
Lesson 2.6

MEASURING POTS

Subjects: science, mathematics.

Skills: knowledge, comprehension, application, analysis, evaluation.

Strategies: brainstorming, analogy, discussion, computation, compare and contrast.

Duration: 45 to 60 minutes.

Class Size: any.



Pottery vessel from Stanly County, North Carolina, 100 BC–AD 800.

Objectives

In their study of measuring pots, students will use an activity sheet or modern pottery rim sherds to:

- compute circumference from a section of a circle;
- construct analogies based on their own experience about possible functions of ancient or historic ceramics.

Materials

For each student, “Broken Pots” activity sheet, or rim sherds from broken modern vessels. Metric ruler with centimeter (cm) or millimeter (mm) increments.

Vocabulary

Ceramic: an item or material made from soft, moist clay that is first shaped and then fired at high temperatures. Pottery is a ceramic material.

Pottery: a ceramic item or material made of fired clay, usually in the form of a vessel.

Rim sherd: a piece of the rim or border of a broken vessel.

Sherd: a broken piece of pottery; a shard.

Vessel: a hollow or concave utensil for holding something.

Background

Ceramic vessels are common artifacts found by North Carolina archaeologists on Native American sites occupied after 1000 BC. This date marks when most southeastern Indians began making clay *pottery*. It marks, too, the beginning of other broad cultural changes.

Population had grown enough that the territory each group used to get seasonally available foods got smaller. People started staying much of the year in villages, many of which were located near rivers or along major tributaries. To supplement the food they hunted and gathered, people began growing crops. Pottery became a key element in this village-based lifestyle. Once people became settled and less nomadic, pottery vessels became practical, everyday tools used for cooking and storage.

Pottery’s relative abundance at archaeological sites is due to the fact that it is very durable. It can last for thousands of years, whether buried in the ground or lying on the surface. For today’s

archaeologists, pottery holds clues to past life. Archaeologists and other historians have learned through their research that pottery styles are distinctive to particular groups of people, and the styles change over time. This knowledge, which is refined as more research is done, helps archaeologists determine how old a site is, which group of people lived there, and what interactions they might have had with people living in other far and near places. Archaeologists also study vessel shapes and sizes to infer whether the pots were used for cooking, serving, or food storage.

Indeed, archaeologists can understand much about how a group of people lived by studying vessel sizes and shapes. The storage capacity of vessels, for example, allows calculation of how much stored food people had, and, from that, estimates are possible of how many people lived at a site. Functions of different sizes of pottery can also be determined. A small-necked vessel probably stored liquids or very small seeds, rather than large seeds. Large open vessels, such as bowls, probably weren't used for storage, since they would be difficult to seal from moisture, rodents, and insects.

Because ancient pots are usually found broken into hundreds of pieces (*sherds*), archaeologists find it tedious and often impossible to glue them back together. One way they get an idea of how large a pot was is by calculating its original circumference. *Rim sherds* are used to do this because they often indicate how large the vessel opening was.

Setting the Stage

Spread the rims from some broken modern ceramics on a table. Have the students imagine the rims were found at an archaeological site near the North Carolina coast. Imagine the rims were from pots made by one of the Algonkian tribes just before Europeans arrived. What are some of the questions that they, as archaeologists, might ask about the sherds? Brainstorm ideas. One question archaeologists might ask is: "How big were the pots from which these sherds came?" How would they find out?

Here are some general tips for making this lesson plan work: Rims from broken flower pots or old dishes and bowls work well for this lesson. Use ceramics with rims of different circumferences. Make sure sherd edges are not sharp. Also, most sherds will yield decimal measurements. This is not bad, but if possible choose the first examples so that their measurements are as close to being integers as possible. Round decimals to the nearest tenth.

Procedure

1. Share the background information about when southeastern Indians started making pottery, why archaeologists study ceramics, and how they use the information to study the lifeways of past people. Include a short discussion on how differently sized and shaped vessels are used for different purposes.
2. Calculate the interior circumference of the pots represented by either actual rim sherds or those represented on the activity sheet drawings. If you are using real pottery pieces, lay each rim sherd's finished side down on a sheet of paper and trace around its inner edge. Note that the circumference of the rim must be flat against the paper. Using either the rim tracing or the first sherd on the activity sheet, measure a straight line between two points on the curve. Measure the length of that line (chord length), calculate its midpoint, and then measure the perpendicular distance from the midpoint to the inside of the curve (middle ordinate).
3. There are a couple of ways to calculate a pot's circumference. One way involves two steps. First, calculate the radius of a circle from a portion of it using the formula,

$$r = (L^2 / 8M) + (M / 2)$$

where r is the radius, L is the chord length, and M is the middle ordinate. Then determine the pot's circumference (c) using the formula,

$$c = 2\pi r$$

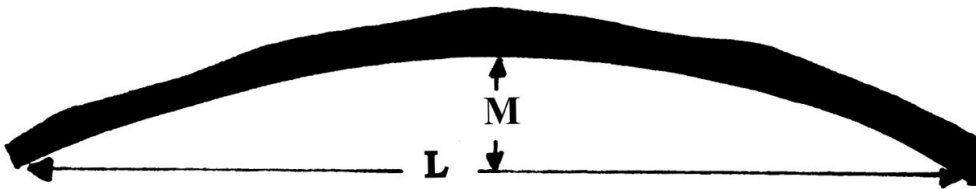
where π equals 3.14. For example, in the sketch below assume that L equals 7.8 cm and M equals 1 cm.

First calculate the radius (r) as:

$$\begin{aligned} r &= (L^2 / 8M) + (M / 2) \\ r &= [7.8^2 / (8 \times 1)] + (1 / 2) \\ r &= (60.8 / 8) + (.5) \\ r &= 8.1 \text{ cm} \end{aligned}$$

Then, plug the radius figure into the circumference formula to get:

$$\begin{aligned} c &= 2\pi r \\ c &= 2 (3.14) (8.1) \\ c &= 50.9 \end{aligned}$$



Another way to calculate a pot's circumference is to use one formula. This way, substitute the expression $[(L^2 / 8M) + (M / 2)]$ for r in the preceding circumference formula. The revised equation reads:

$$\begin{aligned} c &= 2\pi[(L^2 / 8M) + (M / 2)], \text{ which reduces to} \\ c &= (\pi L^2 / 4M) + (\pi M) \end{aligned}$$

For example, still assuming that L equals 7.8 cm and M equals 1 cm, the alternative equation calculates the circumference in this way:

$$\begin{aligned} c &= (\pi L^2 / 4M) + (\pi M) \\ c &= [(3.14 \times 7.8^2) / (4 \times 1)] + (3.14 \times 1) \\ c &= 50.9 \end{aligned}$$

Note that, because pots are not always perfectly round, the relationship between chord length and radius is approximate. Archaeologists know that even though the mathematical calculation is precise, there is generally a small range of error. This means the calculated figure may not exactly match the pot's actual circumference.

4. Have students do homework using pottery items in their home kitchens. They should describe the different shapes and sizes of ceramic vessels they find there. Ask them to write descriptions or draw pictures of the vessels. You may also want them to measure the opening of the kitchen vessels to find size/use relationships. Regarding pottery from their homes, ask the students:

- Are vessels of different shapes used for different purposes or occasions? Give examples.
- Are vessels of different sizes used for different purposes or occasions? Give examples.
- How might archaeologists interpret the presence of vessels of variable sizes and shapes in an archaeological site?

Closure

Summarize the reasons why archaeologists compute the circumference of ancient pottery vessels.

Evaluation

Students calculate the circumference for each of the pots on the activity sheet, and turn in their work for evaluation.

Sources

- Smith, Shelley J., Jeanne M. Moe, Kelly A. Letts, and Danielle M. Paterson. 1993. *Intrigue of the Past: A Teacher's Activity Guide for Fourth through Seventh Grades*. Washington, D.C.: Bureau of Land Management, U.S. Department of the Interior. [This lesson is adapted from "Measuring Pots" on pp. 70–72, courtesy of the Bureau of Land Management.]
- Ward, H. Trawick, and R. P. Stephen Davis, Jr. 1999. *Time Before History: The Archaeology of North Carolina*. Chapel Hill: University of North Carolina Press. [The image in this lesson's main heading is taken from Figure 4.4.]

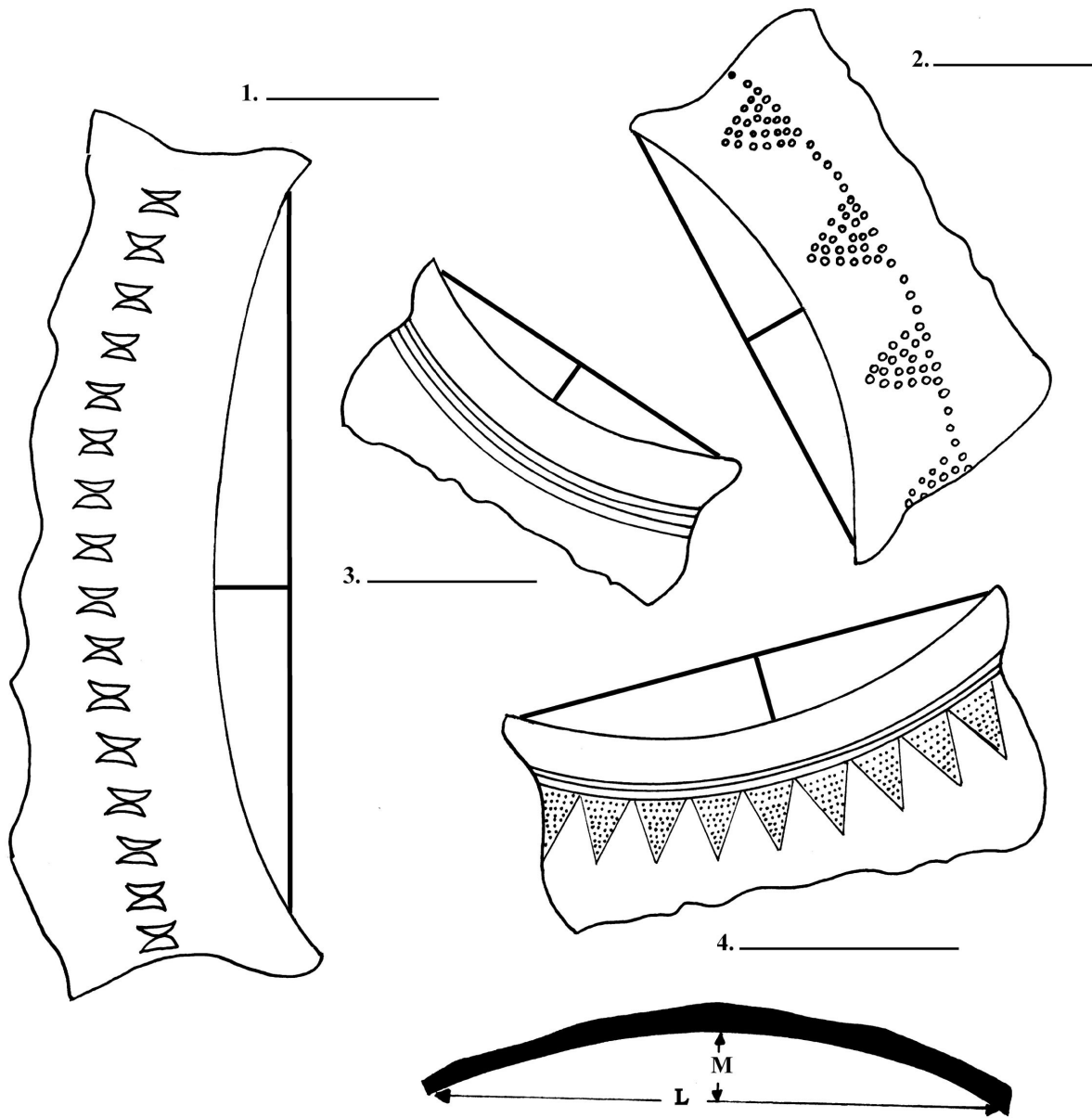
"Broken Pots" Activity Sheet Answers:

The following answers are approximate, in the sense that one should expect minor deviations due to slight differences in measurement or rounding: 1, 79.2 cm; 2, 38.4 cm; 3, 27.0 cm; 4, 40.5 cm.

Broken Pots

Name: _____

Find the circumference (c) of the pots represented by the sherds below.



$$r = (L^2 / 8M) + (M / 2)$$
$$c = 2\pi r, \text{ where } \pi = 3.14$$