Curriculum Guidelines for the Required Subject *Math* in Senior High Schools

I. Goals

Goals expected to be achieved for the required subject *Math* are stated below:

A. Guide students to understand the context, meaning and methods of math.
B. Cultivate students' abilities in thinking, analyzing and solving problems through math.
C. Provide students the math abilities which are needed in daily life and in learning related subjects.
D. Cultivate students' ability to appreciate the simplified spirit and complete structure of math.

II. Schedule Recommendation

This four-credit hour course is designed for first- and second-year students in high school. Class can be scheduled in each semester. Course hours are advised to be four class periods each week.

III. Outline of Teaching Materials

The required courses of *Math* in senior high school account for 16 credits.

The first year

Topic	Main Contents	Explanation
(i) Numbers and coordinate system	1. Integers	1-1 Include factor, multiple and division algorithm.
	2. Rational numbers and real numbers	2-1 Introduce irrational numbers, such as $\sqrt{n}$ and π, where n is not a perfect square positive integer and the proof that $\sqrt{2}$ is irrational number. 2-1 Introduce the basic computation of radicals, such as $\sqrt{18}=3\sqrt{2}$, $\sqrt{6}=\sqrt{2}\times\sqrt{3}$, $\sqrt{\frac{2}{3}}=\frac{\sqrt{2}}{\sqrt{3}}$, which includes the rationalizing denominators of $\sqrt{n}\pm\sqrt{m}$, where n and m are all positive integers.
	3. Plane coordinate system*	3-1 Review plane coordinate system, equations and introduce gradients. 3-1 Explain the meaning of using binary linear equations by the relationship of two lines.
	4. Complex numbers and planar complex numbers	4-1 Introduce i, including the discussion of unary and binary quadratic equations, especially in the condition of discriminants smaller than 0. 4-2 Introduce arithmetic of planar complex number and complex numbers. Planar complex numbers strengthen on the relationship of one by one.
(ii) Number lines and progression	1. Arithmetical series and geometric progressions	1-1 Including the basic concept of number lines and series.
	2. Infinite geometric progressions and recurring decimals	2-1 Introduce the basic concept of limits.
	3. Finite induction*	3-1 Introduce finite induction and apply in proofs.
(iii) Poly-nomials	1. The arithmetic of polynomials	1-1 Including synthetic division.

Topic	Main Contents	Explanation
	2. Remainder theorem and factor theorem 3. Highest common factor and lowest common multiple 4. Polynomial functions 5. Polynomial equations 6. Polynomial inequalities	2-1 Including the linear factor test of coefficient polynomials. 3-1 Compute the highest common factor by division algorithm. 4-1 Including the figures of unary and binary polynomial functions. 5-1 Including the introduction of basic algebra, Blzano's Theorem and coefficient polynomial equation imaginary root pair theorem. 6-1 Understand the interval of positive and negative of the polynomial on the proper number line with linear factor product.
Attachment	Recognize proofs	Introduce how to compute consequences and proofs using math that students have learned.
(iv) Exponent and logarithm	1. Exponents 2. Exponent functions and figures 3. Logarithms 4. Logarithm functions and figures 5. Checking tables and interpolation method	4-1 Present the meaning of exponents and logarithms when they are inverse functions by formula. It is not necessary to mention “inverse function” but need to present the figures of those two functions on the plane coordinate grid. 5-1 Compute the products of value of exponent functions and logarithm functions by the calculator.
(v) The basic concept of trigonometric functions	1. Acute trigonometric functions	1-1 Starting to handle the characteristics of sides and angles of a right triangle with a 30- degree or 45-degree acute angles.

Topic	Main Contents	Explanation
	2. Basic relationship of trigonometric functions 3. Simple measurements and trigonometric function tables 4. Trigonometric function of generalized diagonals 5. Law of sines and cosines. 6. Basic measurements of a triangle	2-1 Reciprocal relationships, square relationships, quotient relationships and complement angle relationships. 3-1 Compute trigonometric functions by calculator.
(vi) Characters and application of trigonometric	1. Figures of trigonometric functions* 2. Sum and Difference Formulas* 3. Double angle formula* and half-angle formula 4. Congruence of sinusoidal function 5. Polar form (of complex numbers)	1-1 Including radian and only discuss sines, cosines and tangents of trigonometric function figures. 2-1 Including product to sum formula. 4-1 Explain the meaning of congruence by examples. 5-1 Introduce the concept of radius vector, argument and polar coordinates including De Moivre's theorem and nth roots of one.
Attachment	1. Concept of functions* 2. Figures of cotangent function, secant function and cosecant function	Integrate the concept of functions using the math they have learned.

The second year

Topic	Main content	Explanation
(i) Vector	1. Directed line segments and vectors	1-1 Including the computation of addition, subtraction, coefficient product and inner product of vectors.
	2. Basic application of vectors*	2-1 Including the applications of plane geometry proof questions of vectors, such as Connect the dots of two sides of the triangle law and Parallelogram law.
	3. The presentation of plane vectors on the coordinate grid*	3-1 Including the computation of addition, subtraction, coefficient products and inner products, points of division coordinate and parametric form of straight lines.
	4. Inner product of plane vectors*	4-1 Including Cauchy Schwarz Inequality, direct projectivity, included angle of two straight lines and the distance between a dot and a straight line.
(ii) Straight line and plane of space	1. Space concept	1-1 The position relationships of straight line and straight line, straight line and plane and plane and plane in space.
	2. Space coordinate system*	
	3. The presentation of Space vectors on coordinates	3-1 Including computation of addition, subtraction, coefficient product and inner product, Cauchy Schwarz Inequality and direct projectivity.
	4. Plane equations	4-1 Including the distance of normal vectors, included angle of plane and dot to plane.

Topic	Main content	Explanation
	5. Space rectilinear equation 6. Linear equation groups	5-1 Including the length of parametric form of straight line, distance between dot and straight line, parallels and common perpendicular of skew lines. 6-1 Limit to binary and tertiary. 6-2 Including Gaussian elimination. 6-3 Introduce Cramer's law and the second order determinant by binary linear equation groups with coefficient of words. 6-4 Compute the area of plane parallelograms by binary linear.
(iii) Circle and sphere equation	1. Circle equation* 2. The relationship between circles and straight lines 3. Sphere equation 4. The relationship of spheres and planes	
(iv) Conic section	1. The origin of the name of conic section 2. Parabola (Standard) 3. Ellipse (Standard) 4. Hyperbola (Standard) 5. Light characteristics of conic section	4-1 Including asymptote.

Topic	Main content	Explanation
(v) Permutation and combination	1. Counting combined elements 2. Addition and multiplication 3. Permutation 4. Combination 5. Binomial theorem 6. Recurrence relationships	1-1 Including the Principle of Inclusion and Exclusion. 5-1 Introduced by combination concept. 6-1 Recurrence relationship is subject to $a_n = \alpha a_{n-1} + f(n)$ and $a_n = \beta a_{n-1} + \gamma a_{n-2}$. α, β, γ are constants and f(n) is a polynomial smaller than three degrees.
(vi) Probability and Statistic (I)	1. Events and combination. 2. Characteristics of probability 3. Mathematical expectations 4. Sources of statistic data 5. Analyze one-dimensional data	1-1 Introduce combination. 1-2 Sample space and events. 4-1 Observation study, sampling survey experiment. Need to introduce and use tabular random numbers and sampling surveys should include simple random sampling survey. 5-1 Understand the data in charts, data showing centralized tendency, data showing dispersion tendency and integrate centralized tendency and dispersion tendency.

Topic	Main content	Explanation
	6. Recognition of confidence interval and confidence level	6-1 Normal Distribution and 68-95-99.7 law. Understand the recognition of confidence interval and confidence level by teaching activities, only need to handle binary data, not necessary to introduce probability model.

Note:「*」is the content of common core curriculum guidelines for the latter period of secondary education.

IV. Implementation

A. Compiling of Teaching Materials

(1) 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.

(2) Teaching materials should be presented in classic and complete publications.

(3) Teaching materials should be well compiled, integrated and connected.

(4) The presentation of teaching materials should follow the procedures, stimulate learning motivation, maintain balance between direct view and strictness and include exceptions and general reasoning.

(5) Practice should be connected with the subject and class practice should follow the examples. The practice should stimulate deep thinking after the content is presented.

(6) Teacher's manuals should lead teachers understand the teaching material more and find the most efficient methods for teaching. It also needs to offer more related information for teachers' reference.

(7) Math terms should follow the Ministry of Education latest terms. Terms and foreign names should be presented together in the index.

(8) To increase the recognition of confidence interval and confidence level of Probability and statistics (I) it is suggested that every student in each class imitate the process of throwing coins according to the Random Number

Table. Introduce the computation of probability of confidence interval of the front side of coin $\sqrt{\frac{p(1-p)}{n}}$ for each confidence interval and observe most students' confidence interval will cover the true value of the probability of the front side of the coin turning up.

B. Teaching Methods

(1) To achieve the goal of teaching students in accordance with their aptitude, the subject study group of each school will request coordination from the administrative system in that school.

(2) Teaching should be flexible and control the core of teaching material to make the teaching smooth and clear.

(3) Offer prompts for exercises, request students to do the exercises and process discussion to keep improving teaching methods.

C. Teaching Aids and Equipment

(1) Assist in processing the classes of function figures, solid geometry, equations and statistics by using computers.

(2) The relevant unit should offer the related teaching websites as follows:

1. The Mathematical Society of the Republic of China.
2. National Statistics Society of the Republic of China.
3. Department of Science Education, National Science Council.
4. Teacher Training Institutions.
5. National Institute of Educational Resources and Research.

E. Teaching Assessment

Practice is the key point to learning Math.

(1) Class practice should be processed by the students on the classroom platform; each school should offer some class hours for practice.

(2) Homework should be returned to the teachers when finished with tips

offered by the teachers. The school should provide some assistants to correct the homework.

(3) The examinations should be flexible and offer the enough time for the students to think. The questions on the examination should be divided into two parts: basic and advanced.