

# Make your own piece of Hyperbolic Plane!

## A SURFACE OF CONSTANT NEGATIVE CURVATURE

by Chaim Goodman-Strauss and Eugene Sargent

1 Cut out pieces.

These corners are 85.7 degrees, so when you connect them into a square, something has to give!

Nature creates negative curvature along the edges of leaves and flowers when

KALE: It's Hyperbolic!

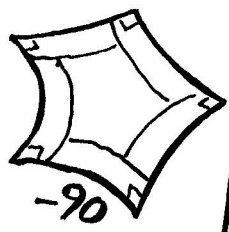
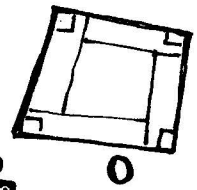
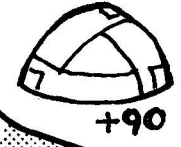
2 Connect the ends as shown by arrows with tape or glue.

The paper will warp, creating **NEGATIVE CURVATURE**. The Total Curvature of a disk =  $360$  - total turning around outside.

Cells multiply adding extra area. The surface ruffles to accommodate. This can also be observed in the torn edges of plastic trash bags.

Line up the center lines

The material stretches and permanently deforms along the tear, creating a complex pattern that turns out to be a fractal.



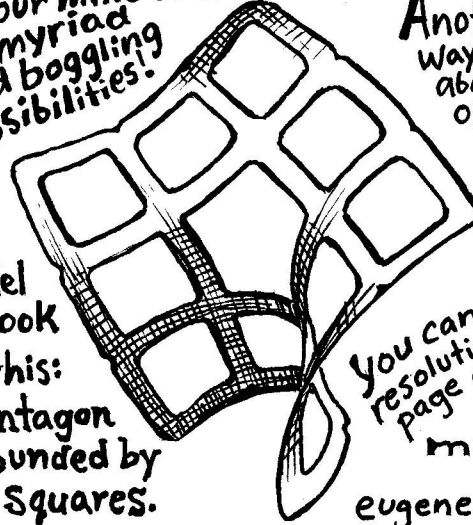
As Seen at G4G11 March 2014

this is the last corner of the inside Pentagon

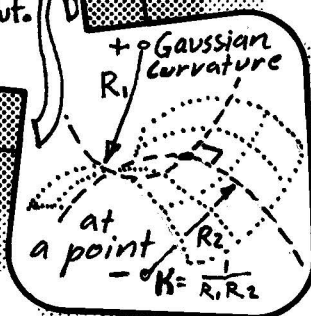
Marvel at the curious thing you have created and let your mind consider the myriad mind boggling possibilities!

Another way to think about it: cut strips off the edge of a wavy leaf and flatten them out.

Your Model will look like this: A pentagon surrounded by ten squares.



You can get the full resolution file for this at: [mathbun.com](http://mathbun.com) and [eugenesargent.com/g4g11](http://eugenesargent.com/g4g11)



The Total Curvature remains constant, and the Gaussian curvature at each point is constant even when the surface flexes.

May reproduce freely but not for profit.

Torn Plastic

Daffodil