

Pries: 470 Euclidean and non-Euclidean Geometry

Homework 2: Axioms, parallel postulates, and construction problems

Due Friday 1/27

Axioms for the projective plane:

1. Draw a picture of a geometry with 5 points satisfying axioms P1 and P4 with exactly two points on each line.
2. Which axioms does the Poincaré upper half plane satisfy?
3. Use the axioms to prove: There exist three distinct lines such that no point lies on all three of the lines.
4. Use the axioms to prove: If P is any point, then there exists at least one line ℓ such that P does not lie on ℓ .

Parallel Postulates:

1. What parallel postulate does Fano's geometry satisfy? Explain.
2. What parallel postulate does the Poincaré upper half plane satisfy? Draw a picture illustrating this.

Construction problems: List all your steps, using only a straight-edge and compass.

1. Use a straight-edge and compass to construct a square.
2. Draw a flower with 6 petals whose tips are at 6 points regularly spaced on a circle.
3. Use a straight-edge and compass to construct a regular hexagon. Hint: start either with the flower from C.2 or the equilateral triangle.