Grade 8 Mathematics
Measurement: Lesson 1

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol (⇨) by them.

Purpose of Lesson 1:

- In this lesson, the tutor and the students will
  - ✓ select the best unit to measure length,
  - ✓ read linear measurements accurately to the nearest millimeter or 1/16 inch,
  - ✓ estimate length,
  - ✓ solve problems involving length, and
  - ✓ convert from one unit to another within a system.

Materials/Equipment Needed:

- Rulers or measuring tapes (You can use the ruler from the Mathematics Reference sheet, Student Sheet 27.)
- Copies of Student Sheets 19 and 20
- A quarter, a dime, and paper clips

Preparations before Beginning Lesson 1:

- Gather rulers or measuring tapes, a quarter, a dime, and paper clips.
- Run off one copy of Student Sheets 19 and 20 for each student.
- Run off one copy of the Mathematics Reference Sheet (Student Sheet 27, Measurement 4) for each student. This sheet will be used again in Lessons 3 and 4 of Measurement.

Lesson 1: Measurement

In this lesson, we will work on **length**.

Say:

What are some times that you might need to measure length? (to find their height, the distance from home to school, the distance around the track, etc.) **What kind of tools do you use to measure length?** (rulers, measuring tapes, yardsticks) **What units do you use to measure length?** See the next part.

⇨ As the students tell you the units, make a list. Divide the units into English/customary units and metric units. There are other units, but these are the ones on which we will focus.

Customary	**Metric**
mile, foot, inch, yard	meters, centimeters, millimeters kilometers, decimeters

Say:

Let's put the units in order from smallest to largest in each system. Give the students time to think about the order. Listed below is the correct order. Write the units and the symbols on the board in the correct order. It is acceptable now **not** to use periods, except for **inch**.

Customary	**Metric**
inch (in.)	millimeter (mm)
foot (ft)	centimeter (cm)
	decimeter (dm)
yard (yd)	meter (m)
mile (mi)	kilometer (km)

Note: We will start with the customary system and work on the two systems separately.

Say:

About how big is an inch? (It is about the diameter (across) of a quarter or about the length of a paper clip.) **About how big is a foot?** (It is **about** the size of a man's shoe.) **About how big is a yard?** (It is about the width of a doorway in a house.) The following questions will ask students to think about which units are better to measure length. Sometimes there will be more than one correct answer.

Which unit would you use to measure the following?
A. The distance from Lake Charles to Crowley (miles)
B. The height of the door in your house (feet or yards)
C. The length of the tennis court (feet or yards)
D. The length of a swimming pool (yards or feet)
E. The circumference of the Superdome (yards)
F. The length of a new pencil (inches)
G. The thickness of a dime (All of the customary units are too big, so you would have to measure in parts of an inch.)

Note: Although students will be given a reference sheet with many of the conversions, they often have trouble knowing whether they should multiply or divide. You need to look at the reference sheet to help them know which conversions they should memorize. The only customary conversion for length on the reference sheet is 5,280 feet = 1 mile. Therefore, students must know the number of inches in a foot and the number of feet in a yard. Measurement, Lesson 4 focuses on using the reference sheet.

⇨ Hold up a large and a small paper clip.

Say:

If I were to measure the length of a bulletin board with the large paper clips and then with the smaller ones, which would I need more of? (small paper clips) **Why?** (They are smaller.)

⇨ Hold up a pencil and a paper clip.

Say:

If I were to measure the length of the room with pencils and then with paper clips, which would I need fewer of? (pencils) **Why?** (Pencils are longer.)

Say:

You are telling me that, if I use longer objects to measure, I will have fewer of them. If I use shorter objects to measure, I will need more of them. If I measure the room in inches, and then in feet, which will I need more of? (inches) **Why?** (Inches are smaller, so we will have more.) **This information can help you when you convert from one unit to another. If you have 10 feet and need to convert to inches, you should multiply. Why?**

(Feet are bigger, so I should have fewer. If I multiply 10 times 12, I will get a larger number.) **If I tell you that 3 feet = 1 yard, and that you have 36 feet, should you multiply or divide by 3 to get the number of yards?** (divide) **Why?** (Yards are bigger, so I need fewer.)

⇨ Give Student Sheet 19 to the students. Allow the students to work the problems independently, but come back to discuss the problems. It is so important for the students to discuss these problems.

Answers:

1) 4 inches	2) C	3) B	4) less	5) more
6) inches or feet	7) miles	8) feet or inches		9) <
10) >	11) divide	12) multiply		

Say:

Note: We will now go to the metric system. **About how long is a millimeter?** (It is about the thickness of a dime.) **About how long is a centimeter?** (A thumbtack is about a centimeter wide or a centimeter is about the width of your little finger.) **About how long is a decimeter?** (A cassette tape is about one decimeter long.) **About how long is a meter?** (It is a little longer than a yard, or about the width of a doorway or the length of a baseball bat.) **About how long is a kilometer?** (A kilometer is a little longer than one half mile.) The following questions will ask students to think about the units that are the better ones to use to measure length. Sometimes there will be more than one correct answer. **What unit would you use to measure the following?**

A. The distance from Lake Charles to Crowley (kilometers)
B. The height of the door in your house (meters)
C. The length of the tennis court (meters)
D. The length of a swimming pool (meters)
E. The circumference of the Superdome (meters)
F. The length of a new pencil (centimeters or decimeters)
G. The thickness of a dime (millimeters)

Say:

Which is bigger, meters or kilometers? (kilometers) **If I have 8 kilometers, should I multiply or divide by 1000 to find the number of meters?** (multiply) **Why?** (Meters are smaller, so I need more.) **If I have 80 centimeters, should I multiply or divide by 10 to get the number of millimeters?** (multiply) **Why?** (Millimeters are smaller, so I need more.)
It may help the students to look at a chart for metric units.

⇨ Write this chart on the board or on a piece of paper.

1000 mm = 100 cm	100 cm = 10 dm	100 cm = 1 m
1000 mm = 10 dm	10 dm = 1 m	
1000 mm = 1 m		
1000 m = 1 km		

Note: The following conversions are on the reference sheet.
1 kilometer = 1,000 meters
1 centimeter = 0.01 meter
1 millimeter = 0.001 meter
Some students may have trouble realizing that
1000 millimeters = 1 meter is the same conversion as
1 millimeter = 0.001 meter.

Say:

The metric system is really a lot easier to use than the customary system. The metric system makes use of prefixes. These same prefixes are used in length, mass, and capacity units.

⇨ Write the following prefixes on the board.

milli means one thousandth
centi means one hundredth
deci means one tenth
kilo mean one thousand

Say:

A millimeter equals one thousandth of a meter; a milliliter is one thousandth of a liter; and a milligram is one thousandth of a gram. A centimeter is how many meters? (0.01 m) **A kilogram is how many grams?** (1000 g)

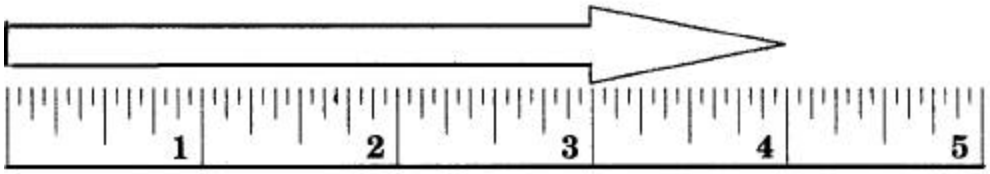
⇨ Give Student Sheet 20 to the students. Have the students work independently, but discuss each item after they have finished.

Answers:	1) 9.8 cm or 98 mm	2) A	3) C
4) longer	5) more	6) mm	7) km
8) meters	9) <	10) >	11) multiply
12) divide	13) B	14) D	

⇨ Have one student summarize today's lesson. You want the students to think about how conversions make sense, not just to memorize the tables.

Student Sheet 19 (Measurement: Lesson 1)

1. Use the ruler to answer the question. What is the length of the arrow to the nearest $\frac{1}{16}$ inch? _____.



Choose the best answer.

2. About how many inches long is the segment?

A. 4 inches
B. 3 inches
C. 2 inches
D. 1 inch

3. The length of a car is about 15 _____.

A. inches
B. feet
C. yards
D. miles

4. Is the length of a calculator more or less than a foot?_____

5. Is the length of a swimming pool more or less than a yard? _____

In 6–8, choose the best unit to use to measure each object.

6. The length of Michael Jordan's shoe _____

7. The distance from Winnsboro to Rayville _____

8. The height of Kareem Abdul Jabar _____

Fill in each circle with the sign (>, <, or =) to make the sentence true. You can use the reference sheet.

9. 9in. ◯ 1ft

10. 1yd 4ft ◯ 2 yards

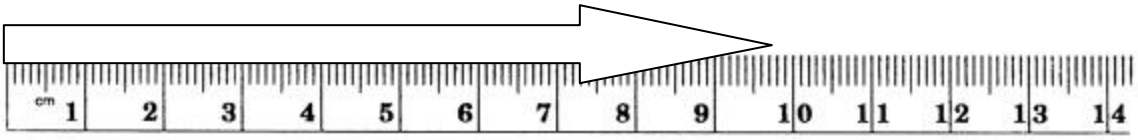
Fill in each blank with the correct answer.

11. To change from feet to miles, _____ by 5280.

12. To change from feet to inches, _____ by 12.

Student Sheet 20 (Measurement: Lesson 1)

1. Use the ruler to answer the question. What is the length of the arrow to the nearest millimeter?



Choose the best answer.

2. About how many centimeters long is the segment?

•————————•

A. 4 centimeters
B. 5 centimeters
C. 9 centimeters
D. 10 centimeters

3. The height of a kitchen counter is about one _____ .

A. millimeter
B. centimeter
C. meter
D. kilometer

4. Is the length of a carrot longer or shorter than a centimeter? _____
5. Is the height of a classroom door more or less than a meter? _____

In 6–8, choose the best unit to use to measure each object.

6. Christina Aguilera's ring size _____
7. The distance from Arcadia to Ruston _____
8. The length of a basketball court _____

Fill in each circle with the sign (>, <, or =) to make the sentence true. You can use the reference sheet.

9. 350m ◯ 3km

10. 120dm ◯ 1m

Fill in each blank with the correct answer.

11. To change from meters to centimeters, _____ by 100.
12. To change from millimeters to meters, _____ by 1000.

Choose the best answer.

13. Nancy is 1.3 meters tall. How many centimeters is 1.3 meters?

A. 13cm
B. 130cm
C. 1300cm
D. 13000cm

14. Dolly's compact disc stack is 43cm tall. What is this height in meters?

A. 4300m
B. 430m
C. 4.3m
D. 0.43m