



Rods and Chains

Unit: Henry as Mathematician

Topic: Unit conversion

Thoreau Quotation

“In one instance, on a line arbitrarily chosen, the depth did not vary more than one foot in thirty rods.”

—“The Pond in Winter”, *Walden* (1854)

Background

In Henry’s day, land surveyors measured lengths in rods and chains, units of measure that are not frequently used today. In the late winter of 1846, Henry completed a detailed survey of Walden Pond including its depth. Though he was very precise with his measurements, it can be difficult to interpret just how long the pond actually is because rods and chains are unfamiliar units to us today.

Understanding units can help us: 1) read text with unfamiliar units and convert those units into a measurement we understand, 2) understand the many different units of measure used throughout the world today, including in our own country, and 3) avoid mistakes.

Understanding units is very important when working on real world problems. For example, in 1998, NASA, the U.S. space agency, experienced the destruction of a robotic orbiter in the upper atmosphere of Mars. After reviewing the data, it was determined that a very simple error led to the loss of the orbiter: while one team of scientists made measurements in pounds and feet, another made measurements in kilograms and meters. This simple mistake led to the failure of the mission and loss of the orbiter.

Objectives

1. Students will recognize different units of measure.
2. Students will be able to convert between different units of measure.

Method

Begin this exploration by researching and exploring different units of measure for length. Then find as many ways as possible to express the length of the classroom or an outdoor area.

Time Required

60-75 minutes

Materials

- Markers for the beginning and end of the lines being measured
- Pencils
- Field notebook (or paper and clipboards)
- Yard sticks or rulers (1 per every 2 students, minimum)

Procedure

1. Mark off at least two lines of different lengths that the students will measure. This can be done indoors or out, but, if possible, Thoreau would encourage you to take your students outside.
2. Explain why units of measure are so important (see Background for relating to Thoreau and real world problems).
3. Have the students research different units of measure for length. Include metric (SI) and U.S. standard units (also known as "English Units" or "US Customary Units"). Ask them to write down the different conversion factors (i.e. 12 inches = 1 foot, 3 feet = 1 yard, 1 foot = 0.3048 meters, etc.). To keep it relevant to Thoreau's work, you'll want to include rods as one unit of measurement.
4. Pair the students up and have one student measure the length of the line using the yard stick and have the other student record. For the 2nd line, have the students switch roles.
5. Once they have measured at least 2 lines, have them use their researched conversion factors to convert between units of measure. Include converting to rods and/or metric and/or U.S. standard units.
6. They can also work on adding the measurements together or completing other operations on the measurements.

Reflect and Explain

- When converting measurements, was it easier or harder to use the metric or imperial system? Why?
- When might they need to convert from one unit to another?
- Have any of the students ever been somewhere that used other units of measurement (such as kilograms rather than pounds, kilometers per hour rather than miles per hour, Celsius rather than Fahrenheit) or even a different form of money/currency that required conversion? If so, was that a challenging experience? Did they ever get used to making the conversion?

Extensions

1. Include additional measurements other than length when converting units. This could include temperature, weight, volume, and/or area.

2. Take the students outside and have them measure different items in nature, such as the length of a leaf they find, a blade of grass, a rock, a branch, the circumference of a tree, etc. (giving them a list of items to find might help with aimless wandering and could be made into a scavenger hunt). Then convert from the measured units into other units. Have them use the appropriate tool for the job, i.e. provide ruler, yard sticks, and tape measures and have them use the one that fits best for that object.

Vocabulary

chain - equal to four rods or 66 feet.

rod - 16.5 ft; farmers would place fence posts one rod (16.5 feet) apart. In addition to being about the right distance to support a wire fence, this helped them quickly estimate the number of posts needed (80 rods is a quarter mile).

unit of measure - a quantity used as a standard of measurement, i.e., miles, feet, or meters are used to measure distance.

Common Core Standards

Math Practice Standards (all grades)

- [CCSS.MATH.PRACTICE.MP1](#) Make sense of problems and persevere in solving them.
- [CCSS.MATH.PRACTICE.MP2](#) Reason abstractly and quantitatively.
- [CCSS.MATH.PRACTICE.MP3](#) Construct viable arguments and critique the reasoning of others.
- [CCSS.MATH.PRACTICE.MP6](#) Attend to precision.

Grade 3 Content Standards

- [CCSS.MATH.CONTENT.3.MD.B.4](#)
Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

Grade 4 Content Standards

- [CCSS.MATH.CONTENT.4.MD.A.1](#)
Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*
- [CCSS.MATH.CONTENT.4.MD.A.2](#)
Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a

larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Grade 5 Content Standards

- CCSS.MATH.CONTENT.5.MD.A.1
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Additional Resources

Information about rods and chains and why they were used for measuring distance and area
<http://lancaster.unl.edu/ag/factsheets/291.htm>