

**EXAMINATIONS SECTION
KARAKORAM INTERNATIONAL
UNIVERSITY
GILGIT-BALTISTAN, GILGIT**



**ASSESSMENT FRAMEWORK
FOR
MATHEMATICS GRADE-XI CURRICULUM 2022-23**

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

To enhance clarity and accuracy in assessments, the learning outcomes have been divided into two types: formative and summative. This distinction is essential for effectively tracking student progress and understanding. Each Student Learning Outcome (SLO) is clearly labeled as either formative or summative in the newly designed Assessment Framework. Summative SLOs are included in the Final Examination, while formative SLOs are part of regular teaching and learning activities but are not assessed in the Final Examination.

Each SLO is associated with specific cognitive levels: Knowledge (K), Understanding (U), and Application (A). Note that all higher-level cognitive skills are grouped under the "Application" level. For subjects with practical components (lab work), the framework specifies whether an SLO is summative for theoretical exams or for Practical-Based Assessment (PBA). If an SLO is summative for PBA, this means that lab work is required during instruction and will be assessed in the Practical Examination or Practical-Based Assessment.

The Assessment Framework serves as a comprehensive resource for students, teachers, and exam creators. Students can follow clear guidelines for exam preparation, teachers can better understand the curriculum and prepare students effectively, and paper setters can use the framework to guide their question-setting process.

FORMATIVE ASSESSMENT: A KEY COMPONENT OF EFFECTIVE LEARNING

Formative assessment is a fundamental part of the educational process, offering continuous feedback that benefits both students and teachers. Unlike summative assessments, which measure student learning at the end of a term or unit, formative assessments are embedded within the learning process to regularly track student comprehension and inform instructional choices.

The main goal of formative assessment is to identify gaps in understanding and correct misconceptions as they arise, enabling timely support. This responsive approach allows teachers to adjust their methods based on student needs. For example, if a teacher notices through a quick quiz or class discussion that many students are struggling with a particular concept, they can review it, introduce alternative explanations, or employ different teaching strategies. This flexibility is essential for helping students build a stronger grasp of the material.

Formative assessments come in various forms, from informal techniques like discussions, observations, and questioning to more structured methods like quizzes, peer assessments, and self-reflection exercises. These assessments can extend beyond traditional paper tasks and include digital tools that provide instant feedback. This adaptability helps teachers address different learning styles, ensuring that every student is actively engaged and supported in their educational journey.

Additionally, formative assessment fosters a positive classroom environment by shifting the focus from grades to the learning process itself. Students see assessments as opportunities to grow rather than final judgments of their abilities, reducing stress and increasing motivation and engagement in their studies.

In summary, formative assessment is an empowering educational strategy that, when used effectively, enriches the entire learning journey! It offers invaluable insights to both teachers and students, igniting a growth-focused environment and cultivating essential skills along the way. As education

evolves, formative assessment will undoubtedly remain at the heart of creating meaningful, impactful, and successful learning experiences for every student.

SUMMATIVE ASSESSMENT: ACHIEVEMENT AND MASTERY THROUGH FINAL EXAMINATIONS

Summative assessment is an exciting culmination of the learning journey, designed to evaluate student achievements at the end of an instructional period. Unlike formative assessments, which provide continuous feedback, summative assessments serve as a conclusive measure of what students have mastered. Conducted at the end of a unit, course, or academic year, summative assessments gauge how well educational goals have been achieved.

The primary purpose of summative assessment is to assess the full impact of learning and teaching, capturing a comprehensive view of students' progress. Through tests, final projects, or standardized exams, these assessments reveal a student's level of mastery in a subject, often culminating in grades or scores that reflect their dedication and hard work throughout a specific period.

Summative assessments also play a pivotal role in shaping students' academic paths, helping to make important decisions about advancement, certification, or placement. Beyond individual evaluation, these assessments provide valuable insights for curriculum development, as educators can analyze results to identify trends, strengths, and areas for growth within instructional methods. This feedback loop is key to refining and enhancing future learning experiences.

Summative assessment is a vital part of the learning journey, offering students an opportunity to demonstrate their achievements and understanding at the end of an instructional period. While formative assessments guide learning along the way, summative assessments provide a focused, culminating moment for students to showcase their hard work and knowledge.

This final evaluation not only highlights each student's growth but also gives educators a valuable measure of the success of their instructional strategies. By analyzing these outcomes, teachers gain insights into what worked well and areas for future enhancement, ultimately strengthening the learning experience for all students. Together, formative and summative assessments create a balanced and supportive framework for learning, combining ongoing feedback with milestone achievements. In this way, summative assessment plays a key role in both celebrating progress and setting the stage for continued academic success.

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**NATIONAL CURRICULUM OF PAKISTAN 2022-2023
ASSESSMENT FRAMEWORK MATHEMATICS (THEORY)
DETAILS OF CONTENT AREAS/ SLOS GRADE XI**

Keys for the Document

1. (Number of Periods Required, 1 period=40 minutes)
2. **Summative.** Summative assessment is an assessment administered at the end of an instructional unit in a course. Unlike formative assessment, this assessment model is intended to evaluate student learning by comparing performance to a standard or benchmark. (Question(s) will be asked in annual examination)
3. **Formative.** Formative assessment includes both formal and informal techniques of assessment that teachers employ during the learning process. It is also referred to as formative evaluation, formative feedback, or assessment for learning, including diagnostic testing. The objective is to improve student achievement by modifying teaching and learning activities. (Question(s) will not be asked in annual examination)

Cognitive Levels (K=Knowledge, U= Understanding and A=Application)

Domain	Content Area	SLO No.	SLO Description	Cognitive Level	Type of Assessment	No. of Periods Required
A. Numbers and Algebra	Complex Numbers	[SLO: M-11-A-01]	Recall complex number z represented by an expression of the form $z = a + ib$ or of the form (a, b) where a and b are real numbers and $i = \sqrt{-1}$	K	Formative	14
		[SLO: M-11-A-02]	Recognize a as a real part of z and b as an imaginary part of z .	U	Formative	
		[SLO: M-11-A-03]	Know the condition for equality of complex numbers.	K	Formative	
		[SLO: M-11-A-04]	Carryout basic operations on complex numbers.	U	Formative	
		[SLO: M-11-A-05]	Define $z = a - ib$ as the complex conjugate of $z = a + ib$.	K	Formative	
		[SLO: M-11-A-06]	Define $ z = \sqrt{a^2 + b^2}$ as the absolute value or modulus of a complex number $z = a + ib$.	K	Formative	
		[SLO: M-11-A-07]	Solve the simultaneous linear equations with complex coefficients. For example, $5z - (3 + i)w = 7 - i,$ $\begin{cases} (2 - i)z + 2iw = -1 + i \end{cases}$	U	Summative	

	[SLO: M-11-A-08]	Write the polynomial $P(z)$ as a product of linear factors. For example, $z^2 + a^2 = (z + ia)(z - ia)$ $z^3 - 3z^2 + z + 5 = (z + 1)(z - 2 - i)(z - 2 + i)$	K	Summative	
	[SLO: M-11-A-09]	Solve quadratic equation of the form $pz^2 + qz + r = 0$ by completing squares, where p, q, r are real numbers and z a complex number. For example, Solve $z^2 - 2z + 5 = 0$ $(z - 1 - 2i)(z - 1 + 2i) = 0$ $z = 1 + 2i, 1 - 2i$	K	Summative	
	[SLO: M-11-A-10]	Explain the polar coordinates system.	U	Formative	
	[SLO: M-11-A-11]	Describe the polar representation of a complex number.	U	Summative	
	[SLO: M-11-A-12]	Apply the operations with complex numbers in polar representation.	U	Summative	
	[SLO: M-11-A-13]	Demonstrate simple equations and inequations involving complex numbers in polar form.	A	Summative	
	[SLO: M-11-A-14]	Apply concepts of complex numbers to real world problems (such as cryptography, wave phenomena, calculate voltage, current, circuits, the velocity and pressure of the fluid).	A	Summative	
Matrices & Determinants	[SLO: M-11-A-15]	Apply matrix operations (addition / subtraction and multiplication of matrices) with real and complex entries.	K	Formative	21
	[SLO: M-11-A-16]	Evaluate determinant of 3×3 matrices by using cofactors and properties of determinants.	U	Summative	
	[SLO: M-11-A-17]	Use row operations to find the inverse and the rank of a matrix.	U	Summative	
	[SLO: M-11-A-18]	Explain a consistent and inconsistent system of linear equations and demonstrate through examples.	U	Summative	
	[SLO: M-11-A-19]	Solve a system of 3 by 3 non homogeneous linear equations by using matrix inversion method and Cramer's Rule.	U	Summative	
	[SLO: M-11-A-20]	Solve a system of three homogeneous linear equations in three unknowns using the Gaussian elimination method.	U	Summative	
	[SLO: M-11-A-21]	Apply the concepts of matrices to real world problems such as (graphic design, data encryption, seismic analysis, cryptography, transformation of geometric shapes, social network analysis).	A	Summative	
Sequences and Series	[SLO: M-11-A-22]	Solve problems by analyzing arithmetic sequences and series up to n terms.	U	Summative	21
	[SLO: M-11-A-23]	Solve problems by analyzing geometric sequences and series up to n terms.	U	Summative	
	[SLO: M-11-A-24]	Identify a sequence as arithmetic or geometric sequence up to n terms.	U	Formative	

	[SLO: M-11-A-25]	Solve problems by analyzing harmonic sequences and series up to n terms.	U	Summative	
	[SLO: M-11-A-26]	Find the sum of: <ul style="list-style-type: none"> ❖ first n natural numbers ($\sum n$), ❖ squares of first n natural numbers ($\sum n^2$), ❖ cubes of first n natural numbers ($\sum n^3$). 	K	Formative	
	[SLO: M-11-A-27]	Recognize the arithmetic geometric sequence, determine its general term, find sum to n terms and sum to infinite number of terms, using sigma notation.	U	Summative	
	[SLO: M-11-A-28]	Identify leasing of motor vehicles, down payment, motor vehicle insurance, processing charges, repayment in monthly instalments.	K	Formative	
	[SLO: M-11-A-29]	Solve problems related to leasing of motor vehicle under different conditions.	A	Summative	
	[SLO: M-11-A-30]	Apply concepts from sequence and series to real world problems (such as simple interest on loan, investment, depreciation, Investment planning on compound interest, projectile motion, gaming strategy, health care management, web page design, traffic modelling).	A	Summative	
Mathematical Induction and Binomial Theorem	[SLO: M-11-A-31]	Describe a mathematical argument, identify the base case, induction of hypothesis and a precise conclusion.	K	Formative	28
	[SLO: M-11-A-32]	Apply the principle of Mathematical Induction to prove statements, identities, divisibility of numbers and summation formulae.	A	Summative	
	[SLO: M-11-A-33]	Evaluate and justify conclusions, communicating a position clearly in an appropriate mathematical form in daily life.	A	Summative	
	[SLO: M-11-A-34]	State and apply the Binomial Theorem to expand expressions of the form $(a + b)^n$ where n is a positive integer.	K	Summative	
	[SLO: M-11-A-35]	Describe Binomial Theorem as expansion of binomial powers restricted to the set of natural numbers.	U	Summative	
	[SLO: M-11-A-36]	Calculate binomial coefficients using Pascal's triangle.	K	Formative	
	[SLO: M-11-A-37]	Expand using the Binomial Theorem, and use appropriate techniques to simplify the expression.	U	Summative	
	[SLO: M-11-A-38]	Find an approximate value using the Binomial Theorem.	A	Summative	
	[SLO: M-11-A-39]	Use Binomial Theorem to find the remainder when a number to some large exponent is divided by a number.	A	Summative	

		[SLO: M-11-A-40]	Use Binomial Theorem to find the last digit of a number, test the divisibility by a number and compare two large numbers.	A	Summative	
		[SLO: M-11-A-41]	Apply concepts of Mathematical Induction and Binomial Theorem to real world problems such as (Puzzles, Domino Effects, Pascal's Triangle, Economic Forecasting, Rankings, Variable Subletting).	A	Summative	
	Division of polynomial	[SLO: M-11-A-42]	Divide a polynomial of degree up to 4 by a linear and quadratic polynomial to identify quotient and remainder.	U	Summative	14
		[SLO: M-11-A-43]	Demonstrate and apply Remainder Theorem.	U	Summative	
		[SLO: M-11-A-44]	Analyze and apply Factor Theorem to factorize a cubic polynomial.	A	Summative	
		[SLO: M-11-A-45]	Apply concepts of Remainder and Factor Theorems to real world problems (such as polynomial regression, signal processing, and coding theory).	A	Summative	
B. Geometry	Vectors in Space	[SLO: M-11-B-01]	Recognize rectangular coordinate system in space.	K	Formative	28
		[SLO: M-11-B-02]	Define unit vectors \hat{i} , \hat{j} and \hat{k} and Recognize components of a vector.	K	Formative	
		[SLO: M-11-B-03]	Find the magnitude of a vector.	K	Formative	
		[SLO: M-11-B-04]	Repeat all fundamental mathematical operations for vectors in space which, in the plane, have already been discussed.	K	Formative	
		[SLO: M-11-B-05]	Demonstrate and prove properties of Vector Addition <ul style="list-style-type: none"> ❖ The Commutative Law, ❖ The Associative Law, ❖ Null vector $\vec{0}$ as an identity vector, ❖ $-\vec{a}$ as additive inverse vector of \vec{a} . 	K	Formative	
		[SLO: M-11-B-06]	Explain Dot or Scalar Product of two vectors and give its geometrical interpretation.	U	Summative	
		[SLO: M-11-B-07]	Express dot product in terms of components.	K	Summative	
		[SLO: M-11-B-08]	Find the condition for orthogonality of two vectors.	K	Summative	
		[SLO: M-11-B-09]	Use dot product to find the angle between two vectors.	U	Summative	
		[SLO: M-11-B-10]	Find the projection of a vector along another vector.	K	Summative	
		[SLO: M-11-B-11]	Find the work done by a constant force in moving an object along a given vector.	U	Summative	
		[SLO: M-11-B-12]	Solve daily life problems based on vectors. Cross or Vector Product.	A	Summative	
		[SLO: M-11-B-13]	Explain the cross or vector product of two vectors and give its geometrical interpretation.	U	Summative	

	[SLO: M-11-B-14]	Apply a cross product to find the angle between two vectors.	A	Summative	
	[SLO: M-11-B-15]	Solve situations in daily life based on Cross or dot Vector Product.	A	Summative	
	[SLO: M-11-B-16]	Describe scalar triple product of vectors.	U	Summative	
	[SLO: M-11-B-17]	Express Scalar Triple Product of vectors in terms of components (determinant form).	K	Summative	
	[SLO: M-11-B-18]	Prove that $\hat{i} \cdot \hat{j} \times \hat{k} = \hat{j} \cdot \hat{k} \times \hat{i} = \hat{k} \cdot \hat{i} \times \hat{j} = 1$ $\hat{j} \cdot \hat{i} \times \hat{k} = \hat{k} \cdot \hat{j} \times \hat{i} = \hat{i} \cdot \hat{k} \times \hat{j} = -1$. Prove that dot and cross are inter-changeable in scalar triple product.	K	Summative	
	[SLO: M-11-B-19]	Find the volume of a $\hat{\diamond}$ Parallelepiped, $\hat{\diamond}$ Tetrahedron, determined by three given vectors.	K	Summative	
	[SLO: M-11-B-20]	Define coplanar vectors and find the condition for planarity of three vectors.	K	Summative	
	[SLO: M-11-B-21]	Apply concepts of vectors in space to real world problems such as (design and execute optimal navigation paths in transportation and logistics, graphing complex 3D motion, vector operations in engineering and computer graphics, practical proficiency for work, flux, and circulation).	A	Summative	
Fundamental Law of Trigonometry	[SLO: M-11-B-22]	Establish fundamental law of trigonometry.	U	Summative	14
	[SLO: M-11-B-23]	Apply fundamental law and its deductions to derive: Trigonometric ratios of allied angles, double angle, half angle and triple angle identities.	A	Summative	
	[SLO: M-11-B-24]	Express the product (of sines and cosines) as sums or differences (of sines and cosines).	K	Summative	
Trigonometric Functions	[SLO: M-11-B-25]	Find the domain and range of the trigonometric functions.	U	Summative	21
	[SLO: M-11-B-26]	Discuss even, odd functions and the periodicity of trigonometric functions.	U	Summative	
	[SLO: M-11-B-27]	Find the maximum and minimum value of a given function of the type: $\hat{\diamond} a + b \sin \theta$, $\hat{\diamond} a + b \cos \theta$ $\hat{\diamond} a + b \sin(c\theta + d)$, $\hat{\diamond} a + b \cos(c\theta + d)$ $\hat{\diamond}$ the reciprocals of above, where a, b, c and d are real numbers.	U	Summative	
	[SLO: M-11-B-28]	Graph and analyze the trigonometric functions sine, cosine, and tangent to solve problems.	U	Summative	
	[SLO: M-11-B-29]	Explain the properties of graphs of $\sin \theta$, $\cos \theta$ and $\tan \theta$.	U	Summative	

		[SLO: M-11-B-30]	Apply the concepts of trigonometric functions, identities, graphs, periodicity, even & odd functions and extreme values to real world problems such as distance, elevation, and direction of tall structures, navigation and mapping, lengths of irregular shapes, graphs to visualize and predict patterns in data, frequency and periodic length of Ferris wheel, forces on a see-saw or lever, the ideal angle for solar panel placement.	A	Summative	
C. Information Handling	Permutation and Combination	[SLO: M-11-C - 01]	Explain and solve problems that involve the fundamental counting principle.	U	Summative	14
		[SLO: M-11-C - 02]	Explain and Solve problems that involve permutations.	U	Summative	
		[SLO: M-11-C - 03]	Explain and Solve problems that involve combinations.	U	Summative	
		[SLO: M-11-C - 04]	Apply the concepts of permutation and combination to real world problems such as cryptography, estimating the odds of winning a lottery, calculating the number of possible DNA sequences or protein structures, choosing different sets of songs for certain occasions.	A	Summative	