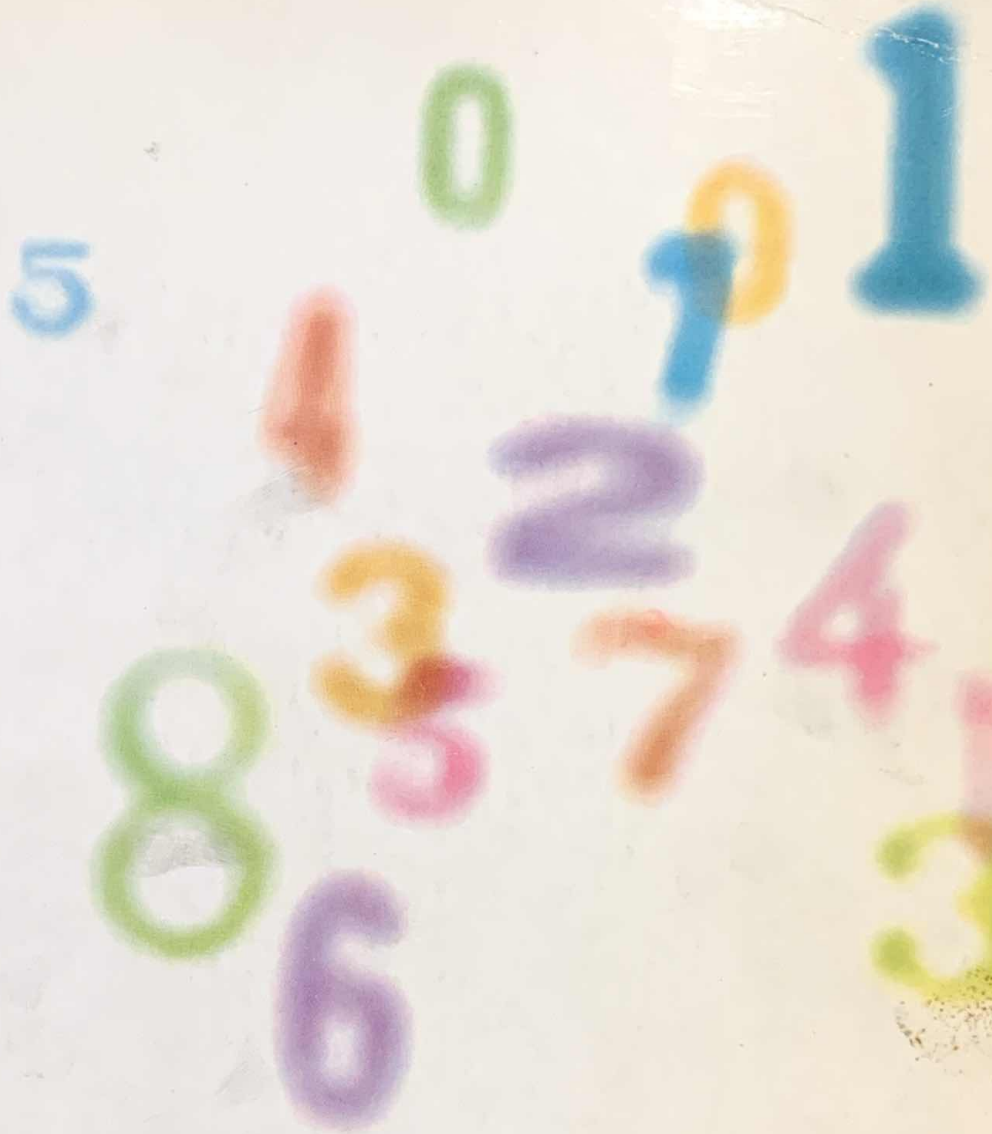


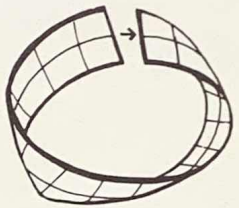
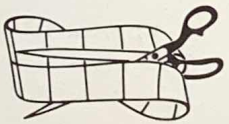
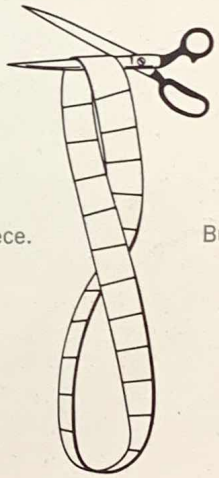
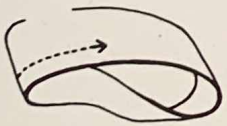
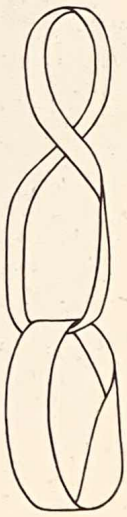
MATHEMATICA: A world of numbers . . . and beyond

Presented by **IBM**

Mathematica: A world of numbers... and beyond, is the title of an exhibit presented by IBM at the California and Chicago Museums of Science and Industry. The exhibit designed for IBM by Charles and Ray Eames is part of a program to stimulate interest in mathematics and the sciences. ▲ Mathematics has been called "the Queen of the Sciences", for its intrinsic beauty and because it has mothered a host of other sciences. Traditionally, its branches have been arithmetic, algebra, geometry, trigonometry, statistics and logic. It forms the base of many practical sciences such as physics, chemistry, geology and meteorology. It provides the foundation for cultural arts such as music, art and architecture. It is rapidly being adapted as a basic tool by the social sciences and humanities —for studies of population, political trends and economic theories. ■ The progress of mathematics and devices for calculating and computing have been closely interrelated since the invention of the abacus. Today's modern computers solve in seconds problems that would have taken mathematicians months or years just two decades ago. ● IBM hopes that this book based on the exhibit will help communicate the scope of mathematics and the work mathematicians do:

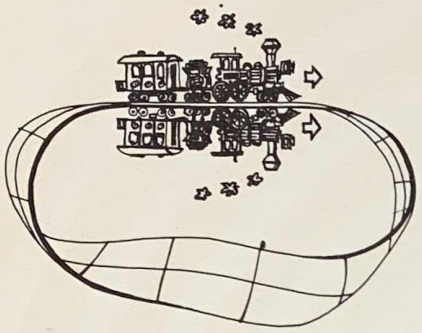

TOPOLOGY
CELESTIAL

The arrow seems to travel around the **Moebius band** on both sides. But this is a surface that has only one side and one edge!

You can make a Moebius band by putting a twist  in a piece of paper and joining the ends. If you cut it in half down the middle  it will stay in one piece.  But if you cut a Moebius band ⅓ of the way  from the edge you get 2 pieces—one of them another Moebius band. 

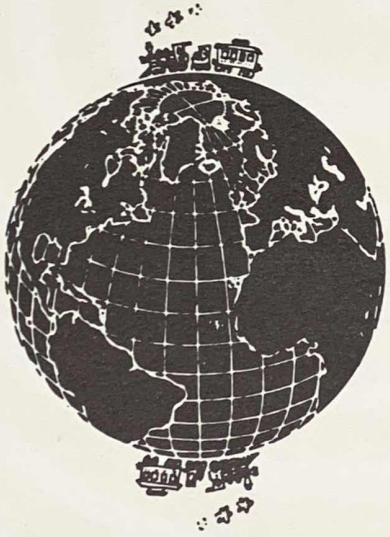
While we can make a model of a Moebius band out of paper or plastic, mathematicians actually define surfaces as having no thickness at all.

When do the trains return to the starting point? On an ordinary surface the train must make a complete circuit. On a Moebius surface the train comes back to the starting point upside down the first time. On a Moebius band "up" and "down" have no meaning.



A Moebius band has one side, and one edge.

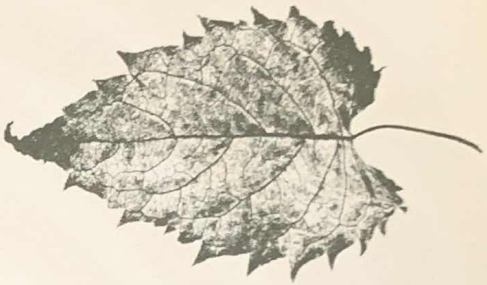
An ordinary band has two sides and two edges.

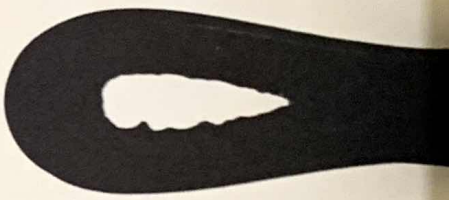


A sphere has two sides (inside and outside) but no edges.

The Maze on the right you can solve in the dark. Just walk along, touching one finger to the wall all the time. Your finger will trace a curve that completely surrounds the wall. The wall is inside that curve, and so, part of the time, you will be in the open air. To picture in your mind why it works, imagine that the wall is just a blob . . . a queerly shaped blob. It won't work on a maze with an island in it. When you think of walls as blobs . . . talk about the "inside" of a closed curve . . . and worry about islands . . . you are dealing with the ideas of **Topology.**

Image Wall





The image wall is made of a variety of familiar items . . . a snowflake, a sea shell, an egg, a photograph of a tornado. All have a relationship to various forms of mathematics like the leaf and the frying pan, whose networks follow the theorems of Topology.