cubic unit
• Skills 4ME01: Ability to use a ruler and tape measures to measure linear units
• Concepts 4ME01: Demonstrate understanding of the concept of length.

Related GLEs: See Related GLE’s file for explanations
• Content: GLE 1.2.1, 1.2.2, 1.2.3, 1.2.4 and 1.2.5
• Process: GLE 2.2.1, 2.2.2, 3.1.1, 3.2.3, 3.3.2, 4.2.2 and 5.3.1
5ME01, 6ME01 Demonstrates understanding of the concepts of perimeter, area and volume of rectangular figures and prisms.

GLE 1.2.1 Understand the concepts of volume.
Students will demonstrate their understanding of volume when they find the volume of rectangular prisms in the student worksheet and in the exit ticket of the lesson Volume: The Cube Club.

GLE 3.1.1 Analyze information from a variety of sources to interpret & compare information.
Students will analyze information from a variety of sources to interpret and compare information during each summary of lesson Part A through Part B when they identify patterns in the data collected and develop generalizations in the form of formulas to find perimeter, area, and volume of rectangular figures.

GLE 4.2.2 Apply communication skills to clearly & effectively express or present ideas & situations using mathematical language or notation.
Students will apply communication skills to clearly and effectively support their generalizations created during summaries in each lesson Part A through Part C.
Students will also apply communication skills to clearly and effectively express their solutions to extended problems related to perimeter, area and volume of rectangular figures at the end of each lesson and in the exit tickets.

GLE 5.3.1 Understand that mathematics is used in daily life & extensively outside the classroom.
Students will demonstrate understanding of perimeter, area and volume situations in the real world when they generate lists of examples in each lesson.
They will also demonstrate understanding of this connection as they solve real world problems in the extended responses at the end of each lesson and in the exit tickets.

6ME02 Demonstrates understanding of the differences between square & cubic units

GLE 1.2.2 Understand the differences between square & cubic units.

GLE 1.2.3 (5th grade) understand how measurement units of volume & length are organized in the U.S. system.
Students will demonstrate an understanding of the differences between square and cubic units when they create and use square and cubic models to solve problems in the last two lessons. They will also demonstrate their understanding by their choice of units in the extended response problems.

6ME03 Use systematic procedures to measure, describe, & compare the area of rectangles & the volumes of rectangular prisms. Identify area or volume as the attribute to be measured, select & use appropriate unit for area or volume, select & use tools that match the unit chosen, count to determine the number of units; use formulas to find the perimeter and area of rectangles.

GLE 1.2.4 Understand & apply systematic procedures to measure volume for solid shapes.
GLE 1.2.5 (5th grade) Understand & apply formulas to measure area and perimeter of rectangles.

Students demonstrate understanding of systematic procedures to find perimeter, area, and volume as they apply these procedures in the extended response problems at the end of each lesson. They will observe data patterns and create generalized formulas at the end of each lesson. They will be asked to use and explain these formulas in their final assessment.

GLE 2.2.1 Apply strategies, concepts, & procedures to devise a plan to solve the problem.

GLE 2.2.2 Apply mathematical tools to solve the problem.

Students will apply strategies, concepts, and procedures to devise plans to solve problems connected to perimeter, area, and volume as they work in groups during each lesson. They will further develop these plans during summary session and demonstrate an ability to implement their plans to solve the extended response problems at the end of each lesson.

GLE 3.1.1 Analyze information from a variety of sources to interpret & compare information.

GLE 3.2.3 Analyze procedures & results in various situations.

GLE 3.3.2 Analyze procedures & information used to justify results using evidence.

Students will analyze and compare information from a variety of sources during each lesson as they collect class data. Each day during summary and partner work, they will develop varied procedures based on their analysis and analyze the effectiveness of their procedures to justify generalizations related to finding perimeter, area, and volume of rectangular figures.

**Test Specs:** [Of following form…

- We suggest you read (4ME01 and 6ME01) prior to teaching the lessons, paying specific attention to the concepts of length, perimeter, area and volume.
- We suggest you read 5ME02, 6ME02 prior to teaching the lessons, paying specific attention to the differences between length units, square units, and cubic units using the U.S. system.
- We suggest you read 4ME03, 6ME03 prior to teaching the lessons, paying specific attention to the identification of perimeter, area or volume as the attribute to be measured and the selection and use of appropriate tools to derive appropriate units of measurement.

**Materials Needed:** See materials chart in expanded files.
Suggested Teaching Sequence: See expanded teacher notes with each lesson
- Students take the pre-test to determine prior knowledge. (20 minutes)
- In Lesson 1 students explore the meaning of perimeter, use of appropriate units for its measure, and calculate and report perimeter correctly. (1-2 days)
- In Lesson 2 students explore the meaning of area, use of appropriate units for its measure, and calculate and report area correctly. (1-2 days)
- In Lesson 3 students explore the meaning of volume, appropriate units for its measure, and calculate and report volume correctly. (1-2 days)
- The final test assesses student understanding of the concepts of perimeter, area and volume by identifying the attribute to be measured, using appropriate units, and the using of a systematic procedure (formula) to find the perimeter and area of rectangles and the volume of rectangular prisms. (1 day)

Modifications for Differentiated Instruction:
- Simplifications: See expanded teacher notes with each lesson
- Extensions: See expanded teacher notes with each lesson

Suggested Future Experiences:
- Extend the concept of area to surface area of rectangular prisms.
- Apply formulas to measure area and perimeter of right triangles.
- Apply strategies to obtain reasonable estimates of area for rectangles and triangles.
- Specific lessons
- Enduring Understandings:
  GLE 1.2.1: Compare the surface area of two different rectangular prisms. Describe surface area measurement. Explain how area and surface area are related.
  GLE 1.2.5: Explain and use a formula to find the area of a right triangle. Use estimation to justify reasonableness of a measurement.
  GLE 1.2.6: Identify situations in which estimated measurements are sufficient. Use estimation to justify reasonableness of a measurement.

Assessments:
- Formative assessments: Pre-test
  Student worksheet included with each lesson
  Student exit tickets included with each lesson
- Summative assessment: Final test