This practice test is meant to help you review and to convey the general format of the test. It does not include every possible type of question which may be asked on the test.

For the test, you will be allowed to use any of your manipulables, but no notes of any kind. Calculators are not allowed.

**Problem 1**
State the Protractor Axiom. Of the spaces that we have studied ($\mathbb{E}^2$, $\mathbb{S}^2$, $\mathbb{H}^2$, the cylinder, the half-plane, the Moebius band), for which is it true and for which is it not true? (Consider each part of the axiom.) Explain why or give a counterexample in each case. Also, state any relevant theorems.

**Problem 2**
Consider the hyperbolic plane $\mathbb{H}^2$. Are the following curves geodesics or not? State as many reasons for your answer as you can. (Consider the axioms and the properties of straightness.)

1. The radial curves. On your model, these are formed by the short straight edges of the annular pieces. Continue these edges infinitely in both directions.
2. The annular curves, perpendicular to the radial curves. On your model, these are formed by the curved edges of the annular pieces.

**Problem 3**
Prove that every isometry takes straight lines to straight lines. Hint: you will need to use the definition of isometry, and the relationship between shortness and straightness.

**Problem 4**
State and prove the vertical angle theorem.

**Problem 5**
Answer the following question for both $\mathbb{S}^2$ and $\mathbb{H}^2$. Consider a trilateral $T$ with vertices that are not collinear. Is $T$ necessarily simple? Prove or give a counterexample.