Exam 1

At the Exam

- We'll take advantage of the space we have and spread out from each other around the room.
- You may have your child's ball with you and I will give you a copy of *Euclid's Elements* Book I. Otherwise this exam is closed to notes/books and closed to technology. For example, any IGS explorations I ask you to create would specify "roughly sketch" so a sketch by-hand without tools will be fine.
- There will be various types of question related to Geometric Perspectives, Proof Considerations & IGS Exploration and your grade will be based on the quality of your responses in a timed environment (turned in by the end of class).
- Partial credit may be earned, so (if you have time) showing your reasoning or thoughts on questions you are unsure of can help your grade.
- Follow directions carefully in order to earn full credit. Skip portions of problems that you are struggling with and come back to them later if there is time.
- I'll provide you with scratch paper, but be sure to copy your responses to the exam.
- You may have out food, hydration, ear plugs, or similar if they will help you (however any ear plugs must be standalone–no cell phone, internet or other technological connections)

Topics to Review

Review the following and be sure that you could respond to these. The vast majority of the exam will come from a subset of these. However, exams are not only an opportunity for you to demonstrate your mastery of the material, but are also an opportunity for you to be challenged to make new connections.

- Eratosthenes from class and Project 1
  - picture
  - how parallels relate
  - how alternate interior angles relate
  - set up but do not solve the proportion equation
  - theoretical assumptions versus real-life considerations/limitations (e.g., light rays)
- I-1 [Construct an equilateral triangle] from class and Project 2
  - sketch the construction in Euclidean geometry
  - write a paragraph proof
  - identify underlying assumptions (e.g., the two circles intersect) and what happens on the sphere
  - sketch the construction on the sphere for small and large segments
- I-4 [SAS] from class and Project 2
  - familiarity with proof of SAS from class

  - identify underlying assumptions (e.g., there is a unique Euclidean segment connecting two points)
  - sketch a pair of triangles that give a counterexample on the sphere

- I-9 [Bisect an angle] from Project 1
  - sketch the construction in Euclidean geometry
  - write a paragraph proof
  - how can I-9 be applied to prove I-10?

- SSA from the worksheet on congruence and similarity
  - Sketch a pair of triangles that give a counterexample for SSA in Euclidean geometry
  - How does the law of cosines factor in?
  - What theorem is needed to prove the law of cosines in the proof referenced on the worksheet (#4 on the worksheet)?
  - Is the pair you provided enough in a proof that SSA doesn't hold in Euclidean geometry or do we need to create other pairs?

- Reasons why HL provides congruence in Euclidean geometry from class
- Can we form a square on a sphere from Project 2?
- Counterexample of AAAA in a Euclidean quadrilateral from class
- AAA on Project 2 and 3
  - familiarity with proof of AAA from Theorem 4.4.5 on p. 149–150 from Project 3
  - name a congruence or similarity theorem that we used in the Euclidean proof
  - sketch a pair of triangles that give a counterexample on the sphere from Project 2 and 3

- Midpoints of Euclidean quadrilaterals from Project 3
  - what figure do we form when we construct the segments connecting the midpoints of a quadrilateral?
  - name a congruence or similarity theorem that we used in the proof

- Models of Rowing a Regatta from Project 3
  - model of logger measurements if all trees are right circular cylinders and all trees are about the same height relating diameter$^{\text{to some power}}$ to board feet/10
  - model of logger measurements if all trees are still right circular cylinders but that the height of the tree is now proportional to the diameter relating diameter$^{\text{to some power}}$ to board feet/10
  - which was the better model for the data in project 3?

- I-47 Pythagorean theorem from class and Project 2

- sketch a picture of *Euclid's Elements* proof of the Pythagorean theorem
- describe one of the IGS explorations from the worksheet on Pythagorean theorem
- sketch a picture from 周髀算經 or *Zhoubi Suanjing*
- write a paragraph proof using the picture from 周髀算經 or *Zhoubi Suanjing*
- identify underlying assumptions in 周髀算經 or *Zhoubi Suanjing* (e.g., sum of the angles is 180°)
- what happens to the proof on the sphere?
- sketch a picture of a right triangle on the sphere

- Fill in the reasons of a given proof using *Euclid's Elements* Book I (e.g., like we did in the given proof of the Pythagorean Theorem based upon the notion of similar triangles from Project 3 or the proof of the Pythagorean theorem using similarity on the Geometric Modeling Using the Sphere and Similarity worksheet, or it could be applied to a new given proof like the Euclidean proof of AAA Theorem 4.4.5 on p. 149–150)

  ***Euclid's Element's* Book I**

  I will give you a copy to use on the test. You should be familiar with the statements of definitions and common notions we covered, the five postulates, and roughly know where some of the propositions are located (and be able to find others), such as:

  - Create a line segment: Postulate 1
  - Extend a line: Postulate 2
  - Create a circle: Postulate 3
  - All right angles are equal: Postulate 4
  - How to tell that two lines intersect: Postulate 5
  - Construct an equilateral triangle: Prop 1
  - Construct or mark off a line of a given length starting at a point off the given length and continuing along a line through that point: Prop 3
  - Bisect an angle: Prop 9
  - Construct perpendiculars: Prop 11 or 12
  - Congruence Theorems: Prop 4: SAS, Prop 8: SSS, Prop 26: ASA and AAS

  Statements that use the parallel postulate begin with Prop 29:

  - Parallels have alternate interior angles and corresponding angles congruent...: Prop 29
  - lines parallel to the same line are also parallel to each other: Prop 30
  - Construct a parallel to a line through a point: Prop 31
  - Sum of the angles in a triangle is two right angles (180° in our measurements) : Prop 32
  - Pythagorean Theorem: Prop 47 and 48

I want you to understand and I am happy to help!