# Cubing the Pyramid

or

# Why We Need Calculus (and Measure Theory!)

Once you agree that a 1 inch x 1 inch square should have area 1 (isn't that the very definition of one square inch?), you can find the area of any polygon by cutting it up and rearranging the pieces. Can we do the same in three dimensions? Can you chop up a regular tetrahedron and rearrange the pieces into a cube? This was Hilbert's third problem, solved by Max Dehn, and the answer turns out to be "no". To find the volume of a regular tetrahedron, we (sadly? intriguingly?) need calculus.

But all of this analysis is based on an assumption: if you cut up an object and rearrange the pieces, the new object will have the same volume as the original. We will next challenge this assumption. Weirdness ensues! A subject called measure theory comes to the rescue.

**Professor Kevin Woods (Oberlin College)**

**Monday Oct. 8          3:10pm          RBH 311**