MathWalk

#13) The Outdoor Classroom

Sanford Mall is the name of a green area of campus that hosts all sorts of outdoor booths and information tables at certain times of the year. It is also where students meet to practice rope walking or to swing or just hang out. At one end is a group of statues that look like a teacher holding her class outdoors.


Fig 17: A group of statues in Sanford Mall

There are a series of dates and names which App State has been called throughout its history carved around each side of the platform which has a pentagon shape. Some examples of those dates and names are:
1899-1903 Watauga Academy
1903-1925 Appalachian Training School 1925-1929 Appalachian State Normal School
1929-1967 Appalachian State Teachers College 1967-present Appalachian State University

The base of the platform is made up of 2 layers of regular (or equiangular) pentagons. This means that angles are all equal, as well as all the sides.
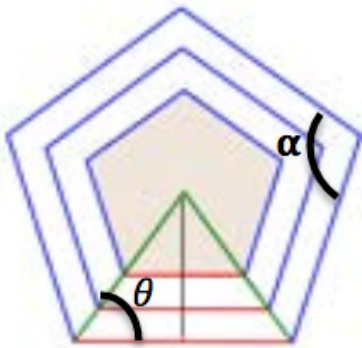
The central angle goes from the center of the figure to two adjacent vertexes (a vertex is where 2 edges meet). To find the central angle you take 360° (the number of degrees in a circle) and divide it by the number of sides in your polygon (in this case 5). In a regular pentagon, therefore, each central angle is 72°. Since the sides forming the central angle are both radii, this makes each of the five triangles originating from the 5 central angles isosceles triangles. Therefore, the other 2 angles in each triangle must be equal to each other.

Tasks:
Grades 6 – 12:
   a) What is the measure in degrees of the angle θ?
   b) What is the measure in degrees of the angle α?

Grades K- 5:
   c) Looking at fig.17, if 3 children can fit on each of the empty benches and 1 child can fit on each of the other benches with a statue on them, how many children can all the benches hold?

#14) Going with the Flow

Next to Jimmy Smith Park is a little creek that runs up and down the River Street which called Boone Creek.

One of the App State math professors had his modeling class come up with a way to estimate the flow of this creek. Different teams came up with different ways to attempt this. The only piece of information the class was given is that *stream flow is measured in cubic meters per second*. This group of students came up with some amazing ways to determine the flow. Why is this important?

Fig 18. The Boone Creek

In the past five decades or so evidence has been accumulating about an environmental factor, which appears to be influencing mortality, in particular, cardiovascular mortality, and this is the hardness of the drinking water. In addition, several epidemiological investigations have demonstrated the relation between risk for cardiovascular disease, growth retardation, reproductive failure, and other health problems and hardness of drinking water or its content of magnesium and calcium. In addition, the acidity of the water influences the reabsorption of calcium and magnesium in the renal tubule. Not only, calcium and magnesium, but other constituents also affect different health aspects. Thus, the present review attempts to explore the health effects of hard water and its constituents. (Abstract from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3775162/).

Which means that being able to identify accumulation points based off sources of flow in and flow out can be used to control concentrations of harmful minerals in the water and where to best deal with them.

Tasks:
Grades 9-12:

 a) Given that the river flows at 12 cubic meters per second, the concentration of calcium carbonate is 0.0001 grams per liter, and there are 1000 liters in a cubic meter. How many grams of calcium carbonate has the river moved in 30 minutes? (Note: 1 cm³ = 1 mL)

Grades 6-8:

 b) Given that you have 4 liters of water with a concentration of 0.0001 grams per liter of calcium carbonate, how many milligrams of calcium carbonate do you have?

Grades K-5:

 c) If a fish can swim 1 meter every minute in stationary water and you are standing in water that is moving away from you at 2 meters per minute can the fish ever reach you if it starts 10 meters away?

#16) Pyramid Sculptures (Near #3)

Fig 20. Pyramid Sculptures

On the back side of the Justice Hall, there are a set of Pyramids with blue and red lights at the top. Let's consider the following dimensions for the shortest pyramid which has a blue light on the top:

Square base of 36"x36" and the height of the pyramid is 93.5". *Please note this is the height of the pyramid not the line from the tip of the pyramid down the side to the middle of the base*

Tasks:
Grades 6-12:

a) What is the approximate total surface area of the 4 sides of the sculpture?
b) According to the CDC, from a study conducted from 2011 to 2014 the average male height in USA is 69.2 inches. How much taller in percentage is this statue than the average American male?
https://www.cdc.gov/nchs/fastats/body-measurements.htm

#17) The Wind Turbine (At the top of Bodenheimer Drive)

You might have noticed the Broyhill Wind turbine as you entered the campus of the Appalachian state University today. This Wind Turbine is located on 755 Bodenheimer Drive which is the highest point on our campus. Wind is one of the forms of renewable energy employed at Appalachian State University. The uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth cause wind. Wind flow patterns are modified by the earth's terrain, bodies of water, and vegetative cover. This wind flow, or motion energy, when "harvested" by a wind turbine, is converted from kinetic energy to mechanical power. This mechanical power is then converted by a generator into useable, and in our case, grid-tied electricity.

Fig 21. The Broyhill Wind Turbine

The ASU wind turbine has become the iconic symbol of Appalachian's commitment to renewable energy. The 100-kW facility is the largest wind turbine in the state of North Carolina. It is situated on the highest point on campus and stands more than 152 feet tall. Funding for the turbine came predominately from the student-backed ASU Renewable Energy Initiative with generous support from New River Light & Power Company (https://sustain.appstate.edu/initiatives/renewable/wind/).
You can use the following link to get to the Real Time Output Data for the wind Turbine.
(https://rei.appstate.edu/pagesmith/61). On average, the turbine produces 104,000 kWh yearly. This is enough energy to power about 8 North Carolinian homes each year.

You may use the following link for a map of the locations of wind turbines throughout the state of North Carolina. (https://wind.appstate.edu/turbine-map)