

MATH 108 - FALL 2002

HOMEWORK 4, DUE THURSDAY NOVEMBER 7

Do FOUR of the following FIVE problems.

Recall that the points of the projective space \mathbb{P}_p^n are the line through the origin in \mathbb{F}_p^{n+1} , and the line in \mathbb{P}_p^n are the two-dimensional subspaces of \mathbb{F}_p^{n+1} .

- (1) 5A
- (2) Recall that a projective cap is a collection of points in projective space not containing any lines. Show that every projective cap in \mathbb{P}_2^2 has at most four points.
- (3) List all the points and lines in \mathbb{P}_3^2 . Show that a projective cap in \mathbb{P}_3^2 also has at most four points.
- (4) Give an example of a projective cap in \mathbb{P}_3^3 with nine points. Hint: think of our affine caps. Extra credit: There is actually a projective cap in \mathbb{P}_3^3 with ten points. Can you find it?
- (5) Read either: One of the recent Mathematical Entertainments columns in the Mathematical Intelligencer (available in the library) or the survey article on SET available on the homework webpage. There have been four Mathematical Entertainments columns recently, and two are available online (link on homework webpage). The SET paper is still a draft - extra credit for any typos. After reading the article, write a short (less than a page) summary. You do not need to understand everything in the article, but should make a solid attempt to read it all.