



آغا خان یونیورسٹی ایگزامینیشن بورڈ
AGA KHAN UNIVERSITY EXAMINATION BOARD

Secondary School Certificate
Examination Syllabus

Mathematics

(Humanities Group)

Grades IX - X

(Based on New National Curriculum 2022-2023)

Published by
Aga Khan University Examination Board
Block - C, IED - PDC, 1-5/B-VII
Federal B. Area, Karimabad, Karachi, Pakistan

Latest revision: June 2025

© The Aga Khan University Examination Board, 2025

All rights and entitlements reserved.

This syllabus is developed by Aga Khan University Examination Board for distribution to all its affiliated schools only. No part of this syllabus may be copied, reproduced or used for any other purpose whatsoever without prior written permission of the Aga Khan University Examination Board.

**Secondary School Certificate
Examination Syllabus**

**MATHEMATICS
(HUMANITIES GROUP)
GRADES IX-X**

**This syllabus will be examined in both
Annual and September Examination sessions from
Annual Examinations 2026 for Grade IX and Annual
Examinations 2027 for Grade X**

Table of Contents	Page No.
Preface	5
Understanding of AKU-EB Syllabi	7
Subject Rationale of AKU-EB Mathematics (Humanities Group)	8
Student Learning Outcomes of AKU-EB SSC Mathematics (Humanities Group) Syllabus	10
Scheme of Assessment	40
Acknowledgements	43

For queries and feedback

Address: Aga Khan University Examination Board
Block - C, IED - PDC, 1-5/B-VII
Federal B. Area, Karimabad, Karachi, Pakistan

Phone: (92-21) 3682-7011-8

E-mail: examination.board@aku.edu

Website: <http://examinationboard.aku.edu>

Facebook: <https://www.facebook.com/AKUEBOfficial>

Linktree: <https://linktr.ee/akuexamboard>

Preface

Established in 2002 through the Pakistan government's ordinance, the Aga Khan University Examination Board (AKU-EB) is country's first private autonomous qualification awarding body for Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSSC). Its vision is to be a model of excellence and innovation in education in Pakistan and the developing world.

AKU-EB achieves its vision by developing examination syllabi which inculcate conceptual thinking and higher order learning and is aligned with the National Curriculum and mapped with provincial curricula and international standards. AKU-EB revises its syllabi periodically to support the needs of students, teachers and society.

The aims of the syllabus review of SSC and HSSC are to:

- Ensure continued compatibility with the goals of the National Curriculum of Pakistan.
- Review the content for inclusion of new knowledge and deletion of obsolete knowledge.
- Review the content for clarity and relevance as per the changing needs of students, teachers and society.
- Enhance and strengthen continuation and progression of content both within and across grades IX - XII (SSC and HSSC).
- Ensure the readiness of students for higher education.

During the syllabus review, the needs of all the stakeholders were identified through a needs-assessment survey. Students and teachers of AKU-EB affiliated schools from across Pakistan participated in the survey. Thereafter, a revision panel, which consisted of examiners, teachers of affiliated and non-affiliated schools, teacher trainers and university academicians, reviewed and revised the syllabus following a planned, meticulous and standardised syllabi review process.

The development of the revised syllabus has been made possible by the creativity and relentless hard work of Curriculum and Examination Development unit and the constant support provided our Principal Syllabus Reviewers, Syllabus Revision Panellists and all other reviewers for their contribution. We are also thankful to all the students and teachers who took part in the needs-assessment survey and to the principals of AKU-EB affiliated schools who made this endeavour possible by facilitating and encouraging their teachers and students to be a part of the survey and the syllabus revision panel.

With your support and collective hard work, AKU-EB has been able to take the necessary steps to ensure effective implementation of the National Curriculum of Pakistan through this syllabus. We are confident that this syllabus will continue to provide the support that is needed by students to progress to the next level of education and we wish the very best to our students and teachers in implementing this syllabus.



Dr Naveed Yousuf
Chief Executive Officer (CEO), Aga Khan University Examination Board
Associate Professor of Practice, Educational Development, Faculty of Health Science, Aga Khan University

FOR ANNUAL EXAMINATION 2026 AND ONWARDS

Understanding of AKU-EB Syllabi

1. The AKU-EB syllabi guide the students, teachers, parents and other stakeholders regarding the topics that will be taught and examined in each grade (IX, X, XI and XII). In each syllabus document, the content progresses from simple to complex, thereby, facilitating a gradual, conceptual learning of the content.
2. The topics of the syllabi are divided into subtopics and **student learning outcomes (SLOs)**. The SLOs define the depth and the breadth at which each topic or sub-topic will be taught, learnt and examined. The syllabi also provide enabling SLOs where needed to scaffold student learning.
3. Each SLO starts with an achievable and assessable **command word** such as describe, relate, evaluate, etc. The purpose of the command words is to direct the attention of teachers and students to specific tasks that the students are expected to undertake in the course of their studies.
4. The SLOs are classified under the following cognitive levels of Bloom's Taxonomy: Remember (R), Understand (U), Apply and beyond [Apply (A), Analyse (An), Evaluate (E), Create (C)]. This is to facilitate effective planning for teaching, learning and assessment. In addition, some SLOs are identified as Formative Assessments (FA), where applicable.
5. The **Examination Specification** is provided which elucidates the weightage of each topic in the examinations determined on the basis of the content as well as the relevance of the topic.
6. To implement this syllabus, students and teachers can take support from additional material provided by the board to its affiliated schools including **Learning Resource Guides, Pacing Guides and Model Papers**.
7. The AKU-EB syllabi for Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSSC) are designed to foster not only conceptual understanding but also critical thinking and problem-solving skills. These syllabi ensure students develop the cognitive, affective and psychomotor skills essential for success at the university and beyond.

Subject Rationale of AKU-EB Mathematics (Humanities Group)

Why study Mathematics?

Mathematics offers far more than just formulae and equations. It fosters critical thinking, logical reasoning, and problem-solving skills that are invaluable in every aspect of life. Whether you are embarking on a career in science, technology, finance, or even the arts, mathematics equips you with the tools and mindset to analyse, interpret, and innovate. This essential discipline opens doors to countless opportunities, empowering you to face life's challenges with confidence and clarity.

What will you learn in AKU-EB Mathematics Compulsory?

Mathematics is an empowering and versatile tool that drives success across a vast array of fields, from science, engineering, and technology to economics, psychology, and beyond. It equips you with invaluable skills; critical thinking, problem-solving, and logical reasoning, that are essential for thriving in today's world. By mastering mathematics, you unlock endless opportunities and develop the core abilities needed to excel in any endeavour. Most of the school-going students understand the use of basic math in daily life.

Mathematics is essential for careers in data science, finance, and engineering, and it enhances cognitive abilities, creativity, and decision-making. It also prepares you for complex challenges, both professionally and in everyday life, by teaching persistence and resilience.

In mathematics, you are mastering the art of problem-solving through systematic and critical thinking. The key is to take a complex problem and break it down into simpler, more solvable components. This method of reduction and logical reasoning can be applied to tackle any real-world challenge.

The current National Curriculum of Pakistan covers a wide array of topics that provide a deep conceptual understanding of Mathematics. The AKU-EB syllabus of Mathematics has enhanced it further by making conceptual connections between the topics.

The AKU-EB Mathematics syllabus focuses on developing understanding, mathematical skills and logical thinking. It helps improve students' ability to apply their content knowledge in new and unexpected situations, rather than focusing on rote learning. This is particularly evident in the application of theorems, where students are not simply memorising and reciting them, but learning how to apply them effectively.

Where will it take you?

The AKU-EB syllabus of Mathematics (Humanities Group) will provide a conceptual basis for higher studies in many subjects. For those who pursue Mathematics (Humanities Group) in higher studies, wide career opportunities are available such as the role of:

- Actuary
- Banker
- Musician
- Fashion Designer
- Graphic Designer (Creating 3D and 2D animations)
- Data Scientist & Analyst
- Finance Officer
- Artificial Intelligence Engineers

How to approach the syllabus?

The AKU-EB syllabi is carefully designed with a reader-friendly approach to ensure that students and teachers can easily comprehend it, making it functional for teaching, learning and assessment purposes. The syllabus includes following parts:

Subject Rationale	It is an introductory document for students.
Student Learning Outcomes (SLOs)	These guides regarding the details about what has to be achieved.
Exam Specification	It guides regarding what is expected in the examination.
Additional Resources:	
Pacing Guide	It ensures smooth transition and curricular continuity of a school's academic year. It also predicts the time and pace of syllabi implementation.
Resource Guide	It includes teaching and learning resources for students and teachers.
Model Paper	It guides regarding exam pattern, types of questions and marking scheme.
Command Word Guide	It clarifies expectations regarding the cognitive levels and skills that should be acquired by the students and which are assessed in its examinations.

Student Learning Outcomes of AKU-EB SSC Mathematics (Humanities Group) Syllabus

Part I (Grade IX)

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level ¹		
		R	U	A and beyond
1. Real Numbers	Students should be able to:			
1.1 History of Numbers	1.1.1 explain, with examples, that civilisations throughout history have systematically studied living things e.g., the history of numbers from sumerians and its development to the present arabic system;		FA ²	
1.2 Real Numbers	1.2.1 describe terminating and non-terminating (recurring and non-recurring) decimal as rational and irrational numbers;		*	
	1.2.2 identify the set of real numbers as a union of sets of rational and irrational numbers;		*	
1.3 Properties of Real Numbers	1.3.1 identify the properties of real numbers (closure, commutative, associative, identities, inverse, distributive properties);		FA	
1.4 Radicals and Radicands	1.4.1 identify radicals and radicands;		*	
	1.4.2 convert radical form to exponential form and vice versa;			A
1.5 Laws of Exponents/ Indices	1.5.1 apply the laws of exponents to simplify expressions with real base and exponents: $x^m \cdot x^n = x^{m+n}$, $(xy)^m = x^m y^m$, $(x^m)^n = x^{mn}$, $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$, where $y \neq 0$, $y^0 = 1$, $\frac{x^m}{x^n} = x^{m-n}$, where $x \neq 0$.			A

¹R = Remember, U = Understand, A = Application and beyond [Apply (Ap), Analyse (An), Evaluate (E), Create (C)]

²FA= Formative Assessment, not to be assessed under examination conditions.

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
2. Logarithms	Students should be able to:			
2.1 Scientific Notation	2.1.1 convert a number in ordinary form (common form) to scientific notation and vice versa;			A
2.2 Logarithms	2.2.1 convert logarithmic form into exponential form and vice versa: (i.e., $a^x = y \leftrightarrow \log_a y = x$, $a > 0$, $y > 0$ and $a \neq 1$);			A
	2.2.2 solve problems related to SLO 2.2.1;			A
2.3 Laws of Logarithms	2.3.1 describe the following laws of logarithms: a. $\log_a (mn) = \log_a m + \log_a n$, b. $\log_a \left(\frac{m}{n}\right) = \log_a m - \log_a n$, c. $\log_a m^n = n \log_a m$, d. $\log_m n = \frac{\log_a n}{\log_a m}$, where $a > 0$, $a \neq 1$;		*	
2.4 Application of Logarithms	2.4.1 solve problems using the given laws of logarithm (without using log and antilog tables) in SLO 2.3.1.			A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
3. Sets Theory	Students should be able to:			
3.1 Explore the Foundations of Mathematics	3.1.1 describe mathematics as the study of pattern, structure, and relationship;		FA	
3.2 Operations on Sets (Revision)	3.2.1 identify the sets denoted by N, Z, W, O, P, Q and by other symbols;		*	A
	3.2.2 solve problems using the following operations on sets: a. union, b. intersection, c. difference, d. symmetric difference, e. complement;			
3.3 Properties of Union and Intersection	3.3.1 describe the following fundamental properties of union and intersection of two or three sets: a. commutative property of union, b. commutative property of intersection, c. associative property of union, d. associative property of intersection, e. distributive property of union over intersection, f. distributive property of intersection over union, g. De Morgan's laws;		*	
3.4 Venn Diagram	3.4.1 draw Venn diagrams to represent: a. union and intersection of sets, b. difference of sets, c. complement of a set, d. symmetric difference of sets;			A
	3.4.2 apply properties/ laws of union and intersection to solve problems using Venn diagram of: a. two distinct and overlapping sets;			A

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
	3.4.3	apply properties/ laws of union and intersection to solve problems using Venn diagram of: a. three overlapping sets;			FA
3.5 Application of Sets Theory	3.5.1	apply concepts of set theory up to three overlapping sets to solve world problems;			FA
3.6 Ordered Pairs and Cartesian Product	3.6.1	describe ordered pairs and Cartesian product;		*	A
	3.6.2	solve problems based on ordered pairs and Cartesian product;			
3.7 Binary Relation	3.7.1	describe a binary relation;		*	A
	3.7.2	find the domain and range of a binary relation.			

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
4. Functions and Graphs	Students should be able to:			
4.1 Functions	4.1.1 define function; 4.1.2 identify: a. into function, b. into and one-one function (injective function), c. onto function (surjective function), d. one-one and onto function (bijective function); 4.1.3 describe the concept and notation of a function, its domain, codomain and range; 4.1.4 determine the value of a function for given values of dependent and independent variables; 4.1.5 apply concepts from functions to real world problems; 4.1.6 interpret the functions mentioned in SLO 4.1.2;	*	*	A FA An
4.2 Inverse Functions	4.2.1 describe the inverse of a function and its notation; 4.2.2 find the inverse of a function and its domain and range;		*	A
4.3 Composition of Functions	4.3.1 describe the composition of functions and its notation; 4.3.2 write composite functions as defined by $g(f(x)) = f(g(x))$;		*	A
4.4 Graphical Representations	4.4.1 plot graphs of a constant functions, identity function, linear function and absolute valued functions; 4.4.2 apply concepts of absolute valued functions to real world problems.			FA FA

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
5. Factorisation	Students should be able to:				
5.1 Algebraic Identities (Revision)	5.1.1	apply the following algebraic identities to solve problems: a. $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$, b. $(a + b)^2 - (a - b)^2 = 4ab$, c. $(a + b)(a - b) = a^2 - b^2$, d. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$;			A
5.2 Factorisation	5.2.1	factorise the expression of the following types: a. $ka + kb + kc$, b. $ac + ad + bc + bd$, c. $a^2 \pm 2ab + b^2$, d. $a^2 - b^2$, e. $a^2 \pm 2ab + b^2 - c^2$, f. $ax^2 + bx + c$;			A

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
5.3 Remainder Theorem	5.3.1	define zeros of a polynomial;	*		
	5.3.2	solve the expression to find the remainder using remainder theorem; (Note: when a polynomial of degree up to 4 is divided by polynomial of degree up to 2)			A
5.4 Factorisation of a Cubic Polynomial	5.4.1	apply factor theorem to: a. factorise a cubic polynomial, b. find zeros of a polynomial;			A
	5.4.2	apply concepts of remainder and factor theorem to solve problems.			A

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
6. Algebraic Manipulation	Students should be able to:				
6.1 Highest Common Factor and Least Common Multiple	6.1.1	determine the highest common factor (H.C.F.) and the least common multiple (L.C.M.) of algebraic expressions using factorisation;			A
	6.1.2	apply H.C.F., L.C.M. and their relationship in solving problems;			A
6.2 Algebraic Fraction	6.2.1	describe rational expressions;		*	
	6.2.2	simplify algebraic fractional expressions or rational expressions involving basic operations of $+$, $-$, \times , \div ;			A
6.3 Square Root of Algebraic Expressions	6.3.1	calculate square root of algebraic expressions by: a. factorisation, b. division;			A
6.4 Partial Fractions	6.4.1	distinguish between proper and improper rational fractions;		*	
	6.4.2	convert an algebraic fraction into partial fractions when its denominator consists of: a. non-repeated linear factors, b. repeated linear factors;			A
	6.4.3	represent an algebraic fraction into partial fractions when its denominator consists of non-repeated quadratic factors.			A

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
7. Linear Equations and Inequalities	Students should be able to:				
7.1 Linear Equations and Radical Equations	7.1.1	define linear equation in one variable;	*		
	7.1.2	solve linear equation with real coefficients;			A
	7.1.3	solve problems based on linear equations;			A
	7.1.4	solve radical equations reducible to linear form;			A
	7.1.5	verify the solution (discarding extraneous roots);			E
7.2 Equations involving Absolute Value	7.2.1	define absolute valued functions in one variable;	*		
	7.2.2	solve equations involving absolute valued functions in one variable;			A
7.3 Linear Inequalities	7.3.1	define inequalities: a. less than ($<$), b. greater than ($>$), c. less than or equal (\leq), d. greater than or equal (\geq);	*		
	7.3.2	solve linear inequalities with real coefficient, in one and two variables and represent the solution on the number line;			A
	7.3.3	solve absolute valued inequalities in one variable and represent the solution on the number line;			A
	7.3.4	plot linear inequality with two variables on graph;			FA
	7.3.5	solve two linear inequalities with two variables graphically;			FA
	7.3.6	interpret the regions in the plane that are bounded by two linear inequalities involving two variables.			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
8. Vectors	Students should be able to:			
8.1 Introduction of Vector	8.1.1 describe rectangular coordinate system in plane; 8.1.2 describe magnitude of a vector, equal vectors, negative of a vector, unit vector, zero/ null vector, position vector, parallel vectors; 8.1.3 determine magnitude of a vector; 8.1.4 represent translation by a vector; 8.1.5 represent vectors as directed line segment;		*	A A A
8.2 Vectors in a Plane	8.2.1 explain addition and subtraction of vectors; 8.2.2 explain multiplication of a vector by a scalar; 8.2.3 apply the concepts given in SLOs 8.2.1 and 8.2.2 of two vectors geometrically; 8.2.4 represent a vector in a Cartesian plane by describing the fundamental unit vectors i and j ; 8.2.5 apply concepts from geometrical problems involving the use of vectors (such as parallel and perpendicular lines in geometrical shapes).		*	A A FA

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
9. Introduction to Coordinate Geometry	Students should be able to:				
9.1 Distance Formula	9.1.1	describe coordinate geometry;		*	
	9.1.2	explain distance formula by locating the position of two points in coordinate plane;		*	
	9.1.3	determine the distance between two given points;			A
9.2 Midpoint Formula	9.2.1	calculate the midpoint of a line segment;			A
	9.2.2	solve word problems related to midpoint formula;			A
9.3 Gradient of a Straight Line	9.3.1	explain inclination and gradient of a line;		*	
	9.3.2	determine the gradient of a straight line: a. when coordinates of two points are given, b. when inclination is given;			A
	9.3.3	determine the gradient of: a. parallel lines, b. perpendicular lines;			A
9.4 Standard Form of Equation of a Straight Line	9.4.1	describe equation of a straight line in: a. slope-intercept form, b. point-slope form;		*	
	9.4.2	convert the general form of the equation of a straight line into the form mentioned in SLO 9.4.1(a);			A
	9.4.3	determine the x and y intercepts from the given linear equation;			A
9.5 Application of Coordinate Geometry	9.5.1	apply the concepts of coordinate geometry to real world problems.			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
10. Loci	Students should be able to:			
10.1 Locus	10.1.1 define locus; 10.1.2 describe simple loci of points in two dimensions; 10.1.3 explain the locus of points under the given conditions: a. at a given distance from a given point, b. at a given distance from a given straight line, c. equidistant from two given points, d. equidistant from two given intersecting straight lines;	FA	FA FA	
10.2 Application of Loci	10.2.1 solve problems using the method of intersecting loci for sets of points in two dimensions which are mentioned in SLO 10.1.3.			FA

FOR ANNUAL EXAMINATIONS

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
11. Logic	Students should be able to:			
11.1 Logic	11.1.1 differentiate between a mathematical statement and its proof; 11.1.2 differentiate between an axiom, conjecture and theorem; 11.1.3 formulate simple deductive proofs [algebraic proofs that require showing the LHS to be equal to the RHS].		FA FA	FA

FOR ANNUAL EXAMINATION 2026

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
12. Similar Figures	Students should be able to:			
12.1 Similar Figures	12.1.1 describe the conditions for the following polygons and solids to be similar: a. triangle, b. square and rectangle, c. cube and cuboid, d. semi-circle and circle;		*	
	12.1.2 solve problems by applying the relationship between area and volume of similar figures as mentioned in SLO 12.1.1;			A
	12.1.3 analyse whether the two figures are similar as mentioned in SLO 12.1.1.			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
13. Geometrical Properties of Regular Polygons	Students should be able to:				
13.1 Parallelograms and Triangles	13.1.1	apply the following properties to solve related problems: a. if two opposite sides of a quadrilateral are congruent and parallel, it is a parallelogram, b. in a parallelogram: i. the opposite sides are congruent, ii. the opposite angles are congruent, iii. the diagonals bisect each other; c. the line segment, joining the midpoints of two sides of a triangle, is parallel to the third side and is equal to one half of its length;			FA
13.2 Application of Regular Polygon	13.2.1	solve real world problems that involve the properties mentioned in SLO 13.1.1 of the following polygons: a. triangle, b. rectangle, c. square.			FA

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
14. Introduction to Trigonometry	Students should be able to:				
14.1 Measurement of an Angle	14.1.1	describe the sexagesimal system (degree, minute and second);		*	A
	14.1.2	convert an angle from $D^{\circ}M'S''$ to decimal form or vice versa;			
	14.1.3	define radian;	*		
	14.1.4	convert an angle from degree to radian and vice versa;			A
14.2 Trigonometric Ratios	14.2.1	identify quadrants and quadrantal angles ($0, \pm 90^{\circ}, \pm 180^{\circ}, \pm 270^{\circ}, \pm 360^{\circ}$);		FA	
	14.2.2	identify the signs of trigonometric ratios in different quadrants;		FA	
	14.2.3	calculate the values of trigonometric ratios and their reciprocals for $30^{\circ}, 45^{\circ}$ and 60° ;			FA
14.3 Application of Pythagoras' Theorem and Trigonometric Ratios	14.3.1	determine the unknown sides or angles in a right-angled triangle by applying Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles ($30^{\circ}, 45^{\circ}$, and 60°);			A
14.4 Trigonometric Identities	14.4.1	explain the fundamental trigonometric identities i.e., $\sin^2 \theta + \cos^2 \theta = 1, 1 + \tan^2 \theta = \sec^2 \theta, 1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$;		*	
	14.4.2	prove different trigonometric relations using the trigonometric identities mentioned in SLO 14.4.1;			E
14.5 Angle of Elevation and Depression	14.5.1	describe the angle of elevation and depression;		*	
	14.5.2	solve word problems involving angle of elevation and depression in a right-angled triangle.			A

Part II (Grade X)

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level ³		
		R	U	A and beyond
15. Quadratic Equations	Students should be able to:			
15.1 Quadratic Equations (in one variable)	15.1.1 distinguish between quadratic equations and other equations; 15.1.2 convert a given quadratic equation in standard form;		*	A
15.2 Solution of Quadratic Equations	15.2.1 solve a quadratic equation in one variable by: a. factorisation method, b. completing square method, c. using quadratic formula;			A
	15.2.2 solve problems of “changing the subject”;			A
15.3 Solution of Equation Reducible to Quadratic Equation in one Variable	15.3.1 solve equations reducible to quadratic equation in one variable of the following forms: a. $px^{2n} + qx^n + r = 0$, $p \neq 0$, b. $(x + p)(x + q)(x + r)(x + s) = k$, where $p + q = r + s$, c. radical equations (e.g., $l(ax^2 + bx) + m\sqrt{ax^2 + bx + c} = 0$);			FA ⁴
	15.3.2 solve equations reducible to quadratic equation in one variable of the following forms: a. exponential equations (e.g., $p^{2x} - q.p^{x+2} + k = 0$), b. reciprocal equations (e.g., $px^4 + qx^3 + rx^2 + sx + t = 0$, $\frac{1}{(x+p)} + (x + p) = r$), c. radical equations (e.g., $\sqrt{x+p} + \sqrt{x+q} = \sqrt{x+r}$); (check extraneous roots if any by substitution) (where p, q, r and s are real numbers);			FA

³R = Remember, U = Understand, A = Application and beyond [Apply (Ap), Analyse (An), Evaluate (E), Create (C)]

⁴FA= Formative Assessment, not to be assessed under examination conditions.

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
15.4 Nature of the Roots of a Quadratic Equation	15.4.1	define discriminant ($b^2 - 4ac$) of the quadratic equation $ax^2 + bx + c = 0$; $a \neq 0$;	*		
	15.4.2	determine the nature of roots of a given quadratic equation by using discriminant;			A
15.5 Simultaneous Equations	15.5.1	solve system of two simultaneous equations in two variables when: <ul style="list-style-type: none"> a. one equation is linear and the other is quadratic (i.e., $a_1x + b_1y = c_1, a_2x^2 + b_2y^2 = c_2$), b. both the equations are quadratic (i.e., $a_1x^2 + b_1y^2 = c_1, a_2x^2 + b_2y^2 = c_2$); 			FA
15.6 Applications of Quadratic Equations	15.6.1	solve word problems related to quadratic equations.			A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
16. Plotting and Interpreting the Graphs	Students should be able to:			
16.1 Plotting and Interpreting the Graphs	16.1.1 describe graphs of the Linear and Quadratic functions;		*	An
	16.1.2 interpret graphs of the Linear and Quadratic functions;			A
	16.1.3 solve a system of equations (one linear and one quadratic equation) graphically;			FA
	16.1.4 interpret exponential growth/ decay of a practical phenomenon through its graph;			FA
16.2 Graphs Sketching	16.2.1 sketch graphs of the Linear functions and Quadratic functions;			A
	16.2.2 sketch graph of the function where n is a positive integer, negative integer, rational number for $y = x^n$;			FA
16.3 Application of Graphs	16.3.1 apply concepts of sketching and interpreting graph to solve real life problems (such as in tax payment, income and salary problems and cost and profit analysis).			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
17. Complex Numbers	Students should be able to:			
17.1 Introduction to Complex Numbers	17.1.1 describe complex number z represented by an expression of the form $z = a + ib$, where a and b are real numbers and $i = \sqrt{-1}$; 17.1.2 identify a as real part and b as imaginary part of $z = a + ib$; 17.1.3 state $\bar{z} = a - ib$, the complex conjugate of $z = a + ib$; 17.1.4 describe the condition for equality of complex numbers; 17.1.5 apply the condition for equality of complex numbers; 17.1.6 solve problems based on the conjugate of a complex number where $i^n, n = 2$; 17.1.7 calculate $ z = \sqrt{a^2 + b^2}$, the absolute value or modulus of a complex number $z = a + ib$;	*	*	A A A
17.2 Basic Operations on Complex Numbers	17.2.1 apply basic operations (i.e, addition, subtraction, multiplication, and division) on complex numbers;			A
17.3 Properties of Complex Numbers	17.3.1 describe the properties of complex numbers (commutative, associative and distributive with respect to addition and multiplication); 17.3.2 describe the following properties of complex numbers: a. $ z = -z = \bar{z} = -\bar{z} $, b. $\overline{\bar{z}} = z, z\bar{z} = z ^2, \overline{z_1 \pm z_2} = \bar{z}_1 \pm \bar{z}_2$, c. $\overline{z_1 z_2} = \bar{z}_1 \bar{z}_2, \overline{\left(\frac{z_1}{z_2}\right)} = \frac{\bar{z}_1}{\bar{z}_2}, z_2 \neq 0$; 17.3.3 determine the additive inverse and multiplicative inverse of a complex number;		*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	17.3.4 solve problems based on the properties of complex numbers mentioned in SLO 17.3.2;			A
	17.3.5 determine the real and imaginary parts of the following types of complex numbers: a. $(x + iy)^n$, b. $\left(\frac{x_1 + iy_1}{x_2 + iy_2}\right)^n$; $x_2 + iy_2 \neq 0$, a. where $n = \pm 1$ and $n = \pm 2$;			FA
17.4 Application of Complex Numbers	17.4.1 apply mathematical models and equations to predict outcomes, evaluate hypotheses, and analyse complex systems in various scientific contexts.			FA

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
18. Matrices and Determinants	Students should be able to:				
18.1 Introduction to Matrices	18.1.1	define matrix;	*		
	18.1.2	describe: a. order of a matrix, b. equality of matrices;		*	
18.2 Types of Matrices (up to order 3)	18.2.1	describe row matrix, column matrix, rectangular matrix, square matrix, zero/ null matrix, diagonal matrix, scalar matrix, unit matrix and symmetric matrix;		*	
	18.2.2	explain the transpose of a matrix;		*	
18.3 Addition and Subtraction of Matrices (up to order 3)	18.3.1	explain that the given matrices are conformable for addition/ subtraction;		*	
	18.3.2	determine the sum and difference of two matrices;			A
	18.3.3	explain commutative and associative laws under addition;		*	
	18.3.4	define the additive identity of a matrix;	*		
	18.3.5	determine the additive identity of a matrix;			A
	18.3.6	define the additive inverse of a matrix;	*		
	18.3.7	determine the additive inverse of a matrix;			A
18.4 Multiplication of Matrices (up to order 2)	18.4.1	determine the multiplication of a matrix by a real number;			A
	18.4.2	explain that the given matrices are conformable for multiplication;		*	
	18.4.3	determine the multiplication of two (or three) matrices;			A
	18.4.4	describe associative law under multiplication;		*	
	18.4.5	describe distributive laws of multiplication over addition and subtraction;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
	18.4.6	explain that the commutative law under multiplication does not hold in general (i.e, $AB = BA$);		*	
	18.4.7	verify the result $(AB)^t = B^t A^t$ with the help of examples;			E
18.5 Multiplicative Inverse of a Matrix (up to order 2)	18.5.1	describe the determinant of a square matrix;		*	A
	18.5.2	calculate the determinant of a matrix;	*		A
	18.5.3	define singular and non-singular matrix;			A
	18.5.4	solve problems related to singular and non-singular matrix;			A
	18.5.5	determine the adjoint of a matrix and related problems;			A
	18.5.6	define the multiplicative identity of a matrix;	*		A
	18.5.7	determine the multiplicative inverse of a non-singular matrix A ;			E
	18.5.8	verify that $AA^{-1} = I = A^{-1}A$, where I is the multiplicative identity matrix;			E
	18.5.9	verify the result $(AB)^{-1} = B^{-1}A^{-1}$ with the help of examples;			E
18.6 Solution of Matrix Equations and Simultaneous Linear Equations	18.6.1	solve matrix equations (e.g, Find A , if $A + \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = 5 \begin{bmatrix} 3 \\ 2 \end{bmatrix}$);			A
	18.6.2	solve a system of two simultaneous linear equations in two unknowns using: a. matrix inverse method, b. Cramer's rule;			A
18.7 Application of Matrices	18.7.1	convert a real life word problem in the form of a matrix equation;			FA
	18.7.2	analyse the key role played by mathematics in the development of new scientific theories and technologies.			FA

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
19. Application of Trigonometry	Students should be able to:				
19.1 Laws of Sine and Cosine	19.1.1	define law of Sine and Cosine;	*		
19.2 Area of Triangles	19.2.1	explain the formulae for the area of a triangle when length of:		*	
		a. two sides and their included angle are given, b. one side and two angles are given, c. three sides are given (Heron's form);			
	19.2.2	apply the above formulae to determine the area of a triangle;			A
	19.2.3	solve trigonometric problems in two dimensions;			A
19.3 Bearing	19.3.1	describe bearing;		*	
	19.3.2	solve problems involving bearing;			FA
19.4 Application of Trigonometry	19.4.1	apply concepts of trigonometry to real life world problems.			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
20. Circles	Students should be able to:			
20.1 Chords of a Circle	20.1.1 apply the following theorems to solve related problems: a. one and only one circle can pass through three non-collinear points, b. a straight line drawn from the centre of a circle to bisect a chord which is not a diameter is perpendicular to the chord and vice versa, c. if two chords of a circle are congruent then they will be equidistant from the centre and vice versa;			A
20.2 Tangent to a Circle	20.2.1 apply the following theorems to solve related problems: a. if a line is drawn perpendicular to a radial segment of a circle at its outer end point, it is tangent to the circle at that point and vice versa, b. the two tangents drawn to a circle from a point outside it is equal in length, c. if two circles touch externally or internally the distance between their centres is respectively equal to the sum or difference of their radii;			A
20.3 Chords and Arcs	20.3.1 apply the following theorems to solve related problems: a. if two chords of circle (or of congruent circles) are equal, then their corresponding arcs (minor, major or semi-circular) are congruent and vice versa, b. equal chords of a circle (or of congruent circles) subtend equal angles at the centre (at the corresponding centres) and vice versa;			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
20.4 Angle in a Segment of a Circle	20.4.1 apply the following theorems to solve related problems: <ol style="list-style-type: none"> the measure of a central angle of a minor arc of a circle, is double that of the angle subtended by the corresponding major arc, any two angles in the same segment of a circle are equal, the inscribed angle in a semi-circle is a right angle, the angle in a segment greater than a semi-circle is less than a right angle, the angle in a segment less than a semi-circle is greater than right angle, the opposite angles of any quadrilateral inscribed in a circle are supplementary. 			A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
21. Practical Geometry	Students should be able to:			
21.1 Construction of triangle	21.1.1 construct a triangle when: a. two sides and one of the angles is given, b. one side and two of the angles are given;			A
	21.1.2 construct the following using compass for a given triangle: a. angle bisectors, b. perpendicular bisectors, c. medians, d. altitudes;			A
	21.1.3 verify, for a given triangle, the concurrency of: a. angle bisectors, b. altitudes, c. perpendicular bisectors, d. medians;			E
21.2 Construction of Circle	21.2.1 find the centre of a given circle;			A
	21.2.2 draw a circle passing through three given non-collinear points;			A
	21.2.3 complete the circle: a. by finding the centre, b. without finding the centre, c. when a part of its circumference is given;			A
21.3 Tangents to the Circle	21.3.1 draw a tangent to a given arc, without using the centre, through a given point P when P is: a. the middle point of the arc, b. at the end of the arc, c. outside the arc;			FA
	21.3.2 draw a tangent to a given circle from a point P when P lies: a. on the circumference of the circle, b. outside the circle;			A
	21.3.3 draw two tangents to a circle meeting each other at a given angle.			FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
22. Basic Statistics	Students should be able to:			
22.1 Frequency Distribution and Graphs	22.1.1 construct a grouped frequency table (using direct and tally marks method); 22.1.2 draw histograms with equal and unequal class intervals; 22.1.3 draw a frequency curve and a frequency polygon; 22.1.4 interpret the histogram frequency curve and frequency polygon;			A A A An
22.2 Cumulative Frequency Distribution	22.2.1 construct a cumulative frequency table; 22.2.2 draw a cumulative frequency curve and cumulative frequency polygon; 22.2.3 draw box and whisker plot; 22.2.4 interpret the cumulative frequency curve, cumulative frequency polygon, box and whisker plot;			A A A An
22.3 Measures of Central Tendency	22.3.1 calculate the arithmetic mean by direct method (only), weighted mean, median and mode for ungrouped data; 22.3.2 calculate the arithmetic mean by direct method (only), median and mode for grouped data; 22.3.3 solve real life situations involving mean, weighted mean, median, and mode for given data; 22.3.4 find the approximate value of median and mode graphically; 22.3.5 define quantiles (quartiles, deciles and percentiles); 22.3.6 calculate quartiles, deciles and percentiles for ungrouped and grouped data; 22.3.7 interpret the median, quartiles, deciles, percentiles, and inter quartile range from cumulative frequency curve;		*	A A A An A An

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
22.4 Measures of Dispersion	22.4.1	calculate the range, variance and standard deviation for grouped and ungrouped data;			A
	22.4.2	calculate the coefficient of variation for grouped and ungrouped data;			A
	22.4.3	solve problems related to variance, standard deviation and coefficient of variation;			A
22.5 Correlation	22.5.1	draw scatter diagrams and a line of best fit;			FA
	22.5.2	interpret the correlation between the variables from scatter diagram.			FA

FOR ANNUAL EXAMINATION 2025

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
23. Probability	Students should be able to:			
23.1 Probability	23.1.1 define the following terms: a. statistical experiment, b. sample space and event, c. mutually exclusive and mutually inclusive events, d. equally likely events, e. dependent and independent events, f. simple and compound events;	*		
	23.1.2 apply the given formula to find the probability of an event E , i.e., $P(E) = \frac{n(E)}{n(S)}$, $0 \leq P(E) \leq 1$;			A
	23.1.3 solve word problems involving probability;			A
23.2 Probability of Combined Event	23.2.1 describe combine events, tree diagram and venn diagrams;		*	A
	23.2.2 calculate the probability of combined events using tree diagrams and Venn diagrams;			A
	23.2.3 explain the given laws of probability: a. law of compliment, b. law of addition, c. law of multiplication;		*	
	23.2.4 solve problems related to laws of probability mentioned in SLO 23.2.3;			A
23.3 Relative and expected frequencies	23.3.1 define relative frequency and expected frequency;	*		A
	23.3.2 calculate relative frequency and expected frequency as an estimate of probability;			A
	23.3.3 solve real life problems involving relative and expected frequencies.			A

Scheme of Assessment

Grade IX

Table 1: Exam Specifications

Topic No.	Topics	Marks Distribution		Total Marks
		MCQs	CRQs	
1.	Real Numbers	2	Total 3 Marks (1 CRQ)	5
2.	Logarithms	2	Total 3 Marks (1 CRQ)	5
3.	Sets Theory	7	Total 3 Marks (1 CRQ)	10
4.	Functions and Graphs	4	Total 3 Marks Choose any ONE from TWO	7
5.	Factorisation	5	Total 3 Marks Choose any ONE from TWO	8
6.	Algebraic Manipulation	5	Total 3 Marks (1 CRQ)	8
7.	Linear Equations and Inequalities	4	Total 3 Marks Choose any ONE from TWO	7
8.	Vectors	4	-	4
9.	Introduction To Coordinate Geometry	5	Total 3 Marks (1 CRQ)	8
10.	Loci	FA	FA	-
11.	Logic	FA	FA	-
12.	Similar Figures	3	-	3
13.	Geometric Properties of Regular Polygon	FA	FA	-
14	Introduction To Trigonometry	4	Total 6 Marks Choose any TWO from THREE	10
Total		45	30	75

Note: The cognitive distribution of marks for Mathematics SSC (Humanities Group) are as follows:

Remember: 0 to 10%

Understand: 35 to 45%

Apply and beyond: 45 to 55%

Table 2: Exam Specifications

Topic No.	Topics	Marks Distribution		Total Marks
		MCQs	CRQs	
15.	Quadratic Equation	5	Total 3 Marks (1 CRQ)	8
16.	Plotting and Interpreting the Graphs	2	Total 4 Marks (1 CRQ)	6
17.	Complex Number	7	Total 3 Marks (1 CRQ)	10
18.	Matrices and Determinants	10	Total 4 Marks Choose any ONE from TWO	14
19.	Application of Trigonometry	3	Total 3 Marks (1 CRQ)	6
20.	Circles	3	Total 3 Marks Choose any ONE from TWO	6
21.	Practical Geometry	2	Total 3 Marks (1 CRQ)	5
22.	Basic Statistics	8	Total 4 Marks Choose Any ONE from TWO	12
23.	Probability	5	Total 3 Marks (1 CRQ)	8
Total		45	30	75

Note: The cognitive distribution of marks for Mathematics SSC (Humanities Group) are as follows:

Remember: 0 to 10%

Understand: 35 to 45%

Apply and beyond: 45 to 55%

Examination Structure for Grades IX and X

- Multiple Choice Question (MCQ) requires candidates to choose one best/ correct answer from four options for each question. Each MCQ carries ONE mark.
- Constructed Response Question (CRQ) requires students to respond with a short text (few phrases/ sentences), calculations or diagrams.
- Table 1 and 2 contains the mark distribution for each topic.
- There will be two examinations, one at the end of grade IX and one at the end of grade X.
- In each grade, the theory paper will be of 3 hours and will consist of two parts: paper I and paper II.
- Paper I theory will consist of 45 compulsory, multiple choice items. These questions will involve four responses options. The answer sheet for paper I will be provided separately.
- Paper II theory will carry 30 marks and consist of Constructed Response Questions (CRQs).
- The booklet for paper II will serve as an answer script.

Acknowledgements

Aga Khan University Examination Board (AKU-EB) would like to acknowledge the contributions of all those who played an important part in the revision of the AKU-EB SSC Mathematics (Humanities Group) syllabus.

We would like to thank **Shahneel Muhammad Jawaid Alam**, and **Muhammad Kasshaf Shaikh Specialists, Mathematics**, AKU-EB, for taking the subject lead during the entire process of revising the SSC Mathematics (Humanities Group) syllabus.

We are particularly thankful to the **syllabus revision panel** for their time, commitment and effort in revising the syllabus. The panel included:

- **Shahnila Muhammad**
Principal Syllabus Reviewer
Habib Public High School, Karachi
- **Uroosa Manzar**
Panellist
Bai Virbaiji Soparivala Parsi High School, Karachi
- **Fawad Rauf**
Panellist
Ghulaman e Abbas School, Karachi
- **Farzana Mohammad**
Panellist
Habib Girls School, Karachi

We also thank the following **post-revision reviewers** for their feedback on relevance of the content, skills and resources of the syllabus:

- **Mukhtar Ali Khan**
AKU-EB Support Unit of AKESP, Chitral

Furthermore, we thank the following for reviewing the syllabus for **Higher Education Preparedness**, ensuring that the syllabus includes adequate skills and content to effectively prepare students for the next level of education.

- **Haris ur Rehman Horani**
NED University of Engineering and Technology, Mathematics Department

In-house Team

- **Mentor and Advisor:**
Dr Naveed Yousuf
CEO, AKU-EB
- **Operational Advisor:**
Hanif Shariff
Director, AKU-EB
- **Syllabi Review Lead:**
Kashif Hussain, Manager, Curriculum Development
- **Syllabi Review Facilitators:**
Dur Nasab, Associate, Curriculum Development
Mahrukh Jiwa, Specialist, Middle School Programme
- **Internal Reviewer:**
Zain-ul-Muluk, Manager, Examination Development
- **Learning Resources Reviewer:**
Ali Bijani, Manager, Teacher Support, and team
- **Assessment Reviewer:**
Munira Muhammad, Lead Specialist, Assessment
- **Administrative Support:**
Raheel Sadruddin, Manager, Administration, and team
- **School Coordination Support:**
Danish Hussain, Senior Manager, Operations, and team
- **Syllabi Feedback Data Analysts:**
Muhammad Faheem, Lead Specialist, Assessment
Muhammad Kamran Afzal, Specialist, Assessment
- **Communications and Design Support:**
Shanoz Aqnazarbekova, Manager, Communications
Hatim Yousuf, Specialist, Communications
- **Quality Assurance:**
Malik Azam, Manager, and Team
Raabia Hirani, Former Manager, Curriculum Development
- **Data Compilation and Formatting:**
Riyan Ali, Assistant, AKU-EB
Akber Hashmani, Specialist, Assessment AKU-EB

Aga Khan University Examination Board

Block-C, IED-PDC, 1-5/B-VII, Federal B Area,
Karimabad, Karachi, Pakistan - 75950

examinationboard.aku.edu



AKUEBOfficial

AKUEBOfficial



linkedin.com/school/akueb

akuexamboard



examination.board@aku.edu

AKUEBOfficial



+92 21 3682 7011-8