

## FSLT Homework due Nov. 20th

Please read all of the instructions before starting. The following is to be done in preparation for the class on Wednesday, November 20th.

1. The YouTube channel 3Blue1Brown has excellent, intuitive videos on linear algebra. Before Wednesday, please watch the first two videos of the series. They cover vectors, linear combinations, spans and basis vectors.

- [https://www.youtube.com/watch?v=fNk\\_zzaMoSs](https://www.youtube.com/watch?v=fNk_zzaMoSs)
- <https://www.youtube.com/watch?v=k7RM-ot2NWY>

2. The content of the linear algebra class of the University of Warwick is very similar to ours (with some things extra that we'll skip). They kindly uploaded their lecture notes publicly, so we'll use them! You can find the lecture notes here:

<https://homepages.warwick.ac.uk/~maskal/MA106NotesMacLaganTesta.pdf>

Some general advice on how to read the lecture notes:

- The document consists of numbered definitions, propositions, theorems, examples, etc., as well as text between them. I will ask you to read certain definitions etc.; please read the text in between them as far as it provides useful context to you.
- Similarly, have a look at the examples as far as you find them useful, and ignore the others.
- Feel free to skip all the proofs, unless I specifically ask you to read them.
- This is a dense, technical text. It requires multiple readings and some thinking and digesting on your end to understand. Definitions must be remembered in technical detail. This is what I ask you to do, when I ask you to read the text. If some parts are still cryptic after multiple readings, don't worry, just ask me in class. But don't give up too soon, an important part of learning maths is to be persistent!

Before Wednesday, please read the following parts:

- The list of different kinds of numbers at the start of Section 4 (Fields). Skip the complex numbers if you want.
- Definition 4.1 (Fields)
- Definition 5.1 (Vector spaces)
- Properties (i)-(iv) at the end of Section 5.

- Definitions 6.1, 6.2, 6.6, 6.7.
  - Proposition 6.8
  - Definition 6.9
  - Theorem 6.11
  - Definition 6.12
3. When watching the video and reading the text, answer the following questions. We will then discuss them in class.
- a) So, what is a vector?
  - b) The lecture notes use technical mathematical language, such as the symbol “ $\in$ ” for *being an element of a set*, “ $\subseteq$ ” for *subset* or the word *axiom*. Which symbols, words and phrases are unknown to you, or seem to be used in an unfamiliar way?
  - c) What differences can you find between the lecture notes and the videos (besides of course the text being more technical)? Are these just differences in notation, or are they more substantial?
  - d) For a set of vectors  $S \subseteq V$ , we can define its *span*, written  $\text{span}(S)$ , to be the set of all vectors that can be expressed as a linear combination of vectors in  $S$ . Rewrite Definition 6.6 using this notation.
  - e) Does the technical definition of *dimension* given in the lecture notes fit with how you think about dimensions in real life (e.g. 3D vs 2D movies)?