

Problems:

7.2.1

7.2.2

Also:

1.

In this problem you will draw an affine plane of order 5 (the idea also generalizes to higher order planes of prime power).

a How many parallel classes are there in an affine plane of order 5?

b Draw a 5x5 square grid of points. The lines and rows of the grid form two parallel classes. These are easy to spot, so we will ignore them in our drawings. Lines of “slope 1” form another parallel class. To draw a line of slope 1, you make your line go over 1 and up 1, with the convention that you wrap around if you go off the square (so the point above the upper left point is the lower left point). Draw each line in this parallel class in its own color.

c For each remaining parallel class, repeat part **b**. Draw each parallel class on its own 5x5 grid to keep things from getting too messy.

d Write down a solution of the 25 officer problem based on your drawings.

e If there exists an affine plane of order n , then there exists a solution of the n^2 officer problem. There exist solutions of the n^2 officer problem for every value of n except 2 and 6. But there are infinitely many values of n for which we know there are no affine planes of order n . Why is it so much harder to have an affine plane of order n ?

2.

In class we showed that the dual of axiom **PP1** of a projective plane is also true. Prove that the duals of

PP2 There are at least four points with no three on the same line.

PP3 Every two lines have at least one point on them both.

are also true.

3.

Show that in a projective plane that if one line has $n + 1$ points on it, then the plane is order n .

4.

Show that no affine plane satisfies the principle of duality.