then around itself (as shown) until it covers the curved larger surface of the hemisphere, and at that point of complete coverage, extra string is cut off (as was the masking tape).

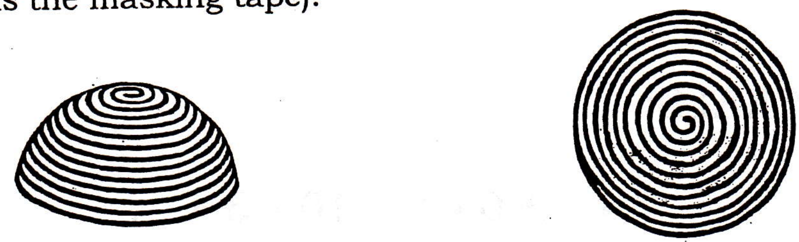

Figure 3

The string is now anchored and wound at the center of the Great Circle that is the other surface of the hemisphere. At the point of complete coverage, the string is marked. Students are asked to estimate what fraction of the hemisphere length string was needed for the Great Circle.

With little trouble, students will see that no matter what size hemisphere was used, the area of the curved larger surface was twice that of the smaller, the latter being πr^2. Thus the area of the curved larger surface of a hemisphere is $2\pi r^2$, and the area of an entire sphere is $4\pi r^2$. The second section of the chain of thought is now concluded, as the students are now ready to build the foregoing knowledge and modes of thought to three dimensions.

The **ninth link** consists of <u>defining</u> volume as the number of cubes of uniform size needed to fill a space. Such is the three-dimensional counterpart to defining area at the beginning of the second section of the chain. Armed with this definition, students given rectangular prisms with integer dimensions quickly formulate the **tenth link**: volume is calculated as a product of base area and height.

The relationship between the volume of a pyramid and that of a prism of equal base area and height can be discovered in a special case by the <u>activity</u>, the **eleventh link,** and material provided on the following pages. Done correctly, this activity gives students a paper prism that unfolds to make three prisms of equal base area and height.

Thus is established that the volume of a pyramid V_{py} is a third of the volume of a prism V_{pr} of equal base area and height.

$$V_{py} = \frac{1}{3} V_{pr} = \frac{1}{3} (\text{Base area} \times \text{height})$$

The **twelfth link** concludes the experience with <u>analysis</u>, producing a formula for volume of a sphere. Students may now cut (or imagine cutting) spheres into equal halves, quarters, eighths, etc., until the sections resemble the divisions of an unpeeled orange. It should now be the student's task to

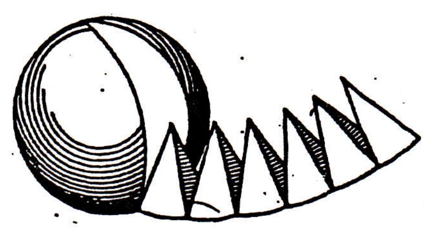

Figure 4