MATH 1B03 FINAL EXAM INFO SHEET

The purpose of this handout is to help you study by listing the concepts, definitions, and results you will need to know for the final exam.

EXAM INFORMATION. The final exam will be on DECEMBER 13, 2019 at 7:30PM. The exam will be in IWC (Ivor Wynne Centre). The exam will be 2.5 hours long. You will *not* be allowed to bring in any notes, use the text book, or use a calculator.

Please bring your **student card**. The final exam is a multiple-choice test with 39 questions.

MATERIAL COVERED. The final exam will cover all the material discussed in the course. Please see the review sheets of the last two midterms for the material of Chapters 1, 2, 5, and Chapter 10 (of the 9th edition). Below, I have given a breakdown of what you will need to know of the material discussed since the second midterm.

(Section 3.1) Know what is meant by vectors in n-space, and the related terminology, e.g., direction, length, initial point, and terminal point. Know how to add vectors and do scalar multiplication. Know how to find vectors whose initial point is not the origin. Know the properties in Theorem 3.1.1 and 3.1.2. As well, know what we mean by a linear combination.

(Section 3.2) Know the definition for the norm of a vector, and some of its properties (e.g., Theorem 3.2.1). Know what a unit vector is, and how to normalize a vector. Know how to compute the distance between two vectors. Also, know the definition of the dot product (using Definition 3 in this chapter or Definition 4). Know the properties of the dot product in Theorem 3.2.2 and 3.2.3. Know the statement of Cauchy-Schwarz, and how it can be used to define the angle between two vectors in n-space. You do not need to know the formulas of Theorems 3.2.6 and 3.2.7.

(Section 3.3) Know what it means for two vectors to be orthogonal. You do not need to know about lines and planes determined by points and normals. Know how to compute orthogonal projections. Know Pythagoras's theorem in $\mathbb{R}^n$. You should also know how to compute distance between a point and a line (or plane) (see Theorem 3.3.4).

(Section 3.4) Know how to find the equation of a line or plane parallel to some given vectors (Definition 1 and 2). You do not need to know Definition 3. Know the material about the dot product form of a linear system (on page 168) and the rest of this section.

(Section 3.5) Know the definition of a cross product of two vectors. Know some of its properties (Theorem 3.5.1 and 3.5.2). Know Theorems 3.5.3 and 3.5.4 and how to use these theorems to compute area of paralelograms and triangles.

(Section 4.1) Know the definition of a vector space, and know the examples of vector spaces discussed in class (e.g., n-space, the set of $m \times n$ matrices, the set of polynomials of degree $\leq n$).

(Section 4.2) Know the definition of a subspace, and how to check if a subset is a vector space. Know examples of subspaces. Know what it means to have a linear combination of vectors in a vector space. Know Theorem 4.2.3. Know what it is meant when we say a set of vectors span a vector space. Know some spanning sets of $\mathbb{R}^n$ and $\mathbb{P}_n$. Know Theorem 4.2.4,

and how to find a spanning set for the space of solutions of a homogeneous system of linear equations.

(Section 4.3) Know what is meant for a set of vectors to be linear independent. Know Theorem 4.3.1. Know how to check if a set of vectors is a linear independent set. Know Theorem 4.3.2. and 4.3.3. You do not need to know about the linear independence of functions.

(Section 4.4) Know what it means for a set of vectors to be a basis for a vector space. Know the standard bases for $\mathbb{R}^n$ and $\mathbb{P}_n$ and $M_{m,n}$. Know Theorem 4.4.1 and Definition 2, i.e., the coordinate vector $\mathbf{v}$ relative to a basis B.

(Section 4.5) Know Theorems 4.5.1 and 4.5.2. Know the definition of dimension, and know the dimension of $\mathbb{R}^n$ and $\mathbb{P}_n$ and $M_{m,n}$. Know how to compute the dimension of a solution space. Know Theorems 4.5.3, 4.5.4, 4.5.5, and 4.5.6. You can skip the optional material of this chapter.

(Section 4.7) Know what is meant by the row space, column space, and null space of a matrix. Be able to compute a basis for each of these spaces.

(Section 4.8) Know what is meant by rank and nullity. Know Theorem 4.8.1 and 4.8.2 and 4.8.3. You do not need to know about the fundamental spaces of a matrix (and the rest of the chapter).

(Section 6.3) Know what it means for a basis to be orthogonal or orthonormal. Know how to use the Gram-Schmidt process to find an orthogonal (or orthonormal) basis for a vector space.

(Matlab) There will be a Matlab question like the Matlab question on the previous midterms.

FINAL MARK. When computing the final mark, we will use the HIGHER of the following two weightings:

Weight 1.

- Homework/Labs =20%
- Two midterm tests $2 \times 20\% = 40\%$
- Final Examination 40%

Weight 2.

- Homework/Labs =20%
- Maximum among {Midterm 1, Midterm 2} = 20%
- Final Examination 60%

If you have questions, please feel free to email us. We hope to arrange a review using the Math Help Centre – We'll send out any information via email. We will also post some additional office hours on the class web page. Good luck! –Dr. Van Tuyl and Dr. Zuniga!