Curriculum Guidelines for the Elective Subject *Math (Ⅱ)* in Senior High Schools

I. Goals

Goals expected to be achieved for the elective subject *Math (Ⅱ)* are stated below:

A. Guide students to understand the content, meaning and method of infinitesimal analysis by using polynomial functions.

B. Provide the foundational capacity for what students are going to learn in university.

II. Schedule Recommendation

This three-credit hour course is designed for the third year. This one-semester class can be scheduled in fall or spring semester. Course hours are advised to be three class periods each week.

III. Outline of Teaching Materials

Topic	Main contents	Explanation
(i) The limit and derivative of polynomial functions	1. Functions and figures	1-1 Review linear functions and rectilinear equations. 1-2 Review binary functions and parabola equations.
	2. Concept of limits	2-1 Introduce Δx and explain the meaning of limits by intuition.

Topic	Main contents	Explanation
	3. Secants and tangents	3-1 Introduce Δy and $\Delta y/\Delta x$ to discuss the slope of function secant and explain the meaning in kinematics. 3-2 Explain the limit of secant slope is the slope of tangent by binary functions. 3-3 Review the light characteristics of parabolas.
	4. Gradients of derivatives and tangents	4-3 Definite derivatives and tangent equations. 4-2 Explain the meaning of derivatives in kinematics. 4-3 Compute limits to arrive at derivatives of polynomials by binomial theorem or factorization.
(ii) The application of derivatives	1. Drawing the function figures 2. Extreme value of functions 3. Figures of cubic functions 4. Applications of extreme value	◦ 1-1 Increasing, decreasing and critical point of function figures. 1-2 Concavity and inflection point of function figures. 2-1 The first and second order test of extreme values of functions. 3-1 Include the understanding of the root number of cubic polynomials.

Topic	Main contents	Explanation
(iii) The integration of polynomial functions	1. Riemann sum and area	1-1 Explain the limit divided by Riemann sum is area through intuition. 1-2 Compute the limit of Riemann sum with $y = x^2$ in division.
	2. Compute the area composed by polynomials figure and straight lines for which $x = a$, $x = b$ and $y = 0$	2-1 Introducing the symbol of integration and antiderivative functions (Antiderivatives).
	3. Definite integrals and its applications	3-1 Focus on area of circle, volume of spheroid and pyramid and motion equations of freely falling objects.
Attachment 1	Basic theory of infinitesimal analysis	
Attachment 2	Compute approximate value of integer square root by Newton's Method	

IV. Implementation

A. Compiling of Teaching Materials

(a) When compiling teaching materials, editors need to make sure the connection to the Grades 1-9 Curriculum is maintained. Contents should be up to date and forward-looking.

(b) Compiled teaching materials should be polynomial-centered and present the core of infinitesimal analysis.

(c) The characteristics which limit the process from secants to tangents and from histograms to areas should be explained clearly in teaching materials.

(d) The concept of how infinitesimal basic theory is connected with differentiation and integration should be attached to the teaching materials.

(e) When compiling teaching materials, multiple proper examples must be presented to illustrate the importance of infinitesimal analysis.

B. Teaching Methods

(a) Explain the elements which affect infinitesimal analysis; the important elements are as follows:

1. Discuss the non-uniform motions.
2. Discuss curves, tangents and normals.
3. Questions of extreme value.
4. Discuss areas and volumes.

(b) Provide firm grasp of the pivotal importance of the concept of limits and process with intuition.

(c) Integrate the roles which polynomials play in math in the first and second years; the important elements are as follows:

1. The computation of Algebra.
2. Freely falling objects and parabola.
3. Roots of polynomials.
4. Figures of polynomial functions.

C. Teaching Aids and Equipment

(a) Enhance students' grasp of various functions, plane figures and solid figures by applying computer drawing software.

(b) Present the process of finding limits by applying computer calculation software.

E. Teaching Assessment

(a) Arrange class practice and have students solve and discuss questions in class.

(b) Homework should include practice, written reports and oral reports.

(c) Understand students know well what they have learned through regular assessment.