Ne‘epapa Ka Hana 2.0
Seventh-Grade Mathematics Resources
STEMD² Book Series

STUDENT ACTIVITIES

LET'S TAKE CARE OF THE LO‘I

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http://stemd2.com/

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Ne‘epapa Ka Hana Seventh-Grade Mathematics Resources

Let’s Take Care of the Lo‘i

Student Activities

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Unit 4: Geometry

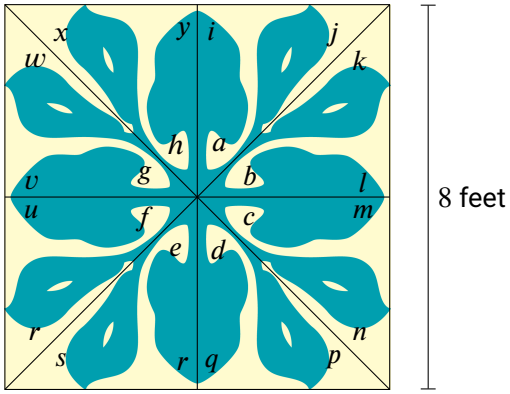
In this unit, we'll learn about scale drawings, and two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, and right prisms through Hawaiian quilt making, constructing fish traps, and building an imu. There are four activities in this unit. *Module 8* involves modeling geometric figures by measuring and drawing a kalo quilt. *Module 9* has two activities that focus on circumference, area, and volume while exploring the size and structure of umu. The final activity is cumulative and incorporates concepts from each of the previous activities in this unit.

For some of the activities in this unit, students will need a ruler with centimeters.

Module 8: Modeling Geometric Figures *Activity*

For this activity, you will need a ruler with centimeters.

As you know, kalo was a very important plant to the Native Hawaiians. It even made its way into the patterns of Hawaiian quilts. Below is an image of a quilt with some lines showing the symmetry of the design. This particular **square** quilt measures 8 feet by 8 feet in real life.



Hawaiian quilt

1. Use a ruler to sketch a scale drawing of this quilt. For your scale, 2.5 centimeters in your drawing should be 2 feet in real life. (You don't have to draw the pattern perfectly, a rough sketch is fine.)

2. Find **2** angles that are adjacent to $\angle a$.

   (a) $\angle$ ____

   (b) $\angle$ ____

3. Find **3 pairs** of vertical angles on the quilt.

   (a) $\angle$ ____ and $\angle$ ____
   (b) $\angle$ ____ and $\angle$ ____
   (c) $\angle$ ____ and $\angle$ ____

4. Find **2 pairs** of complementary angles.

   (a) $\angle$ ____ and $\angle$ ____
   (b) $\angle$ ____ and $\angle$ ____

5. Find **2 pairs** of supplementary angles.

   (a) $\angle$ ____ and $\angle$ ____
   (b) $\angle$ ____ and $\angle$ ____

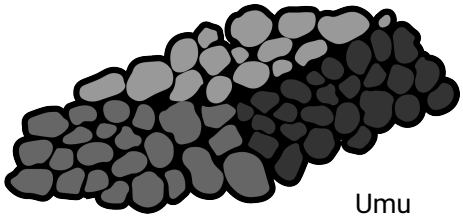
6. Looking at the original image, it is divided into 8 isosceles triangles. Each triangle has two sides with the same length of 4 feet, and a third side. For any triangle where two sides have a length of 4 what is the shortest and longest possible length for the third side? Explain your reasoning and sketch a drawing to help with your explanation.

Module 9: Circumference, Area, and Volume *Activity 1*

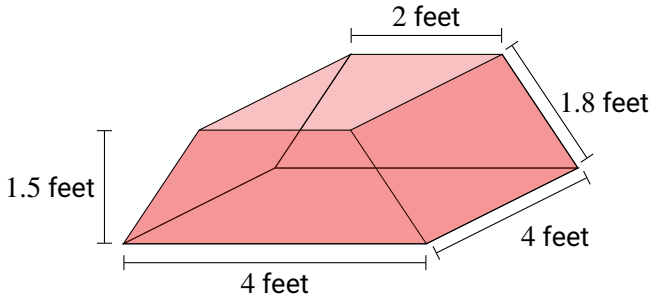
The umu is a fish trap made out of rocks or coral that is, basically, a man-made home for fish. The umu is a place for fish to find food and protection. When a big enough fish begins to get comfortable in its man-made environment, fishermen can surround the umu with a net to catch the big buggah.

Fishing with an umu

We built an umu that is the shape of a trapezoidal prism.



Umu



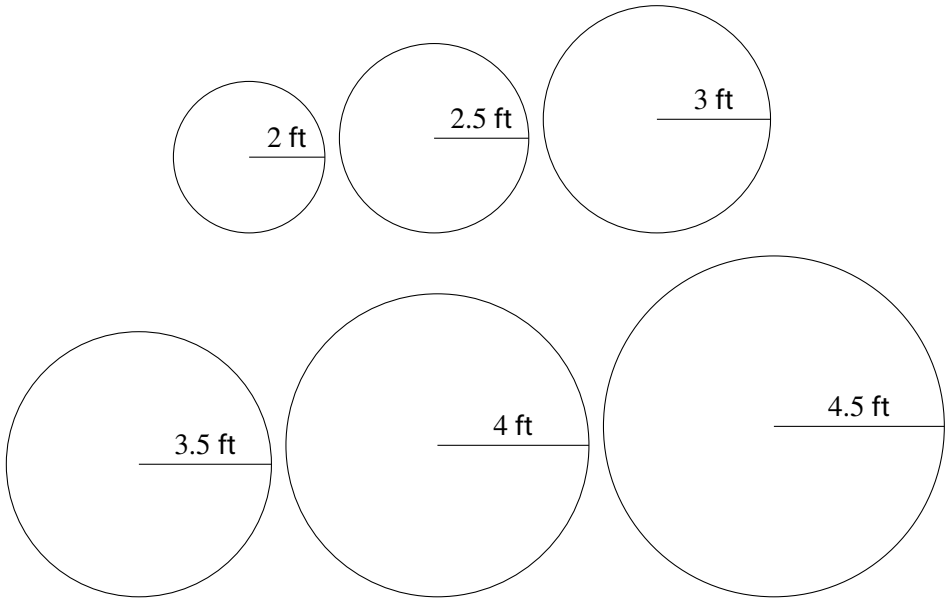
1. Find the volume of this umu. Give your answer in cubic feet.

2. After a few weeks, plenty of fish had swam into the umu. We found that for every cubic foot of umu, there were 0.3 pounds of fish. Find the total weight of the fish in the umu.

There are a few ways to catch the fish in the umu. If you are working with several friends, you can hold a long net and create a fence around the whole umu. Then, someone can take apart the umu and guide the fish into the net. If you are working with one friend, you can make two openings in the umu. You can hold the net at one opening, while your friend scares the fish from the other opening.

3. You are trying to get the fish on your own, so you decide to cover the entire umu with a large net. Then, one by one, you remove the rocks from the umu until the fish have nowhere left to hide. Find the **total** surface area of the top and the four sides of the umu. (Do not include the bottom in your total.)

4. Below are the sizes of some of the circular nets. Cross out the nets that **do not have enough area** to cover the top and four sides of the umu.

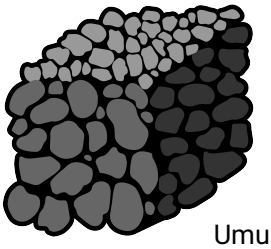


Module 9: Circumference, Area, and Volume *Activity 2*

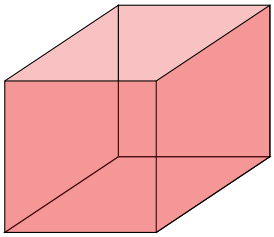
The umu is a fish trap made out of rocks or coral that is basically, a man-made home for fish. The umu is a place for fish to find food and protection. When a big enough fish begins to get comfortable in its man-made environment, fisherman can surround the umu with a net to catch the big buggah.

Fishing with an umu

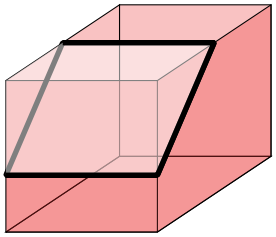
We were able to make a cube-shaped umu before a part of it broke off in the waves.



Umu

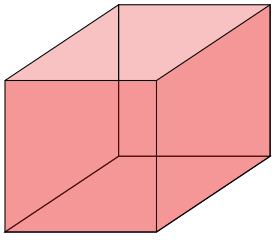


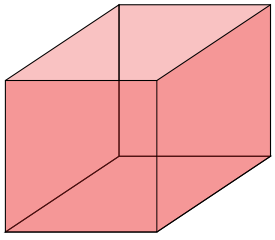
If the top front edge broke off, we would see a **rectangular cross section**.

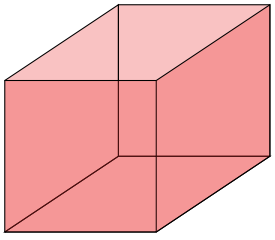


For each of the following questions, three cubes are given to you. **You only have to use one** and may use the other two for practice.

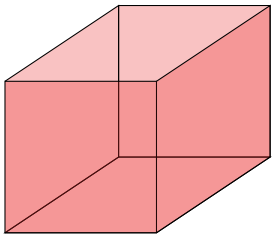
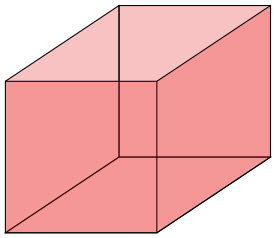
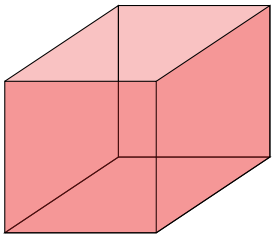
1. How can a piece be broken off and leave behind a **rectangular cross section** that is different from the one shown above? Use four lines to draw this rectangle.



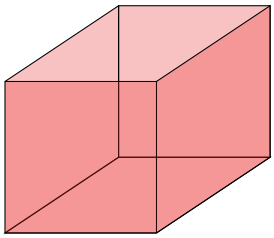
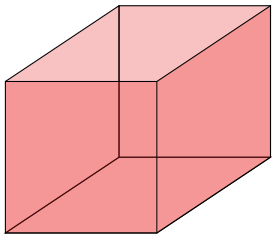
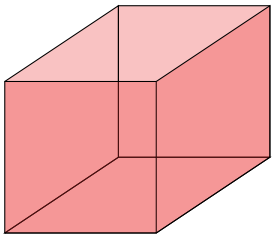




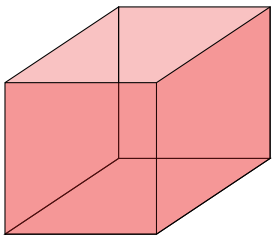
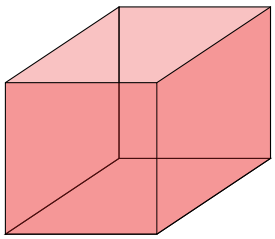
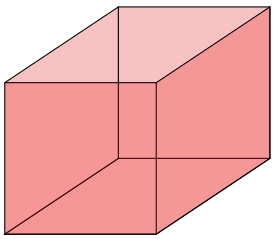
2. How can a piece be broken off and leave behind a **triangular cross section**? Use three lines to draw this triangle.

3. How can a piece be broken off and leave behind a **pentagonal cross section**? Use five lines to draw this pentagon.

4. How can a piece be broken off and leave behind a **hexagonal cross section**? Use six lines to draw this hexagon.

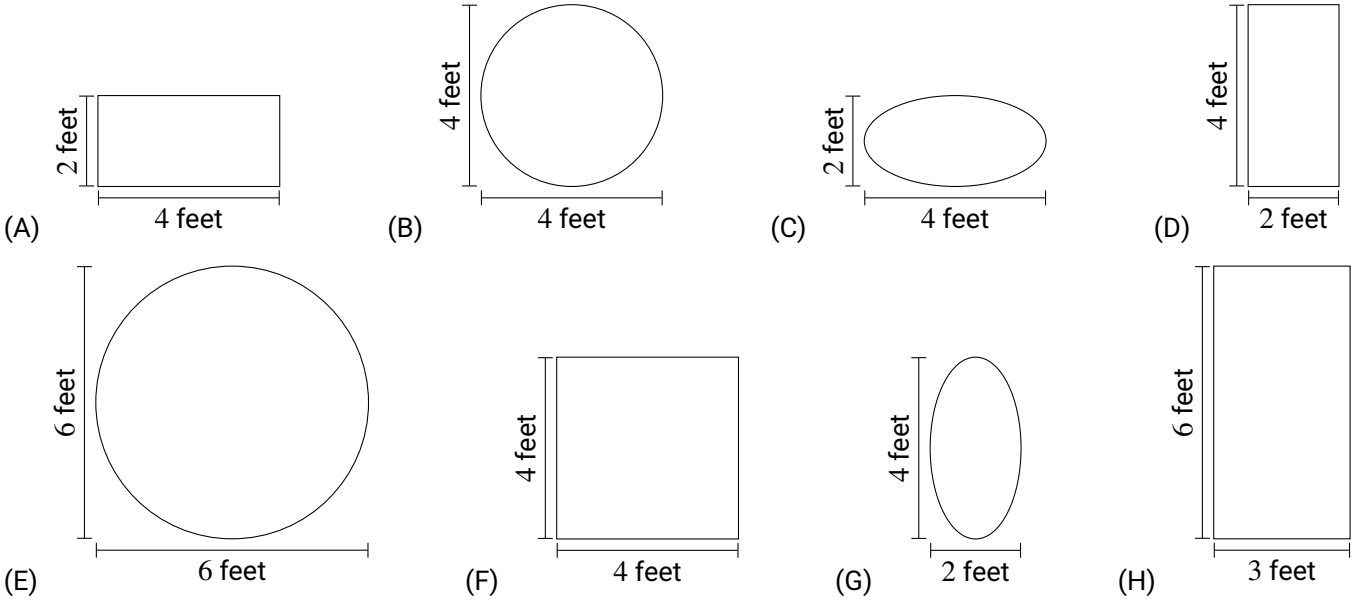




Unit 4: *Cumulative Activity*

In the Hawaiian culture, food was often cooked in underground ovens called imu. The building and use of an imu requires an enormous amount of preparation.

Rectangular imu Round imu

To build an imu, a pit must be dug into the ground. The pit can have a variety of shapes. Here are some drawings and measurements of common pits used for imu.



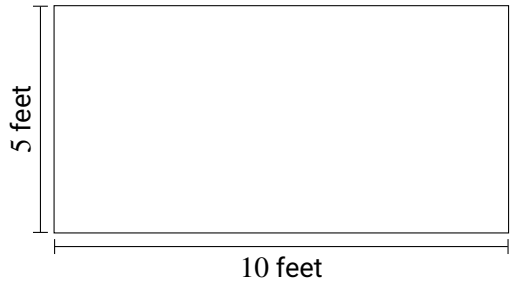
1. Find the perimeter/circumference and area of the two biggest imu in the drawings, (E) and (H). Round to 1 decimal point.

	Perimeter or circumference	Area
Imu (E)		
Imu (H)		

Imu (E)
Circumference $= 2\pi \times 3 \approx 18.9$
Area $= \pi \times (3)^2 \approx 28.3$

Imu (H)
Perimeter $= 3 + 3 + 6 + 6 = 18$
Area $= 3 \times 6 = 18$

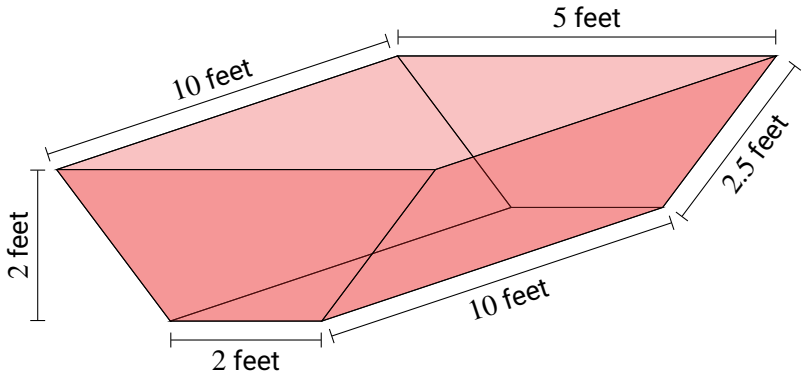
2. Mathematically speaking, which of the previous imu drawings are **similar** to this one:



The other shapes that are mathematically similar are the rectangles with one side twice as long as the other. These are Imu (A), (D), and (H).

3. How do you know that the shapes that you chose were similar shapes?

After digging the pit, we build a fire to heat up some rocks. The red hot rocks are then arranged to make space available in the hole.



Let's look inside the imu. Our imu is 2 feet deep. The opening of the imu is 5 feet wide by 10 feet long, and the bottom of the imu is 2 feet wide and 10 feet long. The shape turns out to be a trapezoidal prism with the sides sloping in 2.5 feet from the top to the bottom.

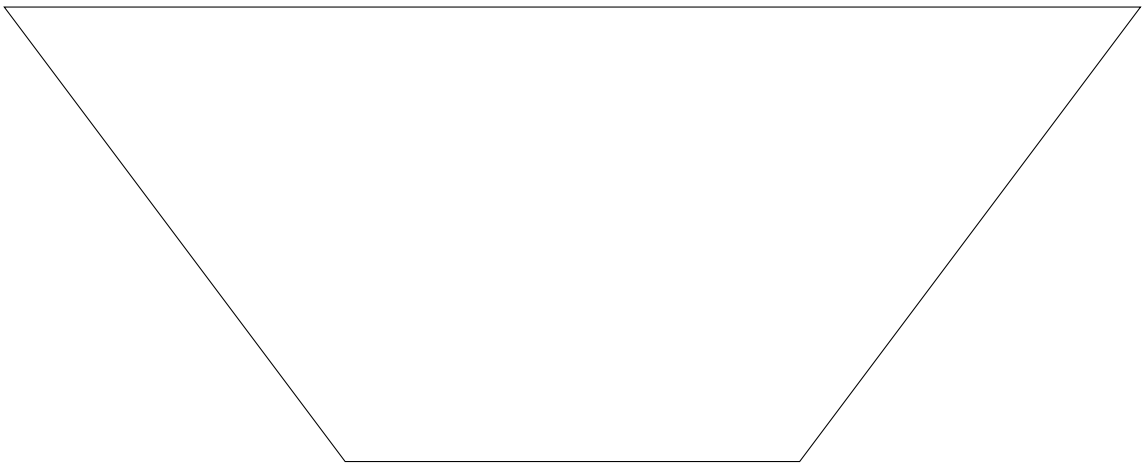
4. What is the volume of our imu?

5. Do you think an adult pig would fit in this imu? Discuss with your partner and justify your reasoning. What did you decide and why?

6. Sketch this imu as a geometric **net** (include the rectangle at the opening on top), and label each side of the net. What is the surface area of our imu?

Banana tree stumps, ti leaves, and other native plants are placed on the hot rocks first. This green leafy layer produces steam to cook the food, while protecting the food from the rocks. Meat and other foods are placed on top of the green leafy layer. If a large animal like a whole pig is to be cooked, hot rocks are also placed in their belly. Another layer of banana leaves, old lauhala mats, and tarps cover the food to protect it from dirt. A final layer of dirt will help to keep the heat in until all the food has completely cooked.

7. What would you put in this imu? Below is a cross section of the imu. Draw and label each layer with the items above and anything else you would like to put in there.



8. With your partner or in the online comment section, share some of the ideas you came up with in part 7.