Body Ratios and the Statue of Liberty Problem
A Lesson for Grade 7
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Overview of Lesson
In this lesson students will learn to analyze proportional relationships and use them to solve real-world and mathematical problems.

Common Core State Standards for Mathematics
Grade 3
Ratios and Proportional Relationships—7.RP
Analyze proportional relationships and use them to solve real-world and mathematical problems.

Materials
- String (enough so that each student can have a length equal to his or her height)
- Scissors
- 1 sheet of construction paper per student
- 1 student sheet per student
- Markers, 1 dark-colored marker per group
- Chart paper, 1 sheet per group of 4

Vocabulary
ratio, proportion

Introduction
1. Introduce students to the following graph, and ask them to place an “x” above the appropriate number to show an estimate to the following question:

   How many times will a piece of string equal to your height wrap around your head?

   1  2  3  4  5  6  7  8  9  10  >10
2. Guide students to make observations about fractions that are close to 1/2 by noticing the relationship between the numerators and denominators. (It may be helpful to have students draw a vertical line down the page to make 1/2 more obvious to them.) Have students use strings equal to their heights to check out their estimate. As a class, discuss findings and confirm the relationship between height and head circumference.

3. Having determined that there is a consistent relationship between height and circumference of the head, have students, in groups of four, investigate other body ratios. Using cutouts of their feet as a unit of measure, students determine the following:

   - **Vertical height to foot length**
   - **Length of arm (fingertip to shoulder) to foot length**
   - **Length of head (chin to top of forehead) to foot length**

Students enter their data into a class chart and look for patterns that can be used to generalize ratios between foot length and specific parts of the body.

<table>
<thead>
<tr>
<th>Group #</th>
<th>Height</th>
<th>Arm Length (Fingertip to Shoulder)</th>
<th>Head Length (Chin to Top of Forehead)</th>
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4. In groups of four, students use the body ratios and proportions determined earlier to solve the following task:

**The Statue of Liberty Problem**

The length of Lady Liberty’s sandal is 25 feet. Using what you know about body ratios, approximate the following measurements.

- Heel to top of head
- Head from chin to top of forehead
- Arm length

Record your calculations and the measurements you find on chart paper using dark markers and large lettering.

Be ready to share your findings in _____ minutes.

**Basic/Limited:** As groups work, determine which measurements are appropriate for students to investigate. Some students will be able to determine one measurement; others may be able to determine two measurements.

**Advanced/Proficient:** As groups work, determine which measurements are appropriate for students to determine. Some students will be able to determine two measurements, and others will be able to determine all three measurements.

5. As you interact with students, ask questions such as the following, and decide which students will report their findings. Also, link students’ proportional reasoning with formal strategies for writing and solving proportions.

- How are you using the body ratios determined earlier to make your predictions?
- How might you convince someone that your measurements are reasonable?
- Would Lady Liberty’s sandal fit in our classroom? How do you know?

**Summary**

6. Invite groups to post their charts and share their findings.

7. Share the actual measurements so that students can determine the accuracy of their predictions.

- Heel to top of head: 111 feet
- Head from chin to top of forehead: 17 feet
- Length of right arm: 42 feet

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