

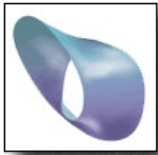


© 1997–2009, Millennium Mathematics Project, University of Cambridge.

Permission is granted to print and copy this page on paper for non-commercial use. For other uses, including electronic redistribution, please contact us.

Jan 2002

Regulars



Puzzle page



The Möbius Challenge

(and a Mathematical Valentine!)

If you've never come across a Möbius Strip before, you may be surprised to learn that it is easy to make a loop of paper with only one side and only one edge!

How? Well, take a strip of paper, give it one twist, and join the two ends. That's all.

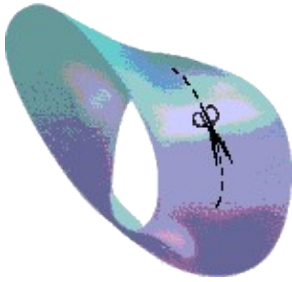
Sorry, You will need a Java enabled Browser to use the applets of the Mobius strips.

A mobius strip with one twist. This applet was created by Benjamin Wardhaugh and can be rotated by pressing the left mouse button and moving the mouse. Zoom by holding down shift, left mouse button, and moving the mouse vertically. You can play with the [Mobius Strips Explorer](#)

But how can this simple procedure get rid of one side and one edge of your paper, when, after all, it started with the usual number of sides and edges, namely two?

To see that the Möbius Strip has only one side, try painting it. Choose a point on the strip, start colouring it in in one direction, and see what happens! Similarly, to see it only has one edge, run a pen along an edge and keep going.

Can you see why a Möbius Strip would be good to use in a conveyor belt? The Goodrich Tyre Company has the patent on Möbius Strip belts, although they're not manufactured this way any more, because modern belts are made from an untwisted loop, with several layers of different materials.



Cutting a strip in half

Once you've made your Möbius Strip you can cut it along the middle down the whole length of the strip. (To start the cut off, fold the strip and make a small cut, then unfold the strip and use the hole as a starting point.)

What do you end up with?

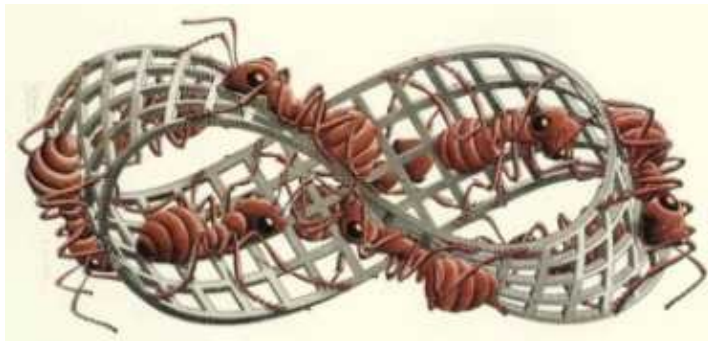
Now start off with a new Möbius Strip (quite a fat one), and cut it about a third of the way in from the edge. What do you get?

Next, mark your strip into quarters at some point along its length, and cut along the length of the strip, making sure you cut through each mark. How many separate cuts will you make? What do you end up with?

How about if you had marked your strip in fifths? Sixths? And so on?

Do the twist (again)

Now, instead of just giving your loop of paper one twist before joining the ends, give it two. How many sides and edges does this shape have? What happens when you cut it down the middle? And how about three twists? And more? You can use the [Möbius Strips Explorer](#) to help you visualise the answer.



M.C. Escher's "Möbius band II".

All M.C. Escher works © 2002 Cordon Art – Baarn – Holland (www.mcescher.com). All rights reserved. Used by permission.

Mathematical Valentine

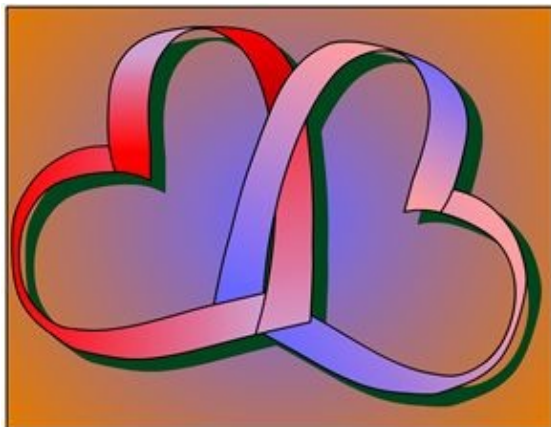
If you know anyone who might appreciate a rather geeky Valentine tribute, try this. Make two Möbius Strips, with one twisted clockwise and the other twisted anticlockwise. (It won't work unless you get this right.)

Stick the two loops together, at right angles to each other. Send this to your inamorata, with instructions to cut

Do the twist (again)

Puzzle page

along the middle of both loops. (When you get to the join, cut through both loops.) What you get is a Mathematical Valentine!



You can send your solution by e-mail to plus@maths.cam.ac.uk.

If you are stumped by [last issue's puzzle](#), here is [the solution](#). We were delighted to get a record number of correct solutions!

For some challenging mathematical puzzles, see the [NRICH](#) puzzles from [this month](#) or [last month](#).



Plus is part of the family of activities in the Millennium Mathematics Project, which also includes the [NRICH](#) and [MOTIVATE](#) sites.