

Name: _____

MATH 110 – EXAM 4
31 March 2004

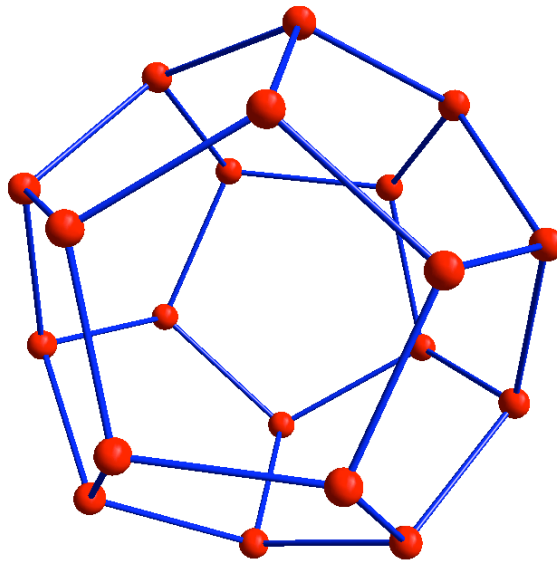
Directions: There are nine questions on this exam. Answer every question. Show all work and justify your answers. Each question is worth five points.

1. I am thinking of a Platonic Solid. Each face of my solid has three sides. Each vertex of my solid has four edges leaving it.

(a) What is my solid?

(b) How many vertices does it have? How many edges? How many faces?

2. Consider the following Platonic Solid:



(a) What is its name?

(b) What is the name of the Solid which is *dual* to this one?

3. (a) What does it mean for two objects to be *equivalent by distortion*?

(b) Are \otimes and θ equivalent by distortion? Why or why not?

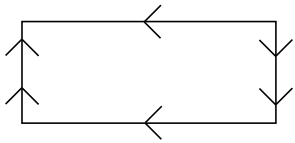
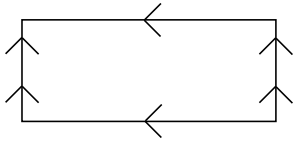
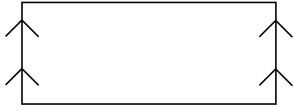
4. List two ways in which a cylinder is different from a Möbius strip.

5. Consider the following digits made of 1-dimensional line segments:

1234567890

Which digits are equivalent to one another by distortion? Group equivalent digits together.

6. What figure is represented by each edge identification diagram (mathematical recipe)?



7. (a) What is the difference between a regular polygon and a regular polyhedron (Remember, “Platonic Solid” is another name for “regular polyhedron.”)?

(b) How many regular polygons are possible?

(c) How many regular polyhedra are possible?

8. (a) Augusta has drawn a planar graph. Her graph has 123 vertices and 99 regions. How many edges are there in her graph?

(b) Olympia says that she has drawn a planar graph with 94 regions and 87 edges. What do you think of her claim?

9. In our proof of the number of Platonic Solids, we defined the quantities s and c , where s stood for the number of sides on a face and c stood for the number of edges leaving each vertex. We ended up with the three inequalities $s \geq 3$, $c \geq 3$, and $\frac{2}{c} + \frac{2}{s} > 1$. What are the allowable pairs of values of s and c ?

[Bonus: 3 points] Imagine you have a tetrahedron made out of clay and you slice off all its corners. Describe the shape which you end up with. What do its faces look like? How many faces does it have? How many edges? How many vertices? Try to sketch it.