



ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

**Higher Secondary School
Certificate (HSC)**

**Examination syllabus
&
Model Paper**

Mathematics-XII

Based on Provincial revised curriculum (Sindh)

Prepared by: Mr. Farooq Muhammad

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You can Approach us:

Address: Ziauddin University Examination Board
D / 20 Block 1 Clifton Karachi
Phone: 92 21 35148594
E-mail: info@zueb.edu.pk
Website: www.zueb.edu.pk

PREFACE

Ziauddin University Examination Board (ZUEB) was established by the Sindh ACT XLI 2018, with the aim of improving the quality of education. The Board administers examinations for the Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSSC) based on the latest Reviewed National Curriculum by Directorate Curriculum Assessment and Research (DCAR) Sindh. ZUEB has a mandate by Ordinance to offer such examination services to English /Urdu and Sindhi medium candidates for SSC and HSSC from private schools in Sindh. This examination syllabus exemplifies ZUEB's commitment to provincial educational goals

The Examination Board has prepared with the help of subject professors, subject wise syllabus. It is important to make the difference between syllabus and curriculum. The syllabus of a subject is considered as a guide for the subject teacher as well as the students. It helps the students understand the subject in detail. It also helps students to anticipate what is expected from them while preparing for the exams.

This examination syllabus brings together all those cognitive outcomes of the Provincial Curriculum statement which can be reliably and validly assessed. While the focus is on the cognitive domain, particular emphasis is given to the application of knowledge and understanding.

The examination syllabus is uploaded on the ZUEB website. This is done to help affiliated schools in planning their teaching. It is the syllabus, not the prescribed textbook which is the basis of the ZUEB examinations. In addition, the ZUEB examination syllabus is used to develop learning support materials for students and teachers. The examination board stand committed to all students who have embarked upon the SSC, and HSSC courses in facilitating their learning outcomes. Our examination syllabus document ensures all possible support.

On the Ziauddin University Examination Board website a tab e –resource is made available which provides resource material in all subjects both in text form in line with the curriculum and also videos on topics to give students access to learn at their own pace and own time. These 15 to 20 minutes videos are prepared around subject concept / topics. These videos are available to the students for revisiting a lesson taught by their teacher or watch it prior to the lesson and as a reinforcement strategy. The work on videos is in progress and new titles will be uploaded.

Please look out for the videos on the given website



Humbly Yours;

Shahbaz Nasim
Curriculum Coordinator

Rationale For The Reviewed Provincial Curriculum

The process of revising the National Curriculum 2006 was initiated in August 2004 when newly elected government of Pakistan decided to introduce education reform in the country. The education reform process included the announcement of new National Education Policy. National Education Census and changing the curricula (Ministry of Education, 2009)

In reality, change in secondary school curriculum was initiated in 2006 and as result, scheme of studies for classes I to XII was reviewed and curriculum of 25 compulsory subjects.

The 18th Amendment to the constitution of Pakistan has reconfigured the federal and provincial relationship by abolishing the “concurrent legislative list”. The Act (2010) provides the provinces with strong legislative and financial autonomy in education, health, and other social sectors. Major implication of the 18th Amendment for education is that the curriculum, syllabus, planning, policy, centers of excellence and standards of education will fall under the purview of the provinces. This was a big step forward for education.

In Sindh the Curriculum review team was assigned a task by the School Education Department, Government of Sindh to review the National Curriculum 2006 for all subjects and prepare a revised version that best suits the needs of the students’ teachers and meets the spirit of the 18th amendment.

Subject wise curriculum review committees were formed. Curriculum review team critically examined the contextual and textual parts and aligned the different sections horizontally and vertically of the Curriculum. The Bureau of Curriculum (BOC) played vital role in organizing the workshops and meetings at Hyderabad for the completion of task. The positive support from a number of educationists, researchers and teachers helped in completing the mammoth task of curriculum revision.

On the DCAR website http://dcar.gos.pk/BoC_Other_Pages/curriculum_dev.html the national curriculum as well as the revised curriculums are all placed for easy reference.

The Ziauddin University Examination Board Examination syllabi for SSC and HSSC are prepared with the Sindh Revised curriculum. Up till now following subject text books have been developed as per the revised curriculum.

AIMS AND OBJECTIVES:

Curriculum of mathematics is comprised of five standards

1- Numbers and Operations

The students will be able to:

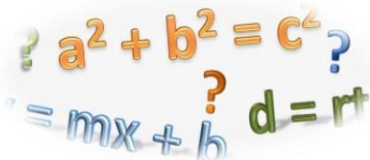
- Identify numbers, ways of representing numbers and effects of operations in various situations,
- Compute fluently with fractions, decimals and percents,
- Manipulate different types of sequence and apply operations on matrices.



2 - Algebra

The students will be able to:

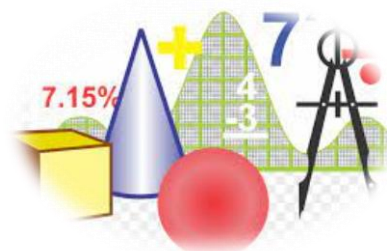
- Analyze number patterns and interpret mathematical situations by manipulating algebraic expressions and relations.
- Model and solve contextualized problems, interpret functions, calculate rate of change of functions.
- Integrate analytically and numerically. determine orthogonal trajectories of a family of curves and solve non-linear equations numerically



3 - Measurements and Geometry

The students will be able to:

- Identify measurable attributes of objects, construct angles and two-dimensional figures.
- Analyze characteristics and properties of geometric shapes and develop arguments about their geometric relationships.
- Recognize trigonometric identities, analyze conic sections, draw and interpret graphs of functions.



4 - Information Handling

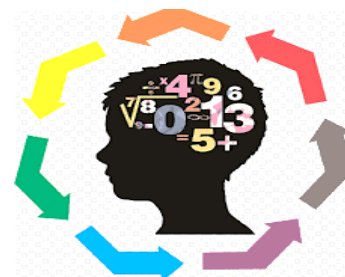
The students will be able to:

- collect, organize, analyze, display and interpret data/ information

5 - Reasoning and Logical Thinking

The students will be able to:

- Use patterns, known facts, properties and relationships to analyze mathematical situations.
- Examine real life situations by identifying, mathematically valid arguments and drawing conclusion to enhance their mathematical thinking



ZIAUDDIN UNIVERSITY EXAMINATION BORD
SLOs CATEGORIZATION
XII-MATHEMATICS
Detailed Syllabus

UNIT 1 FUNCTIONS AND LIMITS

S.no	Topic	Student learning outcomes
1.1	Functions	i) Identify through graph the domain and range of a function. ii) Draw the graph of modulus function (i.e. $y = x $) and identify its domain and range
1.2	Composition of Function	i) Describe the composition of functions ii) Find the composition of two given functions.
1.3	Inverse of Composition of Functions	Find the inverse of composition of two given functions.
1.4	Transcendental functions	Identify algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, hyperbolic (and their identities), explicit and implicit functions, and parametric representation of functions
1.5	Graphical Representations	i) Draw the graphically graph of <ul style="list-style-type: none"> The explicitly defined functions like $y = f(x)$ where $f(x) = e^x, a^x, \log_a x, \log_e x$. The implicitly defined functions such as $x^2 + y^2 = a^2$ and $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and distinguish between graph of a function and of an equation The parametric equation of functions such as $x = at^2, y = 2at; x = a \sec \theta, y = b \tan \theta$. The discontinuous functions of the type $f(x) = \begin{cases} x, & 0 \leq x < 1, \\ x - 1, & 1 \leq x \leq 2. \end{cases}$ ii) Apply MAPLE graphic commands for two – dimensional plot of <ul style="list-style-type: none"> an expression (or a function), parameterized from a function, implicit function, By restricting domain and range. iii) Apply MAPLE package plots for plotting different types of functions.
1.6	Limit of a function	i. Identify a real number by a point on the number line ii. Define and represent <ul style="list-style-type: none"> Open interval, Closed interval, Half open and half closed intervals on the number line. iii. Explain the meaning of phrase: <ul style="list-style-type: none"> x tends to zero ($x \rightarrow 0$), X tends to a zero ($x \rightarrow \alpha$), X tends to infinity ($x \rightarrow \infty$)

		ii. Define limit of a sequence. iii. Find the limit of a sequence whose nth term is given. iv. Define limit of a function. vii. State the theorems on limits of sum, difference, product and quotient of functions and demonstrate through examples. viii. Apply the theorems on limits of sum, difference, product and quotient of functions and demonstrate through examples.
1.7	Important Limits	Evaluate the limits of functions of the following types: <ul style="list-style-type: none"> ▪ $\frac{x^n - a^n}{x - a}, \frac{x - a}{\sqrt{x} - \sqrt{a}}$ when $x \rightarrow a$, ▪ $(1 + \frac{1}{x})^x$ when $x \rightarrow \infty$, ▪ $(1 + x)^{\frac{1}{z}}, \frac{\sqrt{x+a} - \sqrt{a}}{x}, \frac{a^z - 1}{x}$, ▪ $\frac{(1+x)^n - 1}{x}$, and $\frac{\sin x}{x}$ when $x \rightarrow 0$ <ul style="list-style-type: none"> • Evaluate limits of different algebraic, exponential and trigonometric functions • Apply MAPLE command limit to evaluate limit of a functions.
1.8	Continuous Discontinuous Functions	<ul style="list-style-type: none"> • Describe left hand and right hand limits and demonstrate through examples. • Define continuity of function at a point and in an interval. • Evaluate test continuity and discontinuity of a function at a point and in an interval • Apply MAPLE command iscont to test continuity of a function at a point and in a given interval.

UNIT 2 THE STRAIGHT LINE

S.no	Topic	Student learning outcomes
2.1	Division of a Line Segment	i) Recall distance formula to calculate distance between two points given in Cartesian plane. ii) Find coordinates of a point that divides the line segment in given ratio (internally and externally). iii) Verify that medians and angle bisectors of a triangle are concurrent.
2.2	Slope of a Straight line	i) Determine the slope of a line. ii) Derive the formula to find the slope of a line passing through two points. iii) Find out the condition that two straight lines with given slopes may be: <ul style="list-style-type: none"> • Parallel to each other, • Perpendicular to each other.
2.3	Equation of a straight line parallel to Co-ordinate Axes	i) Find the equation of a straight line parallel to <ul style="list-style-type: none"> • Y-axis at a distance α from it. • X-axis at a distance b from it
2.4	Standard Form of Equation of a	i) Determine intercepts of a straight line. Derive equation of a straight line in <ul style="list-style-type: none"> • Slope-intercepts form, • Point-slope form,

	Straight Line	<ul style="list-style-type: none"> • Two-point form, • Intercepts form , • Symmetric form, • Normal form. <p>ii)Verify that a linear equation in two variables represents a straight line. iii)Reduce the general form of the equation of a straight line to the other standard forms.</p>
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UNIT 3 THE GENERAL EQUATION OF STRAIGHT LINE

3.1	Distance of a point from a line	<p>i)Recognize a point with respect to position of a line. ii)Find the perpendicular distance from a point to the given straight line.</p>
3.2	Angle Between Lines	<p>i)Show that the angle between two coplanar intersecting straight lines. ii)Determine the equation of family of lines passing through the point of intersection of two given lines iii)Calculate angles of the triangle when the slopes of the sides are given.</p>
3.3	Concurrency of Straight Lines	<p>i)Show the condition of concurrency of three straight lines. ii)Find the equation of median, altitude and right bisector of a triangle: iii)Show that:</p> <ul style="list-style-type: none"> • Three right bisectors. • Three medians. • Three altitudes, <p>Of a triangle are concurrent</p>
3.4	Area of a Triangular Region	<p>i)Find area of a triangular region whose vertices are given.</p>
3.5	Homogenous Equation	<p>i)Recognize homogenous linear and quadratic equations in two variables. ii)Investigate that the 2nd degree homogenous equation in two variables x and y represents a pair of straight lines through the origin and find acute angle between them.</p>

UNIT 4 DIFFERENTIATION

S.no	Topic	Student learning outcomes
4.1	Derivative of a Functions	<p>i)Differentiate between independent and dependent variables. ii)Evaluate corresponding change in the dependent variable when independent variable is incremented (or decremented). iii)Describe the concept of rate of change. iv)Define derivative of a function as an instantaneous rate of change of a variable</p>

		<p>with respect to another variable.</p> <p>v) Explain derivative or differential coefficient of a function.</p> <p>vi) Find the derivative $y=x^n$, where $n \in \mathbb{Z}$ (the set of integers), from first principles.</p> <p>vii) Find the derivative by first principles of $y=(ax+b)^n$, where $n=\frac{p}{q}$ and p, q are integers such that $q \neq 0$</p>
4.2	Theorems on Differentiation	<p>Prove the following theorems for differentiation.</p> <ul style="list-style-type: none"> The derivative of a constant is zero. The derivative of any constant multiple of a function is equal to the product of that constant and the derivative of the function. The derivative of a sum (or difference) of two functions is equal to the sum (or difference) of their derivatives. Derivative of two product functions $\left(u \frac{d}{dx} v + v \frac{d}{dx} u\right)$ Derivative of two quotient functions $\frac{\left(v \frac{d}{dx} u - u \frac{d}{dx} v\right)}{v^2}$
4.3	Application of theorem on differentiation	<p>Differentiate:</p> <ul style="list-style-type: none"> Constant multiple of x^n, Sum (or difference) of functions, Polynomials, Product of functions Quotient of two functions.
4.4	Chain Rule	<p>i) Verify that $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$ when $y=f(u)$ and $u=g(x)$.</p> <p>ii) Show that $\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$</p> <p>iii) Apply chain rule to show that $\frac{d}{dx} [f(x)]^{n-1} f'(x)$</p> <p>iv) Solve derivative of implicit function.</p>
4.5	Differentiation of trigonometric and inverse trigonometric functions	<p>Differentiate:</p> <ul style="list-style-type: none"> Trigonometric functions ($\sin x, \cos x, \tan x, \operatorname{cosec} x, \operatorname{sec} x, \cot x$) from first principles. Inverse trigonometric functions ($\arcsin x, \arccos x, \arctan x, \operatorname{arccosec} x, \operatorname{arcsec} x, \operatorname{arccot} x$) using differentiation formulae.
4.6	Differentiation of Exponential and logarithm functions	<p>i) Find the derivative of e^x and a^x from first principles.</p> <p>ii) Find the derivative of $\ln x$ and $\log_a x$ from first principles.</p> <p>iii) Find the derivative of algebraic expression involving product, quotient and power.</p>

UNIT 6 INTEGRATION

S.no	Topic	Student learning outcomes
6.1	Introduction	i) Determine the concept of the integral as an accumulator ii) Know integration as inverse process of differentiation iii) Explain constant of integration iv) Know simple standard integrals which directly follow from standard differentiation formulae.
6.2	Rules of Integration	i) Recognize the following rules of integration. <ul style="list-style-type: none"> ▪ $\int \frac{d}{dx} [f(x)] dx = \frac{d}{dx} [\int f(x) dx] = f(x) + c$ ▪ where c is a constant of integration. ▪ The integral of the product of a constant and a function is the product of the constant and the integral of the function. ▪ The integral of the sum of a finite number of functions is equal to the sum of their integrals. ii) Use standard differentiation formulae to prove the results for the following integrals: <ul style="list-style-type: none"> ▪ $\int [f(x)]^n f'(x) dx$ ▪ $\int \frac{f'(x)}{f(x)} dx$ ▪ $\int e^{ax} [af(x) + f'(x)] dx$
6.3	Integration by Substitution	i) Explain the method of integration by substitution. ii) Apply method of substitution to evaluate indefinite integrals iii) Apply method of substitution to evaluate integrals of the following types: <ul style="list-style-type: none"> ▪ $\int \frac{dx}{a^2-x^2}, \int \sqrt{a^2-x^2} dx, \int \frac{dx}{\sqrt{a^2-x^2}},$ ▪ $\int \frac{dx}{a^2+x^2}, \int \sqrt{a^2-x^2} dx, \int \frac{dx}{\sqrt{x^2+a^2}},$ ▪ $\int \frac{dx}{x^2-a^2}, \int \sqrt{x^2-a^2} dx, \int \frac{dx}{\sqrt{x^2-a^2}},$ ▪ $\int \frac{dx}{ax^2+bx+c}, \int \frac{dx}{\sqrt{ax^2+bx+c}},$ ▪ $\int \frac{px+q}{ax^2+bx+c} dx, \int \frac{px+q}{\sqrt{ax^2+bx+c}} dx,$
6.4	Integration by parts	i) Recognize the formula for integration by parts. ii) Apply method of integration by parts to evaluate integrals of the following types: $\int \sqrt{a^2-x^2} dx, \int \sqrt{a^2+x^2} dx, \int \sqrt{x^2-a^2} dx.$ iii) Evaluate integrals using integration by parts.
6.5	Integration using partial fractions	Use partial fractions to find $\int \frac{f(x)}{g(x)} dx$, where f(x) and g(x) are algebraic functions such that g(x) $\neq 0$
6.6	Definite Integrals	i) Define definite integral as the limit of a sum. ii) Describe the fundamental theorem of integral calculus and recognize the following basic properties:

		<ul style="list-style-type: none"> ▪ $\int_a^a f(x)dx = 0$ ▪ $\int_a^b f(x)dx = 0,$ ▪ $\int_a^b f(x)dx = -\int_b^a f(x)dx$ ▪ $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx, a < c < b,$ $\int_{-a}^a f(x)dx = \begin{cases} 2 \int_0^a f(x)dx & \text{when } f(-x) = f(x) \\ 0 & \text{when } f(-x) = -f(x) \end{cases}$ <p>iii)Extend techniques of integration using properties to evaluate definite integrals.</p> <p>iv)Represent definite integral at the area under the curve.</p> <p>v)Apply definite integral to calculate area under the curve.</p> <p>vi)Apply MAPLE command int to evaluate definite and indefinite integrals.</p>
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UNIT 7 CIRCLES

S.no	Topic	Student learning outcomes
7.1	Introduction	Define conics and demonstrate members of its family i.e. circle, parabola, ellipse and hyperbola
7.2	Circle 7.2.1 Equation of a Circle 7.2.2 General Form of an Equation of Circle 7.2.3 Equation of Circle determined by a given condition	<p>i) Define Circle and derive its equation in standard form i.e. $(x-h)^2 + (y - k)^2 = r^2$</p> <p>ii) Recognize general equation of a circle $x^2 + y^2 + 2gx + 2fy + c = 0$</p> <p>iii) Determine the equation of a circle passing through</p> <ul style="list-style-type: none"> • Three non -collinear points, • Two points and having its center on a given line, • Two points and equation of tangent at one of these points is known, • Two points and touching a given line.
7.3	Tangent and Normal	<p>i)Find the condition when a line intersects the circle</p> <p>ii)Find the condition when a line touches the circle</p> <p>iii)Determine the equation of tangent to a circle in slope form</p> <p>iv)Find the equations of a tangent and a normal to a circle at a point</p> <p>v)Find the length of tangent to a circle from a given external point</p> <p>vi)Show that two tangents drawn to a circle from an external point are equal in length</p>

7.4	Properties of Circle	<p>Prove analytically the following properties of a circle</p> <ul style="list-style-type: none"> • Perpendicular from the center of a circle on chord bisects the chord • Perpendicular bisector of any chord of a circle passes through the center of the circle • Line joining the center of a circle to the midpoint of a chord is perpendicular to the chord • Congruent chords of a circle are equidistant from its center and its converse. • Measure of the central angle of a minor arc is double measure of the angle subtended by the corresponding major arc. • An angle in a semi – circle is a right angle • The perpendicular at the outer end of a radial segment is tangent to the circle. <p>The tangent to a circle at any point of the circle is perpendicular to the radial segment at the point.</p>
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UNIT 8 CONICS

S.no	Topic	Student learning outcomes
8.1	Parabola 8.1.1 General Form of Equation of a Parabola 8.1.2 Standard Form of equation of parabola 8.1.3 Equation of Tangent and Normal 8.1.4 Application of Parabola	i) Explain parabola and its elements (i.e. focus, directrix, eccentricity, vertex, axis, focal chord and latus rectum) ii) Derive the general form of an equation of a parabola. iii) Derive the standard equations of parabola, sketch their graphs and find their elements. iv) Find the equation of a parabola with the following given elements: <ul style="list-style-type: none"> • Focus and vertex • Focus and directrix • Vertex and directrix v) Identify tangent and normal to a parabola. vi) Find the condition when a line is tangent to a parabola at a point and hence write the equation of a tangent line in slope form. vii.) Find the equation of a tangent and a normal to a parabola at a point viii) Simplify the suspension and reflection problems related to parabola.
8.2	8.2 Ellipse 8.2.1 Standard for	i) Define ellipse and its element (i.e. center, foci, vertices, covertices, directrices, major and minor axes, eccentricity, focal chord and latera recta). ii) Explain that circle is a special case of an ellipse. iii) Derive the standard form of equation of an ellipse and identify its elements. iv) Find the equation to the ellipse with the following given element <ul style="list-style-type: none"> • Major and minor axes,

U n i t : 9 3 9	form of Equation of an Ellipse	<ul style="list-style-type: none"> • Two points, • Foci, vertices or length of a latera reta, • Foci ,minor axes or length of latus rectum.
	8.2.2 Equations of Tangent and Normal	v) Transform a given equation to the standard form of equation of an ellipse, find its elements and draw the graph. vi) Identify tangent and normal to an ellipse vii) Find points of intersection of an ellipse with a line including the condition of tangency. viii) Find the Equation of a tangent in slope form. ix) Obtain the equation of an tangent and a normal to an ellipse at a point
	8.3.1 Standard Form of Equation of Hyperbola	i) Define hyperbola and its elements (i.e. center, foci vertices, directrices, transverse and conjugate axes, eccentricity focal chord and latera recta). ii) Derive the standard form of equation of a hyperbola and identify its elements. iii) Find the equation of a hyperbola with the following given elements <ul style="list-style-type: none"> • Transverse and conjugate axes with center at origin, • Two points • Eccentricity, latera recta and transverse axes, • Focus, eccentricity and center, • Focus, center and directrix iv) Convert a given equation to the standard form of equation of a hyperbola, find its element and sketch the graph. v) Identify tangent and normal to a hyperbola vi) Find <ul style="list-style-type: none"> • Points of intersection of a hyperbola with a line including the condition of tangency • The equation of a tangent in slope form
	8.3.2 Equation of Tangent and Normal	vii) Find the equation of a tangent and a normal to a hyperbola at a point
8.4	Translation and Rotation of Axes	i) Define translation and rotation of axes and demonstrate through examples. ii) Find the equations of transformation form <ul style="list-style-type: none"> • Translation of axes, • Rotation of axes. iii) Find the transformed equation by using translation or rotation of axes iv) Find new origin and new axes referred to old origin and old axes. v) Find the angle through which the axes be rotated about the origin so that the product term xy is removed from the transformed equations.
S.no	Topic	Student learning outcomes
9.1	Vectors in Plane	i) Define a scalar and a vector. ii) Give geometrical representation of a vector. iii) Give the following fundamental definitions using geometrical representation: <ul style="list-style-type: none"> ☐ magnitude of a vector, ☐ equal vectors, ☐ negative of a vector, ☐ unit vector, ☐ zero/null vector, ☐ position vector, ☐ parallel vectors, ☐ addition and subtraction of vectors,

		<ul style="list-style-type: none"> ▣ triangle, parallelogram and polygon laws of addition, ▣ scalar multiplication iv) Represent a vector in a Cartesian plane by defining fundamental unit vectors i and j. v) Recognize all above definitions using analytical representation. vi) Find a unit vector in the direction of another given vector. vii) Find the position vector of a point which divides the line segment joining two points in a given ratio. viii) Use vectors to prove simple theorems of descriptive geometry.
9.2	Vectors in Space	<ul style="list-style-type: none"> i) Recognize rectangular coordinate system in space. ii) Define unit vectors i, j and k. iii) Recognize components of a vector. iv) Give analytic representation of a vector. v) Find magnitude of a vector. vi) Repeat all fundamental definitions for vectors in space which, in the plane, have already been discussed.
9.3	Properties of Vector Addition	<ul style="list-style-type: none"> i) State and prove <ul style="list-style-type: none"> ▣ commutative law for vector addition. ▣ associative law for vector addition. ii) Prove that: <ul style="list-style-type: none"> ▣ 0 as the identity for vector addition. ▣ $-A$ as the inverse for A.
9.4	Properties of Scalar Multiplication of vectors $m(\vec{r})$	<ul style="list-style-type: none"> State and verify $m(\vec{r}) = \vec{r}m$ ▣ commutative law for scalar multiplication, ▣ associative law for scalar multiplication, ▣ distributive laws for scalar multiplication. ▣ $m(\vec{r}) = m\vec{r}$
9.5	Dot or Scalar Product	<ul style="list-style-type: none"> i) Define dot or scalar product of two vectors and give its geometrical interpretation. ii) Prove that: <ul style="list-style-type: none"> ▣ $i \cdot i = j \cdot j = k \cdot k = 1$, ▣ $i \cdot j = j \cdot k = k \cdot i = 0$. 14 Page iii) Express dot product in terms of components. iv) Find the condition for orthogonality of two vectors. v) Prove the commutative and distributive laws for dot product. vi) Explain direction cosines and direction ratios of a vector. vii) Prove that the sum of the squares of direction cosines is unity. viii) Use dot product to find the angle between two vectors. ix) Find the projection of a vector along another vector. x) Find the work done by a constant force in moving an object along a given vector.

		xi) Solve daily life problems based on work done
9.6	Cross or Vector Product	<p>i) Define cross or vector product of two vectors and give its geometrical interpretation.</p> <p>ii) Prove that:</p> $\vec{i} \times \vec{i} = \vec{j} \times \vec{j} = \vec{k} \times \vec{k} = 0,$ $\vec{i} \times \vec{j} = -\vec{j} \times \vec{i} = \vec{k},$ $\vec{j} \times \vec{k} = -\vec{k} \times \vec{j} = \vec{i},$ $\vec{k} \times \vec{i} = -\vec{i} \times \vec{k} = \vec{j}.$ <p>iii) Express cross product in terms of components.</p> <p>iv) Prove that the magnitude of $A \times B$ represents the area of a parallelogram with adjacent sides A and B.</p> <p>v) Find the condition for parallelism of two non - zero vectors</p> <p>vi) Prove that $A \times B = -B \times A$.</p> <p>vii) Prove the distributive laws for cross product.</p> <p>viii) Use cross product to find the angle between two vectors.</p> <p>ix) Find the vector moment of a given force about a given point.</p> <p>x) Application in daily life based on Cross or Vector Product</p>
9.7	Scalar Triple Product	<p>i) Define scalar triple product of vectors.</p> <p>ii) Express scalar triple product of vectors in terms of components (determinantal form).</p> <p>iii) Prove that:</p> $\vec{i} \cdot \vec{j} \times \vec{k} = \vec{j} \cdot \vec{k} \times \vec{i} = \vec{k} \cdot \vec{i} \times \vec{j} = 1,$ $\vec{i} \cdot \vec{k} \times \vec{j} = \vec{j} \cdot \vec{i} \times \vec{k} = \vec{k} \cdot \vec{j} \times \vec{i} = -1.$ <p>iv) Prove that dot and cross are inter-changeable in scalar triple product.</p> <p>v) Find the volume of</p> \vec{a} a parallelepiped, \vec{a} a tetrahedron, determined by three given vectors. <p>vi) Define coplanar vectors and find the condition for coplanarity of three vectors.</p>

Ziauddin University Examination Board
Grade XII-MATHEMATICS
Table of Specification (TOS)

Topics No	Topics	weightage	MCQS (1 marks)	CRQS (4 marks)	ERQS (8 marks)	Total
01	Functions and Limits	6%	2	1	--	6
02	The Straight Line	18%	2	2	1	18
03	The General equation of straight line	19%	3	2	1	19
04	Differentiation	14%	2	1	1	14
05	Application of Differentiation	14%	2	1	1	14
06	Integration	23%	3	1	2	23
07	Circle	10%	2	2	--	10
08	Parabola, Ellipse and Hyperbola	18%	2	2	1	18
09	Vectors	10%	2	2	--	10
			20/20	40/56	40/56	132

Ziauddin University Examination Board

Grade XII

MATHEMATICS

Scheme of assessment

Maximum marks: 100

Section "A" (Multiple Choice questions)

Multiple choice questions (MCQs)

(1 x 20= 20)

- Attempt 17 MCQs: Each carries equal marks

Section "B" (Constructed Response questions)

Constructed Response questions (CRQs)

(10 x 4 =40)

Attempt any 10 questions from this section. Each carries equal marks

Section "C" (Extended Response Questions)

Extended response questions (ERQs)

(8 x 5= 40)

- Attempt any 5 questions.
- Each consist of eight (08) marks

DEFINITIONS OF COGNITIVE LEVELS

Remember

Remembering is the act of retrieving knowledge and can be used to produce things like definitions or lists. The student must be able to recall or recognise information and concepts. The teacher must present information about a subject to the student, ask questions that require the student to recall that information and provide written or verbal assessment that can be answered by remembering the information learnt.

Question Stems

- Can you name all the ...?
- Describe what happens when ...?
- How is (are) ...?
- How would you define ...?
- How would you identify ...?
- How would you outline ...?
- How would you recognise...?
- List the ... in order.
- What do you remember about ...?
- What does it mean?
- What happened after?
- What is (are) ...?
- What is the best one?
- What would you choose ...?
- When did ...?
- Where is (are) ...?
- Which one ...?
- Who spoke to ...?
- Who was ...?
- Why did ...?

Understand

The next level in the taxonomic structure is Understanding, which is defined as the construction of meaning and relationships. Here the student must understand the main idea of material heard, viewed, or read and interpret or summarise the ideas in their own words. The teacher must ask questions that the student can answer in their own words by identifying the main idea.

Question Stems

- Can you clarify...?
- Can you illustrate ...?
- Condense this paragraph.
- Contrast ...
- Does everyone think in the way that ... does?
- Elaborate on ...
- Explain why ...
- Give an example
- How can you describe
- How would you clarify the meaning
- How would you compare ...?
- How would you differentiate between ...?
- How would you describe...?
- How would you generalise...?
- How would you identify ...?
- Is it valid that ...?
- Is this the same as ...?
- Outline ...
- Select the best definition
- State in your own words
- This represents ...
- What are they saying?
- What can you infer from ...?
- What can you say about ...?
- What could have happened next?
- What did you observe?

	<ul style="list-style-type: none"> • What does this mean? • What expectations are there? • What information can you infer from...? • What is the main idea of ...? • What restrictions would you add? • What seems likely? • What seems to be ...? • What would happen if ...? • What would happen if ...? • Which are the facts? • Which statements support ...?
<p>Apply</p> <p>The third level in Bloom’s taxonomy, Applying, marks a fundamental shift from the pre-Bloom’s learning era because it involves remembering what has been learnt, having a good understanding of the knowledge, and applying it to real-world exercises, challenges or situations. Students must apply an abstract idea in a concrete case to solve a problem or relate it to prior experience. The teacher must provide opportunities for students to use theories and problem-solving techniques in new situations and review and check their work. Assessment questions should be provided that allow students to define and solve problems.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • Can you group by characteristics such as ...? • Choose the best statements that apply • Clarify why ... • Do you know of another instance where ...? • Draw a story map • Explain why a character acted in the way that he did • From the information given, can you develop a set of instructions about ...? • How could you develop ...? • How would you change ...? • How would you demonstrate...? • How would you develop ... to present ? • How would you explain ...? 	<p>Analyse</p> <p>Analysing is the cognitive level where students can take the knowledge they have remembered, understood and applied, then delve into that knowledge to make associations, discernments or comparisons. Students should break down a concept or idea into parts and show relationships between these parts. Teachers must give students time to examine concepts and their requisite elements. Students are required to explain why they chose a solution.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • Can you distinguish between ...? • Can you explain what must have happened when ...? • Determine the point of view, bias, values, or intent underlying the presented material • Discuss the pros and cons of ... • How can you classify ... according to ...? • How can you compare the different parts? • How can you sort the different parts...? • How is ... connected to ...? • How is ... similar to ...? • How would you categorise...? • How would you explain ? • If ... happened, what might the ending have been? • State the point of view of ... • What are some of the problems of ...?

- How would you modify ...?
- How would you present...?
- How would you solve ... ?
- Identify the results of ...
- Illustrate the ...
- Judge the effects of ... What would result ...?
- Predict what would happen if ...
- Tell how much change there would be if ...
- Tell what would happen if ...
- What actions would you take to perform ...?
- What do you think could have happened next?
- What examples can you find that ?
- What other way would you choose to ...?
- What questions would you ask of ...?
- What was the main idea ...?
- What would the result be if ...?
- Which factors would you change if ...?
- Who do you think...?
- Why does this work?
- Write a brief outline ...
- Write in your own words ...

- What assumptions ...?
- What can you infer about...?
- What can you point out about ?
- What conclusions ...?
- What do you see as other possible outcomes?
- What does the author assume?
- What explanation do you have for ...?
- What ideas justify the conclusion?
- What ideas validate...?
- What is the analysis of ...?
- What is the function of ...?
- What is the problem with ...?
- What motive is there?
- What persuasive technique is used?
- What statement is relevant?
- What was the turning point?
- What were some of the motives behind ...?
- What's fact? Opinion?
- What's the main idea?
- What's the relationship between?
- Which events could not have happened?
- Why did ... changes occur?
- Why do you think ?

BLOOMS TAXONOMY WITH EXAMPLES

Conclusion

If you are a teacher looking for ways to engage your students in learning, this LIST of questions might be interesting for your classroom practice. Bloom's Taxonomy question stems can help elicit higher-order thinking skills and promote critical thinking among learners at different taxonomy levels. These question stems can also encourage students to think about their knowledge through reflection before answering questions.

ACTION WORDS FOR COGNITIVE LEVELS

Knowledge	Understand	Apply	Analyze	Evaluate	Create
	 <small>UNDERSTAND</small>				
define	explain	solve	analyze	reframe	design
identify	describe	apply	appraise	criticize	compose
describe	interpret	illustrate	judge	evaluate	create
label	paraphrase	modify	support	order	plan
list	summarize	use	compare	compare	combine
name	classify	calculate	decide	classify	formulate
state	compare	change	discriminate	contrast	invent
match	differentiate	choose	recommend	distinguish	hypothesize
recognize	discuss	demonstrate	summarize	infer	substitute
select	distinguish	discover	assess	separate	write
examine	extend	experiment	choose	explain	compile
locate	predict	relate	convince	select	construct
memorize	associate	show	defend	categorize	develop
quote	contrast	sketch	estimate	connect	generalize
recall	convert	complete	grade	differentiate	integrate
reproduce	demonstrate	construct	measure	divide	modify
tabulate	estimate	dramatize	predict	order	organize
tell	express	interpret	rank	prioritize	prepare
Copy	identify	manipulate	score	survey	produce
discover	indicate	paint	select	calculate	rearrange
duplicate	infer	prepare	test	conclude	rewrite

enumerate	relate	teach	argue	correlate	adapt
listen	restate	act	conclude	deduce	anticipate
observe	select	collect	consider	devise	arrange
omit	translate	compute	critique	diagram	assemble
read	ask	explain	debate	dissect	choose
recite	cite	list	distinguish	estimate	collaborate
record	discover	operate	editorialize	evaluate	facilitate
repeat	generalize	practice	justify	experiment	imagine
retell	group	simulate	persuade	focus	intervene
visualize	illustrate	transfer	rate	illustrate	make
	judge	write	weigh	organize	manage
	observe			outline	originate
	order			plan	propose
	report			question	simulate
	represent			test	solve
	research				support
	review				test
	rewrite				validate
	show				



MODEL PAPER 2023

SUBJECT: Mathematics

GRADE: XII

MAX. MARKS: 100

TIME: 3 HOURS

SECTION 'A' (COMPULSORY) MULTIPLE CHOICE QUESTIONS (MCQ'S)

Time: 30 minutes

Marks: 20

Note: (i). Attempt all Questions from this section.

(ii) Shade **ONE** letter for each question. Make sure you put your answer in line with the correct question number.

(iii). Write the code of your question paper in **bold letters** in the beginning of the answer script.

1. Choose the correct answer for each from the given options:

SECTION 'A' (COMPULSORY) MULTIPLE CHOICE QUESTIONS (MCQ'S)

Time: 20minutes

Marks: 20

Note: (i). Attempt all Questions from this section.

(ii). Shade **ONE** letter for each question. Make sure you put your answer in line with the correct question number.

(iii). Write the code of your question paper in **bold letters** in the beginning of the answer script.

Q1 Choose the correct answer for each from the given options:

i. The function $f(x) = \sin x$ is:

- a) Even b) Odd c) Modulus d) None

ii. $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ =

- a. 1 b) 0 c) c d)1/c

iii. An antiderivative of a function is called

- a. Definite integral b. Indefinite integral c)Summation d)None

iv. Slope of x-axis is:

- a) 0 b) 1 c) -1 d) 1/0

v. In an ellipse $c^2 =$:

- a) $a^2 + b^2$ b) $a^2 - b^2$ c) $b^2 - a^2$ d) $\frac{2b^2}{a^2}$

vi. The length of tangent from the point (2,4) to the circle $2x^2 + 2y^2 - 10 = 0$

- a) 15 b) 5 c) $\sqrt{5}$ d) $\sqrt{15}$

- vii. The necessary condition for $f(x)$ to have an extreme value, is:
 a) $f'(x) = 1$ b) $f(x) = 1$ c) $f'(x) = 0$ d) $f(x) = 0$
- viii. If $y = \ln \cos x$, then $dy/dx =$:
 a) $1/\cos x$ b) $\sec x$ c) $\cot x$ d) $-\tan x$
- ix. $\int \tan 45^\circ dx =$
 a) $\cos 30^\circ + c$ b) $\cot 30^\circ + c$ c) $\frac{-\cos 30 + c}{30}$ d) $x + c$
- x. $\int e^{\tan x} \sec^2 x dx$ is equal to:
 a) $\sec^2 x + c$ b) $e^{\sec x} + c$ c) $e^{\tan x} + c$ d) $\tan x + c$
- xi. If $e < 1$, then conic is:
 a) Circle b) Ellipse c) Parabola d) Hyperbola
- xii. The line $2x + 3y + 6 = 0$ is parallel to the line:
 a) $2x + 3y - 8 = 0$ b) $2x - 3y + 7 = 0$ c) $x - y + 6 = 0$ d) $3x - 2y + 9 = 0$
- xiii. If $s = f(t)$, then d^2s/dt^2 is:
 a) Distance covered b) Speed at time 't' c) Velocity at time d) Acceleration
- xiv. $|a|$ of a vector a when $a = P_1 P_2$ where $P_1 (2, 1, 1)$, $P_2 (-3, 1, 2)$ is:
 a) $\sqrt{12}$ b) $\sqrt{10}$ c) $\sqrt{26}$ d) 5
- xv. If $a \cdot b = 0$, then the angle between the vectors a & b is:
 a) 0 b) $\frac{\pi}{2}$ c) $\frac{\pi}{3}$ d) π
- xvi. An equation involving dy/dx is called
 a) Polynomial Eq b) Differential Eq c) Logarithmic Eq d) Exponential Eq
- xvii. If two line of perpendicular, then:
 a) $a_1 a_2 + b_1 b_2 = 1$ b) $a_1 a_2 + b_2 b_1 = 0$ c) $a_1 a_2 - b_1 b_2 = 1$ d) None of these
- xviii. Three points A, B and C are collinear if:
 a) $\Delta ABC = 1$ b) $\Delta ABC = 0$ c) $\Delta ABC = a$ d) $\Delta ABC = -1$
- xix. The distance between the point $(0,a)$ & $(b,0)$
 a) 0 b) 1 c) a^2 d) $a^2 + b^2$
- xx. The circle has its centre on y - axis
 a. $x^2 + y^2 + 2x + 3y = 0$ b) $x^2 + y^2 + 3x + 2y = 0$ c) $x^2 + y^2 - 2y - 3 = 0$ d) $x^2 + y^2 + 3x + 2y = 2$



MODEL PAPER 2023

SUBJECT: Mathematics

GRADE: XII

MAX. MARKS: 100

TIME: 3 HOURS

Time: 2 ½ hrs.

Marks: 80

SECTION 'B' CONSTRUCTED RESPONSE QUESTIONS (CRQ'S) (10x4=40)

Q.2 Note: Answer any TEN (10) questions from this section. All questions carry equal marks.

- i. A is two – third the way from (1, 10) to (–8, 4) and B is the midpoint of (0, –7), (6, –11). Find the distance $|AB|$.
- ii. Determine the value of λ and μ for which the line $(\lambda + 2\mu - 3)x + (2\lambda - \mu + 1)y + 6\lambda + 9 = 0$ is parallel to the axis of x and has a y-intercept -3 write the equation of this line.
- iii. Find the unit vector perpendicular to both the vectors $\underline{a} = i - 3j + 2k$, $\underline{b} = 2i + 3j - 4k$ also find $\sin(\underline{a}, \underline{b})$.
- iv. Find the volume of the parallelepiped whose three adjacent edges are represented by the vectors.
 $\underline{a} = 2i - 3j + 4k$ $\underline{b} = i + 2j - k$ $\underline{c} = 3i - j + 2k$.
- v. The point P (2, 3) is the foot of the perpendicular dropped from the origin to a straight line. Find the equation of this line.
- vi. Find the eccentricity, foci and equations of directories of the hyperbola $16x^2 - 9y^2 = 144$.
- vii. Find the equation of circle which passes through the origin and cuts off intercepts equal to 3 and 4 from the axes.
- viii. Find the ratio in which y-axis divides the join of (-5, 3) and (8, 6). Also find the coordinates of the point of division.
- ix. Prove that the curves $x^2 + 3y^2 - 24 = 0$ and $3x^2 - y^2 = 12$ intersect at right angle at the point $(\sqrt{6}, \sqrt{6})$.
- x. Find the derivative by the first principles at $x = a$ in the domain $D(f)$ of $f(x) = \cos^2 x$
- xi. Evaluate any two of the following.
(a) $\lim_{x \rightarrow 1} \left(\frac{1}{1-x} - \frac{3}{1-x^3} \right)$ (b) $\lim_{\theta \rightarrow 0} \frac{3e^\theta - e^{-\theta} - 2}{\theta}$
(c) $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{\sin^3 x}$ (d) $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$
- xii. Find an approximate value of $\sin 46^\circ$ using differential.
- xiii. Determine the vertex, focus and equation of directrix of the parabola $x^2 + 4x + 4y - 12 = 0$.
- xiv. Find the area above x – axis under the circle $x^2 + y^2 = 4$ and between the ordinates $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

SECTION 'C' (DESCRIPTIVE ANSWER QUESTIONS)**(Marks:8 x5= 40)**

Note: Attempt any FIVE questions from this section. All questions carry equation marks.

(5 × 8 = 40 marks)

Q.3 Evaluate any **Three** from the following:

(i) $\int \frac{\sec x \tan x}{a+b \sec x} dx$

(ii) $\int x \ln x dx$

(iii) $\int_0^2 \frac{dx}{\sqrt{1+x}-\sqrt{x}}$

(iv) $\int \frac{7x-25}{(x-3)(x-4)} dx$

Q.4. Find the equation of a line through the intersection of the lines $x + y - 1 = 0$ and $3x + y + 3 = 0$ and passing through (2,1).**Q.5.** Solve the following differential equations $\frac{dy}{dx} = 3 \cos 2x$, $y\left(\frac{\pi}{4}\right) = -1$ **Q.6.** Prove that the parabolas $x^2 = 4ay$ and $y^2 = 4bx$ intersect at angle $\theta = \tan^{-1} \frac{3}{2} \left(\frac{a^{1/3} b^{1/3}}{a^{2/3} + b^{2/3}} \right)$ **Q.7.** Find $\frac{dy}{dx}$ of any **TWO** of the following:

(i) $x = \sin t^3 + \cos t^3$, $y = \sin t + 2 \cos^{-1} t$

(ii) $y = \frac{3x^2-1}{3x^2} + \ln \sqrt{1+x^2} + \tan^{-1} x$

(iii) $e^x \ln y = \sin^{-1} y$

Q.8. Find the relative maximum and minimum values of the following function $f(x) = x/\ln x$.**Q.9.** The vertices A, B, C of a triangle are (2, 1), (5, 2) and (3, 4) respectively. Find the coordinates of the circum-center and also the radius of the circum-circle of the triangle

**HSC PART II EXAMINATION
MARKS BREAKUP GRID FOR EXAMINATION 2023**

GROUP: PRE-MEDICAL-II

SUBJECT	THEORY	PRACTICAL	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
BOTANY	45	7	52
ZOOLOGY	40	8	48
TOTAL	505	45	550

GROUP: PRE-ENGINEERING-II

SUBJECT	THEORY	PRACTICAL	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
MATHEMATICS	100	--	100
TOTAL	520	30	550

GROUP: COMPUTER SCIENCE/ GENERAL SCIENCE

SUBJECT	THEORY	PRACTICAL	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
PHYSICS	85	15	100
COMPUTER SCIENCE	75	25	100
MATHEMATICS	100	--	100
TOTAL	510	40	550

GROUP: COMMERCE-II (Private/Regular)

SUBJECT	THEORY	PRACTICAL	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
BANKING	75	-	75
COMMERCIAL GEOGRAPHY	75	-	75
ACCOUNTING	100	--	100
STATISTICS	50		50
TOTAL	550	---	550

GROUP: HUMANITIES-II (Private/Regular)

(Any Three Elective)

SUBJECT	THEORY	PRACTICAL	TOTAL
ENGLISH	100	-	100
URDU NORMAL / SINDHI NORMAL	100	-	100
PAKISTAN STUDIES	50	-	50
COMPUTER STUDIES	75	25	100
CIVICS	100		100
MATHEMATICS	100	-	100
SOCIOLOGY	100	--	100
ECONOMICS	100		100
EDUCATION	100		100
TOTAL	550	---	550