Pebble Power: Investigating Stone Shapes

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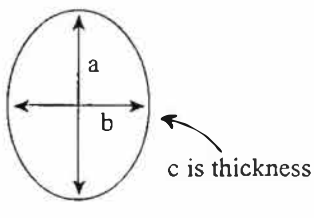
My children, ages 4 and 7, have a habit of collecting rocks wherever we go. To my kids, the rocks have qualities I cannot begin to understand. Their collections include a variety of colors, designs and shapes—the more unusual the better! I know my children's affection for rock collecting is shared by many other kids, much to the exasperation of their teachers and parents. I am pleased I have finally found a mathematical connection by which we can organize and discuss their collection without getting into intensive geological discussions—an area I prefer to avoid for this part of my life.

A geologist acquaintance told me about a method to classify rocks according to calculations made regarding their dimensions. Rocks are placed into one of four categories by making three measurements and computing two simple ratios. In short, the measurements are the three longest diameters of the rock that are perpendicular to each other.

Figure 1



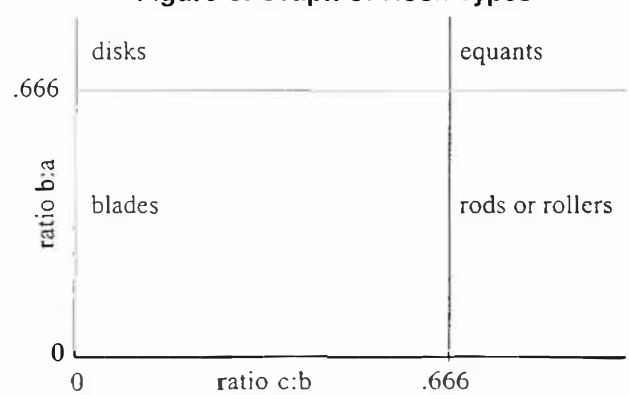
Use calipers, if possible, to do the measurements. They can even be made from a ruler and sticks or you can substitute a drawing compass. A standard ruler can be used for the measurements after students understand how to avoid parallax error by getting close to the ruler and looking perpendicular to its surface. The greatest distance between any two points on the rock is the largest diameter. Call this distance a. The measurement is done by moving the caliper around the rock until it shows the greatest span. Record a. Note the endpoints of a with pencil marks or by returning the caliper to the rock. Measure b, the next greatest diameter of the rock that is perpendicular to the segment that made a. Record b. Try to visualize a plane made up by the intersection of segments a and b. Measure c as the largest diameter perpendicular to that plane. Record c. Divide, preferably by calculator, to find the ratios c:b and b:a. Place the rock on the graph according to its coordinates (c:b, b:a) where you go across the first value then up the second value. Identify the rock's type by its placement on the graph. The table in Figure 1 shows how data can be organized and offers a few examples. The measurements are in millimetres.

Figure 2. Sample Data Table

Rock	a	b	c	c:b	b:a	Rock Type
1	63	44	16	.36	.70	disk
2	109	64	41	.64	.59	roller
3						
4						
5						
and so on						

Draw a large graph like the one in Figure 2 on the classroom floor. Students will begin to make connections between a rock's dimensions and its properties. Rock 1 would make a good skipping stone but rock 2 would not. Students will notice patterns in the shapes as the rocks are distributed across the graph. Students also speculate about why the names given the groups are descriptive and why the ratios never exceed 1. Students also see interesting relationships as they explore the reasons why some rocks are placed on the boundaries between categories, why overall size is unrelated to a rock's classification and how certain characteristics change as one moves from the extremes of one category to another.

Figure 3. Graph of Rock Types



This activity can be done easily and cheaply with students of virtually any age. All they need is a basic understanding of how to measure and what division means. The activity enhances discussions of stone tool use, the forces and products of nature and why we pick up the rocks we choose to collect.

Rocks seem to provide a compelling interest to kids. I believe this activity provides a new dimension to something they already like and provides a way of connecting mathematics to the real world while kids practise skills and develop understanding.

The Last Digits

What are the last two digits of the exponential number 7^{7^7} when written as a whole number?