

Grade 8 Mathematics

Measurement: Lesson 4

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 (\Rightarrow) by them.

Purpose of Lesson 4:

- In this lesson, the tutor and the students will
 - ✓ use the Mathematics Reference Sheet to work problems.

Materials/Equipment Needed:

- Copies of Mathematics Reference Sheet (Student Sheet 27)
- Copies of Student Sheet 28
- Paper and pencils
- Calculators

Preparations before beginning Lesson 4:

- Run off one copy of the Reference Sheet (Student Sheet 27) and one copy of Student Sheet 28 for each student.
- Have at least one calculator available.
- Have paper and pencils available.

Lesson 4: Measurement

⇒ Give the Mathematics Reference Sheet (Student Sheet 27) to the students.

Say:

What kind of things are on this sheet? (formulas, conversion tables, a ruler, and the definition of *mean*, *median*, *mode*, and *range*.) **What do you notice about the ruler?** (It has both metric and customary units on it. It has inches and centimeters on it.) **Let's look at the customary part of the ruler. How many inches are shown?** (6 inches) **What are the divisions in between?** ($\frac{1}{2}$ inches and $\frac{1}{4}$ inches) **Tell me what the 3 divisions between 1 and 2 mean.** (1 and $\frac{1}{4}$, 1 and $\frac{1}{2}$ and 1 and $\frac{3}{4}$, or $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$; some may say $\frac{5}{4}$, $\frac{6}{4}$, $\frac{7}{4}$, but I doubt it. It would be correct, however.) **What are the 3 divisions between 5 and 6?** ($5\frac{1}{4}$, $5\frac{1}{2}$, $5\frac{3}{4}$) **Let's look at the metric part of the ruler. How many centimeters are shown?** (There are 14 numbers shown, but there is a 15th line. Take either as a correct answer.) **What are the divisions between the centimeters?** (Millimeters or 0.1 cm. Either is correct.) **How would you read the measurement halfway between 7 and 8?** (as either 7 cm 5 mm or as 7.5 cm) **How would you read the first 5 measurements between 2 and 3?** (2.1 cm, 2.2 cm, 2.3 cm, 2.4 cm, 2.5 cm or 2 cm 1 mm, 2 cm 2 mm, 2 cm 3 mm, 2 cm 4 mm, 2 cm 5 mm)

⇒ Move to the conversion tables. If you have done Measurement Lessons 1 and 3, you may not have to spend much time here.

Say:

Let's look at the metric conversion table. What do you notice? (There are 3 conversions shown. All of the conversions are length units.) **If I gave you 5 kilometers, how would you find the number of meters?** (multiply 5 times 1000; 5000 m) **If I gave you 4000 meters, how would you find the number of kilometers?** (divide by 1000; 4 km) **If I gave you 25 meters, how would you find the number of centimeters?** (1 cm = 0.01 m or 1 m = 100 cm, so I could multiply 25 times 100; 2500 cm.) **Let's look at the customary conversion table. What do you notice?** (There are 4 capacity conversions, one weight conversion, and one length conversion.) **If I gave you 8 quarts, how would you find the number of gallons?** (divide by 4; 2 gallons) **If I gave you 8 quarts, how would you find the number of pints?** (multiply by 2; 16 pints)

How would you find the number of pints in 6 gallons? (multiply by 4 to find the number of quarts; then multiply this answer by 2 to find the number of pints)

⇒ Move to the formulas.

Say:

Let's look at the formulas now. How many area formulas do you see? (5) **What are they?** (Area of a circle = πr^2 ; area of a rectangle = $l \times w$; area of a trapezoid = $\frac{1}{2}h(b_1 + b_2)$; area of a triangle = $\frac{1}{2} b \times h$; area of a parallelogram = $b \times h$. **All of the figures are what kinds of figures?** (flat or plane figures) **Remember that, when you find area, you are finding the amount it would take to cover the figure. What would you find if you were looking for the distance around a plane figure?** (perimeter, or circumference for circles) **Why is there no formula for the area of a square?** (A square is just a special rectangle for which the length and width are the same, but you can still use the formula for a rectangle.) **Most of the area formulas have an h in them. What does h stand for?** (height) **What kind of formulas are given for the solid or 3-dimensional figures?** (volume and surface area) **Volume is the amount that a figure would hold. Surface area is the amount that it would take to cover a 3-dimensional figure, such as the amount of wrapping paper to wrap a package.** **There are two other formulas on the sheet. What are they?** (Pythagorean theorem and the distance formula.) **When would you use the Pythagorean theorem?** (to find the missing side lengths in a right triangle) **When would you use the distance formula?** (to find out the distance you have driven at a certain speed for a certain time; to find out how long it would take to get to a place driving at a certain speed; to find out how fast you need to drive to cover so many miles in a certain amount of time)

⇒ Move to the definitions of *mean*, *median*, *mode*, and *range*. Write the numbers 2, 8, 10, 8, 12, 14 on the board or on a piece of paper.

Say:

Let's look at the definitions on the sheet. These are terms that we use when we are describing data sets. Let's look at a small set of data and find each of these terms. I just wrote the numbers 2, 8, 10, 8, 12, 14 on the board.

I want you to take a few minutes to find the mean, median, mode, and range of these numbers. (To find the mean, add the 6 numbers to get 54; then divide by 6, to get 9. To find the median, put the numbers in order. Since there is an even number of numbers, there is no 1 middle number. Take the numbers *8 and 10*; add them together; and then divide by 2. You get 9 as the median, or middle number. The *mode* is the number that occurs most, or 8. The *range* is the difference in the highest and lowest numbers: $14 - 2 = 12$.)

⇒ Give Student Sheet 28 to the students. Let them work one problem at a time, using the reference sheet. Each time ask them to tell you which part of the sheet they used.

Answers:

1. They may need to look at the reference sheet to get the definitions of mean, median, mode, and range. Students need to put the temperatures in increasing or decreasing order.

A. Subtract 78 from 89. The range is 11° .

B. There are 2 modes: 78° and 89° .

C. Once the temperatures are in order, the students simply need to look for the middle temperature: 82° .

D. To find the mean, they need to add all 7 temperatures. They will get 581. Then they must divide 581 by 7 to get 83° .

2. They will need the formula for the circumference of a circle: $C = 2\pi r$. They need to know that to find the radius, they divide the diameter by 2.

So $C = 2\pi (14)$. If they use the π key on a calculator, they will get approximately 88 yards. If they use $22/7$, the answer will still be 88 yards.

3. They need to use the formula for the surface area of a rectangular solid. They should get 300 sq. in.

4. They should use the formula for the volume of a cylinder. They should get approximately 5,390 cubic cm.

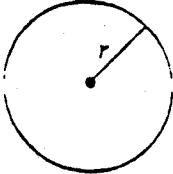
5. 1 mile = 5280 feet, so one-half mile equals 2640 feet.


6. The distance formula says that distance = rate x time. The rate is 50 miles per hour; the time is 3 hours. The distance is 150 miles.

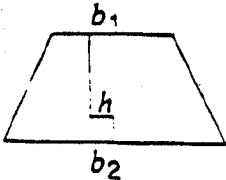
7. They should use the Pythagorean theorem. $c^2 = a^2 + b^2$ so $c^2 = 3^2 + 4^2$. This equation equals $9 + 16 = 25$. $c^2 = 25$, so $c = 5$.

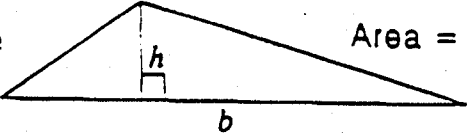
Have one student summarize today's lesson.

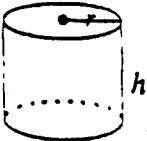
Student Sheet 27 (Measurement: Lesson 4)

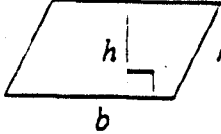
Circle  $\pi \approx 3.14$
 Area = $\pi \cdot r^2$
 Circumference = $2\pi \cdot r$

Rectangle  Area = $l \cdot w$
 Perimeter = $2(l + w)$

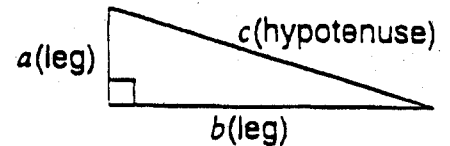
Trapezoid  Area = $\frac{1}{2}h(b_1 + b_2)$

Triangle  Area = $\frac{1}{2}b \cdot h$

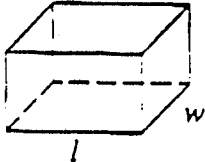
Cylinder  Volume = $\pi \cdot r^2 \cdot h$
 Surface Area = $2\pi \cdot r^2 + 2\pi \cdot r \cdot h$

Parallelogram  Area = $b \cdot h$

Pythagorean Theorem: $a^2 + b^2 = c^2$



Rectangular Solid

 Volume = $l \cdot w \cdot h$
 Surface Area = $2wl + 2lh + 2wh$

Distance Formula: distance = rate \cdot time

Mean: In a collection of data, the sum of all the data divided by the number of data

Median: The middle number or average of the two middle numbers in a collection of data when the data are arranged in order

Mode: The number or numbers that occur most often in a collection of data

Range: The difference between the greatest and the least numbers in a collection of data

Metric Units of Length

1 kilometer = 1,000 meters

1 centimeter = 0.01 meter

1 millimeter = 0.001 meter

U.S. Unit Conversions

8 fluid ounces = 1 cup

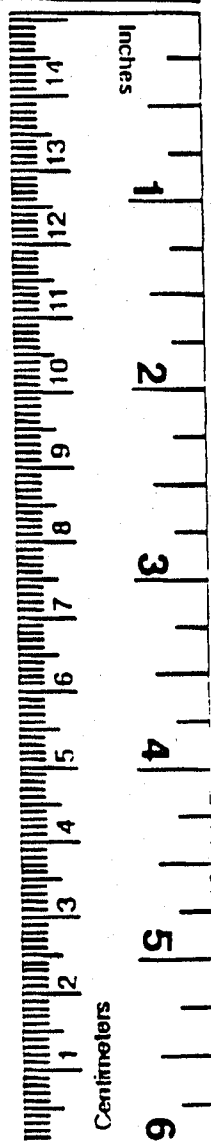
2 cups = 1 pint

2 pints = 1 quart

4 quarts = 1 gallon

16 ounces = 1 pound

5,280 feet = 1 mile



Student Sheet 28 (Measurement: Lesson 4)

Use the reference sheet to help you work the following problems.

1. One week in October, Jan recorded the following temperatures.

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Temperature	78° F	82° F	89° F	86° F	89° F	79° F	78° F

- A. What was the range of temperatures for the week?
B. What was the mode of temperature for the week?
C. What was the median temperature for the week?
D. What was the mean average temperature for the week?
2. Julie wants to build a fence to enclose a circular exercise area for her horse. If the diameter of the exercise area needs to be 28 yards, approximately how many yards long will the fence be?
3. Charmen is wrapping a present in a box that measures 12 inches x 9 inches x 2 inches. What is the least amount of wrapping paper needed to wrap the gift?
4. Removing a bush from the yard left a cylinder-shaped hole that has a radius of 7 cm and a height of 35 cm. Approximately, how much soil will be needed to fill the hole?
5. Chad rode his bike for half a mile. How many feet did he ride?
6. Mr. Jefferson drove approximately 50 miles per hour for 3 hours. How many miles did he drive?
7. In the right triangle, what is the length of side x ?

