Objective To guide children as they investigate the idea of accuracy, explore $\frac{1}{8}$ inch, $\frac{1}{16}$ inch, and $\frac{1}{2}$ centimeter on a ruler, and explore measuring to the nearest half-inch and half-centimeter.

Key Concepts and Skills
- Find fractional parts of an inch and centimeter. (Number and Numeration Goal 3)
- Estimate to the nearest inch. (Measurement and Reference Frames Goal 1)
- Explore the importance of standard units. (Measurement and Reference Frames Goal 1)
- Measure to the nearest inch and centimeter. (Measurement and Reference Frames Goal 1)

Key Activities
Children discuss accuracy, identify subdivisions on tape measures and rulers, and measure to the nearest half-inch and half-centimeter.

Ongoing Assessment: Informing Instruction See page 674.
Ongoing Assessment: Recognizing Student Achievement Use journal page 214. (Measurement and Reference Frames Goal 1)

Key Vocabulary
millimeter

Materials
Math Journal 2, p. 214
My Reference Book, p. 67 (optional)
Home Link 9-2
transparencies of Math Masters, pp. 260 and 261 (optional) 

Home Link 9-3
Math Masters, pp. 262 and 263

Practicing with $+, -$ Fact Triangles
$+, -$ Fact Triangles
Children use fact triangles to practice addition and subtraction facts.

Math Boxes 9-3
Math Journal 2, p. 215
Children practice and maintain skills through Math Box problems.

Home Link 9-3
Math Masters, pp. 262 and 263
Children practice and maintain skills through Home Link activities.

Comparing Lengths of Objects
Math Masters, p. 264 per partnership: strip of paper cut to 3-inch length, 12-inch ruler
Children compare lengths of objects that are almost the same.

Comparing Units of Metric Linear Measure
Math Masters, pp. 265 and 266
tape measure ● meterstick ● length of string or ribbon ● crayons
Children compare the metric units of meter, decimeter, and centimeter by measuring the same objects with all three units.

Advance Preparation
For the Introducing Fractional Units of Length activity in Part 1, you may want to make overhead transparencies of Math Masters, pages 260 and 261. For the optional Readiness activity in Part 3, cut strips of paper to 3 inches in length. For the optional Enrichment activity in Part 3, cut lengths of string or ribbon that are a whole number of meters long, such as 2 meters or 5 meters. For a mathematics and literacy connection, obtain a copy of Inchworm and a Half by Elinor J. Pinczes (Houghton Mifflin, 2001).

Teacher’s Reference Manual, Grades 1–3 pp. 61, 62, 157, 158
Getting Started

**Mental Math and Reflexes**
Encourage children to refer to the Table of Equivalent Measures or My Reference Book, page 67 as necessary to solve the following problems:
- How many inches are in 1 foot? 12
- How many feet are in 1 yard? 3
- How many inches are in 1 yard? 36

**Math Message**
Measure the length of your little finger. Would you say that your little finger is about 1 inch, 2 inches, or 3 inches long?

**Home Link 9-2 Follow-Up**
Children briefly describe some of the objects or distances they measured and give the measurements. Choose one addition problem and have children share strategies for how they solved the problem.

---

1 **Teaching the Lesson**

**Math Message Follow-Up**
Ask children to raise their hands if their little fingers are about 1 inch long. About 2 inches long. About 3 inches long. Can children tell from their responses whose little finger is the longest? The shortest? Might they be able to tell if they had taken more exact measurements?

**Discussing the Need for Accurate Measurements**
People take measurements using tools made by people. Because there is a limit to what people can observe and what tools can do, all measurements differ somewhat from the “exact” or “true” value of the quantity being measured.

A precise and accurate measurement is one that is very close to the true value. Precision and accuracy can be improved by using high-quality tools, reading the tools carefully, and measuring in small units or fractional parts of units.

**Science Link**
When the Hubble telescope was first sent into space (after years of research at a cost of billions of dollars), it did not work properly due to an error in measurement of about \(\frac{1}{10}\) centimeter. Ask children to find \(\frac{1}{10}\) centimeter (1 millimeter) on their tape measures.

---

**NOTE** The precision with which measuring tools are manufactured is often based on intended use, materials, and cost. So the tolerance, or difference, between a standard unit and a particular measuring tool can vary.
Discusses the following ideas with children:

- Some situations require very accurate measurements. For example, people who build cars must measure accurately to be sure that the parts fit together properly. Prescription drugs are usually dispensed in milligrams.

- Other situations require less accurate measurements. For example, it wouldn’t make sense to give the length of a football field in inches or the weight of a truck in milligrams.

- Sometimes an estimate is good enough. For example, is the distance from home to school farther than the distance from home to the fire station?

Have children share examples of measurement situations. Which situations call for very accurate measurements? For which situations is a less accurate measurement, or an estimate, good enough?

**Introducing Fractional Units of Length**

*(Math Masters, pp. 260 and 261)*

Tell children that they can make more accurate measurements if they measure in fractional parts of inches or centimeters. Ask children to examine the inch side of their tape measures. *How many spaces are marked between inch marks? 8 Are all marks equally spaced? yes*

**NOTE** Because children will benefit from repeated exposures to fraction notation, write the fractions on the board as children name them. You might also draw a unit box to remind children of the unit associated with the fractions.

**Ongoing Assessment: Informing Instruction**

Watch for children who are having difficulty finding the dividing marks within an inch and a centimeter. Use overhead transparencies of *Math Masters*, pages 260 and 261 to help children find the dividing marks.

**Links to the Future**

Measuring to the nearest inch is a Grade 2 Goal. Children will benefit from the multiple opportunities of measuring. Through these exposures, children will learn to measure fractional units of length. Measuring to the nearest half-inch is a Grade 3 Goal; to the nearest quarter-inch is a Grade 4 Goal; to the nearest eighth-inch is a Grade 5 Goal; and to the nearest sixteenth-inch is a Grade 6 Goal.

Next, ask children to look for the mark that divides an inch on the tape measure into two equal parts. Check to see that they have found the $\frac{1}{2}$-inch mark.
Ask: How long is the part between the 0-inch mark and the $\frac{1}{2}$-inch mark? $\frac{1}{2}$ inch The part between the $\frac{1}{2}$-inch mark and the 1-inch mark? $\frac{3}{4}$ inch

Have children find the marks that divide an inch into eight equal parts. How long is the part between two such marks? $\frac{1}{8}$ inch Count the divisions of an inch in unison: $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, ..., \frac{8}{8}$ inch. Then follow the same procedure with quarter-inches. Encourage children to find equivalent names for the same fractional measurement units.

Next, have children examine the inch side of the ruler in their tool kits. Children should notice that the inches are divided into even more (smaller) parts than on the tape measure. How many such parts are in an inch? 16 As before, count the marks in an inch space in unison: $\frac{1}{16}, \frac{2}{16}, \frac{3}{16}, ..., \frac{16}{16}$ inch.

Finally, ask children to find the 1-centimeter marks on their rulers. Ask them how many equal parts a centimeter is divided into. 10 Tell them that the name for one of the ten parts of a centimeter is a millimeter (mm). To support English language learners, write millimeter on the board. How many millimeters are in 1 centimeter? 10 A millimeter is $\frac{1}{10}$ of a centimeter. Mention that the prefix milli- means “thousandth of” and that there are 1,000 millimeters in a meter. A millimeter is $\frac{1}{1,000}$ of a meter.

Links to the Future

This is the first exposure to millimeter. Measuring to the nearest centimeter is a Grade 2 Goal. This beginning exposure to millimeters reinforces the concept of equal parts within one whole. Measuring to the nearest millimeter is a Grade 5 Goal.

Point out the half-centimeter marks on the ruler. These marks are a little longer than the millimeter marks. Add millimeters to the Table of Equivalent Measures on the Class Data Pad. (See margin.) Save the table for future discussions.

Measuring to the Nearest Inch and Centimeter

(Math Journal 2, p. 214)

Children use a ruler to measure the lengths of objects in full-size drawings.

Ongoing Assessment: Recognizing Student Achievement

Use journal page 214, Problems 1–3 to assess children’s ability to measure to the nearest inch. Children are making adequate progress if they can correctly measure these three objects. Some children may be able to measure the object in Problem 5 to the nearest half-inch. [Measurement and Reference Frames Goal 1]

Student Page

Lesson 9-3

675
Unit 9: Measurement

NAME DATE TIME

Today your child measured life-size pictures of objects to the nearest half-inch and half-centimeter. Take turns with your child measuring objects to the nearest half-inch and half-centimeter. Check to see if your measurements are the same.

Please return this Home Link to school tomorrow.

Family Note

Cut out the 6-inch ruler on the next page. Measure each line segment to the nearest half-inch. Write the measurement in the blank to the right of each segment.

1. __________________ 2. __________________
2. 3.
3. 4.

Centimeters

Cut out the 15-centimeter ruler on the next page. Measure each line segment to the nearest half-centimeter. Write the measurement in the blank to the right of each segment.

3. __________________ 4. __________________

5. Measure some objects in your home to the nearest half-inch or half-centimeter. List the objects and their measurements below.

Object Measurement

6. 7. 8.

Answers for Problems 5-8 vary.

Home Link 9-3

(Math Masters, pp. 262 and 263)

Home Connection Children measure objects around their homes to the nearest half-inch or half-centimeter. They draw a picture and record the measurements.

Practicing with +, – Fact Triangles

Have children practice addition and subtraction facts using their fact triangles.

As children practice, ask them to sort the Fact Triangles into two piles—facts they know from memory and facts for which they need more practice. Have them write the facts for which they need practice.

Math Boxes 9-3

(Math Journal 2, p. 215)

Mixed Practice Math Boxes in this lesson are paired with Math Boxes in Lesson 9-1. The skill in Problem 6 previews Unit 10 content.

Writing/Reasoning Have children draw, write, or verbalize their answers to the following: Look at Problem 1. Write one multiplication number sentence and one addition number sentence to represent the array. $6 \times 6 = 36$ and $6 + 6 + 6 + 6 + 6 + 6 = 36$
**Differentiation Options**

**READINESS**

> **Comparing Lengths of Objects**
> 
> (Math Masters, p. 264)

To explore estimating lengths, have children assemble a small group of objects and then develop a strategy for comparing their lengths more exactly (see advance preparation). When they have completed Math Masters, page 264, have children share the phrases they wrote describing the objects. Conclude by discussing how it might be easier to report the relative lengths of the objects if they could be measured more accurately.

**ENRICHMENT**

> **Comparing Units of Metric Linear Measure**
> 
> (Math Masters, pp. 265 and 266)

To explore the relationships between metric units of linear measure, have children find lengths of objects using metric units (see advance preparation). They should see a pattern showing the relationship among the three metric units used: 10 centimeters = 1 decimeter; 10 decimeters = 1 meter; and 100 centimeters = 1 meter. If decimeters and meters are not marked on children’s tape measures and metersticks, children can mark these increments using crayons.

---

**Teaching Master**

**Home Link Master**

**Home Link**

9. Draw pictures of two things you measured. Mark the parts you measured. Record the measurements under the pictures.

---

**Math Masters, p. 265**

**Math Masters, p. 266**

**Planning Ahead**

In Lesson 9-4, each child will need a box in the shape of a rectangular prism, with bases smaller than a sheet of paper.