Paraboloid

Parabola

Hyperbola

Line

Hyperboloid

Ellipse

2
Steinhaus'
Toppling Tetrahedron

Hyperbolic
paraboloid

Sphere

www.magicmathworks.org/geomlab2

Line pair

Roll the open tetrahedron around.

Cone

Sine
curve

Lay the solid triangle matching each face it lands on
and watch a tiling grow.

Cylinder

Tractrix

Circle

Exponential
curve

Line
family

Catenary

Loxodrome

Catenoid

Helix

Equiangular
spiral

Helicoid

Archimedean
spiral

Plane

Tiling

Polygon

Polyhedron
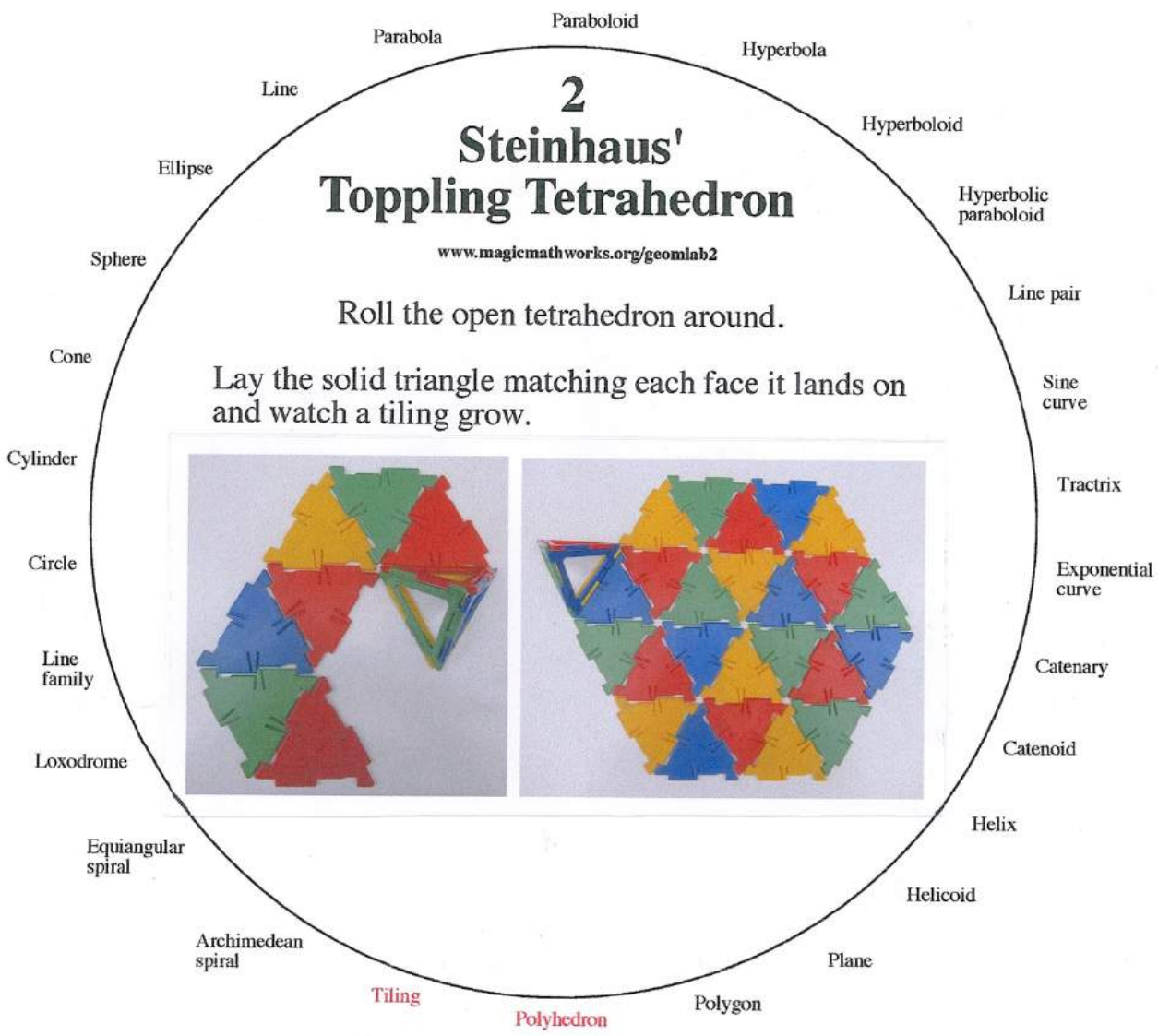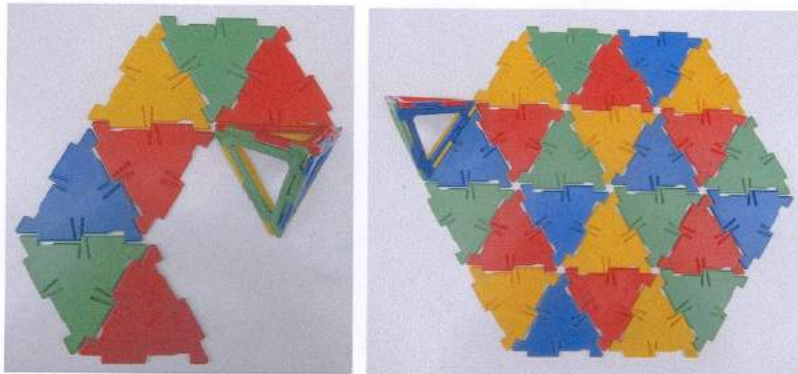
In what ways is a rolling cone analogous to the toppling tetrahedron? The toppling tetrahedron covers the plane whereas the cone has a finite locus. The sum of the tetrahedron's facial angles meeting in a vertex is a unit fraction of a whole angle (1/2 in fact) and this is a requirement here too. (The 1/2 corresponds to a semi-apical angle of .) 30°

John Mason's rolling coffee cup

This coffee cup rolls on the table, printing a design. Extend the frustum to make a complete cone. Points on the cup follow circular arcs centred on the apex.

1

1

α
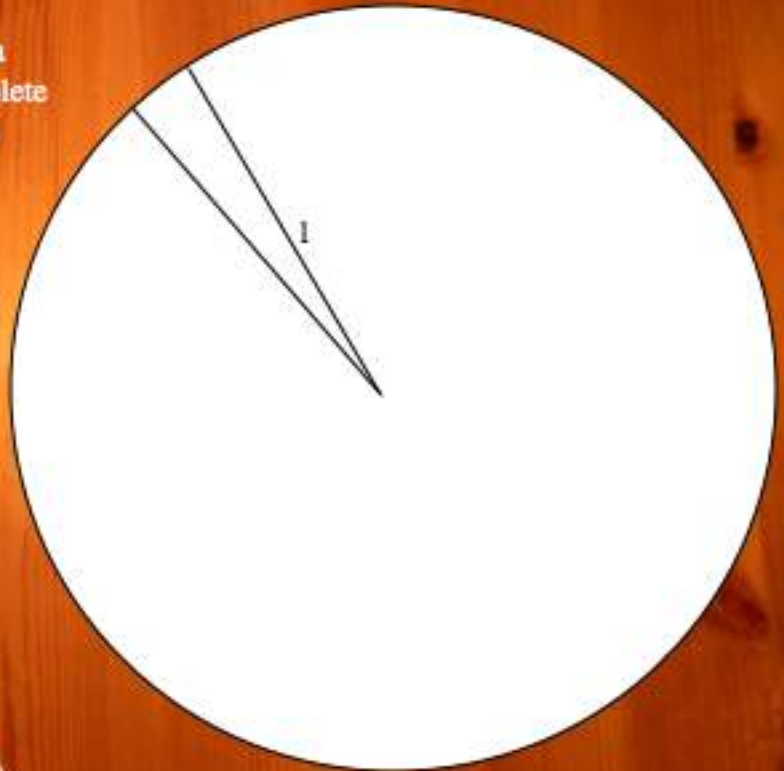
For it to print without smudging, $\sin\alpha$ be a unit fraction.