

Closed book. Closed notes. No calculators. 20 points per problem. Please write very legibly.

1. (20 points) Suppose two circles S_1 and S_2 on the plane intersect in two points A and B . Let C and D be points on S_1 and S_2 , respectively, such that \overline{AC} and \overline{AD} are diameters. Prove B , C , and D are collinear.
2. (a) (5 points) State the Ruler Axiom.
 (b) (15 points) Show every line L has infinite length; i.e., given any positive $x \in \mathbb{R}$, there exist points A and B on L such that $AB \geq x$.
3. (a) (5 points) State Pasch's Separation Axiom for a Line.
 (b) (15 points) Prove Theorem 1.6: Let L be a line and \overrightarrow{AB} a ray. If $A \in L$ and $B \notin L$, then all points on \overrightarrow{AB} , except A , lie on the same side of L as B .