Course number	U-LAS10 20018 LE55		
Course title (and course title in English)	Honors Mathematics B-E2 Honors Mathematics B-E2	Instructor's name, job title, and department of affiliation	Graduate School of Science Professor,COLLINS, Benoit Vincent Pierre

Group	Natural Sciences	Field(Classification)	Mathematics(Development)

Language of instruction	English	Old group	Group B	Number of credits	2

Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)	Year/semesters	2026・First semester

Days and periods	Tue.3	Target year	Mainly 2nd year students	Eligible students	For science students

[Overview and purpose of the course]

This course provides opportunities to learn mathematics in more depth for highly motivated students. It supplements Calculus A, B and Linear Algebra A, B, and takes these basic courses as starting point to treat more advanced related topics.
Through this course, students can also learn how to read, listen to, discuss and present mathematical arguments in English.

[Course objectives]

One of the goals of this course is to help students get used to rigorous proofs of mathematical statements and abstract notions in mathematics. These two features are central to and represent the power of modern mathematics, because rigorously proven facts form unshakeable building blocks of far-reaching theories, and an abstract notion is applicable to various different situations as far as they share a key property.
If the number of students permits, the course will be interactive. In particular, an additional goal of this course is to provide a chance for the students to discuss mathematics in English.

[Course schedule and contents)]

Below is a list of themes that may be covered.
The actual topics of the lecture will be determined upon investigating the interests and level of the participating students.

1. Finite groups (tentatively 4 weeks)
1.1 Definition, basic notions, class formula
1.2 Symmetric and alternating groups
1.3 Elementary graph theory, Cayley graphs

2 Representation of finite groups (tentatively 3 weeks)
2.1 Matrix algebras, representations
2.2 Character formulas
2.3 Examples (symmetric group, SL2(Fp))

3 Matrix groups -- complex and real cases (tentatively 4 weeks)
3.1 Unitary and orthogonal groups
3.2 Matrix decompositions, properties of groups
3.3 Notions of Lie algebras, representations of groups

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3.4 Characters, invariants.

4. Orthogonal functions and Fourier series (tentatively 3 or 4 weeks)
4.1 Orthonormal system of functions
4.2 Space of continuous functions on the circle and its completion
4.3 Fourier series
4.4 Notions of convergence of the Fourier series
4.5 Fourier series and Fourier transform

OR

5. Linear programming (tentatively 3 or 4 weeks)
5.1 Introduction to optimization with constraints
5.2 Basic properties of convex sets and convex functions
5.3 Duality
5.4 The simplex method and Karush-Kuhn-Tucker conditions

Total：14 classes, 1 Feedback session

[Course requirements]

Calculus A, B and Linear Algebra A, B.
Familiarity with materials covered in Honors Mathematics A may be helpful.

[Evaluation methods and policy]

The evaluation of the course will take into account the following criteria:
(1) homework and presentation of students during the course (about 40%)
(2) final examination (about 60%)
Details will be discussed with students during the first classes.

[Textbooks]

Not fixed

[References, etc.]

（References, etc.）
Introduced during class

[Study outside of class (preparation and review)]

As in every math course, students should read notes carefully and repeatedly after the class, solve exercise problems and try to find alternative proofs, counterexamples, etc.
After many hours of such practice you may get an intuitive understanding of the materials covered.

[Other information (office hours, etc.)]

Students are welcome to ask questions during or at the end of the class.
The schedule of office hours will be announced in the first lecture.

[Essential courses]

Faculty of Science