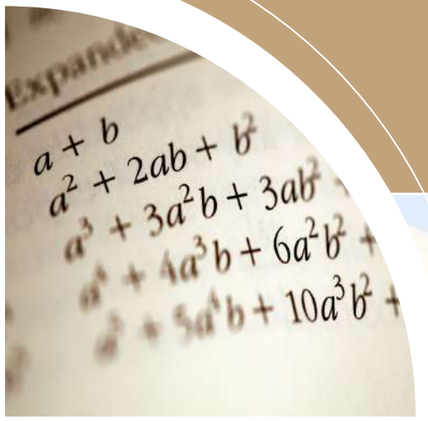
ASSESSMENT FRAMEWORK AND MODEL QUESTION PAPER

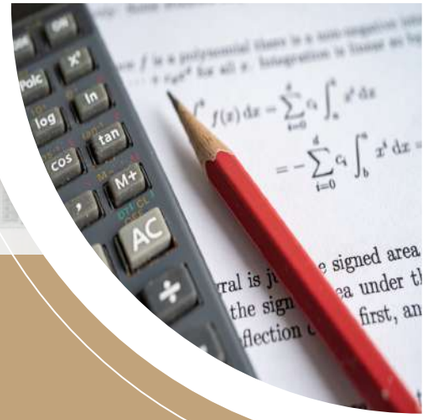
MATHEMATICS

Grade IX

NATIONAL CURRICULUM
2022-23









FEDERAL BOARD OF INTERMEDIATE AND SECONDARY EDUCATION, ISLAMABAD

WE WORK FOR EXCELLENCE

FEDERAL BOARD OF INTERMEDIATE AND SECONDARY EDUCATION

H-8/4, ISLAMABAD

ASSESSMENT FRAMEWORK

FOR

MATHEMATICS GRADE-IX

CURRICULUM 2022-23

ACKNOWLEDGEMENT

It is a great honour that we, at the Federal Board of Intermediate and Secondary Education, have developed the Assessment Framework (AF) for the subject of Mathematics for Grade-IX. The primary objective of the AF is to optimize the current curriculum 2022-23. This comprehensive framework has been crafted meticulously by subject matter and assessment experts who conducted an in-depth review of all learning outcomes for Grade-IX Mathematics curriculum. They evaluated these outcomes in terms of their scope, cognitive level, and progression across the grade.

This significant undertaking was the result of a series of extensive meetings and collaborative efforts of the subject and assessment experts. Their dedication and expertise have been instrumental in bringing this framework to fruition.

The Assessment Framework will serve as a guiding document for students, teachers and paper setters. Students will receive clear directions for preparing themselves for the annual examination. Similarly, teachers will use it as a guide to understand what to teach in class and to prepare students for the final examinations accordingly. Similarly paper setters will also seek guidance from this document.

Following subject as well as assessment experts/committee members remained constantly engaged in the development of the AF:

1. Dr. Muhammad Anwar Assistant Professor, Islamabad Model College for Boys, G-10/4, Islamabad
2. Dr. Javed Iqbal, Vice Principal, OPF Boys College, H-8/4, Islamabad
3. Mr. Anwar ul Haq, Assistant Professor, Bahria College, Naval Complex, E-8, Islamabad
4. Mrs. Zohra Yousaf, HOD Math, Army Public School & College, Hamza Camp Rawalpindi
5. Mr. Ali Raza, Assistant Professor, Islamabad Model College for Boys, F-8/4, Islamabad

The whole work was successfully accomplished under the able supervision and guidance of Syed Junaid Akhlaq, Chairman, FBISE and due to the hard work and dedication of the staff of Research Section of FBISE, in particular, Syed Zulfiqar Shah, Deputy Secretary, Research and Academics who played a pivotal and leading role in finalizing the AF.

MIRZA ALI
Director (Research & Academics)
FBISE, Islamabad

ASSESSMENT FRAMEWORK FOR MATHEMATICS GRADE-IX, CURRICULUM 2022-23

To ensure clarity and precision in assessment, the learning outcomes have been categorized into two distinct groups: formative and summative. This classification helps in effectively measuring student progress and understanding. Each Student learning outcome (SLO) has been carefully marked as either formative or summative within the newly developed Assessment Framework. SLOs of Summative Assessment Format will be part of the Final Examination while SLOs of Formative Assessment will although be part of the teaching-learning activity but they will **NOT** be part of Final Examinations. Estimated cognitive levels i.e Knowledge (K), Understanding (U) and Application (A) of all the SLOs have also been indicated. It may be noted that all the higher cognitive levels have been collectively accumulated in the cognitive level of 'Application'. In subjects involving Practicals (Lab work), it has been mentioned categorically whether an SLO is summative for theory or summative for Practical Based Assessment (PBA). If an SLO is summative for PBA, it means that Laboratory work is required in the teaching-learning activity and it will be part of the Practical Examination/ Practical Based Assessment.

The Assessment Framework will act as a comprehensive guide for students, teachers and paper setters. Students will have clear instructions on how to prepare for the annual examinations. Teachers will use the framework to understand the curriculum and effectively prepare their students for the final examination. Additionally, paper setters will refer to this document for guidance in setting examination papers.

A model question paper has also been developed to provide a clear structure and format for upcoming examinations. The model question paper ensures consistency and fairness, offering students a comprehensive understanding of what to expect in their examinations. By aligning the paper with the Student Learning Outcomes (SLOs) of the curriculum, we ensured that the questions accurately reflect the skills and knowledge that students are expected to acquire.

A detailed Table of Specifications (ToS) has been created to ensure equitable coverage of cognitive levels and content domains in order to generate a balanced question paper. The ToS serves as drawing scale and action plan for the question paper, ensuring that all important areas of the curriculum are adequately and proportionately assessed.

FORMATIVE ASSESSMENT: AN ESSENTIAL COMPONENT OF EFFECTIVE LEARNING

Formative assessment is a pivotal element in the educational process, distinguished by its role in providing ongoing feedback to both students and educators. Unlike summative assessments, which evaluate student learning at the end of an instructional period, formative assessments are integrated into the learning process to monitor student understanding and guide instructional decisions.

The primary objective of formative assessment is to identify learning gaps and misunderstandings as they occur, enabling timely interventions. This dynamic approach allows teachers to adjust their teaching strategies to better meet the needs of their students. For instance, if a teacher notices through a quick quiz or class discussion that a significant portion of the class struggles with a particular concept, they can revisit that topic, providing additional explanations or alternative methods of instruction. This adaptability is crucial for fostering a deeper understanding of the material.

Formative assessments come in various forms, ranging from informal methods like classroom discussions, observations, and questioning, to more structured approaches such as quizzes, peer assessments, and self-reflections. These methods are not limited to paper-and-pencil tasks but can include digital tools that provide instant feedback. The versatility of formative assessments allows educators to cater to diverse learning styles and preferences, ensuring that all students are engaged and supported in their learning journey.

Formative assessment plays a significant role in creating a supportive classroom environment. It shifts the focus from merely achieving grades to understanding the learning process. This approach reduces the pressure on students, as they perceive assessments not as a final judgment of their abilities but as a part of their learning journey. Consequently, formative assessment can lead to increased student motivation and engagement.

In conclusion, formative assessment is a powerful tool that, when effectively implemented, can significantly enhance the learning experience. It provides invaluable insights for both teachers and students, promotes a growth-oriented learning environment, and supports the continuous development of essential skills. As education evolves, the role of formative assessment will undoubtedly continue to be central in fostering successful and meaningful learning experiences.

SUMMATIVE ASSESSMENT: EVALUATING LEARNING OUTCOMES IN THE FORM OF TERMINAL/FINAL EXAMINATION

Summative assessment is a fundamental component of the educational process, designed to evaluate student learning at the conclusion of an instructional period. Unlike formative assessment, which provides ongoing feedback during the learning process, summative assessment serves as a final measure of what students have learned. Typically administered at the end of a unit, course, or academic year. Summative assessment aims to determine the extent to which educational objectives have been achieved.

The primary purpose of summative assessment is to assess the overall effectiveness of instruction and learning. It provides a conclusive evaluation of student performance, often in the form of tests, final projects, or standardized exams. These assessments generate grades or scores that reflect a student's achievement in a given subject area over a specific period or time duration.

Summative assessment is often used to make critical decisions regarding student progression, certification, or placement in subsequent educational levels. Additionally, summative assessments provide valuable data that inform curriculum development and instructional strategies. By analyzing summative assessment results, educators can identify trends, strengths, and weaknesses within their instructional approaches, allowing for improvements in future teaching.

In conclusion, summative assessment plays a critical role in the educational process by providing a final evaluation of student learning. While it differs from formative assessment in its focus and application, it is an essential tool for measuring academic achievement. When balanced with formative assessments, summative assessments contribute to a well-rounded and effective approach to evaluating and supporting student learning.

National Curriculum of Pakistan 2022-23

Assessment Framework

MATHEMATICS Grade-IX (SSC-I)

Details of Content Areas/ SLOs

Content Domain / Area	Topics	SLO No./ Description	Form of Assessment	Cognitive Level (Knowledge, Understanding, Application)	Remarks	Number of Periods required (1 period= 40 minutes)
Domain A: Numbers and Algebra	**Real Numbers**	**[SLO: M-09-A-01]: Explain, with examples, that civilizations throughout history have systematically studied living things [e.g., the history of numbers from Sumerians and its development to the present Arabic system.**	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	12
		[SLO: M-09-A-02]: Describe the set of real numbers as a combination of rational and irrational numbers.	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-A-03]: Demonstrate and verify the properties of equality and inequality of real numbers.	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-A-04]: Apply laws of indices to simplify radical expressions.	Summative	A	**Question(s) will be asked in the annual examination.**	
		[SLO: M-09-A-05]: Express a number in scientific notations and vice versa.	Summative	U	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-06]: Describe logarithm of a number.	**Formative**	**K**	**Question(s) will not be asked in the annual examination;**	

					however, it will be part of regular teaching practice.	
		[SLO: M-09-A-07]: Differentiate between common and natural logarithm.	Summative	K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-08]: Apply laws of logarithm to real life situations such as growth and decay, loudness of sound.	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-09]: Apply concepts of rational numbers to real word problems (such as inventory (stock taking), temperature, banking, measures of gain and loss, sources of income and expenditure).	Summative	A	**Question(s) will be asked in the annual examination**	
	Sets and Functions	**[SLO: M-09-A-10]:** Describe mathematics as the study of pattern, structure, and relationships.	Summative	U	**Question(s) will be asked in the annual examination**	15
		[SLO: M-09-A-11]: Identify sets and apply operations on three sets (Subsets, overlapping sets and disjoint sets), using Venn diagrams	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-12]: Solve problems on classification and cataloguing by using Venn diagrams for Scenarios involving two sets and three sets. Further application of sets.	**Formative**	**U**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-A-13]: Verify and apply properties/laws of union and intersection of three sets through analytical and Venn diagram method.	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-14]: Apply concepts from set theory to real world problems (such as in demographic classification, categorizing products in shopping malls and music playlist by genre) Relation.	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-15]: Explain product, Binary Relations and its domain and range.	Summative	K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-16]: Recognize that a relation can be represented by table, order pair and graphs.	Summative	A	**Question(s) will be asked in the annual examination**	

	Factorization	**[SLO: M-09-A-17]: Identify common factors, trinomial factoring, concretely, pictorially and symbolically.**	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	15
		[SLO: M-09-A-18]: Factorize quadratic and cubic algebraic expressions. • $a^4 + a^2b^2 + b^4$ or $a^4 + b^4$ • $x^2 + px + q$ • $ax^2 + bx + c$ • $(ax^2 + bx + c)(ax^2 + bx + d) + k$ • $(x + a)(x + b)(x + c) + k$ • $(x + a)(x + b)(x + c)(x + d) + kx^2$ • $a^3 + 3a^2b + 3ab^2 + b^3$ • $a^3 - 3a^2b + 3ab^2 - b^3$ • $a^3 \pm b^3$	Summative	U	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-19]: Find highest common factor and least common multiple of algebraic expressions and know relationship of LCM and HCF.	Summative	U/K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-20]: Find square root of algebraic expression by factorization and division.	Summative	U/K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-A-21]: Apply the concepts of factorization of quadratic and cubic algebraic expressions to real world problems (such as engineering, physics, and finance.)	Summative	A	**Question(s) will be asked in the annual examination**	
	Linear Equations and Inequalities in one variable	**[SLO: M-09-A-22]:** Solve linear equations and inequalities with rational coefficients and represent the solution set on a real line.	Summative	U	**Question(s) will be asked in the annual examination**	10

		[SLO: M-10-A-23]: Solve two linear inequalities with two unknowns simultaneously	Formative	U	**Question(s) will not be asked in the annual examination (This SLO will be taught in Class X)**	
Domain B: Geometry	**Coordinate Geometry**	**[SLO: M-09-B-01]:** Derive distance formula by locating the position of two points in coordinate plane	Summative	U	**Question(s) will be asked in the annual examination**	15
		[SLO: M-09-B-02]: Calculate the midpoint of a line segment	Summative	K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-03]: Find the gradient of a straight line when coordinates of two points are given.	Summative	K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-04]: Find the equation of a straight line in the form $y = mx + c$	Summative	K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-05]: Find the gradient of parallel and perpendicular lines.	Summative	U	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-06]: Apply distance and midpoint formulas to solve real life situations such as physical measurements or distances between locations.	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-07]: Apply concepts from coordinate Geometry to real world problems (such as, aviation and navigation, landscaping, map reading, longitude and latitude).	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-08]: Derive equation of a straight line in slope-intercept form, point-slope form, two-point form, intercepts form, symmetric form, normal form.	Summative	U	**Question(s) will be asked in the annual examination**	

		[SLO: M-09-B-09]: Show that a linear equation in two variables represents a straight line and reduce the general form of the equation of a straight line to the other standard forms.	Summative	U	**Question(s) will be asked in the annual examination**	
	Angle Between Lines	**[SLO: M-09-B-10]:** Find the angle between two coplanar intersecting straight lines.	Summative	K	**Question(s) will be asked in the annual examination**	07
		[SLO: M-09-B-11]: Find the equation of the family of lines passing through the point of intersection of two given lines.	Summative	U/K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-12]: Calculate angles of the triangle when the slopes of the sides are given.	Summative	K	**Question(s) will be asked in the annual examination**	
	Logic	**[SLO: M-09-B-13]: Differentiate between a mathematical statement and its proof.**	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	05
		[SLO: M-09-B-14]: Differentiate between an axiom, conjecture and theorem.	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-B-15]: Formulate simple deductive proofs [algebraic proofs that require showing the LHS to be equal to the RHS. E.g., showing $(x-3)^2+5=x^2-6x$	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
	Similar Figures	**[SLO: M-09-B-16]:** Identify similarity of polygons. Area and Volume of Similar Figures	Summative	K	**Question(s) will be asked in the annual examination**	05
		[SLO: M-09-B-17]: Solve problems using the relationship between areas of similar figures and volume of different solids	Summative	U	**Question(s) will be asked in the annual examination**	
	Geometrical Properties of regular	**[SLO: M-09-B-18]:** Solve real life problems that involve the properties of regular polygons, triangles	Summative	A	**Question(s) will be asked in the annual examination**	10

	Polygons, Triangles and Parallelograms	and parallelograms (such as building architectural structures, fencing, tiling, painting, carpeting a room).				
	Loci	**[SLO: M-09-B-19]:** Solve real life problems using the following loci and the method of intersecting loci for sets of points in two dimensions which are: at a given distance from a given point, at a given distance from a given straight line, equidistant from two given points equidistant from two given intersecting straight lines.	Summative	A	**Question(s) will be asked in the annual examination**	05
	Trigonometry	**[SLO: M-09-B-20]:** Identify angles in standard position, expressed in degrees and radians.	Summative	K	**Question(s) will be asked in the annual examination**	10
		[SLO: M-09-B-21]: Apply Pythagoras' theorem and the sine, cosine and tangent ratios for acute angles to find a side or of an angle of a right-angled triangle.	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-22]: Solve real life trigonometric problems in two dimensions involving angles of elevation and depression.	Summative	A	**Question(s) will be asked in the annual examination**	
	Trigonometric Identities	**[SLO: M-09-B-23]:** Prove the trigonometric identities and apply them to show different trigonometric relations.	Summative	K/A	**Question(s) will be asked in the annual examination**	05
		[SLO: M-09-B-24]: Solve real life problems involving trigonometric identities.	Summative	A	**Question(s) will be asked in the annual examination**	
	Bearing	**[SLO: M-09-B-25]:** Interpret and use three figure bearings.	Summative	K	**Question(s) will be asked in the annual examination**	07
		[SLO: M-09-B-26]: Solve problems involving bearing.	Summative	U	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-B-27]: Apply the concepts of trigonometry	Summative	A	**Question(s) will be asked in the annual examination**	
	Construction of Triangle	**[SLO: M-09-B-28]: Construct a triangle having given two sides and the included angle.**	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	10

		[SLO: M-09-B-29]: Construct a triangle having given one side and two of the angles.	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-B-30]: Construct a triangle having given two of its sides and the angle opposite to one of them (with all the three possibilities).	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	
		[SLO: M-09-B-31]: Draw angle bisectors, perpendicular bisectors, medians, altitudes of a given triangle and verify their concurrency.	Summative	U	**Question(s) will be asked in the annual examination**	
Domain C: Information Handling	**Frequency Distribution**	**[SLO: M-09-C -01]: Construct a grouped frequency table, histogram (with unequal class intervals) and frequency polygon.**	**Formative**	**K**	**Question(s) will not be asked in the annual examination; however, it will be part of regular teaching practice.**	05
	Measure of Central Tendency	**[SLO: M-09-C -02]:** Calculate the mean modal class and median of a grouped frequency distribution.	Summative	U	**Question(s) will be asked in the annual examination**	10
		[SLO: M-09-C -03]: Solve real life situations involving mean, weighted mean, median, and mode for given data (such as allocation of funds in different projects, forecasting future demographics, marketing, forecasting government budgets).	Summative	A	**Question(s) will be asked in the annual examination**	
	Probability	**[SLO: M-09-C -04]:** Calculate the probability of a single event and the probability of event not occurring	Summative	K	**Question(s) will be asked in the annual examination**	07
		[SLO: M-09-C -05]: Solve real life problems involving probability	Summative	A	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-C -06]: Calculate relative frequency as an estimate of probability.	Summative	K	**Question(s) will be asked in the annual examination**	05

	Relative and expected frequencies	**[SLO: M-09-C -07]:** Calculate expected frequencies.	Summative	U/K	**Question(s) will be asked in the annual examination**	
		[SLO: M-09-C -08]: Solve real life problems involving relative and expected frequencies.	Summative	A	**Question(s) will be asked in the annual examination**	

Federal Board SSC-I Examination
Model Question Paper Mathematics
(Curriculum 2022-23)

ROLL NUMBER					
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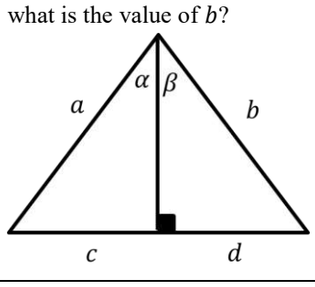
Section - A (Marks 15)

Time Allowed: 20 minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. *Do not use lead pencil.*

Candidate Sign. _____ **Invigilator Sign. _____**

Q1. Fill the relevant bubble against each question. Each part carries one mark.

Sr no.	Question	A	B	C	D	A	B	C	D
i.	The radical form of $x^{-\frac{3}{2}}$ is:	$\sqrt[3]{x^2}$	$\frac{1}{\sqrt{x^3}}$	$\sqrt{x^3}$	$\frac{1}{\sqrt[3]{x^2}}$	○	○	○	○
ii.	Which of the given options represents the scientific notation of 0.25^2 ?	625×10^{-4}	62.5×10^{-3}	6.25×10^{-2}	0.625×10^{-1}	○	○	○	○
iii.	If $A = \{2,4,6\}$ and $B = \{0,1\}$, then find number of elements in $A \times B$.	5	6	8	9	○	○	○	○
iv.	What is the least common multiple of $7x - 6xy$ and $5xy^3 - 3x^2$?	$(7-6y) \times (5x^3 - 3x)$	$(7x - 6xy) \times (5y^3x - 3x^2)$	$x(7-6y)$	$x(7-6y) \times (5y^3 - 3x)$	○	○	○	○
v.	Solution of inequality $-2x - \frac{1}{2} \leq \frac{3}{2}$ is:	$x > -1$	$x < -1$	$x \geq -1$	$x \leq -1$	○	○	○	○
vi.	What is the radian measure of $15^o50'$?	$\frac{19\pi}{216}$	$\frac{19\pi}{36}$	$\frac{19\pi}{180}$	$\frac{216\pi}{19}$	○	○	○	○
vii.	If a navigator gives bearing 0°, in which direction should he travel?	North	South	East	West	○	○	○	○
viii.	In the figure, if $\alpha = \beta$ then what is the value of b? 	$\frac{cd}{a}$	$\frac{c}{ad}$	$\frac{ad}{c}$	$\frac{ac}{d}$	○	○	○	○

ix.	What is the value of $-3-3\tan^2\theta$ in a single trigonometric function?	$3cosec^2\theta$	$-3\sec^2\theta$	$3\sec^2\theta$	$-3cosec^2\theta$	○ ○ ○ ○
x.	Which of the following points is the intersection of the angle bisectors of a triangle?	circumcenter	orthocenter	incentre	centroid	○ ○ ○ ○
xi.	Each of the internal angle of a regular hexagon is:	60^o	72^o	108^o	120^o	○ ○ ○ ○
xii.	Locus of points equidistant from $P(5,4)$ and $Q(5,-6)$ is:	$x=0$	$x=5$	$y=-1$	$y=1$	○ ○ ○ ○
xiii.	The mean of 11 numbers is 7. One of the numbers 13 is deleted. What is the mean of the remaining 10 numbers?	7.7	6.4	6.0	5.8	○ ○ ○ ○
xiv.	What is the probability of picking a king from well-shuffled 52 playing cards?	$\frac{1}{52}$	$\frac{1}{13}$	$\frac{4}{13}$	$\frac{1}{26}$	○ ○ ○ ○
xv.	A fair coin is tossed twice, then the frequency of appearing head twice is:	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	○ ○ ○ ○

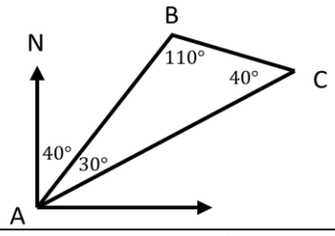
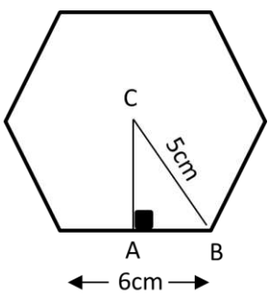
Federal Board SSC-I Examination
Model Question Paper Mathematics
(Curriculum 2022-23)

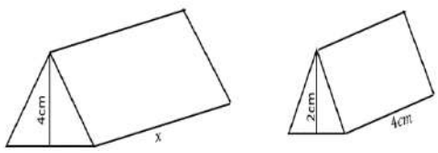
Time allowed: 2.40 hours | Total Marks: 60

Note: Answer all parts from Section 'B' and all questions from Section 'C' on the **E-sheet**. Write your answers on the allotted/given spaces.

SECTION – B (Marks 36)

$(9 \times 4 = 36)$

Q.2	Question	Marks		Question	Marks
i.	Simplify the expression $\left[(125)^{\frac{1}{3}} \times (25)^{\frac{1}{2}} + (64)^{\frac{2}{3}} \times 6 + (8)^{\frac{2}{3}}\right]^{\frac{-2}{3}}$	4	***OR***	If $X = \{1,3,9\}, Y = \{3,5,7\}$ and $Z = \{3,5,7,9,11\}$ then using Venn diagram, prove that $X \cup (Y \cap Z) = (X \cup Y) \cap (X \cup Z)$	4
ii.	The attached figure shows the position of three points A, B, and C. State the bearing of: B from A; A from B; B from C, and C from B. 	4	***OR***	For $A = \{1,2,3\}, B = \{3,4\}$ (a) List all the ordered pairs of the Cartesian Product $A \times B$, (b) List all the ordered pairs of a relation $R = \{(x,y) \mid x \epsilon A, y \epsilon B \wedge x < y\}$, (c) Find domain and range of the relation R.	4
iii.	Bani Gala had a population of 10,000 people in the year 2015. The population has been growing exponentially at a rate of 2.5% per year. Using the exponential growth formula $P(t) = P_o e^{rt}$, apply laws of logarithm to determine the year when population reaches up to 25,000.	4	***OR***	Find equation of the family of lines passing through a point $(5,2)$ and through the intersection of lines $x + 2y - 10 = 0$ and $2x + y - 2 = 0$.	4
iv.	Solve the linear equation $\frac{1}{3}(x-2) + \frac{2-3x}{2} = \frac{x+5}{6}$	4	***OR***	Simplify $\frac{5}{5+p-18p^2} - \frac{2}{2+5p+2p^2}$	4
v.	Prove that: $\frac{1}{1+cosx} + \frac{1}{1-cosx} = 2 + 2\cot^2 x$	4	***OR***	In the given figure, find area of a regular hexagonal roof of a building shown below. 	4

vi.	A hiking trail rises 500 meters over a horizontal distance of 2 kilometers. What is the slope of a trail? Express the slope in percentage.	4	***OR***	A decagonal die labeled 4,4,4,4,5,5,6,7,8,8 is rolled once. Find the probability of an odd number, an even number, and a factor of 12.	4
vii.	A triangular garden XYZ shows corners $X(-4,-4)$, $Y(12,0)$ and $Z(4,8)$ geometrically. Find locus of the corners equidistant from XZ and YZ.	4	***OR***	Given the equation of a line $y = 4x - 2$ and a point $(1, 2)$, how would you determine the equation of a line that passes through this point and is perpendicular to the given line? Express your final answer in the form $y = mx + c$	4
viii.	In the adjacent similar figures,  find the value of x and the ratio of volumes v_1 and v_2.	4	***OR***	A fair die is rolled 75 times and 5 appears up 20 times, what is the relative frequency of appearing any number up except 5.	4
ix.	Find the HCF of the polynomials $x^3 + 2x^2 - 4x - 8$ and $2x^3 + 7x^2 + 4x - 4$	4	***OR***	In a 50-over cricket match, average runs scored by Pakistani team for different sessions of the innings is given below: The score in 01 to 10 overs: 12 runs per over, 11 to 35 overs: 06 runs per over, 36 to 50 overs: 13 runs per over. Find average runs scored by the team in an innings.	4

SECTION – C (Marks 24)

$(3 \times 8 = 24)$

Note: Attempt all questions. Marks of each question are given.

Q. No.	Question	Marks		Question	Marks
Q3	For what value of k, the expression $y^4 + 4y^2 + k + \frac{8}{y^2} + \frac{4}{y^4}$ becomes a perfect square.	8	***OR***	Slopes of the sides of a triangle ABC are given as $m_1 = \frac{3}{2}$, $m_2 = -\frac{3}{2}$ and $m_3 = 2$. Find interior angles of the triangle ABC.	8
Q4	The height H of the tide at a coastal location varies over a day, modeled by $H = H_o + A \cdot sin\left(\frac{2\pi t}{T}\right)$, with H_o: the average tide height, A: the amplitude of tidal variation, t: the time in hours, and T: the period of tidal cycle in hours. If $H_o = 2m, A = 1m, T = 24hours$ use trigonometry to find the tide's height at $t = 0, 6, 18$ hours.	8	***OR***	Transform $-2x + 5y = 10$ in the following: (i) Two points form (ii) Two Intercepts form (iii) Symmetric form and (iv) Normal form	8

<table>
<tr>
<td>Q5</td>
<td>Construct altitudes of triangle ABC with side measures $m\overline{AB} = 4.8cm$, $m\overline{BC} = 3.5cm, m\overline{AC} = 4cm$ and show that the altitudes are concurrent. Write down the construction steps also.</td>
<td>8</td>
<td>OR</td>
<td>The grouped data for a company’s monthly expense (in million rupees) is given as:
<table>
<tr><td>C-I</td><td>140 – 149</td><td>150 – 159</td><td>160 – 169</td><td>170 – 179</td></tr>
<tr><td>f</td><td>3</td><td>7</td><td>5</td><td>9</td></tr>
</table>
Calculate the median and mode expense for 24 months.</td>
<td>8</td>
</tr>
</table>

Federal Board SSC-I Examination

Mathematics Model Question Paper

(Curriculum 2022-23)

Alignment of Questions with Student Learning Outcomes

OBJECTIVE PART
SECTION A

Q. No. (Part no.)	Content Area/ Domain	Student Learning Outcomes	Cognitive Level *	Allocated Marks
Q1(i)	Domain A	**[SLO M-09-A-04]:** Apply laws of indices to simplify radical expressions.	**K**	1
Q1(ii)	Domain A	**[SLO: M-09-A-05]:** Express a number in scientific notations and vice versa.	**K**	1
Q1(iii)	Domain A	**[SLO M-09-A-15]:** Explain product, Binary Relations and its domain and range.	**U**	1
Q1(iv)	Domain A	**[SLO: M-09-A-19]:** Find highest common factor and least common multiple of algebraic expressions and know relationship of LCM and HCF.	**K**	1
Q1(v)	Domain A	**[SLO: M-09-A-22]:** Solve linear equations and inequalities with rational coefficients and represent the solution set on a real line.	**U**	1
Q1(vi)	Domain B	**[SLO: M-09-B-20]:** Identify angles in standard position, expressed in degrees and radians.	**K**	1
Q1(vii)	Domain B	**[SLO: M-09-B-26]:** Solve problems involving bearing.	**A**	1
Q1(viii)	Domain B	**[SLO: M-09-B-16]:** Identify similarity of polygons. Area and volume of similar figures.	**U**	1
Q1(ix)	Domain B	**[SLO: M-09-B-23]:** Prove the trigonometric identities and apply them to show different trigonometric relations.	**K**	1
Q1(x)	Domain B	**[SLO: M-09-B-31]:** Draw angle bisectors, perpendicular bisectors, medians, altitudes of a given triangle and verify their concurrency.	**K**	1
Q1(xi)	Domain B	**[SLO: M-09-B-18]:** Solve real life problems that involve the properties of regular polygons, triangles and parallelograms (such as building architectural structures, fencing, tiling, painting, carpeting a room).	**A**	1
Q1(xii)	Domain B	**[SLO: M-09-B-19]:** Solve real life problems using the following loci and the method of intersecting loci for sets of points in two dimensions which are: at a given distance from a given point, at a given distance from a given straight line, equidistant from two given points equidistant from two given intersecting straight lines.	**A**	1
Q1(xiii)	Domain C	**[SLO: M-09-C -02]:** Calculate the mean modal class and median of a grouped frequency distribution.	**K**	1
Q1(xiv)	Domain C	**[SLO: M-09-C -04]:** Calculate the probability of a single event and the probability of event not occurring.	**K**	1

Q1(xv)	Domain C	**[SLO: M-09-C -06]:** Calculate relative frequency as an estimate of probability.	**U**	1

SUBJECTIVE PART
SECTION B & C

Q. No. (Part no.)	Content Area/ Domain	Description of Student Learning Outcomes	Cognitive Level *	OR	Content Area/ Domain	Description of Student Learning Outcomes	Cognitive Level *	Allocated Marks
Q2(i)	**Domain A**	**[SLO: M-09-A-04]** Apply laws of indices to simplify radical expressions.	**U**	***OR***	**Domain A**	**[SLO: M-09-A-13]** Verify and apply properties/laws of union and intersection of three sets through analytical and Venn diagram method.	**K**	**4**
Q2(ii)	**Domain B**	**[SLO: M-09-B-26]** Solve problems involving bearing.	**K**	***OR***	**Domain A**	**[SLO: M-09-A-15]** Explain product, Binary Relations and its domain and range.	**K**	**4**
Q2(iii)	**Domain A**	**[SLO: M-09-A-08]** Apply laws of logarithm to real life situations such as growth and decay, loudness of sound.	**K**	***OR***	**Domain B**	**[SLO: M-09-B-11]** Find the equation of the family of lines passing through the point of intersection of given two lines.	**K**	**4**
Q2(iv)	**Domain A**	**[SLO: M-09-A-22]** Solve linear equations and inequalities with rational coefficients and represent the solution set on a real line.	**U**	***OR***	**Domain A**	**[SLO: M-09-A-18]** Factorize quadratic and cubic algebraic expressions.	**K**	**4**
Q2(v)	**Domain B**	**[SLO: M-09-B-23]** Prove the trigonometric identities and apply them to show different trigonometric relations.	**U**	***OR***	**Domain B**	**[SLO: M-09-B-18]** Solve real life problems that involve the properties of regular polygons, triangles and parallelograms (such as building architectural structures, fencing, tiling, painting, carpeting a room).	**A**	**4**
Q2(vi)	**Domain B**	**[SLO: M-09-B-03]** Find the	**A**	***OR***	**Domain C**	**[SLO:M-09-C-04]** Calculate the	**K**	**4**

		gradient of a straight line when coordinates of two points are given.				probability of a single event and the probability of event not occurring.		
Q2(vii)	**Domain B**	**[SLO: M-09-B-19]** Solve real life problems using the following loci and the method of intersecting loci for sets of points in two dimensions which are: at a given distance from a given point, at a given distance from a given straight line, equidistant from two given points equidistant from two given intersecting straight lines.	**A**	***OR***	**Domain B**	**[SLO: M-09-B-04]** Find the equation of a straight line in the form $y = mx + c$.	**K**	**4**
Q2(viii)	**Domain B**	**[SLO: M-09-B-17]** Solve problems using the relationship between areas of similar figures and volume of different solids.	**U**	***OR***	**Domain C**	**[SLO: M-09-C-06]** Calculate relative frequency as an estimate of probability.	**U**	**4**
Q2(ix)	**Domain A**	**[SLO:M-09-A-19]** Find highest common factor and least common multiple of algebraic expressions and know relationship of LCM and HCF.	**U**	***OR***	**Domain C**	**[SLO: M-09-C - 03]** Solve real life situations involving mean, weighted mean, median, and mode for given data (such as allocation of funds in different projects, forecasting future demographics, marketing, forecasting government budgets).	**A**	**4**
Q3	**Domain A**	**[SLO: M-09-A-20]** Find square root of algebraic expression by	**U**	***OR***	**Domain B**	**[SLO: M-09-B-12]** Calculate angles of the triangle when the slopes	**U**	**8**

		factorization and division.				of the sides are given.		
Q4	**Domain B**	**[SLO: M-09-B-22]** Solve real life trigonometric problems in two dimensions involving angles of elevation and depression.	**U**	***OR***	**Domain B**	**[SLO: M-09-B-09]** Show that a linear equation in two variables represents a straight line and reduce the general form of the equation of a straight line to the other standard forms.	**U**	**8**
Q5	**Domain B**	**[SLO: M-09-B-31]** Draw angle bisectors, perpendicular bisectors, medians, altitudes of a given triangle and verify their concurrency.	**U**	***OR***	**Domain C**	**[SLO: M-09-C - 03]** Solve real life situations involving mean, weighted mean, median, and mode for given data (such as allocation of funds in different projects, forecasting future demographics, marketing, forecasting government budgets).	**A**	**8**

*Cognitive Level

K: Knowledge
U: Understanding
A: Application

Table of Specification

Model Question Paper Mathematics – Grade IX (SSC-I)

Domain Title/ Content Area **Cognitive Level**	**Domain A** **Numbers and Algebra**	**Domain B** **Geometry**	**Domain C** **Information Handling**	**Total Marks**	**Percentage of Cognitive Level**
Knowledge	Q1(i)1, Q1(ii)1, Q1(iv)1, Q2(i/s)4, Q2(ii/f)4, Q2(iii/f)4, Q2(ii/s)4 (19 marks)	Q1(vi)1, Q1(ix)1, Q1(x)1, Q2(iii/s)4, Q2(vi/f)4, Q2(vii/s)4 (15 marks)	Q1(xiii)1, Q1(xiv)1, Q2(vi/s)4 (06 marks)	40	30%
Understanding	Q1(iii)1, Q1(v)1, Q2(i/f)4, Q2(iv/f)4, Q2(iv/s)4, Q3(f)8 (22 marks)	Q1(viii)1, Q2(v/f)4, Q2(ix/f)4, Q3(s)8, Q4(f)8, Q4(s)8, Q5(f)8 (41 marks)	Q1(xv)1, Q2(viii/s)4 (05 marks)	68	50%
Application		Q1(vii)1, Q1(xi)1, Q1(xii)1, Q2(v/s)4, Q2(vii/f)4, Q2(viii/f)4, (15 marks)	Q2(ix/s)4 Q5(s)8 (12 marks)	27	20%
Total Marks	41	71	23	135	-
Total Percentages	30%	53%	17%	-	100%

Note:

1 This TOS does not reflect policy, but it is particular to this model question paper.
2 Proportionate / equitable representation of the content areas may be ensured.
3 The percentage of cognitive level is 20%, 50%, and 30% for knowledge, understanding, and application, respectively with **± 5%** variation.
4 While selecting alternative questions for Short Response Questions (SRQs) and Extended Response Questions (ERQs), it must be kept in mind that:
- Difficulty levels of both questions should also be same
- SLOs of both the alternative questions must be different

Key: Question Number (part/ first choice) marks example: Q2 (i / f) 4
Question Number (part/ second choice) marks example: Q2 (i / s) 4



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