Tutorials in Maths 190 are **collaborative** tutorials. You should work in groups of 3 or 4 students, discussing the situations and puzzles listed below, or issues arising from lectures. Part of your final mark depends on your participation in tutorials.

Write up your answer to the question marked with a "⋆" and hand it in with Assignment 4 (due October 21st).

1. Decide whether or not the following figures are equivalent by distortion or not:

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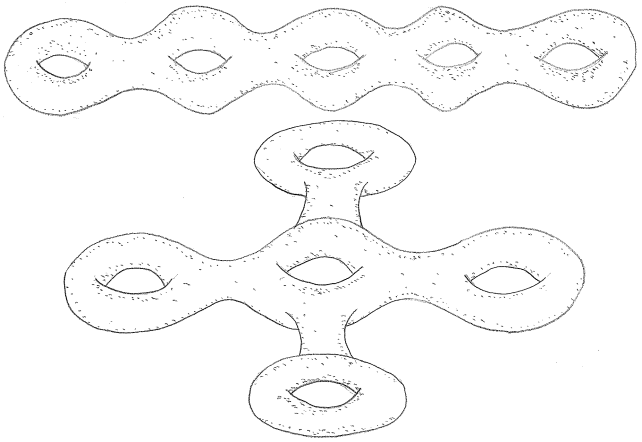
Justify your answer.

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

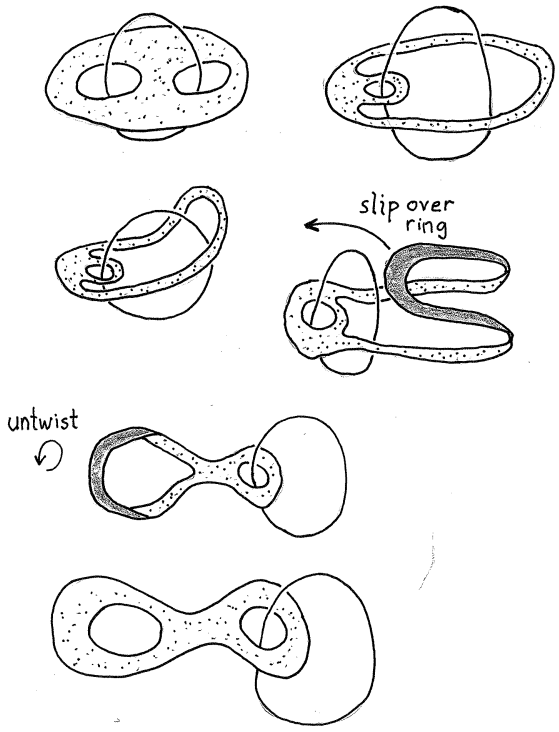
1 2 3 4 5 6 7 8 9

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

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

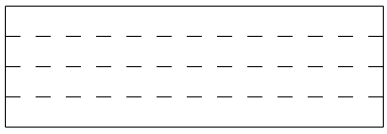


4. Recall the Ring Challenge presented in class, whose solution is illustrated below (and on p. 332 of the textbook):



In the first picture, imagine that the circular boundary of the left hole is colored blue, and that the one on the right is colored red. Where are these two circles in the last picture, after the sequence of distortions that "unlink" the ring from one of the holes?

5. If you took the rectangle below and joined the right and left edges with a twist, you would obtain a Möbius band. Suppose that you cut the Möbius band along the dotted lines. What would you get?



6. Imagine a Möbius band thickened so that the edge is as thick as the side. In particular, this "thickened Möbius" has square cross-sections. How many edges and how many sides does it have?