

## Calculus (微積分)

書名：Introduction to Calculus and Analysis II/2

作者：Richard Courant, Fritz John

Key words:

Limits (L'Hopital's rule), Continuity, Differentiability, Riemann integrals, Techniques of integration, Taylor's formula, Infinite series, Polar coordinates, Cylindrical coordinates, Spherical coordinates, Jacobian, Directional derivatives, Extremum problems, Method of Lagrange multiplier, Green's theorem, Divergence theorem, Stokes theorem.

# Linear Algebra (線性代數)

✚ 應用數學科學研究所碩士班 及 數學系碩士班 適用

書名：Introduction to Linear Algebra, 4<sup>th</sup> Edition

作者：Gilbert Strang

範圍：Chapter 1 ~ Chapter 8

✚ 數學系碩士班 適用

書名：Linear Algebra, 2<sup>nd</sup> Edition

作者：Kenneth M Hoffman, Ray Kunze

Contents:

1. System of linear equations, Gaussian eliminations.
2. Bases and dimension. Inner product spaces and Gram-Schmidt orthogonalization process.
3. Matrices and linear transforms: kernel and cokernel, nullity and rank.
4. Dual vector spaces and adjoint of linear transforms.
5. Characteristic and minimal polynomials. The Cayley-Hamilton theorem.
6. Eigenvalues and eigenvectors of  $n$  by  $n$  matrices. Symmetric and Hermitian matrices. Triangulation and diagonalization. Jordan canonical forms over real and complex numbers and applications.

## Advanced Calculus (高等微積分)

1. 書名：Principles of Mathematical Analysis  
作者：Walter Rudin
2. 書名：An Introduction to Analysis  
作者：William R. Wade
3. 書名：Mathematical Analysis  
作者：Tom M. Apostol

### Key words:

Point set topology, Limits, Continuity, Uniform continuity, Derivatives, Functions of bounded variation, Riemann-Stieltjes integrals, Tests of convergence of an Infinite series, Sequence of functions, Pointwise and Uniform convergence, Multivariable calculus, Inverse function theorem, Implicit function theorem.

# Algebra (代數)

1. 書名 : Basic Algebra (I)  
作者 : Jacobson
2. 書名 : Basic Algebra (II)  
作者 : Jacobson

## Contents:

1. group theory
2. kernel
3. quotient groups
4. isomorphism theorem
5. group actions
6. Sylow theorem
7. fundamental theorem of finitely generated abelian groups
8. ring theory
9. ideals
10. prime ideals
11. maximal ideals
12. integral domains
13. principal ideal domains
14. modules over PID
15. unique factorization domain
16. field theory
17. field extension
18. finite fields
19. Galois theory

## **Geometry (幾何)**

書名：Differential Geometry of Curves and Surfaces

作者：Manfredo P. Do Carmo

參考範圍：Chapter 1 ~ Chapter 4

## **Differential Equations (微分方程)**

書名：Differential Equations, Dynamical System, and Linear Algebra

作者：Morris W. Hirsch, Stephen Smale

範圍：Chapter 1 ~ Chapter 10

Key words:

Linear and nonlinear ordinary differential equations, Initial value problems,  
Basic existence and uniqueness theorem, Linear systems, Nonlinear systems,  
Stability of equilibria, Liapunov functions, Boundary value problems,  
Eigenvalues and eigenfunctions.

## Probability and Statistics (機率與統計)

1. 書名：A First Course in Probability, 8<sup>th</sup> Edition  
作者：Ross, S.
2. 書名：Mathematical statistics and data analysis, 3<sup>rd</sup> Edition  
作者：Rice, J. A.

Contents:

1. Probabilities, random variables, and distributions:  
set theory, counting techniques, probability function, conditional probability, Bayes' rule, independence, random variable, distribution function.
2. Transformations and expectations:  
transformation, moment, moment generating function, characteristic function, Markov's inequality
3. Common families of distributions:  
discrete uniform distribution, Hypergeometric distribution, Bernoulli distribution, Binomial distribution, Geometric distribution, Negative Binomial distribution, Poisson distribution, uniform distribution, Exponential distribution, Gamma distribution, Normal distribution, Lognormal distribution, Cauchy distribution, Beta distribution, double exponential distribution, exponential family, location-scale family
4. Multivariate probability distributions and related properties:  
random vector, joint probability distribution, multivariate transformation, multivariate normal distribution, multinomial distribution, conditional distribution, independence, covariance
5. Random samples, sampling distributions, and convergence concepts:  
random sample, statistic, sampling distribution, properties of sample mean and sample variance, Chi-Square distribution, F distribution, Student's t distribution, order statistic, convergence almost surely, convergence in probability, convergence in distribution, convergence in  $L_p$ , strong law of large numbers, weak law of large numbers, central limit theorem, Slutsky's theorem, Delta method
6. Properties of Estimators:  
sufficient statistic, factorization theorem, minimal sufficient statistic, ancillary statistic, complete statistic, Basu's theorem, likelihood function, uniformly minimum variance unbiased estimator, Cramer-Rao lower bound, Lehmann-Scheffe theorem
7. Point Estimation Methods:  
Maximum likelihood estimation, moment estimation, least squares estimation,

Bayesian estimation

8. Hypothesis testing:

Hypothesis, test function, power function, uniformly most powerful test, likelihood ratio test, Neyman-Pearson lemma, Monotone likelihood ratio, Karlin-Rubin theorem, p-value

9. Interval Estimation:

confidence set, confidence coefficient, uniformly most accurate confidence set, credible set