Wigwametry™

K-12 Geometry Unit

Developed by: RunningHorse Livingston & Joni Theobald
Madison Metropolitan School District, WI

Birchbark House

"At the base of the tree, Nokomis left her offering, sweet and fragrant. Then she peered closely, deciding just where to make the first cut. Suddenly, she pressed her razor-sharp knife into the bark. Omakayas stepped back. Light filtered golden and green onto their faces. Tiny white flower poked out of dead leaves. There were still traces of grainy old snowbanks in the shadiest spots, but in places the sun was actually hot. *Pow!* As soon as Grandma made the proper cuts, the birchbark, filled with spring water, nearly burst from that tree! Omakayas helped her grandmother carefully push the bark aside, then the two peeled it away strip by strip. She and Omakayas carried the light papery pink-brown rolls out of the woods, down a trail to a special place near the water. Here they set up the birchbark house."

Louise Erdrich
1999

Wigwametry

This culturally integrated and responsive unit will help students understand the mathematical, historical, and social importance of the wigwam structure in Northern Woodland cultures. Students will construct a scale model of the traditional home using geometric properties of circles and spheres.

Cultural Information

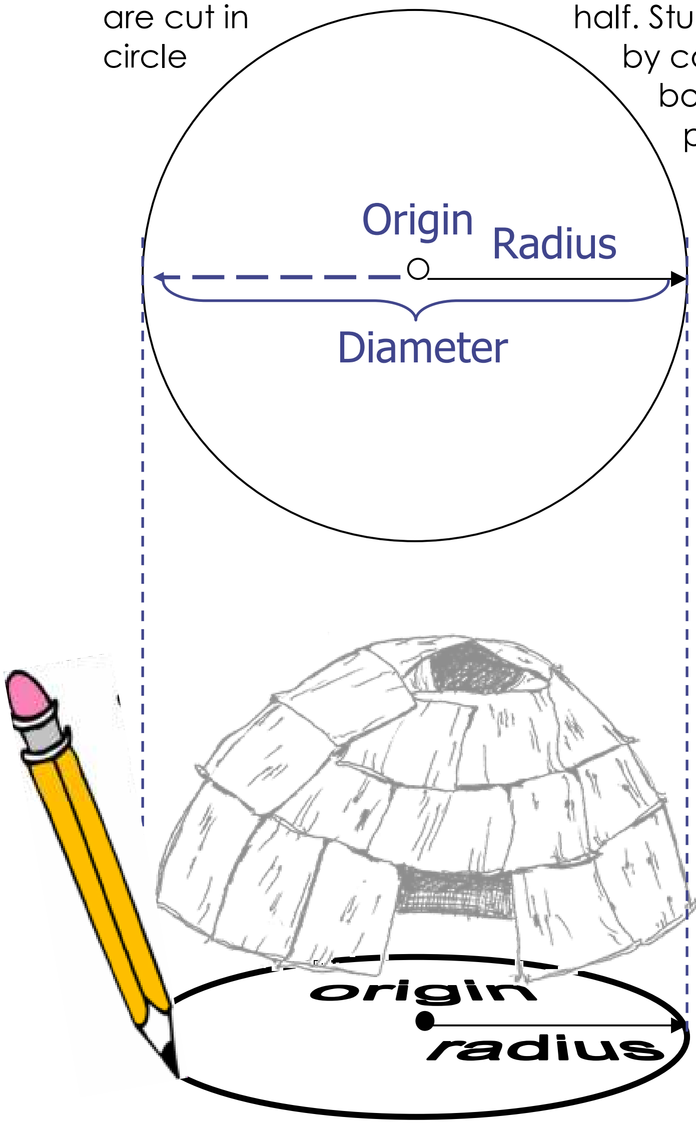
The word "wigwam" is derived from the Ojibwe term for "home" or "house." The term "wigamig" does not necessarily refer to the domelike structure that is commonly associated with it, as some were oblong or conical, but early records describe them as crude circular shelters with little design.

> When we went farther inland we saw their houses, which are circular in shape, about 14 to 15 paces across, made of bent saplings; they are arranged without any architectural pattern, and are covered with cleverly worked mats of straw which protect them from wind and rain. There is no doubt that if they had the skilled workmen that we have, they would erect great buildings, for the whole maritime coast is full of various blue rocks, crystals, and alabaster, and for such a purpose it has an abundance of ports and shelter for ships. They move these houses from one place to another according to the richness of the site and the season. They need only carry the straw mats, and so they have new houses made in no time at all. In each house there lives a father with a very large family, for in some we saw 25 to 30 people.
>
> *Giovanni da Verrazono The Voyages of Giovanni da Verrazzano, 1524-1528*

While difficult relationships with European "discoverers" often prevented any thorough scientific or mathematical analyses of wigwam structures, the construction process reveals the need for remarkable problem-solving strategies.

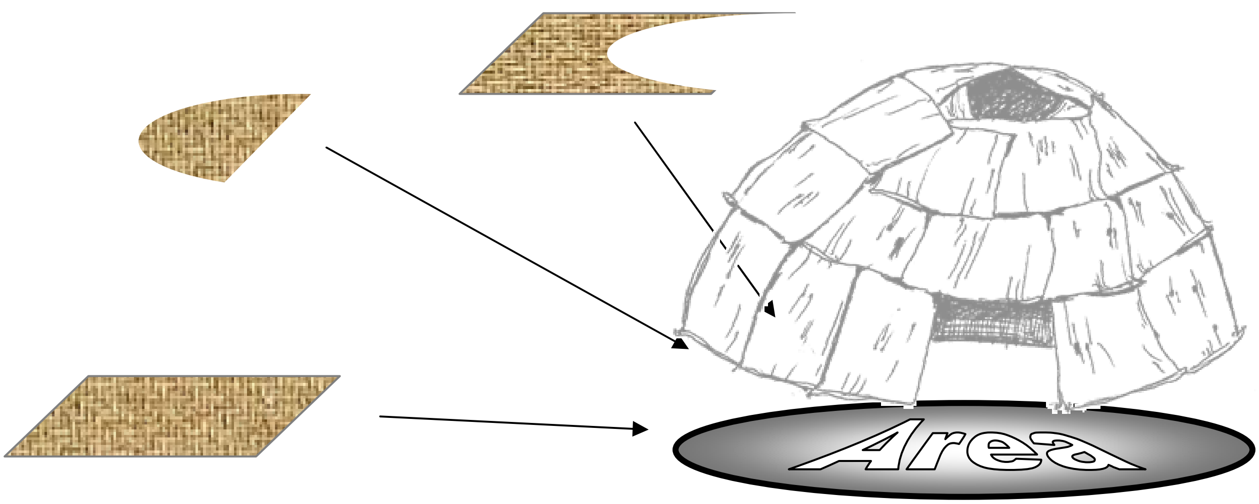
Lesson 1 - Circles

To start the building process students should determine and draw the base shape of a wigwam. The size of the foamboard building platform will provide the measurement parameters. Most boards are 24” x 36” and work best when they are cut in half. Students will create a formal definition of a circle by constructing a “perfect” circle on their board with only a piece of string and pen or pencil.

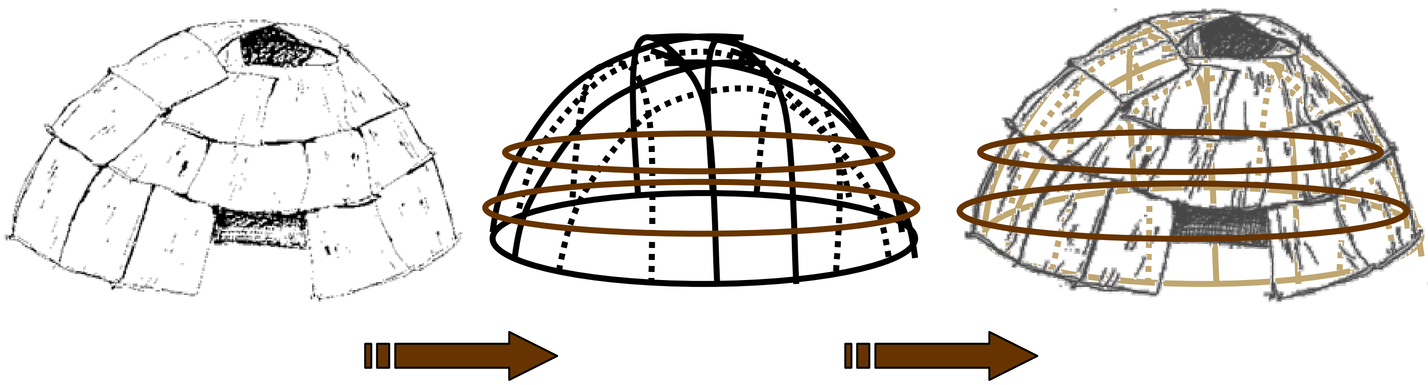


Lesson 2 – Area

Once the base of the structure is drawn, measured, and labeled, students may begin covering the area with paper mats. Mats should resemble the traditional weaved mats that were originally used. In order to keep the math simple and neat, four mats should be used and their size determined by the class. The size of each mat should be the same and should minimize the "leftover" material used in covering the base. Students may cut and paste the mats, and be certain to keep the remaining pieces. Relating square area to circular area helps construct the area formula πr^2.



Lesson 3 – Surface Area



Once the base is covered, the frame will need to be enclosed as well. A great intergration idea is to include the concept of conservation. Students should try to determine ahead of time how much material they would need to cover their structure. The group who has the least amount of "waste" should be recognized. Birch bark paper is very easy to make with a black marker and pen. Once students have determined how much covering material they will need, they are given the exact amount, to see if it will fit. (Note – because of overlapping, it's better to overestimate). Student should cut pieces into the shapes they think are most appropriate.

Lesson 4 – Volume

To extend the lesson to volume, students should be asked to consider the amount of space in their structure. What are the relationships between diamater and circumference, pi and area, as well as height and volume? How much space would a family need? As indicated, some structures housed up to 30 family members! Students should consider the floor space versus the height and how these measurements will change or relate. If 30 people are in one structure, will it need to be taller? How many family members could fit comfortably? Packed in?