

Surfaces and Edges

(Möbius strip)

Equipment

Strips of paper approximately 3cm wide.

Glue.

1 pair of scissors.

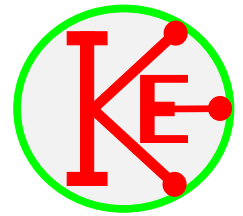
Pencils/pens

Risks.

Cuts from scissors. Stab injuries from scissors. Paper cuts.

SESSION

- 1). Discussion of mathematics.
Why is maths important in STEM
- 2). Discussion of Surfaces.
- 3). Discussion of Edges.
- 4). Discussion of uses of surfaces and edges.
- 5). Experiments with surfaces and edges
 - Loop of paper - no twist
 - Loop of paper - half twist
- 6). Investigation of loops of paper with multiple twists.
General rule?



Experiments with surfaces and edges.

The number of surfaces and edges can change.

- 1). Take a strip of paper.
How many surfaces are there?
How many edges are there?

Glue the ends of the strip together to form a loop.

Now

Draw a coloured line along the middle of the inside of the loop until you return to where you started.

Is there any line on the outside of the loop?

What does this prove?

This is a test for surfaces.

Now

Draw a different coloured line along the very edge of the inside of the loop until you return to where you started.

Is there a line on the other edge of the inside of the loop?

What does this prove?

This is a test for edges.

- 2). Take a new strip of paper and put some glue on the one end.
Bring the two ends of the strip together BUT before sticking,
turn the end with the glue over and then stick together.
This gives the loop of paper a half twist.

Now

Starting on the inside, draw a coloured line along the middle of the loop until you return to where you started.

Is there any line on the outside of the loop?

What does this prove?

Starting on the inside, draw a different coloured line along the very edge of the loop.

Is there any line on the other edge of the inside of the loop?

What does this prove?

Use the scissors to cut along the centre of the strip.

What is the result?

- 3). Make up a new loop of paper with a half twist.
Use scissors, cut round the loop again, but this time one third of the distance from the edge instead of the centre.
What is the result?
How can where you cut affect the outcome?
- 4). Repeat sections 2 and 3 with a loop of paper with a full twist (2 half twists).
What are the results this time?
- 5). Repeat sections 2 and 3 with a loop of paper with 3 half twists.
What are the results this time?
Is there a general rule?

How the half twist works.

Putting the half twist into the paper strip before gluing makes the paper loop have just one surface and one edge.

When the loop is cut in half, every part from the one side of the cut associates with every part from the other side of the cut. The result is a single loop with two half twists.

When the loop is not cut in half but to the one side, you are effectively cutting off the edge of the loop, which forms a single loop with two half twists but this is looped through the original half twist loop, which is still present, just narrower.