Exercises for Week 02

1. Suppose that L is a line in P (plane) and $A, B, C \in P$ satisfy (i) $A \not\in B$ on opposite sides of L, (ii) $B \not\in C$ on opposite sides of L. Prove that $A \not\in C$ on the same side of L.

2. Consider the analogous question if we replace "opposite sides" by "the same side". What conclusion, if any, can be drawn?

3. L and P as above with $L = CD$. If $A \not\in B$ are on the same side of CD, are $C \not\in D$ on the same side of AB? The options are always yes, always no, or either is possible. Either prove this (options 1 & 2) or give examples (option 3).

4. In the definition of a triangle's interior, show $\mathrm{Int}\,\triangle ABC = \mathrm{Int}\,\angle ABC \cap \mathrm{Int}\,\angle BCA$.

Postpone till after L4

5. Why is $\triangle ABC$ equilateral $\Leftrightarrow |\angle BAC| = |\angle ABC| = |\angle ACB|$?

6. Suppose $D \in \text{Int} \triangle ABC$. Prove that $\text{Int} \triangle DBC \subseteq \text{Int} \triangle ABC$.

7. Suppose that $L \subseteq P$ and $A, B \in P$ are such that $AB \cap L = \phi$. Prove that all points of $\overline{AB}$ lie on the same side of L.

8. If $\overline{AB} \cap \overline{CD} = \phi$ (in plane) and $\overline{AD} \cap \overline{BC} = \phi$ why do A, B, C, D form the vertices of a convex quadrilateral?

9. Suppose D & C on same side AB but $BD \neq BC$ and $D \notin \text{Int} \triangle CBA$. Prove that $C \in \text{Int} \triangle ABD$. (Compare with material in L4)

10. Suppose $A, B, C, D \in P$, no 3 collinear with $CA \perp AB$ and $DB \perp AB$. Prove that $\overline{CA} \cap \overline{BD} = \phi$ (i.e., parallel)