MAT 360 Sketchpad Problem guide 2. Problems 5 to 12 are due on Dec 4th.

You need to submit problems 5 to 12 by email as usual (name your file with your last name and email it to Pedro). Each of these problems should be done the in same file and in a separate page. Add a page with Tools->Add page->Duplicate. Unless is explicitly said, all the objects (lines, segments, circles) are hyperbolic. You are allowed to use all the Custom tools defined in the Poincare Disk file.

1) Find the file Poincare Disk.gsp and save it under a different name. (You may save an extra copy to reuse in case you need a "clean" file again)
   http://www.dynamicgeometry.com/general_resources/advanced_sketch_gallery/downloads/Poincare_Disk.gsp
2) Make the disk larger and move it to the right. (You need to use "Disk Controls")
3) Construct a hyperbolic segment and a Euclidean segment with the same endpoints. Move the endpoints and observe both segments. Observe what happens when the endpoints of the segments get closer to the boundary.
4) Construct a hyperbolic circle (Use the hyperbolic circle by CP –circle , point -tool). Observe how the circle changes when you drag the point of the circle and the center of the circle.
5) Construct a hyperbolic triangle and compute the angle sum. Drag the vertices and observe how the angle sum changes. Construct a triangle with the angle sum as small as you can and another one, with angle sum as large as you can. State a conjecture.
6) Construct a hyperbolic line l and a point P outside that line.
   a) Construct ten distinct hyperbolic lines parallel to l through P.
   b) Give description of the parallel lines to l through P (You need to find some defining properties of these lines and you cannot use the word "parallel").
7) With the same data of problem 6.
   a) Construct the perpendicular to l through P. Denote by Q the foot of this perpendicular.
   b) Measure the angle between the ray PQ and five of the parallel lines.
   c) State a conjecture about the measure of these angles.
8) Construct two similar triangles, such that only one of them contains the center of the disk in the interior (Hint: Use SAS).
   a) Compute the defect of each of the triangles.
   b) Are these triangles congruent?
   c) If your answer to b) is yes, explain why they do not "look" congruent.
9) Construct a Saccheri quadrilateral ABCD, with A and B as right angles.
   a) Is the angle C congruent to the angle D?
   b) Construct the segment with endpoints the midpoint of AB and the midpoint of CD.
   c) Compare the hyperbolic measure of this segment with the hyperbolic measure of BC and AD.
   d) State a conjecture about the measures of the segments.

10)
   a) Construct two hyperbolic lines l and m (to make your construction more interesting, make sure that l is “bigger” than m in Euclidean distances).
   b) Construct a line p perpendicular to l.
   c) Measure the angle between p and m (Drag p if necessary so p intersects m).
   d) Drag p and observe how the angle between p and m changes (you need to be careful in the choice of the points determining the angle).
   e) How many positions of p can you find such that this angle is a right angle?
   f) Find a common perpendicular to l and m.(You may do this by dragging p)

11) Chose a point P as close as possible to the boundary of the disk. (Recall that the points in the boundary are not a point in this model). Construct two lines through P.
   a) Are these lines parallel?
   b) Do they have a common perpendicular?
   c) What would be the answer of a) and b) if P was on the boundary of the disk?

12) Construct a line l, and a perpendicular p to l. Denote by Q the intersection point of l and. p Choose a point P of p, different from Q, and construct a perpendicular m to p through P. Construct a Saccheri quadrilateral ABCD such that Q is the midpoint of AB and P is the midpoint of CD, AB is included in l and CD is included in m. Compare the hyperbolic distances BC, AD and PQ.