Math 104 Homework 1

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All problems are from the main textbook (*Greenberg*).

- **Chapter 1, Exercise 1, Page 28: Definitions in Euclidean geometry.** To give you some idea of how your definitions should look, here are acceptable definitions for the first two terms:
  - The *midpoint* M of a segment AB is the point M between A and B such that AM is congruent MB.
  - The *perpendicular bisector* of a segment AB is the line $\overline{CM}$ passing through the midpoint M of AB and a point C not on the line $\overline{AB}$, and such that $\measuredangle CMA$ and $\measuredangle CMB$ are right angles.

- **Chapter 1, Exercise 2, Page 28: More definitions in Euclidean geometry.**

- **Chapter 1, Major Exercise 1, Pages 31-32: Basic Euclidean constructions.** Complete the constructions in **parts** (a)**,** (b)**,** (c)**, and** (d).

- **Chapter 1, Major Exercise 2, Pages 32-33: Collapsible compass.** Complete parts (a) and (b) to show that one can "transfer" distances from one place to another in Euclidean geometry. You do *not* need to "check through your constructions in Exercise 1" as the book requests.

  Hints:
  - Remember that a *collapsible compass* forbids constructions like "let K be a circle centered at Q with radius PR. The center must be one of the endpoints of the segment giving the radius.
  - Refer to the definition of *rectangle* on page 30 (in Exercise 8).
  - You may use any of the seven propositions from major Exercise 1.
  - You may use the following consequence of the parallel postulate: *If* $\square ABCD$ *is a rectangle (four right angles), then* AB *and* CD *are congruent, as are* AD *and* BC*.*

- **Extra Credit:** Euclid addresses the "collapsible compass" issue differently in Proposition 2 of Book I of the *Elements*.
  - Read the statement and proof of this proposition and explain them in your own words.
  - Does this proposition accomplish the same thing as Major Exercise 2 above?

- **Chapter 2, Exercise 6, Page 64: Propositions in incidence geometry.** This problem asks you to prove the five propositions at the bottom of page 51. Make sure that your proofs use only the incidence axioms on pages 50 and 51. (In fact, as noted in the problem, you should not need Axiom 2.)