



## If the Shoe Fits...

### Mathematics Measurement

It was all in the shoe for Cinderella; having the right measurement, size and foot for the perfect fit into the glass slipper.

#### National Standards: Mathematics > Measurement

**NM-MEA.3-5.1, NM-MEA.3-5.1 (Grade 4 and 5) (Grade 6) Understand measurable attributes of objects and the units, systems, and processes of measurement**

- understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute
- compare and order objects according to these attributes
- understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems
- carry out simple unit conversions, such as from centimeters to meters, within a system of measurement
- understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.
- understand that measurements are approximations and how differences in units affect precision

**NM-MEA.3-5.2, NM-MEA.3-5.2 (Grades 4 and 5) (Grade 6) Apply appropriate techniques, tools, and formulas to determine measurements.**

- use repetition of a single unit to measure something larger than the unit, for instance, measuring the length of a room with a single meter stick
- use tools to measure develop common referents for measures to make comparisons and estimates
- select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles; angle measures to appropriate levels of precision
- select and use benchmarks to estimate measurements
- select and apply techniques and tools to accurately find length, area, volume, and
- develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes

#### Kentucky: Mathematics Standard

2. Students shall develop their abilities to apply core concepts and principles from mathematics, the sciences, the arts, the humanities, social studies, practical living studies, and vocational studies to what they will encounter throughout their lives.

**Measurement (2.8, 2.10, 2.12)**

2.8 Students understand various mathematical procedures and use them appropriately and accurately.

2.10 Students understand measurement concepts and use measurements appropriately and accurately.

**(Grades 4 and 5)**

**MA-E-2.2.5** Use nonstandard and standard units to measure weight, length, perimeter, area (figures that can be divided into rectangular shapes), and angles

**MA-E-2.2.7** Choose appropriate tools (e.g., protractors, meter sticks, rulers) for specific measurement tasks.

**MA-E-2.2.8** Identify measurable attributes of an object and make an estimate using appropriate units of measurement

**MA-E-2.2.9** Use measurements to describe and compare attributes of objects

**(Grade 6)**

**MA-M-2.2.2** Use appropriate tools and strategies (e.g., combining and subdividing shapes) to find measures of both regular and irregular shapes

**MA-M-2.2.4** Estimate measurements in standard units

**MA-M-2.2.5** Use formulas to find area and perimeter of triangles and quadrilaterals, area and circumference of circles, and surface area and volume of rectangular prisms

**Ohio: Mathematics > Measurement**

- Estimate and measure to a required degree of accuracy and precision.
- Select and use appropriate units, tools and technologies.

**Benchmark(s) Grade 4**

A. Select appropriate units for perimeter, area, weight, volume, time and temperature.

B. Know that the number of units is inversely related to the size of the unit for any item being measured.

D. Identify appropriate tools and apply counting techniques for measuring side

lengths, perimeter, and area of squares, rectangles, and simple irregular two-dimensional shapes...

**Benchmark(s) Grades 5 and 6**

A. Select appropriate units to measure angles, circumference, surface area, mass and volume.

C. Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area.

F. Analyze and explain what happens to area and perimeter or surface area and volume when the dimensions of an object are changed.

**Ohio: Mathematics > Mathematical Processes Standard**

- Use mathematical processes and knowledge to solve problems.
- Apply problem-solving and decision-making techniques, and communicate mathematical ideas.

*Note: The following benchmarks are embedded within the grade level indicators.*

### **Benchmark(s) Grade 4**

A, B, C, D, E, F, G, H, I, J and K (see all)

### **Benchmark(s) Grades 5 and 6**

A, B, C, D, E, F, G, H, I, J and K (see all)

### **Objective**

Student will:

- Understand the concept of units of measure, non-standard and standard.
- Establish personal or common referents for units of measure to make estimates and comparisons.
- Find perimeter and area of a foot tracing using a non-standard unit of measure and a standard unit of measure.
- Describe and compare the relationships among units of measure.
- Recognize and explain the need and benefit for fixed units and tools for measuring an object's length.

### **Assessment**

Students will be able to:

- Measure objects that are not uniform.
- Measure and calculate perimeter.
- Measure and calculate area.
- Measure the perimeter and area of their foot using a non-standard and a standard unit of measurement for comparison of data.
- Explain the reason and benefit for using fixed standard units of measure and appropriate tools.

Sample items to gauge student understanding:

1. Why is it important to have a standard unit of measure?
  - a. Everyone can measure the exact same way.
  - b. Everyone can measure for consistent results.
  - c. Everyone can measure accurately for precision.
  - d. Everyone can measure using appropriate tools.
  - f. All of the above (*all of the above*)
2. What is a job that someone may do at your house that would require knowledge and skill to measure "area"? \_\_\_\_\_  
(*e.g., carpet installation*)
3. If you were going to position a fence around a pond, would it be more helpful to know the perimeter or area of the pond? Explain your answer. (*perimeter*)

### **Vocabulary**

- Unit of measurement
- Perimeter
- Area

### **Materials**

- Graph paper
- Pencil

- String
- Rulers
- Tape Measure

### **Activity 1**

#### **How Many Feet Is That?**

##### **Teacher will:**

1. Introduce the concept of measurement and the various ways to measure objects – non-standard and standard.
2. Introduce the glass slipper from Cinderella as an object of that can be measured.
3. Instruct each student to trace one of their own feet on a piece of graph paper and cut it out.
4. Have students measure and record a variety of different objects in the classroom using the foot cut out as a common referent for a unit of measure (e.g., height of a door, distance from back of the room to front of room, length of the chalk board, etc.)
5. Facilitate student discussion to explore how the measurements of various objects and the same object differed and why.
6. Guide and extend the discussion to address the concepts of perimeter and area.
7. Instruct students to measure the perimeter of their foot cut out, suggesting student brainstorming for various measurement strategies (*e.g., use a string to outline the perimeter of the foot cut out, and then measure the length of the string*).
8. Instruct students to measure the area of their foot cut out, suggesting student brainstorming for various measurement strategies (*e.g., counting all of the squares on the graph paper using the following criteria--whole squares count as one, and partial squares count as halves or quarters*).
9. Instruct students to order their individual foot cut outs from smallest to largest based on their measurements of perimeter (or area).
10. Have students observe and comment on the range of sizes of the foot cut outs and how the sizes alter the measurement of the same object.
11. Facilitate student discussion on how results would differ if everyone used their own personal unit of measure verses a standard unit of measure such as a ruler or tape measure
12. Have students identify the benefits of using standard units of measure.

##### **Students will:**

1. Participate in teacher lead discussion about units of measurement.
2. Trace one of their feet on graph paper and cut out for use as a common referent of measure.
3. Measure various objects around the room using their foot cut out.

4. Recognize that the same length or width may have different measurements if different units of measure vary.
5. Comprehend the concept and meaning of perimeter and area.
6. Measure the perimeter of their foot cut out.
7. Measure the area of their foot cut out.
8. Arrange their foot cut outs and order them from smallest to largest, based on perimeter (or area).
9. Explain how the results differ when personal units of measure are applied vs. standard units of measure.
10. Compare the results of non-standard and standard units of measure.
11. Identify benefits for the use of standard units of measure.

**Self-Selected Reading Suggestions**

Adler, David A. (1999). How Tall, How Short, How Far Away? New York: Holiday House.