

December 2013

The Revised Syllabus for Basic Academic Abilities in the EJU
(To be applied to the questions of the 2015 EJU 1st Session (June))

< **Mathematics Syllabus** >
(the correspondence with the Course of Study for high schools is attached)

[Purpose of the Examination]

The purpose of this examination is to test whether international students have the basic academic ability in mathematics necessary for studying at universities or other such higher educational institutions in Japan.

[Classification of Examination]

There are two courses. Course 1 is for undergraduate faculties and departments for which a basic knowledge of mathematics is considered sufficient. Course 2 is for undergraduate faculties and departments for which math is very important.

At the time of taking the examination the examinee must choose whether to take Course 1 or Course 2; the examinees should follow the instructions given by the university or the department to which they are applying.

[Symbols and Terminologies]

The symbols are the ones used in Japanese high school text books; the English version of the test uses standard English terms, and the Japanese version of the test uses terms used in Japanese high school text books.

[Scope of Questions]

The topics covered by the examination are as follows.

- **The Course 1 examination covers only topics 1 to 6.**
- **The Course 2 examination covers all 18 topics.**

The topics are covered by the standard text books used in Japanese high schools.

In addition, it is assumed that material covered in Japanese elementary and junior high schools has been mastered.

< **Topics** >1. Numbers and expressions ... Mathematics I

- (1) Numbers and sets
 - 1) Real numbers
 - 2) Sets and propositions
- (2) Calculation of expressions
 - 1) Expansion and factorization of polynomials
 - 2) Linear inequalities
 - 3) Equations and inequalities containing absolute values

2. Quadratic functions ... Mathematics I

- (1) Quadratic functions and their graphs
 - 1) Variation in values of quadratic functions
 - 2) Maximum and minimum values of quadratic functions
 - 3) Determining quadratic functions
- (2) Quadratic equations and inequalities
 - 1) Solutions of quadratic equations
 - 2) Quadratic equations and the graphs of quadratic functions
 - 3) Quadratic inequalities and the graphs of quadratic functions

3. Figures and measurements ... Mathematics I

- (1) Trigonometric ratios
 - 1) Sine, cosine, tangent
 - 2) Relations between trigonometric ratios
- (2) Trigonometric ratios and figures
 - 1) Sine formulas, cosine formulas
 - 2) Measurement of figures (including application to solid figures)

4. The number of possible outcomes and probability ... Mathematics A

- (1) The number of possible outcomes
 - 1) Principles of counting (including the number of elements of a set, the law of sums, the law of products)
 - 2) Permutations, combinations
- (2) Probability and its fundamental properties
- (3) Independent trials and probability
- (4) Conditional probability

5. Properties of integers ... Mathematics A

- (1) Divisors and multiples
- (2) Euclidean algorithm
- (3) Applications of the properties of integers

6. Properties of figures ... Mathematics A

- (1) Plane figures
 - 1) Properties of triangles
 - 2) Properties of circles
- (2) Solid figures
 - 1) Lines and planes
 - 2) Polyhedrons

7. Miscellaneous Expressions ... Mathematics II

- (1) Expressions and proofs
 - 1) Division of polynomials, fractional expressions, binomial theorem, identities
 - 2) Proofs of equalities and inequalities
- (2) Equations of higher degree
 - 1) Complex numbers and solutions of quadratic equations
 - 2) Factor theorem
 - 3) Properties of equations of higher degree and methods of solving them

8. Figures and equations ... Mathematics II

- (1) Lines and circles
 - 1) Coordinates of a point
 - 2) Equations of (straight) lines
 - 3) Equations of circles
 - 4) Relative positions of a circle and a line
- (2) Locus and region
 - 1) Locus defined by an equality
 - 2) Region defined by inequalities

9. Exponential and logarithmic functions ... Mathematics II

- (1) Exponential functions
 - 1) Expansion of exponents
 - 2) Exponential functions and their graphs
- (2) Logarithmic functions
 - 1) Properties of logarithms
 - 2) Logarithmic functions and their graphs
 - 3) Common logarithms

10. Trigonometric functions ... Mathematics II

- (1) General angles
- (2) Trigonometric functions and their basic properties
- (3) Trigonometric functions and their graphs
- (4) Addition theorems for trigonometric functions
- (5) Applications of the addition theorems

11. The concepts of differentiation and integration. ... Mathematics II

- (1) The concept of differentiation
 - 1) Differential coefficients and derivatives
 - 2) Applications of the derivative
 - Tangent lines, increase/decrease in function value (variation in the value of functions, maximums

and minimums, local maximums and minimums)

- (2) The concept of integration
 - 1) Indefinite integrals and definite integrals
 - 2) Areas

12. Sequences of numbers ... Mathematics B

- (1) Sequences and their sums
 - 1) Arithmetic progressions and geometric progressions
 - 2) Various sequences
- (2) Recurrence formulae and mathematical induction
 - 1) Recurrence formulae and sequences
 - 2) Mathematical induction

13. Vectors ... Mathematics B

- (1) Vectors on a plane
 - 1) Vectors and their operations
 - 2) Scalar products (inner products) of vectors
- (2) Space coordinates and vectors
 - 1) Space coordinates
 - 2) Vectors in a space

14. Complex plane ... Mathematics III

- (1) Complex plane
 - 1) Geometric representation of complex numbers
 - 2) Trigonometric form (polar form) of complex numbers
- (2) De Moivre's theorem
- (3) Complex numbers and figures

15. Curves on a plane ... Mathematics III

- (1) Quadratic curves
 - Parabolas, ellipses, hyperbolas
- (2) Parametric representations
- (3) Representation in polar coordinates

16. Limits ... Mathematics III

- (1) Sequences and their limits
 - 1) Limits of sequences
 - 2) Sums of infinite series
- (2) Functions and their limits
 - 1) Fractional functions and irrational functions

- 2) Composite functions and inverse functions
- 3) Limits of functions
- 4) Continuity of functions

17. Differential calculus ... Mathematics III

- (1) Derivatives
 - 1) Derivatives of the sum/difference/product/quotient of two functions
 - 2) Derivatives of composite functions, derivatives of inverse functions
 - 3) Derivatives of trigonometric functions, exponential functions, logarithmic functions
- (2) Applications of the derivative
Tangent lines, increase/decrease in value of functions, velocity, acceleration

18. Integral calculus ... Mathematics III

- (1) Indefinite and definite integrals
 - 1) Integrals and their basic properties
 - 2) Integration by substitution, integration by parts
 - 3) Integrals of various functions
- (2) Applications of the integral
Area, volume, length