DEPARTMENT OF MATHEMATICS

MATHS 190 Tutorial 10

Discuss the following situations with two or three other students and try to work out together a solution to each question. Make sure everyone in the group contributes to the discussion. When you have an answer to a question that everyone agrees with, make some notes outlining how you worked out the answer. Then try to explain your answer to your tutor.

1. Consider the following digits as figures in the plane, made up of one or more straight or curved line segments:

   1 2 3 4 5 6 7 8 9

   Which digits are equivalent to each other via a distortion? Group equivalent digits together.

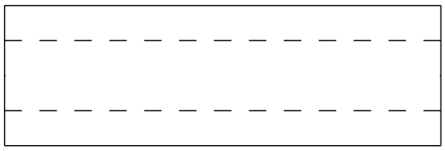
2. Using the paper, tape and scissors provided, make your own Möbius band.

   Cut along the center. What do you get? Cut along the center again – what happens? Why?

3. Make another Möbius band.

   Suppose that you cut the Möbius band along the dotted lines as in the picture below. What would you get? Try to figure out what happens before you try it.

   How many sides and edges does the resulting object have?



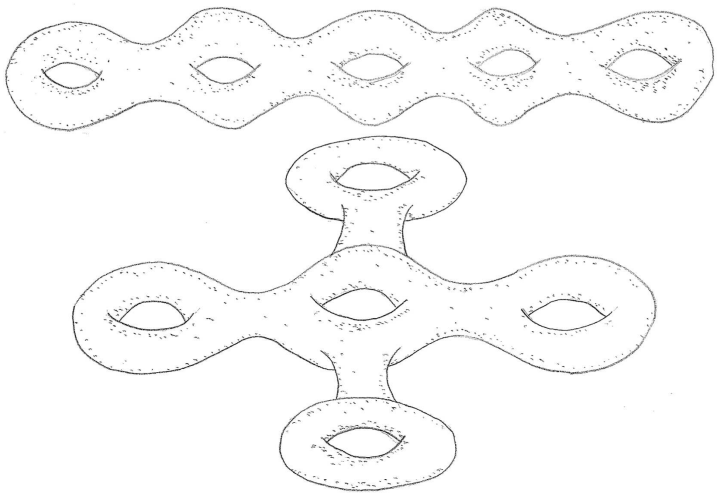
4. **Write up your answer to this question and hand it in with your answers to Assignment 4 (due Monday May 31st).** See below for instructions on writing tutorial reports. Don't forget to write down the names of the people in your tutorial group, so that you can acknowledge your collaborators in your report.

   Give two different arguments to show that a Möbius band is not equivalent by distortion to a cylinder.

5. Imagine taking two strips of paper of the same length and laying them on top of one another. Now add a single twist and tape the ends together (tape the outer strips together on one side and the inner strips together on one side).

   What do you think will happen when you cut along the center? Try it.

6. Are these two surfaces equivalent by distortion? If so, demonstrate the distortion with a sequence of pictures; if not, explain why not.



7. Imagine a piece of flexible hose with square cross section. One can make Möbius hoses by making a 90 degree turn and joining the ends to form a loop, or making a 180 degree turn and joining the ends.

   How many edges and how many sides do each of these objects have?

Writing up tutorial questions

A written solution for question 4 should be handed in for marking with Assignment 4. In your solution, you should include:

- the names of the people you discussed this with in your tutorial group;
- a clear statement of your solution to the puzzle;
- a clear explanation (in one or two paragraphs) or how you arrived at this solution; and,
- a statement of any assumptions you had to make in obtaining your answer.