Chapter 9 Homework

1. Compute the Alexander Polynomial of the following knot. Show your work.

![Knot Image]

2. Show a sequence of Reidemeister moves that transform the following knot into a simple loop.

![Knot Image]

3. Which of the surfaces have the same topology. Give an explanation of how to get one from the other, or explain why one is distinct from the rest:

![Surface Images]
4. Consider the following shape below. Can you morph your piece of clay to look like (f)? If not, explain.

Can you morph your piece of clay into (g)? If not, explain.

If you can do either, go ahead and morph your clay into the corresponding shape without tearing or breaking and reattaching the clay. Also write a short description of the steps needed (like in class).

5. Verify that $T^2 \# (P^2 - D^2) = K^2 \# (P^2 - D^2)$. Give an explanation of the transformation needed. (Hint: Decide what each item is first... We will give you one, figure out which one it is and show it can be morphed into the other.)

Senior Project Ideas:

1. Discover new knot invariants.

2. Further study possible shapes of 3-dimensional manifolds and the properties that pertain to them. Pose both philosophical and creative questions and seek to answer them through what you have learned.

3. Design a freshman/sophomore level course on Manifolds and String Theory to give students the visualization and intuition needed when doing topology technically with use of Analysis and Algebra later in college.

4. Write computer programs to illustrate homeomorphisms from certain manifolds to the other.