Curriculum Guidelines for the 12-Year Basic Education

Vocational Senior High School

The Domain of Mathematics

Ministry of Education

June 2018

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I. Fundamental Beliefs

The curriculum development of the 12-Year National Basic Education is based on the spirit of holistic education. The concepts “taking initiative”, “engaging the public”, and “seeking the common good” emphasize that students are motivated, active learners. Education should: increase students' learning motivation and enthusiasm towards education; help guide them to develop appropriate attitudes and interactions between the public, their peers, themselves and nature; help students apply and practice what they have learned; facilitate students to experience a full and meaningful life; encourage students to commit themselves to the sustainable development of society, nature, and culture. With this, society as a whole can mutually benefit from this holistic approach.

Mathematics should be based on application, which means helping students discover links between real life situations, method adaptions, and problem solving. Overemphasis on knowledge can lead to a deficit in cognitive development, take away meaningful connections to mathematics, and moreover it is no longer a suitable model. Instead, mathematics should take into consideration students’ backgrounds and experiences. Mathematics should also train students to identify problems, analyze problems, and solve problems. By doing so, it can nurture greater potential by empowering students to become more self-motivated, socially adaptable and encourage lifelong learning. Another focal point should pay more attention to diverse needs like: urban and rural backgrounds, current ability levels, equity and equality, diversity and gender equality, and awareness of environmental factors and potential impacts. This will strengthen capacities for career development, lifelong learning and self-development.

The program of the 12-Year National Basic Education for Vocational High School Mathematics regards math as a tool for life application; it is a process developed by a series of life experience, and continual renewal of learning.

Going through the learning process of awareness, to knowledge, then practice, learners are able to realize the concepts of basic mathematics. Students move from numbers, quantities, shapes, arithmetic, symbol algebra, number and shape transformation, abstract mathematics, internalizing mathematical concepts and ways to solve problems. Through this process, they are able to appreciate the art of mathematics, understand the structure of mathematics and allow it to impact their ability to reason. The ability to observe, calculate, solve problems, infer, communicate with

mathematical symbols, cultivate mathematics application, and modeling capabilities, can be built up to solve everyday problems, explain natural phenomena, and be used to analyze social issues.

II. Educational Goals and Curriculum Goals

1. Education goals for vocational high school

(1) To cultivate core literacy and develop modern citizens.

(2) To strengthen basic knowledge and facilitate lifelong learning.

(3) To develop professional skills and meet the needs of the industry.

(4) To cultivate moral character and enhance personal value.

2. Curriculum goals of mathematics domain

(1) To provide equal opportunities to learn mathematics.

(2) To develop the ability to learn and apply mathematical concepts and skills.

(3) To cultivating the ability to use mathematical software tools and technology.

(4) To develop the ability to solve problems using technology.

III. Time Allocation

1. *Mathematics Version A*: for the first and second academic years, students are required to complete the Ministry of Education-required 0-2 credits per semester. The Ministry of Education-required credits must be at most 8 credits, and no less than 4 in total.
2. *Mathematics Version B*: for the first and second academic years, students are required to complete the Ministry of Education-required 0-3 credits per semester. The Ministry of Education-required credits must be at most 8, and no less than 4 in total. Version B applicable group, you must consider mathematics domain and skills learning and application ability requirements. It is recommended to offer 4-6 credits for school-developed curriculum, for a total of 12 credits for the Ministry of Education-required credits and school-developed curriculum.
3. *Mathematics Version C*: for the first and second academic years, students are required to complete the Ministry of Education-required 0-4 credits per semester. The Ministry of Education-required credits must be at most 8, and no less than 4 credits in total. Version C applicable group, you must consider mathematics domain and skills learning and application ability

requirements. It is recommended to offer 8 credits for school-developed curriculum, for a total of 16 credits for Ministry of Education-required and school-developed curriculum.

IV. Core Competency

The following table shows the specific content of Mathematics by following the specific content of the various educational stages core competency in the *General Guidelines* and combining them with the domain of Mathematics' Learning Focus and Core Competencies as in Appendix I.

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	Junior High School (J)	Vocational Senior High School (V-U)
A **Autonomous Action**	**A1** **Physical and Mental Wellness and Self-Advancement**	Possess the ability to conduct sound physical and mental developments, and maintain an appropriate view of humans and self. Through decision making, analyses, and knowledge acquisition, students can effectively plan their career paths, search for meaning in life, and continually strive for personal growth.	數-E-A1 Enjoy learning mathematics and be curios about mathematics. Be active and spontaneous while learning, and be able to apply the language of mathematics in everyday life.	數-J-A1 Have a confident and positive attitude towards learning mathematics. Be able to communicate with appropriate mathematical language, and apply the learned knowledge in everyday life.	數 V-U-A1 Possess the confidence and attitude to learn mathematics well. Discover personal potential and be able to learn independently, exceed and excel. Diligently explore, analyze, and solve mathematical problems.
	A2 **Logical Thinking and Problem Solving**	Possess competency in systematic thinking to understand problems, engage in analyses, think critically, and endeavor in meta-thoughts, with the ability to reflect and conduct actions, to effectively tackle and solve problems in daily life.	數-E-A2 Be able to perform basic arithmetic operations and identify basic shapes and connections. Use mathematics to describe and solve problems in everyday scenarios.	數-J-A2 Possesstment the skills of operating with rational numbers, radicals, and coordinate systems. Be able to use symbols to represent numbers or geometric objects, and to do arithmetic	數 V-U-A2 Strengthen the understanding of everyday scenarios and problems through integrating mathematical concepts in each unit. Learn to analyze and solve problems from different angles. Find

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	**Junior High School (J)**	**Vocational Senior High School (V-U)**
				operations and infer. In everyday scenarios or imaginary situations, analyze the nature of problems and solve them.	correlations from observing life problems to make mathematical conjectures and find solutions.
	A3 Planning, Execution, Innovation, and Adaptation	Possess the ability to devise and execute plans, as well as the ability to explore and develop a variety of professional knowledge; enrich life experience and fully utilize creativity to improve one's adaptability to social change.	數-E-A3 Be able to find connections between everyday problems and mathematics and try to formulate problem-solving plans, after which translate mathematical solutions into everyday applications.	數-J-A3 Possess the skills of identifying connections between real-life problems and mathematics. Be able to formulate problem-solving plans from diverse and flexible angles to translate problem solutions into the real world.	數 V-U-A3 Possess the skills of translating real-life problems into mathematical questions. Be able to explore, formulate, and implement problem-solving plans, and from diverse, flexible, and creative angles to solve problems and apply to real life.
B Communication and Interaction	**B1 Semiotics and Expression**	Possess the ability to understand and use various types of symbols, including languages, characters, mathematics and science, bodily postures, and arts to communicate and interact with others, and understand and feel empathy for others. Be able to make use of these abilities in daily life or at the workplace.	數-E-B1 Be able to convert between everyday language and numbers and arithmetic symbols. Proficient in the manipulation of metrics and time seen in everyday use. Recognize geometric shapes seen in	數-J-B1 Possess the skills of processing mathematical relationships in algebra and geometry. Use them to describe phenomena in scenarios. Use one's experience to express basic relations and properties of planes and	數 V-U-B1 Be able to identify the relations between problems and mathematics. Apply mathematical knowledge, skills, and accurately use appropriate symbols to describe, simulate, explain, and predict various

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	Junior High School (J)	Vocational Senior High School (V-U)
			everyday life and be able to express formulas with mathematical symbols.	spaces in mathematical language. Describe the degree of uncertainty in life in terms of basic statistics and probabilities.	phenomena. Make rational reflections and judgments with mathematical thinking and effectively communicate views with others in the process of problem-solving. Connect abstract symbols with professional subjects and real-world problems. Flexibly Use mathematical knowledge, skills, and symbols to express experiences, thinking, values, and emotions and rationally communicate with others to solve problems.
	B2 Information and Technology Literacy and Media Literacy	Possess the ability to effectively use technology, information, and media of all types, develop competencies related to ethics and media literacy, and develop the ability to analyze, speculate about, and criticize humans' relationships with technology,	數-E-B2 Be able to report, read and make basic statistical graphs.	數-J-B2 Possess the competence of using a calculator to enhance learning. This includes knowing its applicability and limitations, recognizing its complementary value to mathematical	數 V-U-B2 Be able to use technology tools to effectively solve problems in everyday life and professional fields. Based on mathematical understanding, be able to read, critique, and

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	Junior High School (J)	Vocational Senior High School (V-U)
		information, and media.		knowledge, and using it to perform mathematical procedures. Recognize basic characteristics of statistical data.	reflect on the meaning of information and the nature of issues in the media.
	B3 Artistic Appreciation and Aesthetic Literacy	Possess the abilities of art awareness, creation, and appreciation, experience artistic culture through reflection on arts in daily life, enrich artistic experiences, and develop the ability to appreciate, create, and share arts.	數-E-B3 Possess the competence of perceiving mathematical forms or patterns in works of art.	數-J-B3 Possess the competence of identifying geometric shapes or quantitative relationships in works of art. Be able to enjoy the beauty of mathematics through mathematical derivation.	數 V-U-B3 Through drawing, students cultivate the ability to appreciate and create art, further create and express their creativity. Use the changes of geometric shapes and curves such as rhythm of lines, composition of shapes, symmetry, balance, etc. Appreciate beautiful people and things in life, and through images of nature seen in everyday life and media, learn about the relevance of mathematics .
C Social Participation	**C1 Moral Praxis and Citizenship**	Possess competency in putting morality in practice from the personal sphere to the social sphere, and	數-E-C1 Possess the attitude to discuss things from evidence	數-J-C1 Possess the attitude to discuss and reflect on	數 V-U-C1 Possess evidence-based attitudes, construct

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	Junior High School (J)	Vocational Senior High School (V-U)
		gradually develop a sense of social responsibility and civic consciousness; take the initiative in concern for public topics and actively participate in community events; pay attention to the sustainable development of humanity and the natural environment; and exhibit the qualities of moral character to recognize, appreciate, and practice good deeds.	and communicate with others in a structured manner.	matters in light of the evidence. Make reasonable arguments, and be able to rationally communicate and cooperate with others.	viable arguments, and develop ability to communicate rationally with others, becoming a citizen of rational reflection and ethical practice.
	C2 Interpersonal Relationships and Teamwork	Possess the competency in exhibiting friendly interpersonal feelings and the ability to establish strong interactive relationships; establish communication channels with others, tolerate outsiders, and participate and serve in social activities and other activities requiring teamwork.	數-E-C2 Enjoy working with others to solve problems and respect different ideas to solve problems.	數-J-C2 Enjoy interacting and communicating well with others to solve problems, and appreciate multiple solutions to problems.	數 V-U-C2 Possess the competence of cooperating with others to solve problems. Respect different problem-solving approaches, and establish good interactive relationships.

Core Competency Dimension	Core Competency Item	Item Description	Core Competencies of the domain of Mathematics		
			Elementary School (E)	**Junior High School (J)**	**Vocational Senior High School (V-U)**
	C3 Multi-cultural and Global Understanding	Stick to one's own cultural identity, respect and appreciate multiculturalism, show active concern for global issues and international situations, demonstrate the ability to adapt to the contemporary world and to social needs, develop international understanding and a multicultural value system, and strive for world peace.	數-E-C3 Possess the competence of understanding and caring about mathematical representations of multiple cultures or languages, and comparing them with one's own language and culture.	數-J-C3 Possess the competence of observing and embracing mathematical development in the global historical and geographical context.	數 V-U-C3 Possess an international worldview, respect and appreciate the history of mathematical development in different cultures, and understand and use cross-cultural mathematical tools. Through mathematical understanding, care about global issues .

V. Learning Focus

The learning focus consists of "learning performance" and "learning content". Learning performance, such as cognitive skill, and affective aspect, includes N (Number and Quantity), A (Algebra), S (Space and Shape), R (Change and Relationship), and D (Data and Uncertainty).

"Mathematical domain learning focus and core competencies response table reference example" (see Appendix I) is designed to: align learning focus and core competency to each other, implement core competency in the domain through learning focus, guide cross-domain/subject curriculum design, and enhance the rigor of curriculum development.

"Issues appropriate to integrate into domain curriculum guidelines" (see Appendix II) will: enrich learning in the domain, promote the cultivation of core competency, make the topics appropriate to the learning focus of mathematics, so that various issues can be properly combined with the learning focus of mathematics.

1. Mathematics Version A

It is recommended to apply to the Home Economics Group, Art Group, etc.

(1) Learning Performance

Aspect	Code	Dimension	Learning Performance
Cognitive	1-V-1	Understanding of Concepts	Students are able to understand what they have learned the mathematical concepts, operations and relationships.
	1-V-2	Execution of Procedures	Students are able to execute mathematical procedures correctly.
	1-V-3	Problem Solving	Students are able to solve problems operating mathematical concepts, procedures, or methods.
	1-V-4	Link and Application	Students are able to link and apply mathematical concepts, procedures, or methods to daily life or professional disciplines situations.
Cognitive	2-V-1	Application of Tools	Students are able to apply a variety of technologies and tools to solve problems in mathematics, daily life or professional disciplines domains (including learning and application).

Affective	3-V-1	Cultivation of Experience	Students are able to experience the value of mathematics in daily life or hands-on experience in professional disciplines.

(2) Learning Content

①Learning unit theme and content category

N：Number and Quantity

A：Algebra

S：Space and Shape

R：Change and Relationship

D：Data and Uncertainty

Course Attribute	Unit Theme	Suggest Sessions	Learning Content Category
Ministry of Education-required curriculum: for first and second academic years, 0~2 credits per semester are required, for a total of 4 to 8 credits.	Coordinate system and graphing functions	12	N：Number and Quantity A：Algebra R：Change and Relationship
	Linear equation	12	R：Change and Relationship
	Operations	12	A：Algebra
	Trigonometric functions	12	N：Number and Quantity R：Change and Relationship
	Circle and Straight line	12	S：Space and Shape
	Sequence and Series	12	N：Number and Quantity
	Inequality and their applications	18	A：Algebra D：Data and Uncertainty
	Exponent and Logarithm	18	R：Change and Relationship
	Permutation and Combination	16	N：Number and Quantity D：Data and Uncertainty
	Probability and Statistics	20	D：Data and Uncertainty
Ministry of Education-required curriculum total of 4 to 8 credits			

②Stage learning content

A. Tenth grade

	N：Number and Quantity
N-10-1	Number line.
N-10-2	Absolute value.
N-10-3	Plane coordinate system.
N-10-4	The basic properties of angles.
N-10-5	Ratio and Ratio.
N-10-6	Trigonometric function of acute angle (sin, cos, tan).
N-10-7	Trigonometric function of arbitrary angle (sin, cos, tan).
N-10-8	Arithmetic sequence and Arithmetic series.
N-10-9	Geometric sequence and Geometric series.
	A：Algebra
A-10-1	Method of completing square.
A-10-2	The basic concept of polynomial.
A-10-3	Remainder theorem and Factor theorem.
A-10-4	Factorization.
	S：Space and Shape
S-10-1	Triangulation.
S-10-2	Equation of a circle.
S-10-3	Relationship between circle and straight line.
	R：Change and Relationship
R-10-1	Linear function.
R-10-2	Quadratic function.
R-10-3	Slope.
R-10-4	Equation of line.
R-10-5	Characterization of the periodic phenomenon of sine function and cosine function.

B. Eleventh grade

	A：Algebra
A-11-1	Linear inequality with one unknown.
A-11-2	One-variable quadratic inequality.
A-11-3	Absolute value inequality.
A-11-4	Linear inequality with two unknowns.
	R：Change and Relationship
R-11-1	Exponential and exponential functions.
R-11-2	Logarithmic and-Logarithmic functions.
R-11-3	Common logarithms and their applications.
	D：Data and Uncertainty
D-11-1	Linear programming.
D-11-2	Line permutation.
D-11-3	Repeated permutation.
D-11-4	Combination.
D-11-5	Basic concept of set.
D-11-6	Probability calculation.
D-11-7	Mathematical expectations.
D-11-8	Basic concept of statistics.
D-11-9	Statistical data compilation.
D-11-10	Statistic analysis.

③Learning content items and descriptions

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
N-10-1	Number line: basic concept.	Strengthen the content of junior high school	Graph paper	1-V-1
N-10-2	Absolute value: symbol, definition.			1-V-1
N-10-3	Plane coordinate system: cartesian coordinate system, distance formula between two points, formula of point.	Strengthen the content of junior high school	Graph paper	1-V-1 1-V-2
N-10-4	Basic properties of angle: unit of angle,-coterminal angles,–sector.			1-V-1

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
N-10-5	Ratio and Ratio: ratio problem, continued ratio.	Strengthen the content of junior high school, Import the right triangle side length ratio.		1-V-2
N-10-6	Acute angle trigonometric functions (sin, cos, tan): Definition and basic relationship between sin, cos, and tan.	Strengthen the content of junior high school, Students must have experience in operating computers.	Computer	1-V-1
N-10-7	Trigonometric function of arbitrary angle (sin, cos, tan): Standard position angle, trigonometric function value.		Computer Protractor	1-V-1 1-V-3
N-10-8	Arithmetic sequence series and Arithmetic series: finite item series, summation formula.			1-V-3 1-V-4
N-10-9	Geometric sequence and Geometric series: finite item series, summation formula.	Strengthen the content of junior high school, sum the sum of the finite series of numbers.		1-V-3 1-V-4
A-10-1	Method of completing square: Using the multiplication formula completing square.			1-V-2
A-10-2	The basic concepts of polynomials: definitions, equality of polynomials, addition, subtraction, multiplication, division (including long division and comprehensive division).			1-V-1
A-10-3	The remainder theorem and the factor theorem: the remainder theorem, the factor theorem.	Only discuss the comprehensive division of x-a		1-V-2

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
A-10-4	Factorization: propose the common term, the squared difference formula, the squared formula of the sum, the squared formula of the difference, the cross- multiplication method, the cubic difference, the cubic sum.			1-V-2 1-V-3
S-10-1	Triangulation measurement: simple triangulation measurement.	Does not contain sine and cosine theorem.		1-V-4 3-V-1
S-10-2	Circular equation: standard, general.		Compasses	1-V-1 1-V-2
S-10-3	The relationship between a circle and a line: the judgment of the intersection of a circle and a line, and the tangent on a circle.	Points and circles, lines and circles, and tangential lengths. Tangent calculations that do not contain points beyond the circle.	Compasses	1-V-3
A-11-1	One-variable one inequality：shift rule, inequality solution.			1-V-2 1-V-3
A-11-2	One-variable quadratic inequality: use cooperation map to find the range and use discriminant judgment.			1-V-2 1-V-3
A-11-3	Absolute value inequality: simplify absolute value inequality.	Absolute value inequality by principle of the| x-a |>b and| x-a |<b.		1-V-2
A-11-4	Linear inequalities with two unknowns: the area judgment of the solution with the cooperation diagram.		Graph paper	1-V-3
R-10-1	Line type function: use the plot method to map, use the intercept to map.	Introduce the concept of y = f(x).	Graph paper	1-V-2

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
R-10-2	Quadratic function: use the plot method to plot the opening direction, the highest (lowest) point, and the symmetry axis.	Strengthen the content of junior high school, make students skilled in the operation of methods.	Graph paper	1-V-4 3-V-1
R-10-3	Slope: defined, the positive and negative slopes.			1-V-1
R-10-4	Straight line equation: point oblique, intercept, two parallel lines, two vertical lines, the distance from point to line.	It does not include two-point, slope-intercept form.		1-V-2
R-10-5	Characterization of periodic phenomena of sine function and cosine function: definition domain, value range, period.	Let students practice hand-painting to enhance strengthen students' understanding of sin, cos, and tan function graphs.		1-V-4 2-V-1
R-11-1	Exponential and Exponential functions: exponential law, exponential equation, graph.		computer	1-V-4
R-11-2	Logarithms and Logarithmic functions: logarithmic properties, common logarithms, logarithmic equations, graphs.		computer	1-V-4
R-11-3	Common logarithms and their applications: logarithmic tables, first and last numbers, and their applications.		computer	1-V-4 3-V-1
D-11-1	Linear programming: list the constraints and objective functions, and find the optimal solution.			1-V-4 3-V-1

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
D-11-2	Line Permutation: addition principle, multiplication principle, tree diagram, factorial, and straight line arrangement.	Lead students to discuss different sorting orders will lead to different situations, with the arrangement of different objects and the arrangement of different objects as the main content.		1-V-1 1-V-2
D-11-3	Permutation with Repetition：n^m.			1-V-2 1-V-4
D-11-4	Combination：C_m^n.	Based on a straight line, students are made aware of the relationship between composition and arrangement, which is mainly a combination without considering the order. It can be analyzed that the total number of originals, the number of groups to be selected, and the number of different combinations are generated, and the relationship between them is based on the basic concept of combination. It does not involve repeated combination problems.		1-V-2 1-V-4
D-11-5	Basic concepts of collection: writing, universe, intersection, union, difference, complement, remainder, belonging to and containing.	Does not include complex cases where there are empty collection symbols in the collection or collection symbols in the collection.		1-V-1 1-V-3
D-11-6	Probability calculations: sample space, events, probability of property, De Morgan's Laws, classical probability.	Does not include conditional probability, Bayes' Theorem, independent events.		1-V-3 1-V-4
D-11-7	Expectation：partition, expectation...			1-V-4

Code	Content with Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
D-11-8	Basic concepts of statistics: population, samples, sampling.			1-V-1
D-11-9	Statistical data collation: data classification, table drawing.			1-V-2 2-V-1
D-11-10	Statistic analysis: concentrated quantity, discrete quantity (range, quartile range, population standard deviation), linear transformation.	Explain how data is collected and analyzed, important statistical terminology is introduced with simple calculations. This is mainly to enable students to learn the interpretation of concentrated and discrete quantities (range, quartile range, population standard deviation).	computer	1-V-3 1-V-4

2. Mathematics Version B

It is recommended to apply to the Commerce and Management Group, Foreign Language Group, Design Group, Agriculture Group, Food Science Group, Hospitality Group, Marine Technology Group, Fishery Group,etc.

(1) Learning Performance

Aspect	Code	Dimension	Learning Performance
Cognitive	1-V-1	Understanding of Concepts	Students are able to understand what they have learned the
	1-V-2	Execution of Procedures	Students are able to execute mathematical procedures
	1-V-3	Problem Solving	Students are able to solve problems operating mathematical
	1-V-4	Link and Application	Students are able to link and apply mathematical concepts, procedures, or methods to daily life or professional disciplines situations.

Skill	2-V-1	Application of Tools	Students are able to apply a variety of technologies and tools to solve problems in mathematics, daily life or professional disciplines domains (including learning and application).
Affective	3-V-1	Cultivation of Experience	Students are able to experience the value of mathematics in daily life or through hands-on experience in professional disciplines.

(2) Learning Content

① Learning unit theme and content category N：Number and Quantity

A：Algebra

S：Space and Shape

R：Change and Relationship

D：Data and Uncertainty

Course attribute	Unit Theme	Suggest Sessions	Learning Content Category
Ministry of Education- required curriculum: for first and second academic years, 0~3 credits per semester are required, for a total of 4 to 8 credits.	Coordinate system and graph of function	18	N：Number and Quantity A：Algebra R：Change and Relationship
	Linear equation	18	R：Change and Relationship
	Operations	18	A：Algebra
	Trigonometric function	26	N：Number and Quantity R：Change and Relationship
	Plane vector	10	N：Number and Quantity S：Space and Shape
	Circle and straight line	10	S：Space and Shape
	Sequence and series	8	N：Number and Quantity
	Equation	14	A：Algebra
	Linear inequalities with two unknowns and applications	22	A：Algebra D：Data and uncertainty
	Exponent and logarithm	18	R：Change and Relationship

	Application of trigonometric functions	20	N：Number and Quantity S：Space and Shape
	Permutation and combination	16	N：Number and Quantity D：Data and uncertainty
	Probability and statistics	18	D：Data and uncertainty
Ministry of Education-required curriculum and School-developed curriculum total of 12 credits			

② Grade Level Content

A. Tenth grade

	N：Number and Quantity
N-10-1	Number line.
N-10-2	Absolute value.
N-10-3	Plane coordinate system.
N-10-4	Ratio and Ratio.
N-10-5	The basic property of degree measurement.
N-10-6	Trigonometric function of acute angle (sin, cos, tan).
N-10-7	Trigonometric function of arbitrary angle (sin, cos, tan).
N-10-8	Sine theorem.
N-10-9	Cosine theorem.
N-10-10	Coordinate representation of vector.
N-10-11	Inner product of vectors.
N-10-12	Arithmetic sequence and Arithmetic series.
N-10-13	Geometric sequence and Geometric series.
	A：Algebra
A-10-1	Method of completing square.
A-10-2	One-variable quadratic inequality.
A-10-3	The basic concept of polynomial.
A-10-4	Factorization.
A-10-5	Division principle and Remainder theorem.
A-10-6	Fraction.
	S：Space and Shape
S-10-1	Equation of a circle.
S-10-2	Relationship between circle and straight line.
S-10-3	Vector mapping.

	R：Change and Relationship
R-10-1	Linear function.
R-10-2	Quadratic function.
R-10-3	Slope.
R-10-4	Equation of line.
R-10-5	Characterization of the periodic phenomenon of sine function and cosine function.

B. Eleventh grade

	N：Number and Quantity
N-11-1	Binomial Theorem.
	A：Algebra
A-11-1	linear equation with one unknown (linear inequality with one unknown).
A-11-2	Quadratic equation with one unknown.
A-11-3	System of linear equations with two unknowns.
A-11-4	Linear inequality with two unknowns.
	S：Space and Shape
S-11-1	Triangulation.
	R：Change and Relationship
R-11-1	Index and exponential functions.
R-11-2	Logarithms and logarithmic functions.
R-11-3	Common logarithms and their applications.
	D：Data and Uncertainty
D-11-1	Linear programming.
D-11-2	Line permutation.
D-11-3	Repeated permutation.
D-11-4	Combination.
D-11-5	Basic concept of set.
D-11-6	Probability calculation.
D-11-7	Mathematical expectations.
D-11-8	Basic concept of statistics.
D-11-9	Statistical data compilation.
D-11-10	Statistical analysis.

(3) Learning content items and descriptions

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
N-10-1	Number line: basic concept.	Strengthen the content of junior high school.	Graph paper	1-V-1
N-10-2	Absolute value: symbol, definition, absolute value inequality.	absolute value inequality principle of $\| x-a \|>b$ and $\| x-a \|<b$.		1-V-1 1-V-2
N-10-3	Plane coordinate system: Cartesian coordinate system, distance formula between two points, formula of division point.	Strengthen the content of junior high school.	Graph paper	1-V-1 1-V-2
N-10-4	Ratio to ratio: ratio problem, continued ratio.	Strengthen the content of junior high school, Import the right triangle side length ratio.		1-V-2
N-10-5	The basic properties of an angle: the unit of the angle, the same angle, the fan shape.			1-V-1
N-10-6	Acute angle trigonometric functions (sin, cos, tan): the definition and basic relationship between sin, cos, and tan.	Strengthen the content of junior high school, Students must have experience in operating computers.	Computer	1-V-1
N-10-7	Trigonometric function of arbitrary angle (sin, cos, tan): standard position angle, trigonometric function value.		Computer Protractor	1-V-2 1-V-3
N-10-8	Sine theorem: derived formula, Sine theorem and circumscribed circle circumcircle of triangle.		Computer	1-V-2 1-V-3
N-10-9	Cosine theorem: derived formula.		Computer	1-V-2 1-V-3
N-10-10	Coordinate representation of vector: length, parallelism, vector addition and subtraction, and scalar product.			1-V-2

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
N-10-11	Inner product of vectors: vector angle, inner product method.	Does not include the direction angle of the vector, orthogonal projection.		1-V-2
N-10-12	Arithmetic sequence and Arithmetic series: finite sequence, regularity of recursive relations, sum formula.	Strengthen the content of junior high school, join concept of recursion.		1-V-3 3-V-1
N-10-13	Geometric sequence and geometric series: finite sequence, regularity of recursive relations, sum formula.	Strengthen the content of junior high school, join concept of recursion.		1-V-3 3-V-1
A-10-1	Method of completing square: using multiplication formulas completing square	Strengthen the content of junior high school.		1-V-2
A-10-2	One-variable quadratic inequality: discriminant match mathematic construction to find out the range and use discriminant judgment.			1-V-2 1-V-3
A-10-3	Basic concept of polynomial: definition, equality of polynomials, addition, division (including long division and comprehensive division).subtraction, multiplication,			1-V-1
A-10-4	Factorization: propose common terms, square difference formula, sum square formula, cross multiplication, difference of cubes, sum of cubes.	Strengthen the content of junior high school, import cubic multiplication formula.		1-V-2 1-V-3
A-10-5	Division principle and remainder theorem: long division, comprehensive division, remainder theorem, factor theorem.	Discuss only comprehensive division of x-a.		1-V-3
A-10-6	Fraction: merging of fractions (lowest common denominator), fractional equations.	Does not include partial fractions.		1-V-2

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
S-10-1	Equation of a circle: equation of circle in standard form, equation of circle in general form.		Compass	1-V-1 1-V-3
S-10-2	Relationship between circle and straight line: judgment of the intersection of a circle and a straight line and the tangent on a circle.	Point and circle, straight line and circle, length of tangent. It does not include the tangent line calculation of a point outside the circle.	Compass	1-V-3 1-V-4
S-10-3	Vector mapping: vector definition, addition mapping, subtraction mapping, scalar product mapping.			1-V-1
R-10-1	Linear function: use the trace point method to map, use the intercept to map.	Introduce the concept of $y = f(x)$.	Graph paper	1-V-2
R-10-2	Quadratic function: use the trace point method to map. Explain opening direction (the highest and lowest point) and axis of symmetry.	Strengthen the content of junior high school. Make students proficient in the operations and methods of completing square.	Graph paper	1-V-4 3-V-1
R-10-3	Slope: definition, positive and negative of slope.	Links to professional subjects and economics.		1-V-1
R-10-4	Equation of line: point slope form, slope intercept form, intercept form, two parallel lines, two vertical lines, distance from point to straight line, and distance between two parallel lines.	Does not include two-point form.		1-V-2
R-10-5	Characterization of the periodic phenomenon of sine function and cosine function: domain of definition, range of values, period.	Let students practice hand-painting to strengthen students' understanding of sine, cosine, and tangent function. graphics.	Graph paper	1-V-4 2-V-1
N-11-1	Binomial theorem: Pascal triangle, binomial theorem.			1-V-2

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
A-11-1	Linear equations with one unknown: transposition of term rule, inequality solution.	Strengthen the content of junior high school.		1-V-2 1-V-3
A-11-2	Quadratic equation of one unknown: Use factorization to solve the relationship between roots and coefficients.			1-V-2
A-11-3	System of linear equations in two unknowns: Substitution method, addition and subtraction method, geometric figures.	Strengthen the content of junior high school.		1-V-2
A-11-4	Linear inequality with two unknowns: match map to regional judgment of solution.			1-V-3
S-11-1	Triangulation: special triangle side length ratio measurement, using sine theorem and cosine theorem.	can be added simple three-dimensional triangulation measurement.	Computer	1-V-4 3-V-1
R-11-1	Exponential and Exponential functions: exponential law, exponential equation, graph.		Computer	1-V-4
R-11-2	Logarithms and Logarithmic functions: logarithmic properties, common logarithm, logarithmic equations, graphics.		Computer	1-V-4
R-11-3	Common logarithms and their applications: links to scientific notation, logarithmic tables, characteristic of logarithm, mantissa of a logarithm, and their applications.		Computer	1-V-4 3-V-1
D-11-1	Linear programming: list the constraints and objective function and find optimal solution.	Example questions should not be too mathematical, but can be combined with business decision-making theory.		1-V-4 3-V-1

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
D-11-2	Line permutation: addition principle, multiplication principle, tree diagram, factorial, line permutation.	Permutation of different objects, permutation of not entirely different objects.		1-V-1 3-V-1
D-11-3	Permutation with Repetition: n^m.			1-V-2 1-V-4
D-11-4	Combination: $C_m{}^n$, $C_m^n=C_m^{n-1}+C_{m-1}^{n-1}$.	Does not involve repeated combinations.		1-V-2 1-V-4
D-11-5	Basic concept of set: writing, universal set, intersection set, union of sets, difference set, complementary set, remainder set, empty set, belong to and include relationship.	Does not include complex cases where the set has an empty set symbol or the set has a set symbol.		1-V-1 1-V-4
D-11-6	Probability calculation: Sample space, event, property of probability, De Morgan laws, Laplace classical probability, independent event, conditional probability.			1-V-3 1-V-4
D-11-7	Mathematical expectations: segmentation, expectations.	Example questions could be connected to real life scenarios, such as the amount of winnings or insurance claims.		1-V-4 3-V-1
D-11-8	Basic concept of statistics: population, sample, sample.			1-V-1 1-V-4
D-11-9	Statistical data compilation: data classification, table drawing.			1-V-2 2-V-1

Code	Learning Contents and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
D-11-10	Statistic analysis: measure of central tendency, measure of dispersion (full range, quartile deviation, standard deviation), linear transformation, 68-95-99.7 Rule of Normal Distribution	Focal points for the measure of central tendency should include: measure of dispersion, interpretation of polls (full range, quartile deviation, standard deviation, 68-95-99.7 rule). These focal points should be excluded: computer software applications, confidence interval, calculation, percentile and percentile rank.	Computer	1-V-3 1-V-4 3-V-1

3. Mathematics Version C

It is recommended to apply to the Mechanical Engineering Group, Power Mechanical Engineering Group, Electrical Engineering and Electronic Engineering Group, Chemical Engineering group, and Civil Engineering and Architecture Group.

(1) Learning Performance

Aspect	Coding	Dimension	Learning Performance
Cognitive	1-V-1	Understanding of Concepts	Be able to understand the mathematical concepts, operations and relation.
	1-V-2	Execution of Procedures	Ability to execute math programs correctly.
	1-V-3	Problem Solving	Ability to solve problems using mathematical concepts, procedures or method.
	1-V-4	Link and Application	Ability to link and apply mathematical concepts, procedures, or method for everyday life or vocational subjects domain(include learning and application) .

	2-V-1	Application of Tools	Ability to apply a variety of technologies and tools to solve problems in mathematics, everyday life or professional subjects (including learning and application).
Affective	3-V-1	Cultivation of Experience	Ability to experience the value of mathematics in daily life or the practice of vocational subjects.

(2) Learning Content

①Learning unit theme and content category

N：Number and Quantity

A：Algebra

S：Space and Shape

R：Change and Relationship

D：Data and Uncertainty

Course Attribute	Unit Theme	Suggest Sessions	Learning Content Category
Ministry of Education-required curriculum: for first and second academic years, 0~4 credits per semester are required, for a total of 4 to 8 credits.	Coordinate system and graph of function	20	S：Space and Shape R：Change and Relationship
	Trigonometric function	38	A：Algebra N：Number and Quantity S：Space and Shape R：Change and Relationship
	Plane vector	14	S：Space and Shape
	Operation expression	28	A：Algebra
	Straight line and Circle	26	S：Space and Shape
	Sequence and Series	8	N：Number and Quantity
	Permutation and Combination	10	D：Data and Uncertainty

School-developed curriculum: 8 credits	Application of trigonometric functions	12	N：Number and Quantity A：Algebra S：Space and Shape R：Change and Relationship
	Exponents and Logarithms	20	R：Change and Relationship
	Space vector	20	S：Space and Shape
	Linear simultaneous equations and matrix	20	A：Algebra
	Linear inequalities with two unknowns and linear programming	6	A：Algebra
	Curve of second order	14	S：Space and Shape
	Differential	28	R：Change and Relationship
	Integration	24	R：Change and Relationship
Ministry of Education-required curriculum and School-developed required Curriculum, total of 16 credits			

②Stage learning content

A. Tenth grade

	N： Number and Quantity
N-10-1	Real number.
N-10-2	Absolute value.
N-10-3	Directed angles and their metrics.
N-10-4	Arithmetic sequence and Arithmetic series.
N-10-5	Geometric sequence and Geometric series.
	A： Algebra
A-10-1	Basic properties of trigonometric functions.
A-10-2	Four fundamental operations of Polynomial.
A-10-3	Remainder theorem and Factor theorem.
A-10-4	Polynomial equation.
A-10-5	Operations of fraction and root.
	S： Space and Shape
S-10-1	Plane coordinate system.
S-10-2	Acute angle trigonometric functions.
S-10-3	Sine theorem and Cosine theorem.

S-10-4	Vectors and their basic operations.
S-10-5	Inner product of vectors.
S-10-6	Application of inner product.
S-10-7	Line equation
S-10-8	Circle equation.
S-10-9	Relationship between circles and lines.
	R： Change and Relationship
R-10-1	Functions and their graphs.
R-10-2	Trigonometric function of any angle.
R-10-3	Graphs and period of trigonometric functions.
	D： Data and uncertainty
D-10-1	Permutation.
D-10-2	Combination.

B. Eleventh grade

	N：Number and Quantity
N-11-1	Limit of sequence
	A： Algebra
A-11-1	Complex number plane.
A-11-2	Application of polar form
A-11-3	Linear simultaneous equations and matrix row operations.
A-11-4	Operations of matrix.
A-11-5	Linear inequalities with two unknowns and linear programming.
	S： Space and Shape
S-11-1	Triangulation.
S-11-2	Space concept.
S-11-3	Space coordinate system.
S-11-4	Space vector.
S-11-5	Plane in space.
S-11-6	Parabola.
S-11-7	Ellipse.
S-11-8	Hyperbola.
	R： Change and Relationship
R-11-1	Sum angle formula and Difference angle formula.
R-11-2	Exponential function and its graph.
R-11-3	Logarithmic function and its graph.
R-11-4	Common logarithm and its application.

R-11-5	Limit of Function.
R-11-6	Derivative of function of polynomial function.
R-11-7	Differential formula.
R-11-8	Application of differentiation.
R-11-9	Concept of integration.
R-11-10	Integration of polynomial function.
R-11-11	Application of Integration.

③Learning content items and descriptions

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
N-10-1	Real number： number line, operation of rational number, operation of irrational number, arithmetic,geometric mean inequality.	Strengthen the content of junior high school, make students proficient in the operation of irrational numbers (radiation simplification, addition, subtraction, multiplication and division, rationalization).	Computer	1-V-1 1-V-2 1-V-3
N-10-2	Absolute value： geometric meaning of absolute values, absolute inequality.	Absolute value inequality is based on | x-a |>b and | x-a |<b, excluding | x-a | + | x-b | ≤ c.		1-V-1 1-V-2
N-10-3	Directed angles and their metrics： definition of radians, sector arc length and area, computer rad key.		Computer and protractor	1-V-1 1-V-2
N-10-4	Arithmetic sequence and Arithmetic series： introduce the Σ symbol, its basic operations, and commonly used summation formulas.			1-V-3
N-10-5	Geometric sequence and geometric series： application of geometric series in life.	. . .		1-V-3 3-V-1

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
A-10-1	Basic properties of trigonometric functions：square relation, reciprocal relation, quotient relation.			1-V-2
A-10-2	four fundamental operations of polynomial：division principles, synthetic division.			1-V-1 1-V-2
A-10-3	Remainder theorem and-Factor theorem：factorial test method, cube multiplication formula.			1-V-2 1-V-3
A-10-4	Polynomial equation：method of completing square; factorization; imaginary roots of quadratic equation of one unknown, four operations on complex numbers; roots and coefficient.	Strengthen the content of junior high school by encouraging proficiency in the operations and methods of completing square.		1-V-2
A-10-5	Operation of fraction and Root：partial fraction.			1-V-2
S-10-1	Plane coordinate system：rectangular coordinate system, distance between two points formula, formula of division point.		Graph paper	1-V-1 1-V-2

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
S-10-2	Acute angle trigonometric functions：definition of six trigonometric functions. Find the area of the triangle from an angle between the two sides. computer; sin, cos, tan, asin, acos, atan keys.	Strengthen the content of junior high school by linking the vocational subjects of mechanical engineering and electrical engineering, with emphasis on oblique and adjacent edges. Students should be experienced in operating computers. A brief introduction to the computer asin, acos, and atan keys are known trigonometric functions, and the tool for finding the angle can be used, without involving the strict definition of anti-triangulation.	Computer and protractor	1-V-1 1-V-2 3-V-1
S-10-3	Sine theorem and Cosine theorem： sine theorem and cosine theorem.	Linking vocational subjects in mechanical engineering and electrical engineering.		1-V-2 1-V-3 3-V-1
S-10-4	Vectors and their basic operations： physical meaning and definition of vector, the meaning of vector sum, difference and scalar product, unit vector.	Linking vocational subjects in mechanical engineering and electrical engineering.		1-V-2
S-10-5	Inner product of vectors：physical meaning, definition, parallel and vertical of a vector.	Linking vocational subjects of mechanical engineering, electrical engineering (or physics), the concept of "work" is introduced in detail, and the definition of inner product is introduced.		1-V-1 1-V-2 3-V-1

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
S-10-6	Application of inner product: triangle area formula with second- order determinant, Cauchy inequality, orthogonal projection.	Briefly introduce the second-order determinant expansion operation rules. It does not include properties such as common factor proposal, determinant decomposition, and the ratio of each row (column) to 0. It will be introduced in the space vector unit. Cauchy 's inequality is not involved. $(a_1^2 + a_2^2 + a_3^2)(b_1^2 + b_2^2 + b_3^2) \geq (a_1b_1 + a_2b_2 + a_3b_3)^2$ Calculation of the "sub-vector size" needs to link orthogonal projection to future vocational subjects.		1-V-2 1-V-3
S-10-7	Line equation：angle of inclination, slope, point slope form, intercept form, parallel line distance parallel and vertical, point-to-line distance, and two parallel line distance	Need to introduce the intercept.		1-V-1 1-V-2
S-10-8	Circle equation：equation of circle in standard form, equation of circle in general form, equation of circle in parametric form.	Does not include the relationship between two circles.	Compass	1-V-1 1-V-2
S-10-9	Relationship between circles and lines：judgment of the relationship between circles and straight lines, tangent of circles.		Compass	1-V-3 1-V-4

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
R-10-1	Functions and their graphs： meaning of functions, linear functions, quadratic functions, and quadratic inequalities of one variable.	In response to the adjustment of the learning content of junior high school, the concept of y = f (x) is introduced. This will strengthen the content of junior high school, so that students are proficient in method of completing square. Quadratic inequalities of one variable do not include higher-order inequalities and root inequalities, but can instead apply fractional inequalities where the numerator and denominator are all one degree.	Graph paper	1-V-1 1-V-2 1-V-3
R-10-2	Trigonometric function of any angle：definition of six trigonometric functions; computer sin, cos, tan, asin, acos, atan keys.	By linking vocational subjects in electrical engineering and mechanical engineering. students should have practical experience of calculating the estimated value of the trigonometric function of any angle according to the graphs and measurements.	Computer	1-V-2 1-V-3
R-10-3	Graphs and period of trigonometric functions：graphs and periods of six trigonometric functions, emphasizing the translation and expansion of sine and cosine functions.	By linking vocational subjects to electrical engineering, students should have experience of drawing by hand or drawing with the help of drawing software and drawing APP.		1-V-4 2-V-1
D-10-1	Permutation：systematic examples of as much as possible, tree diagram, addition principle, multiplication principle, inclusion-exclusion principle, line permutation, circular permutation.	Concept of logical reasoning should be the focal point, and it is not necessary to involve circular permutation.		1-V-1 1-V-2

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
D-10-2	Combination：C_m^n.	Focus on the basic concepts of combination, and does not need to involve combination with repetition problems.		1-V-1 1-V-2
N-11-1	limit of sequence： Infinite geometric series, recurring decimal.		Computer	1-V-1
A-11-1	Complex number plane： complex absolute value, polar coordinate, polar form.		Graph paper, protractor and ruler Compass	1-V-1
A-11-2	Application of polar form: multiplication and division operations of polar form, geometric meaning of polar form multiplication and division operations.	Linking vocational subjects to electricity. Does not involve De Moivre theorem, Square root of complex number.		1-V-1 1-V-2 1-V-4
A-11-3	Linear simultaneous equations and matrix column operations： system of linear equations with two unknowns, system of linear equations with three unknowns, elimination method solution, matrix column operation solution, and Cramer's formula solution.	The elimination method is used to solve it, then, it is expressed in a matrix, and finally, the meaning of the matrix symbol is defined. The Cramer's formula is used to solve multivariate linear equations in many vocational subjects. Teachers should introduce concepts and demonstrate the use of computers to solve multivariate linear equations.		1-V-1 1-V-2

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
A-11-4	Operations of Matrix：meaning of matrix, addition, subtraction, coefficient product, multiplication, use second-order inverse matrix to solve simultaneous equations.	The matrix is regarded as a data table; explain the significance of the matrix coefficient product, addition and subtraction operations, and matrix multiplication. An inverse of any order can be explored conceptually, but if you want to calculate the inverse exactly, it is limited to order 2. It is not necessary here to use a third-order inverse matrix to solve the ternary simultaneous equations, nor does it include the transition matrix or Markov's theorem.		1-V-2 1-V-3
A-11-5	Linear Inequalities with two unknowns and linear programming: graph system of linear inequalities with two unknowns, objective function is a linear programming of linear inequalities with two unknowns.		Graph paper, ruler and compass	1-V-4 3-V-1
S-11-1	Triangulation measurement: Plane measurement, stereo measurement, triangulation in space.		Computer	1-V-4 3-V-1

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
S-11-2	Space concept: Basic properties of space, the two straight lines, two planes, and the positional relationship between a straight line and a plane, theorem of three perpendicular lines.	Students must have their own hands-on experience with the paper (plane) and pen (straight line) at hand to understand the relationship between the straight line and the plane in the derivation space and the three perpendicular theorem. It is necessary to recognize the dihedral angle, but in addition to the right angle, it is not necessary to deal with the general dihedral angle geometrically. The cuboid can be used to discuss the distance between two points in space.		1-V-1
S-11-3	Space coordinate system： point coordinates, distance formulas, point-to-axis or coordinate plane projections.			1-V-1
S-11-4	Space vector: vector sum, difference and scalar product and inner product (including orthogonal projection, parallel and perpendicular of two vectors), vector cross product, parallelepiped volume and third-order determinant.	The Cauchy inequality is not involved here, but the expansion of the third-order determinant and determinant properties must be introduced in detail. This includes: common factor proposal, determinant decomposition, the ratio of each column (row) equal to 0, reductive algorithm for determinant of a matrix etc. Vector cross product links vocational subjects in mechanical engineering and electrical engineering.		1-V-1 1-V-2
S-11-5	Plane in space： normal vector, plane equation, angle between two planes, distance from point to plane.	The application of vector cross product is mainly used here, and it is not necessary to involve straight lines in space.		1-V-1 1-V-2

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
S-11-6	Parabola：graph and standard style, general style.			1-V-1
S-11-7	Ellipse： graph and standard style, parametric style.			1-V-1
S-11-8	Hyperbola： graph and standard style, hyperboloid equation and asymptote.			1-V-1
R-11-1	Sum angle formula and difference angle formula：double angle formula, superposition of sine and cosine functions, angle between two straight lines.	The sine and cosine functions are mainly used, and the corresponding formula of the tangent function is based on the practice of derivation. Linking professional subjects to electrical engineering. Regarding the superposition of sine and cosine functions, in addition to letting students understand the operation process and practice, students must also have the experience of drawing the superposition of sine and cosine functions by hand, software or drawing APP.		1-V-1 1-V-2 1-V-4
R-11-2	Exponential function and its graph: meaning of negative index and fraction index, use computer x^y key.		Computer	1-V-1 1-V-2 1-V-4
R-11-3	Logarithmic function and its graph：meaning of logarithm, properties of logarithm, the meaning of e, the meaning of the natural logarithm, using the computer 10^x、$\log_{10}$、e^x、ln keys.		Computer	1-V-1 1-V-2 1-V-4

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
R-11-4	Common logarithms and applications：For connection with scientific notation, use computer 10^x 、$\log_{10}$ keys.		Computer	1-V-1 1-V-2
R-11-5	Limit of function：operational properties, absolute value functions and limits of segment defined functions, squeeze theorem.		Computer	1-V-1 1-V-2
R-11-6	Derivative and derivative of function of polynomial function: meaning of function continuity, definition of derivative, derivative and tangent, derivative and kinematics.	Linking vocational subjects to mechanics and electricity or physics.		1-V-1 1-V-2 1-V-3 1-V-4
R-11-7	Differential formula：differential multiplication law, division law, basic chain law, higher order derivative functions.			1-V-1 1-V-2
R-11-8	Application of differentiation: meaning of the interval, function increasing and decreasing concave, extreme value, inflection point, description of function graph.			1-V-1 1-V-2
R-11-9	Concept of integration：meaning of definite integral, fundamental theorem of the calculus, anti-derivative function.			1-V-1 1-V-2 1-V-3 1-V-4
R-11-10	Integration of polynomial function: integral formula, integration by substitution.			1-V-1 1-V-2

Code	Content and Descriptions	Remarks	Teaching Aids	Corresponding Learning Performance
R-11-11	Application of integration: relationship between integration and area.	Linking vocational subjects to mechanical engineering, electrical engineering, or physics, without involving volume of body of rotation.		1-V-2 1-V-3

VI. Implementation Directions

Mathematics textbooks are divided into three versions: A, B, and C. Version A is recommended for Home Economics Group, Arts Group, etc.; Version B is recommended for Commerce and Management Group, Foreign Language Group, Design Group, Agriculture Group, Food Science Group, Hospitality Group, Marine Technology Group, Fishery Group, etc.; and Version C is recommended for Mechanical Engineering Group, Power Mechanical Engineering Group, Electrical and Electronic Engineering group, Chemical Engineering Group, Civil Engineering and Architecture Group, etc. Each school and each domain may flexibly choose the version according to its professional learning needs.

1. Curriculum Development

(1) The curriculum is designed according to the Curriculum Guidelines of 12-year Basic Education or in response to the competency-driven spirit so that students from their learning process may strengthen their holistic development and cultivate lifelong learning

(2) Curriculum development should be guided by core competencies. The curriculum planning should focus both on thinking and action as well as understanding and application. Emphasis should be placed on how to translate learned theory into practical knowledge and then implement it in life. In addition, curriculum design should focus on observing interactions among people, events, objects, and the surrounding environment to seek their associations and solve problems.

(3) School curriculum development should emphasize integration among three versions of Mathematics, A, B, and C in the Mathematics domain with professional subjects in different domains. It should also consider the horizontal articulation of mathematical skills of national junior high schools, vocational, and technological colleges and universities.

(4) Curriculum design should appropriately integrate issues including gender equality, human rights, environment, ocean, life, rule of law, technology, information, energy, safety, disaster prevention, career planning, cultural diversity, reading literacy, outdoor education, international education, indigenous education, family education, labor rights and regulations regarding future employment, etc. These issues should be incorporated into the content of school-developed curriculum when necessary.

(5) Course development may also involve integration of current events. In designing curriculum, teachers may incorporate topics related to personal finance, household income and expenditure, daily consumption, economy and trade, financial information, animation production, construction technology, medical science, astronomy, ocean voyage, and salary calculation for future employment, etc. This aims to increase the diversity of the curriculum through application of different domains and motivate students to learn.

2. Teaching Material Selection and Composition

(1) Selecting and composing teaching material should consider practical application in daily life and occupation groups. Teaching materials should use examples of daily life and technology applications to learn mathematics and link it to the course learning of professional subjects. In addition, teaching materials should incorporate in-class exercises for students to practice in the classroom, emphasizing both theory and application to seek reality in the context.

(2) The content of teaching materials should include concepts of core competencies in mathematics and incorporate human rights education, environmental education, marine education, family education, labor rights, and other issues. With a

contemporary and forward-looking perspective in mind, it should adopt a multicultural perspective and includes gender equality and history, culture, and values of various ethnic groups to enhance understanding and respect among ethnic groups. Apart from cultivating students' basic abilities in mathematical calculation and logical reasoning, it may also for students to develop their diverse wisdom and international perspectives from this subject knowledge, and use specific situations or problems that arouse their learning motivation

(3) The teaching material is designed to offer mathematical skills required for articulation for national junior high schools, transition to comprehensive high schools, and entering vocational and technological colleges and universities in the future. The content will progress and be introduced gradually and adequately. It is based on real-life examples, focusing on students' learning psychology, and designing learning activities to increase students' learning experience and motivation. In addition, it should also include learning material that involves high-level cognitive thinking for students to acquire the ability to apply knowledge and solve problems. Schools may select or compose their teaching materials according to regional characteristics, students' characteristics and needs, and group/subject characteristics, provided that the specific terminology used in teaching materials comply with the latest terminology published by the Ministry of Education and it should be standardized across learning stages.

(4) The teaching material should have sufficient examples and exercises. The examples should be meaningful or realistic problems that reflect mathematical thinking. Furthermore, there should be in-class exercises followed by examples and texts should be followed by thought-provoking exercises. The exercises should be closely related to the topic and gradually progress in depth and should not be too different from the material. It should avoid meaningless, unreasonable, and artificial calculation exercises. In addition to learning knowledge from the text, learning experiences and performances are emphasized for students to enjoy learning and learn how to learn.

(5) It is not necessary to follow the sequence in curriculum guidelines when selecting and composing teaching material. New content may be added to appendices for

coherence and completeness of the teaching material.

(6) The application examples in teaching material and textbooks should be based on relevant needs for mathematics application in various fields, students' future employment, and family management. It should be designed by following the regulations promulgated by the government and includes examples and exercises that can be done using a calculator.

(7) Textbook authors may compose a separate teacher's manual that contains unit learning objectives, textbook summaries, course objectives and the number of sections, status analysis of teaching materials, references, teaching methods and precautions, examples of teaching activity design, exercise answers, digital learning media, instructions of use, etc. to provide teaching reference, fully demonstrating the function of the teachers' manual.

(8) Notes for review: Textbooks should be reviewed with a focus on core competencies, learning content of the curriculum, learning performances, remarks, and descriptions presented. In addition, the design should provide students with adequate learning experiences and comply with above-stated notes and precautions for teaching material selection and composition.

3. Teaching Implementation

(1) Teachers should implement teaching methods or teaching strategies that have been proven effective in the field of mathematics and select appropriate teaching models according to core competencies, teaching objectives, and students' learning performances. Alternatively, teachers should design effective teaching activities for different types of learning content, such as facts, concepts, principles, skills, attitudes, etc., and appropriately incorporate digital learning resources and methods.

(2) Teachers should prepare learning content that meets students' needs when preparing lessons after analyzing students' learning experiences, cultural characteristics of ethnic groups, the nature of teaching material, and teaching objectives. In addition, to enhance understanding, coherence, and application of learning, teachers should also plan diverse and appropriate teaching activities to

provide opportunities for students to learn, observe, explore, ask questions, reflect, discuss, create, and solve problems.

(3) To nurture students' talents, teachers should plan appropriate grouping according to students' differences in various aspects, including age, gender, learning level, learning interests, multiple intelligences, physical and mental characteristics, ethnic culture and socioeconomic background, etc. In addition, teachers should treat students of different genders equally and provide them with same learning opportunities by adopting multiple teaching models and providing learning materials and assessment methods that meet different needs. Teachers may also arrange teaching activities for exchange between general classes and special education classes.

(4) To enhance students' learning effectiveness and help them attain skills of self-directed and lifelong learning, teachers should guide students in learning how to learn, including motivational strategies, general learning strategies, mathematics-specific learning strategies, thinking strategies, and meta-cognitive strategies.

(5) Teachers should foster students' curiosity about their surroundings and their ability to actively explore, experience, experiment, seek answers and learn collaboratively.

(6) Vocational high school is an important development stage for cultivating national talents and labor forces. Teachers should incorporate future employment needs into their classes and make appropriate reference to and explain labor rights and regulations. In addition, teachers should teach how to use mathematics to calculate salaries and statistics related to occupational disaster prevention, thus achieving the flexible application of mathematics across fields and aspects.

(7) Mathematics teaching is the training of logical thinking. This training should be applied to real life and even become an important subject for everyone to solve problems at different stages of life. For example, teachers may use family management and aging as an example to plan and calculate family income, expenses, wealth accumulation, etc. demonstrating the application of mathematics in life.

(8) Teachers should not focus solely on the indoctrination of knowledge but on the role of "learning assistant" to help students develop integrated ability to adapt to future social life and solve problems. The introduction of each mathematical

concept should be based on practical examples, outline key points, simplify the complex, draw general conclusions, and provide remedial or extended instructions based on the principle of teaching students according to their aptitudes.

(9) Teachers may guide students to create and reflect through effective teaching activities and strategies such as questioning, discussion, appreciation, presentation, operation, and contextualized experience, and provide students with more opportunities to participate in interaction and practice that strengthen their role in active learning.

(10) Teachers should assign students with diverse, appropriate, and adequate assignments and let students understand meaning and performance benchmarks of the assignments. This is to enhance learning motivation, stimulate thinking and imagination, extend and apply what they've learned, and for them to gain a sense of accomplishment from the assignment feedback.

(11) Teachers should demonstrate to the students about how to use a calculator to perform calculations.

(12) Students are the main subjects of learning. Teachers should focus on students' learning effectiveness and whether they have gained understandings, not just on the completion percentage of progress.

(13) The allocated hours and semesters of the year for implementation listed in this curriculum are for reference only. Teachers may flexibly adjust the sequence of chapters and increase or decrease unit hours as per students' actual needs and learning conditions to ensure that the students may achieve substantial learning results.

4. Teaching Resources

(1) Teachers should make good use of various teaching resources, including various forms of teaching materials books/equipment, resources developed by research institutions, communities, industries, and non-governmental organizations, as well as manpower resources from various sectors.

(2) In response to future trends, teachers should introduce the use of calculators to solve related problems and make good use of various free mathematical drawing apps and computer-aided drawing software on computers, mobile phones, and tablets to strengthen the concept of creating graphs of function.

(3) Teachers should allow students to appropriately use a calculator in their learning and assessment once they are proficient in calculation principles to prevent reduction in learning efficiency resulting from excessively complicated calculations, such as in exponential, logarithmic and trigonometric functions, etc.

(4) Teachers should continuously improve their professional knowledge and students' learning outcomes by engaging in various professional development activities, such as conducting joint lesson preparation, teaching observation and feedback, research and developing curriculum and teaching materials, participating in workshops, arranging special project lectures, field visits, online learning, action research, classroom teaching research, public sharing and exchange, etc., through teaching and researching committees, grade/ year conferences, or self-organized professional learning communities within schools, across schools, or across fields.

(5) Schools may integrate human resources inside and outside school to collaborate in improving curriculum and developing remedial teaching materials and diagnostic tools to improve students learning outcomes.

(6) Parents should adjust the content and methods of family education based on meaning and content of core competencies to help their children acquire core competencies.

5. Learning Assessments

(1) Learning assessments should be a combination of formative and summative assessments and may include diagnostic assessment, placement assessment, or student transition assessment, depending on the actual needs of students.

(2) Teachers should design their learning assessment tools according to their learning assessment needs. The content of the assessment should take into account students' physical and mental development, individual differences, different socioeconomic status/backgrounds/cultures, and content of core competencies. The content need to consider learning performance in different aspects such as cognition, skills, and affection. In addition, teachers should flexibly adjust the depth and breadth of the assessment.

(3) The learning assessment should be diversified. In addition to written tests, teachers should implement various methods including practical tests, discussions, oral quizzes, pop quizzes, assignments, or group reports, and multiple forms such as practical and file assessments according to unit learning objectives. The emphasis should not be placed on written tests.

(4) Learning assessment reports should provide quantitative data and qualitative descriptions to help students and parents understand learning situation. Teachers may include achievement status of student learning goals, learning strengths, participation situation in learning activities, learning motivation and attitudes, etc. in qualitative descriptions.

(5) Teachers should use results and analysis of learning assessments to diagnose students' learning status, adjust accordingly teaching methods and teaching progress, and provide learning support. For students who fall behind, teachers should adjust teaching methods and provide remedial instruction. On the other hand, teachers should provide accelerated, deepened, and expanded learning for students who learn fast

(6) The assessment of core competencies should consider students' life backgrounds and daily experiences or problems, make proper use of local resources, and develop authentic and effective learning assessment tools.

(7) Teachers should focus on the examination of real-life application of knowledge, abilities, and attitudes of the core competencies which will reflect the effectiveness of students' learning or application and provide effective assessment and feedback.

(8) For students to learn how to correctly use tools, teachers should integrate correct concepts in teaching during the curriculum planning during academic performance

assessments and entrance exams, allow students to use rulers, set squares, protractors, compasses, calculators, and other commonly used mathematical tools. To help students develop literacy in proper use of tools, diagrams featured in test questions can be presents as schematic diagrams with labeling.