

Mathematics 3810H – Ancient and classical mathematics

TRENT UNIVERSITY, Fall 2013

Assignment #3

Due on Friday, 18 October, 2011

One of the things that Eudoxus is supposed to have proved is that the area of a circle is proportional to the square of its diameter. It is likely that proof of this given in Book XII of Euclid's *Elements* is based on Eudoxus' work. The argument given there is based on inscribing regular polygons with 2^n sides in circles; in this assignment you will work through a variation of this argument.

1. A regular 2^n -gon inscribed in a circle of radius r has area $2^{n-1}r^2 \sin\left(\frac{\pi}{2^{n-1}}\right)$. [3]

Note: Eudoxus did his work before trigonometric functions were known, so he could not have had this result.

2. Prove that a regular 2^n -gon inscribed in a circle takes up more than $1 - \frac{1}{2^{n-1}}$ of the area of the circle. [4]
3. Use the result in **2** above to prove that the area of a circle is proportional to the square of its radius or diameter. [3]

On Problems

Our choicest plans
have fallen through,
our airiest castles
tumbled over,
because of lines
we neatly drew
and later neatly
stumbled over.

Piet Hein