MATH 3407, Advanced Linear Algebra
Semester 2, 2021
Class Overview

The class is roughly divided into two parts:

1. First five weeks: the basics, done the "adult way": more abstract, with less emphasis on numbers and row-reduction;
2. Other eight weeks: further topics (these contain calculations as well as theory).

Below is a quick comparison of this class with Math 2207 (Introductory Linear Algebra); for simplicity, not all topics in each class are listed. **You are expected to be familiar with the course content of Math 2207** as written in `http://www.math.hkbu.edu.hk/~amypang/2207/linalbook.pdf`.

Math 2207 (Introductory)	Math 3407 (Advanced)
Vector spaces, mostly finite-dimensional: $\mathbb{R}^n$, matrices, polynomials; scalars: $\mathbb{R}$	More unusual vector spaces, including infinite-dimensional; scalars: $\mathbb{R}$, $\mathbb{C}$, ...
Span and linear independence of finite sets	Span and linear independence of infinitely many vectors
Subspaces	Combining subspaces
Study linear transformations through its matrices relative to different bases	Study linear transformations more abstractly, with and without matrices
Eigenvectors and diagonalisation: $A = PDP^{-1}$	Triangular form and Jordan form for non-diagonalisable matrices: $A = PJP^{-1}$
	Linear forms (functions: vector space $\to \mathbb{R}$)
Orthogonality and dot product (in $\mathbb{R}^n$)	Quadratic forms and inner product spaces (of abstract vectors)

Some other differences:

Most examples / questions are about $\mathbb{R}^n$	Most examples / questions are about abstract vector spaces, e.g. matrices, functions
You are expected to write simple proofs by recalling definitions and rearranging equations	You are expected to write more complicated proofs
Vectors are $\mathbf{v}, \mathbf{w}$ or handwritten $\vec{v}$ linear transformations are S, T, f	Vectors are α, β (no arrows nor bold print); linear transformations are σ, τ
Complete lecture slides available	Class is "written live" and based on textbook; photos of the whiteboard are available after class

To save writing time, you are expected to be familiar with the shorthands:
$\therefore$ (therefore),
$\because$ (because),
$\forall$ (for all),
$\exists$ (there exists),
$\implies$ (implies),
$\Leftrightarrow$, "iff" (if and only if).