Work on the blank paper; attach this page to the front. This exam is worth 150 points.

1. (a) *[2 pts]* Name any FOUR undefined terms that we've encountered this semester.

   (b) *[2 pts]* Besides undefined terms, what are the other components of an axiomatic system?

2. *[16 pts - 4 each]* Formally define: (a) segment, (b) rectangle, (c) collinear, (d) opposite sides of a line.

3. *[20 pts - 5 each]* Formally state: (a) the Ruler Postulate, (b) Pasch's Theorem, (c) your choice of Betweenness Axiom, (d) your choice of Segment or Angle Copying/Construction Axiom.

4. *[9 pts - 3 each]* Craft Vankirk/McClure-quality definitions for these concepts: (a) regular polygon, (b) median of a triangle, (c) diagonal. If you're uncertain, ask me and I'll draw them.

5. (a) *[5 pts]* Name and state your favorite of the NON-Euclidean Parallel Postulates.

   (b) *[2 pts]* Of the three well-known interpretations, which one satisfies your chosen postulate?

   (c) *[6 pts]* Make up your own interpretation that also satisfies the postulate, using the letters of your first name as points and sets of them as lines. Briefly tell how you know it meets the postulate.

   (d) *[3 pts]* Formally NEGATE your chosen Postulate.

6. (a) *[3 pts]* State an Incidence Axiom OTHER THAN the one about non-collinearity.

   (b) *[9 pts - 3 each]* Make up an interpretation that meets your stated axiom and the non-collinearity axiom, but fails to meet the remaining axiom. Use letters of your first name as points, and sets of them as lines. For each axiom, briefly tell how you know it's met/fails.

7. *[10 pts]* On a separate page, draw a large triangle (center of the page, about 1/9 of the entire page) and construct its incircle. Name and state the Theorem that's crucial to this proving the construction works.

8. *[10 pts]* On a separate page, draw three segments labeled 1, a, and b, and construct a/b. Name and state the Theorem that's most crucial to this proving this construction technique.

9. *[6 pts]* On a separate page, construct a parallelogram that is neither a rectangle nor a rhombus.

10. *[8 pts]* Formally prove that, in Euclidean geometry, the interior angle total of any triangle is 180°.

11. *[12 pts]* Prove ASA.

12. (a) *[3 pts]* Craft a Vankirk/McClure definition for apex angle of an isosceles triangle. (Ask; I'll draw.)

    (b) *[4 pts]* State the formal definition of a kite. (Ask, and I'll draw.)

    (c) *[6 pts]* Prove that in a kite, the diagonal joining the two apex vertices bisects each apex angle.

    (d) *[6 pts]* Prove that in a kite, the diagonals are perpendicular. Use 2-column style here.

    (e) *[2 pts]* As corollaries, which other quadrilaterals must also have perpendicular diagonals?

13. *[6 pts]* On Geometer's Sketchpad, construct a pink equilateral triangle and name it $\triangle GSP$; measure its side lengths. Email this to me.