NAME _____ STUDENT NUMBER _____

MIDTERM

Math 445A: Geometry for teachers

May 2, 2014

Problem	Total Points	Score
1	10	
2	10	
3	10	
4	10	
Total	40	

- You may use the lists of axioms and theorems and one-sided page of your own notes prepared for the midterm.

- No other notes, books, or electronic devices. Please turn off your cell phone.

- Show all your work to get full credit. Write your solutions on the pages provided. Use backs for scratch paper if you need it.

- Read instructions for each problem CAREFULLY.

- There are four problems total, each problem is worth 10 points.

- If you are asked to prove a theorem from the textbook, you can use use any theorem/lemma/corollary that comes prior to it.

(1) This is a multiple choice question. For each question, circle **one** correct answer; try to choose the most general one. Complete and correct answer is worth 2 points, incomplete but correct answer is worth 1 point, any other answer or no answer - 0 points.

What is a *incomplete but correct answer*? If the statement is true in Neutral geometry but you only circle Euclidean or Hyperbolic, then the answer is considered correct but incomplete.

Neutral:	The statement is *true in Neutral* geometry
Euclidean:	The statement is *true in Euclidean* geometry
Hyperbolic:	The statement is *true in Hyperbolic* geometry
None:	The statement is *not true in Neutral* geometry

(a) **Neutral** **Euclidean** **Hyperbolic** **None** If two lines are parallel then the interior alternate angles are congruent.

(b) **Neutral** **Euclidean** **Hyperbolic** **None** There exists a line ℓ and a point A not on ℓ such that there are no lines through A parallel to ℓ.

(c) **Neutral** **Euclidean** **Hyperbolic** **None** If all three angles of a triangle are congruent then it is regular.

(d) **Neutral** **Euclidean** **Hyperbolic** **None** There exists a rectangle.

(e) **Neutral** **Euclidean** **Hyperbolic** **None** If all four angles of a quadrilateral are 90^o then it is a rectangle.

(2) (a) (2pts) Define alternate interior angles for two distinct lines cut by a transversal

(b) (8pts) Prove Theorem 7.19, The Alternate Interior Angles Theorem (In Neutral geometry):

If two distinct lines are cut by a transversal making a pair of congruent alternate interior angles, then the lines are parallel.

(3) (a) (7pts) Prove Theorem 10.10, "$45 - 45 - 90$", in Euclidean geometry:
A triangle has interior angle measures 45^o, 45^o, 90^o *if and only if it is an isosceles right triangle.*

(b) (3pts) Only one direction of Theorem 10.10 is still true in Hyperbolic geometry. Which one? Justify your answer both for the direction which is true and for the one which is not. You may accompany your answer with a clear drawing on a Poincare disk.

(4) Show that there exists a regular octagon (polygon with 8 vertices) in Neutral geometry.