Math Walk!

Here's a walk on UNI's campus with some questions to open your eyes to mathematical sights and tickle your brain. To answer the questions, you will need paper and pencil, a calculator (optional!), and a way to estimate lengths (personal benchmarks are fine; if you use a ruler or meter stick, you are expected to be more precise!).

The idea is to discuss methods and reasonings with your group. Include multiple solutions and strategies and indicate which produce "better" answers. Also (very important!), as you walk, point out interesting geometrical shapes to each other.

Ready? Have fun!

1. Leave Wright Hall from the South door so that you are facing the Greenhouse. There is a lot of brick for a greenhouse! This wall prompts some questions –

   (a) How long and how tall is the wall?
   (b) What fraction of the wall is glass?

2. Now proceed around the east side of the building (so you are walking between the Greenhouse and McCullom Science Hall and stop when you get to the south side of the Greenhouse. Now you've seen the plants and lots more glass. Examine the southmost and eastmost greenhouse building. What is the pitch of its roof? Remember to describe your solution strategy.

3. Continue around the Greenhouse complex and admire the plantings (and keep a sharp eye out for interesting geometrical shapes). Go to the parking lot next to Wright Hall and the Greenhouse. You see light poles in the middle of the parking lot. Suppose one could (gently) tip a pole on its side (including its concrete base). How far would it reach? Measure the distance in parking lot space widths. Assume trees don't get in the way!

4. While you are in the parking lot, examine hubcaps. How many kinds of rotational symmetry can you find? Describe the symmetry by giving the smallest angle of rotation. Sketch an interesting hubcap and describe its symmetries. Discuss whether you have to ignore some features (like letters or the bolts or ...).

5. Once you are finished in the parking lot, head over to the Campanile. Look at the curved benches in the plaza. Assume the curve is a circular arc. (Ignore the blocks at the ends.) What is the radius of the circle from which this curve forms a piece? Explain your solution method!

6. The plaza at the Campanile has pink paving stones and gray paving stones surrounded by concrete. Ignore the concrete. What is the ratio of pink to gray stones? Now suppose that the area taken up by the base of the Campanile were paved in gray stones. What is the new ratio of pink to gray?

7. Go to the pine trees between the Union and Begeman Hall (the Physics building). Pick up a pine cone, preferably one with a relatively flat bottom. Count how many rows of "petals" spiral out clockwise from the center; then count how many spiral out counter-clockwise. Did you get Fibonacci numbers?

8. The south portion of Lang Hall has Norman windows – that is, a rectangle topped by a semi-circle. For the tall windows on the west face, estimate the length, width, and radius of the window.

   (a) From your data, calculate the perimeter and area of the window.

   (b) Holding the perimeter fixed, determine the dimensions of the window that will maximize the area of the window.

9. Go to the plaza on the roof of Maucker Union and find the pyramid with a trapezoidal base. Estimate its surface area (indicate whether or not you ignore the base) and its volume.

10. Look over at Rod Library. (You can stay on top of the Union.) The entryway has a portion of the building jutting out over it. The east face of this part of the building has lots of glass, divided into various rectangles. How many rectangles (of all sizes) can you count? Provide a sketch and justify your answer.

11. There are some three-tiered seating areas on the top of the Union. Suppose you needed to create a seating chart for one of these gathering spots. Use the center of the base of the light pole as the origin and use as many coordinate systems as you can to describe the locations of the available seats. Feel free to invent your own system.

12. You are back to Wright Hall. Did you have fun? Exercise some mathematical reasoning? Think of question that should have been asked? (Please share it!) Did you notice an octogon (other than a stop sign) on your walk? How about an ellipse? A frustum of a cone? A Platonic solid? Where?