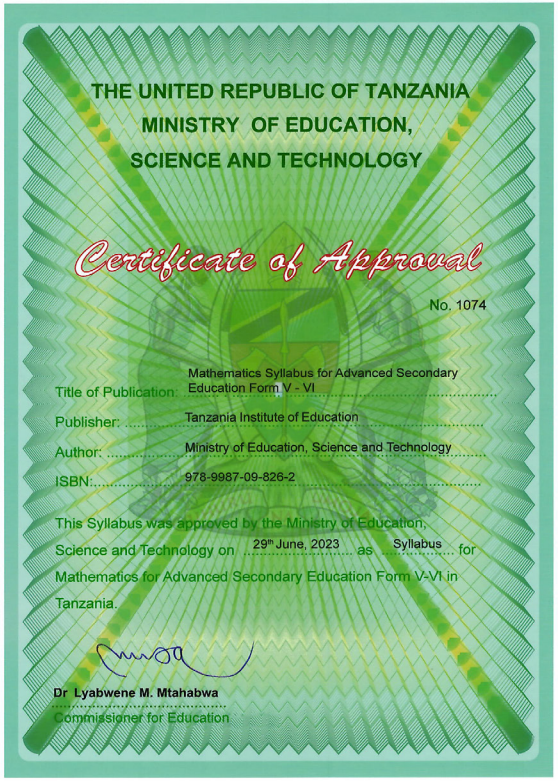
THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY



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Dr Lyabwene M. Mtahabwa
Commissioner for Education

MATHEMATICS SYLLABUS FOR ADVANCED SECONDARY EDUCATION
FORM V-VI
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Table of Contents

List of Tables

Abbreviations and Acronyms

AI	Artificial Intelligence
ICT	Information and Communication Technology
TIE	Tanzania Institute of Education

Acknowledgements

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Dr Aneth A. Komba
Director General
Tanzania Institute of Education

1.0 Introduction

Mathematics for Advanced Secondary Education is a compulsory subject for students who choose to join the Natural Science and Business studies streams taking Mathematics among the subjects in their combinations. The purpose of learning Mathematics is to deepen the students' knowledge, abilities, and capabilities to think rationally, critically, and analytically in order to participate actively in the socio-economic activities. It also builds student's strong understanding of mathematical concepts, principles, skills and its applications in solving real-world problems. Generally, it helps the student to understand how things work or predict how they might change over time and under different circumstances.

This syllabus is designed to guide the teaching and learning of Mathematics at Advanced Secondary Education, Form V-VI, in the United Republic of Tanzania. The syllabus interprets the competences indicated in the 2023 Advanced Secondary Education Curriculum. It provides information that will enable teachers to plan their teaching process effectively. It also provides teaching and learning opportunities that guide teachers to apply different methods and strategies to promote students' mathematical literacy and develop 21st century skills which include communication, collaboration, creativity, critical thinking and problem solving.

2.0 Main Objectives of Education in Tanzania

The main objectives of education in Tanzania are to enable every Tanzanian to:

(a) Develop and improve his or her personality so that he or she values himself or herself and develops self-confidence;
(b) Respect the culture, traditions and customs of Tanzania; cultural differences; dignity; human rights; attitudes and inclusive actions;
(c) Apply science and technology, creativity, critical thinking, innovation, cooperation, communication and positive attitudes for his or her development and the sustainable development of the nation and the world at large;
(d) Understand and protect national values, including dignity, patriotism, integrity, unity, transparency, honesty, accountability and the national language;
(e) Develop life and work-related skills to increase efficiency in everyday life;

(f) Develop a habit of loving and valuing work to increase productivity and efficiency in production and service provision;
(g) Identify and consider cross-cutting issues, including the health and well-being of the society, gender equality, as well as the management and sustainable conservation of the environment; and
(h) Develop national and international cooperation, peace and justice in accordance with the Constitution of the United Republic of Tanzania and international conventions.

3.0 Objectives of Advanced Secondary Education

The Objectives of Advanced Secondary Education are to:

(a) Strengthen, broaden and develop a deeper understanding of the knowledge, skills and attitudes developed at the Ordinary Secondary Education;
(b) Safeguard customs and traditions, national unity, national virtues, democracy, respect for human and civil rights, duties and responsibilities associated with such rights;
(c) Develop self-confidence and the ability to learn in various fields, including science and technology as well as theoretical and technical knowledge;
(d) Improve the use of language in academic communication.
(e) Strengthen accountability for cross-cutting issues, including health, security, gender equality and sustainable environmental conservation;
(f) Develop competence and various skills which will enable the student to employ himself or herself, to be employed and to manage his or her life by exploiting his or her environment well; and
(g) Develop readiness to continue to a college education.

4.0 General Competences for Advanced Secondary Education

The general competences for Advanced Secondary Education are to:

(a) Apply the knowledge and skills acquired in Ordinary Secondary Education to strengthen and broaden academic understanding;

(b) Demonstrate an appreciation of citizenship, national virtues, human rights and civil rights;
(c) Demonstrate confidence in learning various fields, including Science and Technology, theoretical knowledge and vocational education;
(d) Use language skills in academic communication;
(e) Apply knowledge of cross-cutting issues to master the surrounding environment;
(f) Use knowledge and skills to enable a student to employ oneself, be employed as well as manage life and his/her environment; and
(g) Demonstrate readiness to proceed to the next level of education.

5.0 Main and Specific Competences

The main and specific competences to be developed are indicated in Table 1.

Table 1*: Mathematics Subject Competences for Form V-VI*

Main Competences	Specific Competences
1.0 Demonstrate mastery of some advanced concepts in Mathematics	1.1 Demonstrate an advanced understanding of knowledge and skills in Mathematics 1.2 Demonstrate basic understanding of calculus 1.3 Demonstrate an advanced understanding of statistics
2.0 Demonstrate mastery of set theory and logic	2.1 Demonstrate an advanced understanding of set theory and logic
3.0 Demonstrate mastery of advanced algebra	3.1 Demonstrate an advanced understanding of algebra
4.0 Conduct a project in Mathematics	4.1 Carry out a project in Mathematics

6.0 Roles of Teachers, Students and Parents in Teaching and Learning Process

A good relationship between a teacher, student and parent or guardian is fundamental in ensuring successful learning. This section outlines the roles of each participant in facilitating effective teaching and learning of Mathematics for Advanced Secondary Education.

6.1 The teacher

The teacher is expected to:

(a) Help the student to learn and acquire the intended competencies in Mathematics for Advanced Secondary Education.

(b) Use teaching and learning approaches that will allow student with different needs and abilities to:
   (i) Develops the competencies needed in the 21st century; and
   (ii) Actively participate in the teaching and learning process.

(c) Use student centred instructional strategies that make the student a centre of learning which allow them to think, reflect and search for information from various sources.

(d) Create a friendly teaching and learning environment.

(e) Prepare and improvise teaching and learning resources.

(f) Conduct formative assessment regularly by using tools and methods which assess theory and practice.

(g) Treat all the students equally irrespective of their differences.

(h) Protect the student while at school.

(i) Keep track of the student's daily progress.

(j) Identify individual student's needs and provide the right intervention.

(k) Involve parents/guardians and the society at large in the student's learning process.

(l) Integrate cross-cutting issues and ICT in the teaching and learning process.

6.2 The student

The student is expected to:

(a) Develop the intended competences by participating actively in various learning activities inside and outside the classroom;

(b) Actively engage in the teaching and learning process; and

(c) Participate in the search for knowledge from various sources, including textbooks, reference books and other publications in online libraries.

6.3 The parent

The parent/guardian is expected to:

(a) Monitor the child academic progress in school;

(b) Where possible, provide the child with the needed academic support;

(c) Provide the child with a safe and friendly home environment which is conducive for their learning;

(d) Keep track of the child progress in behaviour;

(e) Give the child all necessary materials required in the learning process; and

(f) Instil in the child a sense of commitment and positive value towards education and work.

7.0 Teaching and Learning Methods

The teaching and learning methods are instrumental in developing student's competences. This syllabus suggests teaching and learning methods for each activity which includes but not limited to discussions, presentations, field visits, practical work, research, scientific experiments, and project works. However, a teacher is advised to plan and use other appropriate methods based on the environment or context. All the teaching and learning methods should be integrated with the everyday lives of students.

8.0 Teaching and Learning Resources

The process of teaching and learning requires different resources. In that regard, both the teacher and students should work together to collect or improvise alternative resources available in the school and home environment when needed. The teacher and student are expected to constantly seek for information from various sources to facilitate teaching and learning process. The list of approved textbooks and reference books shall be provided by TIE.

9.0 Assessment of the Learning Process

Assessment is important in teaching and learning of Mathematics subject. It is divided into formative and summative assessments. Formative assessment informs both the teacher and students on the progress of teaching and learning, and in making decisions on improving the teaching and learning process. Teachers are, therefore, expected to apply a wide range of formative assessment methods which include but not limited to discussions, presentations, oral questions, experiments, observations, practical and projects.

Summative assessment, on the other hand, will focus on determining student's achievement of learning. Teachers are expected to use a variety of summative assessments including mid-term tests, terminal, mock examinations and projects. The scores obtained from these assessments will be used as Continuous Assessment (CA). Therefore, the continuous assessments shall contribute 30% and the National Form VI Examination shall be 70% of the student's final achievement, as indicated in Table 2.

Table 2: *Contribution of Continuous Assessment and National Examination in the final score*

Type of Assessment	Form V	Form VI
First Term Examination	5%	6%
Second Term Examination	5%	-
Project	-	7%
Mock Examination	-	7%
National Examination	-	70%
Total	**100%**	

10.0 Number of Periods

This syllabus provides estimates of the time that will be spent in teaching and learning in consideration of the complexity of the specific competencies and the learning activities. Ten periods of 40 minutes each have been allocated for this subject per week.

11.0 Teaching and Learning Contents

The contents of this syllabus are presented in matrix form with seven columns which include main competences, specific competences, learning activities, suggested methods, assessment criteria, suggested resources, and number of periods as presented in Table 3 - 4.

Form V

Table 3: *Detailed Content for Form V*

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1. Demonstrate mastery of some advanced concepts in Mathematics	1.1 Demonstrate an advanced understanding of knowledge and skills in Mathematics	(a) Explore advanced tenets of functions (*polynomials, rational, composite, exponential, and logarithmic*)	**Exploration:** Individually or in groups, allow students to explore tenets of functions through function simulations, relevant books and through series of discussions and sharing of findings	Advanced tenets of functions are adequately explored	Scientific Calculator, Mathematical software such as Maple, GeoGebra, MATLAB, Mathematica, and AI tools	110
		(b) Explore advanced tenets of linear programming (*transportation: two sources and two destinations,*	**Group discussion**: In groups, students discuss how to formulate transportation problems and transform into a	Advanced tenets of linear programming are properly explored		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		two sources and three destinations)	mathematical model (*two sources and two destinations, two sources and three destinations*) **Skills lab**: In groups, allow students to explore various steps of determining solutions for transportation problems graphically			

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Explore advanced tenets of coordinate geometry (*angle between two lines, perpendicular distance, locus of a moving point, ratio theorem, and equations of a circle*)	**Scenario:** Guide students to formulate a scenario which lead them to investigate the angle between two lines **Group discussion**: In groups, the students discuss how to find perpendicular distance and locus of a moving point **Snow-balling**: In groups, students discuss how to find equations of a circle and how to use the ratio theorem	Advanced tenets of coordinate geometry are clearly explored	Geometrical figures, marker pens, ruler mathematical set, scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, and AI tools	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d)Explore advanced tenets of trigonometry (*ratios, small angles, compound angles and factor formulae, trigonometric functions, trigonometric equations, inverse trigonometric functions, graphs of inverse trigonometric functions, domain, and range*)	**Scenario:** Formulate a scenario which lead students to explore various ratios of trigonometry **Case study:** Formulate a case study and through it guide students to approximate small angles, derive and apply compound angles formulae **Gallery walk**: In groups, students discuss how to derive and apply factor formulae. Allow each group to post their findings and other groups walk through, note and discuss in the class	Advanced tenets of trigonometry are adequately explored	Marker pens, ruler, mathematical set, scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, and AI tools	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Think-Ink-Pair-Share: Allow students to discuss the concept of trigonometric functions, trigonometric equations and inverse trigonometric functions **Skills Lab:** In groups, students discuss how to draw the graphs of inverse trigonometric functions and identify domain and range			

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	1.2 Demonstrate basic understanding of calculus	(a) Explore basic tenets of differentiation (*first principles, power rule, chain rule, product rule, quotient rule, and partial derivatives*)	**Scenario:** Provide scenario which lead students to derive and apply the first principles **Exploration**: In groups, students discuss and explore application of power and chain rules **Group discussion**: In groups, the students discuss how to derive and apply product and quotient rules **Jigsaw**: Guide students through jigsaw, to find partial derivatives of functions	Basic tenets of differentiation are properly explored	Mathematical software such as Maple, Geogebra, MATLAB, and AI tools	90

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b)Determine the nature of stationary points, rates of change between quantities, small changes in quantities, and series expansions of different functions	**Scenario:** Through relevant scenarios guide students to determine the nature of stationary points **Project:** In groups, students visit nearby water dam reservoirs and search for information on the rates of change between quantities and small changes in quantities **Gallery walk**: In groups, students discuss how to derive and apply series expansions of different functions and results around the classroom	The nature of stationary points, rates of change between quantities, small changes in quantities, and series expansions of different functions are properly determined		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Explore basic tenets of integration (*by parts, substitution method, and partial fractions*)	**Skills lab:** In groups, students discuss how to derive and apply integration by parts **Role play and Simulation:** Guide students to explore various substitution methods in integrating functions **Think-Ink-Pair-Share:** In groups, students discuss how to integrate functions which involves partial fractions	Basic tenets of integration are adequately explored		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Determine the area enclosed by a curve, volume of a solid of revolution, and length of an arc	**Jigsaw**: Guide students through jigsaw, to determine the area enclosed by a curve and volume of a solid of revolution **Group discussion**: In groups, students discuss how to find the length of an arc	The area enclosed by a curve, volume of a solid of revolution, and length of an arc are properly determined	Mathematical set, scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, and AI tools	
2. Demonstrate mastery of set theory and logic	2.1 Demonstrate an advanced understanding of set theory and logic	(a) Explore advanced tenets of set theory (*operations, expressions, and cardinality*)	**Brainstorming:** Guide students to brainstorm basic operations of sets **Snow-balling:** In groups, students discuss how to simplify set expressions and determine cardinality of sets	Advanced tenets of set theory are adequately explored	Real objects, pictures, playing cards, manila papers, marker pen, coloured, and chalks	56

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Use knowledge of sets to organise, create, and categorise objects	**Field trip:** In groups, students visit nearby real environments and search for different categories of objects **Group discussion**: In groups, students discuss how to use knowledge of sets to organise, create, and categorise objects	The knowledge of sets to organise, create, and categorise objects is properly used		
		(c) Explore basic tenets of logic (*connectives, propositions, arguments, and electrical networks*)	**Think-Ink-Pair-Share:** In groups, students discuss logical connectives, and laws of algebra of propositions	Basic tenets of logic are adequately explored	Logical argument Charts, switches, dry cells, water pipes, and logic networks animations	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Brainstorming: Guide students to brainstorm the meaning of arguments and electrical network			
		(d) Use logic to analyse arguments and construct circuit diagrams	**Group discussion**: In groups, students discuss how to analyse arguments and construct circuit diagrams	Arguments and circuit diagrams in logic are analysed adequately		
3. Demonstrate mastery of advanced algebra	3.1 Demonstrate an advanced understanding of algebra	Explore advanced tenets of algebra (*series of squares and cubes of natural numbers, roots, quadratic*	**Think-Ink-Pair-Share:** In groups, students discuss how to formulate the series of squares and cubes of natural numbers	Advanced tenets of algebra are properly explored	Scientific calculators, Mathematical software such as Maple, GeoGebra, MATLAB, and AI tools	94

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		and rational inequalities, 3x3 *matrices, partial fractions, mathematical induction, and binomial theorem*)	**Jigsaw**: Guide students through jigsaw, to discuss roots of polynomial functions, solution of quadratic and rational inequalities **Group discussion**: In groups, students discuss 3x3 matrices, partial fractions, proof by mathematical induction, and binomial theorem and expansion			
4. Conduct a project in Mathematics	4.1 Carry out a project in Mathematics	Carry out a project to solve a problem using mathematical skills	**Project:** In groups, students design and carry out a project to solve a problem using mathematical skills	A project has been carried out by using various mathematical knowledge and skills	Calculator, Mathematical software such as MATLAB, Maple, Mathematica, and field reports	

Form VI

Table 4: *Detailed Syllabus Content for Form VI*

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1. Demonstrate mastery of some advanced concepts in Mathematics	1.1 Demonstrate an advanced understanding of knowledge and skills in Mathematics	(a) Explore the basic tenets of hyperbolic functions (*definition, conversion into logarithmic form, series of hyperbolic cosine and sine functions, derivatives and integration*)	**Think-Ink-Pair-Share:** In groups, students define hyperbolic functions and convert hyperbolic functions into logarithmic form **Group discussion**: In groups, students discuss the series of expansion of hyperbolic cosine and sine functions, derivatives and integration. Allow some groups to present their findings to other students	Basic tenets of hyperbolic functions are adequately explored	Scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, Mathematica, animations, and AI tools	170

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Explore the basic tenets of probability theory (*counting principles, independent and dependent events, probability distributions*)	**Think-Ink-Pair-Share:** In groups, students discuss the concepts of counting principles, independent events, and dependent events **Jigsaw:** Guide students through jigsaw, to discuss the concept of probability distributions. Ask them to present their findings	The principles, axioms, theorems, and concepts of probability are properly explained	Coins, die, marble, coloured objects, games, playing cards, scientific calculators. animations, and AI tools	
		(c) Determine the probability of an event, expectation, variance, and standard deviation of random variables	**Group discussion**: In groups, students discuss the concepts of probability of an event, expectation, variance, and standard deviation	The probability of an event, expectation, variance, and standard deviation of		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			of random variables. Let students present their findings in the whole class for more inputs	random variables are clearly determined		
		(d) Explore the basic tenets of first and second order differential equations (*linearity, degree, order, formulation, solutions, homogeneity, separability, and exactness*)	**Think-Ink-Pair-Share:** In groups, students discuss the linearity, degree, order, and formulation of differential equations **Snow-balling:** In groups, students to discuss how to determine the solutions, linearity, homogeneity, separability, and exactness of differential equations	Basic tenets of first and second order differential equations are properly explored	Scientific calculators, animations, AI tools, Mathematical software such as Maple, Geogebra, MATLAB, and Mathematica	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Use differential equations to solve real life problems related to growth (*decay, cooling of bodies, falling bodies, electrical circuits, and vibrating springs*)	**Group discussion**: In groups, students discuss how to solve problems related to growth, decay, cooling of bodies, falling bodies, electrical circuits, and vibrating springs. Allow some groups to presents in the class for more inputs	Problems related to growth, decay, cooling of bodies, falling bodies, electrical circuits, and vibrating springs are adequately solved using differential equations		
		(f) Explore the basic tenets of numerical methods (*errors*, *secant method, Newton-Raphson method, trapezoidal rule, and Simpson's rule*)	**Skills lab** In groups, students discuss the concepts of errors, secant method, and Newton-Raphson method	Basic tenets of numerical methods are properly explored	Scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, Mathematica, animations, and AI tools	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Group discussion: In groups, students discuss on how to derive and apply trapezoidal rule and Simpson's rule to evaluate definite integrals			
		(g) Explore advanced tenets of coordinate geometry (*parabola, ellipse, hyperbola, and polar coordinates*)	**Group discussion**: In groups, students discuss and present the concepts of parabola, ellipse, and hyperbola **Gallery walk**: In groups, students discuss how to convert polar equations and draw graphs of polar coordinates. Ask students to display their findings for others to view and comment	Advanced tenets of coordinate geometry are adequately explored	Graph papers, geometrical models, Geoboards, animations, AI tools, Mathematical software such as Maple, Geogebra, MATLAB, and Mathematica	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			ICT based learning: In groups, students discuss how to draw graphs of polar coordinates using software			
		(h) Explore advanced tenets of vectors (*ratio theorems, dot product, cross product, vector differentiation, and vector integration*)	**Think-Ink-Pair-Share:** In manageable groups, students discuss ratio theorems, dot product, and cross product	Advanced tenets of vectors are clearly explored	Scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, Mathematica, and AI tools	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Group discussion: In manageable groups, students discuss on how to differentiate and integrate vector functions			
		(i) Use vectors to solve problems related to displacement, velocity, and acceleration of a particle, work done by forces, and projection of vectors	**Group discussion**: In manageable groups, students discuss and present how to solve problems related to displacement, velocity, and acceleration of a particle, work done by forces, and projection of vectors	Problems related to displacement, velocity, and acceleration of a particle, work done by forces, and projection of vectors are solved using vectors		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(j) Explore the basic tenets of complex numbers (*modulus, argument, Argand diagram, polar form, De Moivre's theorem* and *Euler's formula*)	**Gallery walk**: In groups, students discuss and display how to find modulus and argument of complex numbers and draw graphs on the Argand diagram **Group discussion**: In groups, students discuss concepts of polar form, De Moivre's theorem, and Euler's formula	Basic tenets of complex numbers are clearly explored	Scientific calculators, Mathematical software such as Maple, Geogebra, MATLAB, Mathematica, animations, and AI tools	
	1.2 Demonstrate an advanced understanding of statistics	Explore advanced tenets of statistics (*measures of central tendency and dispersion: mean, variance and standard deviation by coding method, quartiles, and percentiles*)	**Skills lab** In groups, students discuss how to find the measures of central tendency and dispersion, mean, variance and standard deviation by coding method	Advanced tenets of statistics are adequately explored	Collected data, graph papers, scientific calculators, Mathematical software such as Maple, Geogebra, and MATLAB	126

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Think-Ink-Pair-Share: In groups, students discuss how to determine the quartiles and percentiles of the grouped data			
2. Conduct a project in Mathematics	2.1 Carry out a project in Mathematics	Complete the project started in Form Five and submit the report for assessment	**Project:** In groups, students complete the project started in Form Five and submit the report	Project is completed according to the criteria and the report is submitted	Calculator, Mathematical software such as MATLAB, Maple, Mathematica, and field reports	54

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