

Parabola Paraboloid Hyperbola

Line

19 Shortest Paths on the Cylinder

Hyperboloid

Ellipse

Hyperbolic
paraboloid

www.magicmathworks.org/geomlab19

Sphere

Line pair

A) Stretch the rubber band between two points.
It follows a helix.

Cone

Swap the band for the acetate right triangle.
Wind it round the cylinder to see more of the helix.
It is the curve squirrels follow when chasing each other up a tree.

Sine
curve

Cylinder

The cylinder can be rolled out flat. If you do so, the shortest route will appear as the shortest route between two points in the plane: a straight line, (in your case, that ruled on the acetate).

Tractrix

Circle

B) The helix goes *up* in proportion to how far it goes *round*. The analogy in 2-D is the Archimedean spiral, which goes *out* in proportion to how far it goes round. Put a pen in the stick and wind it round the central bolt to make one.

Exponential
curve

Line
family

Catenary

Loxodrome

Catenoid

Equiangular
spiral

Helix

Archimedean
spiral

Helicoid

Tiling

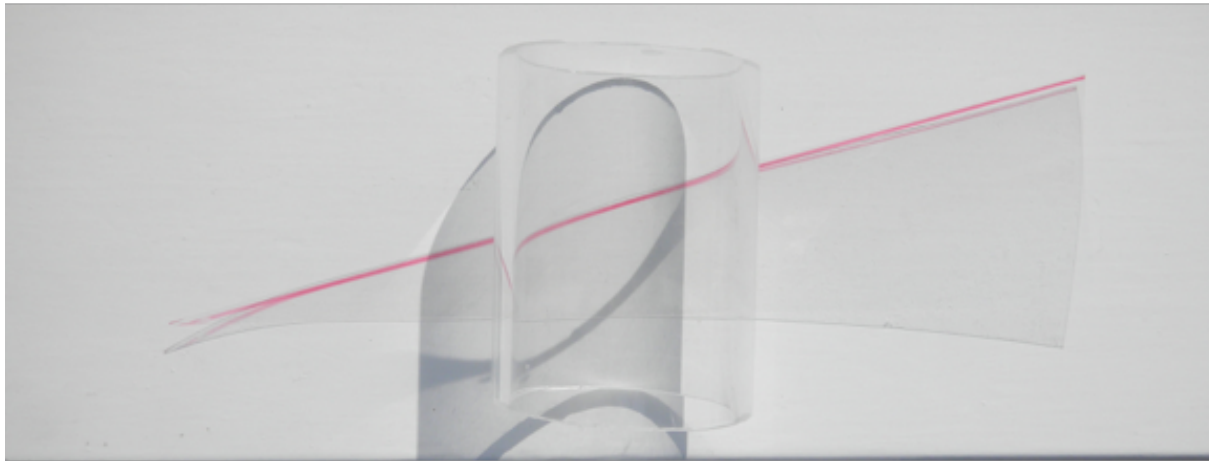
Plane

Polyhedron

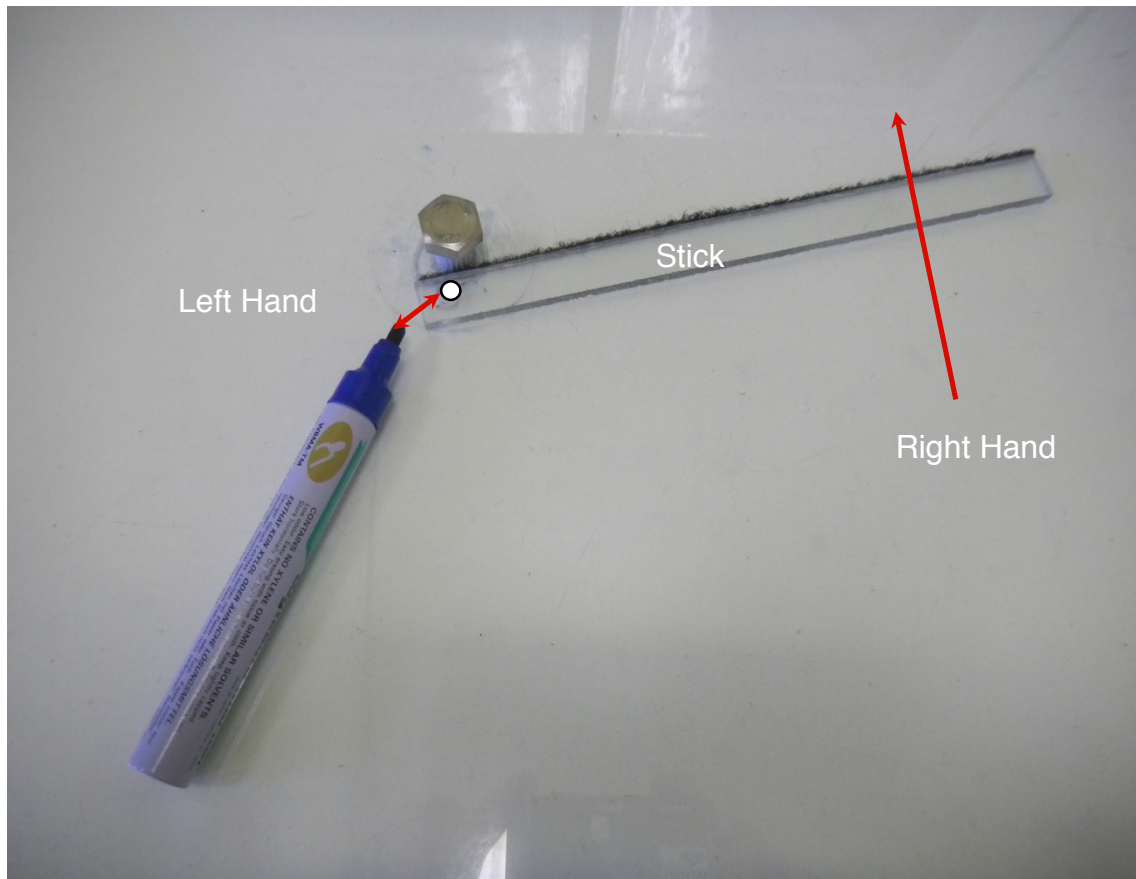
Polygon

19 A

The screw owes its usefulness to the mechanical advantage it confers.
It is an inclined plane wrapped up.



19 B



The curve is in fact the *involute to a circle*, which approaches the Archimedean spiral as the radius of the bolt thread tends to zero. (In **5** the tractrix is the involute to a *catenary* and, inversely, the catenary is the *evolute* to the tractrix.)