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Features

## Imaging maths – Inside the Klein bottle



### The Interactive Klein Bottle

Construct and explore the Klein bottle with various parameters.

#### Exercises

1. Move the "How to build" slider to see the construction of a Klein bottle from a sheet of paper. A square paper is first rolled to a cylinder and then bend to a Klein bottle.
2. The "shift" sliders allows to move the gluing of front and back side over the bottle.
3. You get a different type of bottle when making the "Body Width" smaller than the "Handle Radius".
4. Mark some faces by holding down the 'n' key and picking some faces with the left mouse. Marked faces appear in magenta. Keep track of the movement of the faces over the Klein bottle when changing the "shift" slider.  
To unmark all faces press <shift-u> while dragging a rectangle all over the display.
5. Reset all values and then set the "uMax" slider to 1.57 ( $\sim \text{Pi}/2$ ). Now slowly increase the value of "vMax". What do you get?
6. Move the "Möbius Strip" slider after a reset to open the Klein Bottle to either one of the two Möbius strips.
7. Open the material inspector to adjust surface color and transparency. Right click and choose "Control Panel" in the popup menu.

Here is a list of some control keys to adjust the view. More advanced controls are listed in the [JavaView Help](#).

|                    |                       |
|--------------------|-----------------------|
| <i>Left-Mouse</i>  | Drag to rotate        |
| <i>s</i>           | Drag to scale         |
| <i>t</i>           | Drag to translate     |
| <i>r</i>           | Switch to reset       |
| <i>w</i>           | Enable auto-rotation  |
| <i>q</i>           | Stop auto-rotation    |
| <i>Right-Mouse</i> | Show popup menu       |
| <i>Shift-s</i>     | Enable smooth drawing |

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*Plus* is part of the family of activities in the Millennium Mathematics Project, which also includes the NRICH and MOTIVATE sites.