Exam 2 Study Guide

MA 111 Spring 2015

1. FLATLAND

(a) Know the basic plot and characters of *Flatland*. Know the basic features of life in Flatland and Flatland society (for example, the various rules and laws)

(b) Summarize the major points made by Jann and Smith, Berkove, Baker. Be able to articulate why they come to different conclusions about the conclusion of *Flatland*.

(c) Know the following names and something about their contributions or ideas: William Whewell, J.S. Mill, Janos Bolyai, Nicholai Lobachevsky, C.H. Hinton, J.H. Newman, Euclid.

(d) Know the structure of Euclid's Elements

(e) List examples of satire from *Flatland*.

(f) List ways in which Square contradicts himself over the course of the novel.

(g) List parallels between *Flatland* and Plato's Allegory of the Cave and the "Divided Line" (Socrates' educational method)

2. THE MATHEMATICS OF HIGHER DIMENSIONS

(a) Understand the mathematical description of n-dimensional space.

(b) Given an equation with n-variables be able to relate it to equations with fewer variables.

(c) Given an equation with n variables be able to take a slice of the higher dimensional object by plugging in constants for some of the variables.

(d) Given a pattern for creating objects in high dimensions, be able to use the pattern to count how many vertices, etc. it has.

Here is an example:

A 1–dimensional octotope is simply a line segment. A 2–dimensional octotope is a filled-in diamond created by introducing 2 new points (in a direction perpindicular to the line segment) and connecting

each of the new points to all of the points on the 1–dimensional octotope. In general an n–dimensional octotope is created by starting with an $n-1$ dimensional octotope, introducing 2 new points in a perpindicular direction and joining each of the new points by line segments to each point on the $n-1$ dimensional octotope.

new vertex
new vertex
1–dim
2–dim
3–dim
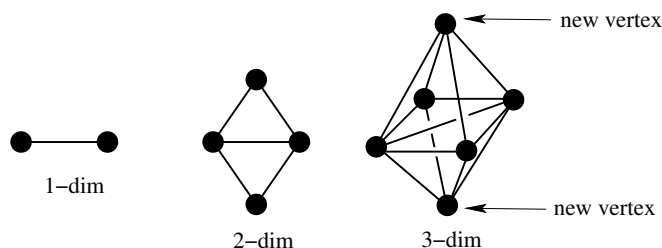
How many vertices does an n-dimensional octotope have? How many 2-dimensional triangles make up a 5–dimensional octotope? How many 3-dimensional octotopes make up a 5–dimensional octotope?

(e) Articulate why high dimensional geometry might be practically useful.

3. PROBABILITY

(a) Carefully state the problem of the points (i.e. the unfinished game discussed by Pascal and Fermat)
(b) Carefully define the following terms:
  (a) experiment (in probability)
  (b) sample space
  (c) probability space
  (d) event
  (e) uniform probability space
  (f) probability of an event E in a probability space.
  (g) Frequentist interpretation of probability
  (h) Subjectivist interpretation of probability
  (i) Independent Events
(c) Given a probability space and an event, calculate the probability of the event.
(d) Summarize the contributions to probability theory of Pascal, Fermat, Cardano, Pacioli, Galileo
(e) Be able to explain the statements and solutions to the "Ace of Spades" paradox, "St. Petersburg" paradox, and Hempel's paradox from Gardner's article.