

## MA 111 Exam 2 Study Guide

- (1) What is meant by  $\text{Symm}(\mathbb{R})$ ? Given two reflections, be able to calculate the translation obtained by combining them (as in PS 4). Be able to define “discrete group of symmetries”. Be able to define “frieze group” and “wall paper group”. Be able to outline the main ideas behind proving that there are 7 frieze groups and 17 wallpaper groups.
- (2) Know the basic facts about Edwin Abbott’s education, mathematical and otherwise.
- (3) Know the basic plot and characters of *Flatland*. Know the basic features of life in Flatland and Flatland society (Law of Compensation, etc.)
- (4) Know the major points made by Jann and by Smith Berkove and Baker.
- (5) List similarities between *Flatland* and the allegory of the cave from the *Republic*. List major differences.
- (6) Know the following names and something about their contributions or ideas: William Whewell, J.S. Mill, Bolyai, Lobachevsky, C.H. Hinton, John Henry Newman, Euclid.
- (7) Know the structure of Euclid’s *Elements*.
- (8) Be able to list examples of satire in *Flatland*.
- (9) Be able to explain the idea of “dimension” and “fractal dimension”.
- (10) Be able to calculate the fractal dimension of basic fractals like the Koch curve and the Sierpinski carpet. Be able to calculate the number of edges or boxes in the  $n$ th step and the length or area of each edge or box in the  $n$ th step. Be able to explain why the Koch curve has infinite length.
- (11) Be able to calculate the (euclidean) distance between points in  $\mathbb{R}$ ,  $\mathbb{R}^2$ ,  $\mathbb{R}^3$ , and  $\mathbb{R}^4$ .
- (12) Given an equation for an object in 4 or 5 dimensions be able to write down an equation for a 2 or 3 dimensional slice of the object.
- (13) Be able calculate basic facts about cubes in all dimensions. (For example, number of vertices, number of edges, volume, etc.) Be able to draw a 2-dimensional picture of 3 and 4 dimensional cubes.
- (14) Be able to give a reason for why it might be helpful to be able to do geometry in high dimensions (from an engineering or scientific standpoint.) As part of your answer you may wish to recall that graphs in 2-dimensions are useful for understanding the relationship between two quantities.
- (15) Know the definitions of “frequentist” and “subjective” probability.

- (16) Know some basic facts about the lives of Pascal and Fermat (eg. what century and what country they lived in, what their professions were.) Know what sparked their series of letters which created probability theory.
- (17) Be able to explain elementary probability facts. eg. the probability of rolling a 3 with a fair die is  $1/6$ . The probability of rolling two 3s is  $1/36$ . The probability of flipping a fair coin so that it lands heads up 7 times in a row is  $1/2^7$ .