ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

# Higher Secondary School Certificate

# (HSSC)

# Examination Syllabus

# Mathematics
# XII

## Based on Provincial Revised Curriculum
## (Sindh)

**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

The Ziauddin University Examination Board (ZUEB) was established under **Sindh ACT XLI 2018**, with the primary objective of enhancing the quality of education in Sindh. ZUEB is responsible for administering examinations for the **Secondary School Certificate (SSC)** and **Higher Secondary School Certificate (HSSC)** in alignment with the most recent revisions to the **National Curriculum**, as outlined by the **Directorate of Curriculum Assessment and Research (DCAR), Sindh**. Through its ordinance, ZUEB is mandated to provide examination services for both English, Urdu, and Sindhi medium candidates from private schools across Sindh. This examination syllabus reflects ZUEB's dedication to achieving the educational goals set by the provincial authorities.

In collaboration with subject professors, ZUEB has developed a comprehensive syllabus for each subject. It is important to distinguish between the syllabus and the curriculum. The syllabus serves as a guide for both teachers and students, outlining the key areas of focus within the subject. It provides students with a clear understanding of what is expected of them in their studies and helps them prepare effectively for their exams.

This examination syllabus incorporates all cognitive outcomes derived from the **Provincial Curriculum Statement**, ensuring that assessments are both valid and reliable. While the focus is primarily on the cognitive domain, significant emphasis is placed on the application of knowledge and understanding.

The syllabus is made available to all stakeholders via the ZUEB website to assist affiliated schools in planning their teaching. It is crucial to note that the syllabus, rather than the prescribed textbook, forms the foundation of ZUEB examinations. Additionally, this syllabus supports the development of learning materials for both students and teachers. ZUEB remains committed to supporting students undertaking the SSC and HSSC courses by facilitating their learning outcomes through this detailed syllabus document.

To further assist in the learning process, ZUEB provides a dedicated **e-resource tab** on its website, offering both text-based and video content on various subjects. These 15-20 minute instructional videos, created around key subject concepts, allow students to learn at their own pace and convenience. The videos can be used as a reinforcement tool to revisit lessons already taught or as pre-lesson material. This initiative is an ongoing effort, and new videos will continue to be uploaded.

We encourage all students and educators to make the most of these resources for a more enriched and flexible learning experience.

Sincerely,
**Shahbaz Nasim**
**Head – Measurement & Testing**
**Ziauddin University Examination Board**

**Reviewed by:**
**Sana Anwer Ali**
**Manager Sciences**
**Ziauddin University Examination Board**
**July 2025**

## Rationale For The Reviewed Provincial Curriculum

The process of revising the National Curriculum 2006 began in August 2004, when the newly elected government of Pakistan initiated education reforms across the country. These reforms included the introduction of a new National Education Policy, a National Education Census, and a revision of curricula (Ministry of Education, 2009).

In practice, the overhaul of the secondary school curriculum began in 2006, leading to a review of the scheme of studies for classes I to XII and the revision of curricula for 25 compulsory subjects.

The 18th Amendment to the Constitution of Pakistan, enacted in 2010, significantly altered the federal-provincial relationship by abolishing the "concurrent legislative list." This amendment granted provinces greater legislative and financial autonomy in sectors such as education and health. The most notable implication of the 18th Amendment for education was the transfer of responsibility for curriculum development, syllabus planning, policy formation, and educational standards to the provinces, marking a significant step forward for education.

In Sindh, the School Education Department tasked a Curriculum Review Team with revising the National Curriculum 2006 for all subjects. The goal was to create a curriculum better suited to the needs of students and teachers while aligning with the principles of the 18th Amendment. Subject-specific curriculum review committees were established to critically examine and align the curriculum's content, both contextually and textually, ensuring coherence across various subjects. The Bureau of Curriculum (BoC) played a crucial role in organizing workshops and meetings in Hyderabad to facilitate the completion of this task. The support of numerous educationists, researchers, and teachers was invaluable in successfully revising the curriculum.

The revised National Curriculum, along with the original version, is available on the DCAR website at https://dcar.gos.pk/Sindh-Curriculum/Curriculum%20for%20Mathematics%20Grades%20XI-XII%20(Revised%20in%202019).pdf for easy access.

The Ziauddin University Examination Board (ZUEB) SSC and HSSC syllabi are developed in accordance with the Sindh Revised Curriculum. To date, textbooks for various subjects have been developed based on the revised curriculum.

# MATHEMATICS, GRADE XII

1. **Introduction to Symbolic Package MAPLE**
2. **Functions and Limits**
3. **Differentiation**
4. **Higher Order Derivatives and Applications**
5. **Differentiation of Vector Functions**
6. **Integration**
7. **Plane Analytic Geometry: Straight Line**
8. **Circle**
9. **Parabola, Ellipse and Hyperbola**
10. **Differential Equations**
11. **Partial Differentiation**
12. **Introduction to Numerical Methods**

| Unit | Student Learning Outcomes | K | U | A |
|---|---|---|---|---|
| | **Introduction to Symbolic Package MAPLE** | | | |
| **1.1 Introduction** | 1.1.1 Recognize MAPLE environment. | ✓ | | |
| | 1.1.2 Recognize basic MAPLE commands. | ✓ | | |
| | 1.1.3 Use MAPLE as a calculator. | | | ✓ |
| | 1.1.4 Use online MAPLE help. | | ✓ | |
| **1.2 Polynomials** | 1.2.1 Use MAPLE commands for factoring a polynomial. | | | ✓ |
| | 1.2.2 Use MAPLE commands for expanding an expression. | | | ✓ |
| | 1.2.3 Use MAPLE commands for simplifying an expression. | | | ✓ |
| | 1.2.4 Use MAPLE commands for simplifying a rational expression. | | | ✓ |
| | 1.2.5 Use MAPLE commands for substituting into an expression. | | | ✓ |
| **1.3 Graphics** | 1.3.1 Plot a two-dimensional graph. | | | ✓ |
| | 1.3.2 Demonstrate domain and range of a plot. | | | ✓ |
| | 1.3.3 Sketch parametric equations. | | | ✓ |
| | 1.3.4 Know plotting options. | ✓ | | |
| **1.4 Matrices** | 1.4.1 Recognize matrix and vector entry arrangement. | ✓ | | |

| Unit | Student Learning Outcomes | K | U | A |
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| | 1.4.2 Apply matrix operations. | | | ✓ |
| | 1.4.3 Compute inverse and transpose of a matrix. | | | ✓ |
| | **Functions and Limits** | | | |
| **2.1 Functions** | 2.1.1 Identify through graph the domain and range of a function. | | | ✓ |
| | 2.1.2 Draw the graph of modulus function (i.e. $y = \|x\|$) and identify its domain and range. | | ✓ | |
| **2.2 Composition of Functions** | 2.2.1 Recognize the composition of functions. | ✓ | | |
| | 2.2.2 Find the composition of two given functions. | | | ✓ |
| **2.3 Inverse of Composition** | 2.3.1 Describe the inverse of composition of two given functions. | | ✓ | |
| **2.4 Transcendental Functions** | 2.4.1 Recognize algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, hyperbolic (and their identities), explicit, implicit, and parametric functions. | ✓ | | |
| **2.5 Graphical Representations** | 2.5.1 Display graphically; explicitly defined, implicitly defined, parametric, and discontinuous functions. | | | ✓ |
| | 2.5.2 Use MAPLE graphic commands for 2D plots of expressions, parameterized forms, and implicit functions. | | | ✓ |
| | 2.5.3 Use MAPLE package plots for different types of functions. | | | ✓ |
| **2.6 Limit of a Function** | 2.6.1 Identify a real number by a point on the number line. | ✓ | | |
| | 2.6.2 Define and represent open, closed, half-open, and half-closed intervals on the number line. | ✓ | | |
| | 2.6.3 Explain the meaning of $x \to 0$, $x \to a$, and $x \to \infty$. | | ✓ | |
| | 2.6.4 Define limit of a sequence. | ✓ | | |
| | 2.6.5 Find the limit of a sequence whose nth term is given. | | | ✓ |
| | 2.6.6 Define limit of a function. | ✓ | | |
| | 2.6.7 State theorems on limits (sum, difference, product, quotient) and demonstrate with examples. | | ✓ | |
| **2.7 Important Limits** | 2.7.1 Evaluate standard limits of algebraic forms (e.g., $(x^2–a^2)/(x–a)$, $(\sqrt{x}–\sqrt{a})/(x–a)$, etc.). | | | ✓ |
| | 2.7.2 Evaluate limits of algebraic, exponential, and trigonometric functions. | | | ✓ |
| | 2.7.3 Use MAPLE command limit to evaluate limits. | | | ✓ |
| **2.8 Continuous and Discontinuous Functions** | 2.8.1 Recognize left-hand and right-hand limits with examples. | | ✓ | |
| | 2.8.2 Define continuity of a function at a point and in an interval. | ✓ | | |

| Unit | Student Learning Outcomes | K | U | A |
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| | 2.8.3 Test continuity and discontinuity of a function at a point and in an interval. | | | ✓ |
| | 2.8.4 Use MAPLE command iscont to test continuity. | | | ✓ |
| | 2.8.5 Apply continuity and discontinuity concepts to problems. | | | ✓ |
| | **Differentiation** | | | |
| **3.1 Derivative of a Function** | 3.1.1 Distinguish between independent and dependent variables. | ✓ | | |
| | 3.1.2 Estimate corresponding change in the dependent variable when independent variable changes. | | ✓ | |
| | 3.1.3 Explain the concept of a rate of change. | | ✓ | |
| | 3.1.4 Define derivative of a function as an instantaneous rate of change. | ✓ | | |
| | 3.1.5 Define derivative (differential coefficient) of a function. | ✓ | | |
| | 3.1.6 Differentiate y=xn,n∈Zy = x^n, n \in \mathbb{Z} from first principles (derive power rule). | | | ✓ |
| | 3.1.7 Differentiate y=(ax+b)p/q,q≠0y = (ax+b)^{p/q}, q \neq 0 from first principles. | | | ✓ |
| **3.2 Theorems on Differentiation** | 3.2.1 Prove theorems: constant rule, constant multiple rule, sum/difference rule, product rule, quotient rule. | | ✓ | |
| **3.3 Application of Theorems** | 3.3.1 Differentiate constant multiples, sums/differences, polynomials, products, and quotients of functions. | | | ✓ |
| **3.4 Chain Rule** | 3.4.1 Prove Chain Rule dydx=dydu·dudx\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}. | | ✓ | |
| | 3.4.2 Show dydx=1dx/dy\frac{dy}{dx} = \frac{1}{dx/dy}. | | ✓ | |
| | 3.4.3 Use Chain Rule to derive ddx[f(x)]n=n[f(x)]n−1f′(x)\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} f'(x). | | | ✓ |
| | 3.4.4 Find derivative of implicit functions. | | | ✓ |
| **3.5 Trigonometric and Inverse Functions** | 3.5.1 Differentiate trigonometric functions (sin, cos, tan, cosec, sec, cot) from first principles. | | | ✓ |
| | 3.5.2 Differentiate inverse trigonometric functions (arcsin, arccos, arctan, arccosec, arcsec, arccot). | | | ✓ |
| **3.6 Exponential and Logarithmic Functions** | 3.6.1 Differentiate exe^x and axa^x from first principles. | | | ✓ |
| | 3.6.2 Differentiate lnx\ln x and logax\log_a x from first principles. | | | ✓ |

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| | 3.6.3 Use logarithmic differentiation for algebraic expressions with products, quotients, powers. | | | ✓ |
| **3.7 Hyperbolic and Inverse Hyperbolic Functions** | 3.7.1 Differentiate hyperbolic functions (sinh, cosh, tanh, cosech, sech, coth). | | | ✓ |
| | 3.7.2 Differentiate inverse hyperbolic functions (sinh−1,cosh−1,tanh−1,\cosech−1,\sech−1,coth−1\sinh^{-1}, \cosh^{-1}, \tanh^{-1}, \cosech^{-1}, \sech^{-1}, \coth^{-1}). | | | ✓ |
| | 3.7.3 Use MAPLE command diff to differentiate functions. | | | ✓ |
| | **Higher Order Derivatives and Applications** | | | |
| **4.1 Higher Order Derivatives** | 4.1.1 Find higher order derivatives of algebraic, trigonometric, exponential and logarithmic functions. | | | ✓ |
| | 4.1.2 Find second derivative of implicit, inverse trigonometric and parametric functions. | | | ✓ |
| | 4.1.3 Use MAPLE command diff repeatedly to find higher order derivatives. | | | ✓ |
| **4.2 Maclaurin's and Taylor's Expansions** | 4.2.1 State Maclaurin's and Taylor's theorems (without remainder). | ✓ | | |
| | 4.2.2 Use theorems to expand sinx, cosx, tanx, axa^x, exe^x, log a(1+x)\log_a(1+x), and ln(1+x)\ln(1+x). | | | ✓ |
| | 4.2.3 Use MAPLE command taylor to expand a function. | | | ✓ |
| **4.3 Applications of Derivatives** | 4.3.1 Give geometrical interpretation of derivative. | | ✓ | |
| | 4.3.2 Find equation of tangent and normal to a curve at a point. | | | ✓ |
| | 4.3.3 Find angle of intersection of two curves. | | | ✓ |
| | 4.3.4 Find point on a curve where tangent is parallel to a given line. | | | ✓ |
| **4.4 Maxima and Minima** | 4.4.1 Define increasing and decreasing functions. | ✓ | | |
| | 4.4.2 Prove monotonicity rules using f′(x)>0f'(x) > 0 or f′(x)<0f'(x) < 0. | | ✓ | |
| | 4.4.3 Examine a function for extreme values. | | | ✓ |
| | 4.4.4 State second derivative rule for extreme values. | ✓ | | |
| | 4.4.5 Apply second derivative rule to test extreme values. | | | ✓ |
| | 4.4.6 Solve real life problems involving maxima/minima. | | | ✓ |

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| | 4.4.7 Use MAPLE maximize/minimize commands for extremum values. | | | ✓ |
| | **Differentiations of Vector Functions** | | | |
| **5.1 Scalar and Vector Functions** | 5.1.1 Define scalar and vector function. | ✓ | | |
| | 5.1.2 Explain domain and range of a vector function. | | ✓ | |
| **5.2 Limit and Continuity** | 5.2.1 Define limit of a vector function. | ✓ | | |
| | 5.2.2 Demonstrate algebra of limits (sum/difference, dot, cross, scalar–vector product). | | | ✓ |
| | 5.2.3 Define continuity of a vector function. | ✓ | | |
| | 5.2.4 Demonstrate continuity of a vector function through examples. | | | ✓ |
| **5.3 Derivative of Vector Function** | 5.3.1 Define derivative of a vector function of single variable. | ✓ | | |
| | 5.3.2 Elaborate derivative formula: f(t)=f1(t)i+f2(t)j+f3(t)kf(t) = f_1(t)\mathbf{i} + f_2(t)\mathbf{j} + f_3(t)\mathbf{k}. | | ✓ | |
| **5.4 Vector Differentiation** | 5.4.1 Prove standard differentiation formulae for vector functions (constant, sum, scalar multiple, dot, cross, quotient). | | ✓ | |
| | 5.4.2 Apply vector differentiation to compute velocity and acceleration from position vector r(t)r(t). | | | ✓ |
| | **Integration** | | | |
| **6.1 Introduction** | 6.1.1 Demonstrate the concept of the integral as an accumulator. | | ✓ | |
| | 6.1.2 Know integration as inverse process of differentiation. | ✓ | | |
| | 6.1.3 Explain constant of integration. | | ✓ | |
| | 6.1.4 Recall standard integrals derived from differentiation formulae. | ✓ | | |
| **6.2 Rules of Integration** | 6.2.1 Recognize basic rules of integration (constant multiple, sum, etc.). | ✓ | | |
| | 6.2.2 Prove standard results using differentiation (e.g., $\int[f(x)]^n f'(x)dx$, $\int f'(x)/f(x)dx$). | | ✓ | |
| **6.3 By Substitution** | 6.3.1 Explain the method of integration by substitution. | | ✓ | |
| | 6.3.2 Apply substitution to evaluate indefinite integrals. | | | ✓ |
| | 6.3.3 Apply substitution to evaluate integrals of algebraic types ($\sqrt{a^2 \pm x^2}$, $\sqrt{x^2 \pm a^2}$, rational forms). | | | ✓ |
| **6.4 By Parts** | 6.4.1 Recognize the formula for integration by parts. | ✓ | | |
| | 6.4.2 Apply integration by parts to evaluate integrals (including roots | | | ✓ |

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| | like $\sqrt{(a^2 \pm x^2)}$. | | | |
| | 6.4.3 Evaluate integrals using integration by parts in general. | | | ✓ |
| **6.5 Partial Fractions** | 6.5.1 Use partial fractions to integrate rational functions. | | | ✓ |
| **6.6 Definite Integrals** | 6.6.1 Define definite integral as the limit of a sum. | ✓ | | |
| | 6.6.2 State & recognize fundamental theorem and properties of definite integrals. | | ✓ | |
| | 6.6.3 Use properties to evaluate definite integrals. | | | ✓ |
| | 6.6.4 Represent definite integral as area under a curve. | | ✓ | |
| | 6.6.5 Apply definite integrals to calculate area under the curve. | | | ✓ |
| | 6.6.6 Use MAPLE command int to compute integrals. | | | ✓ |
| | **Plane Analytic Geometry: Straight Line** | | | |
| **7.1 Division of a Line Segment** | 7.1.1 Recall distance formula for two points. | ✓ | | |
| | 7.1.2 Recall midpoint formula. | ✓ | | |
| | 7.1.3 Find coordinates dividing a line segment in a given ratio (internal/external). | | | ✓ |
| | 7.1.4 Show concurrency of medians and angle bisectors of a triangle. | | ✓ | |
| **7.2 Slope of a Straight Line** | 7.2.1 Define slope of a line. | ✓ | | |
| | 7.2.2 Derive slope formula through two points. | | ✓ | |
| | 7.2.3 Find condition for lines to be parallel or perpendicular. | | | ✓ |
| **7.3 Equation of a Straight Line Parallel to Co-ordinate Axes** | 7.3.1 Find equation of line parallel to y-axis at distance a. | | | ✓ |
| | 7.3.2 Find equation of line parallel to x-axis at distance b. | | | ✓ |
| **7.4 Standard Form OF Equation of a Straight Line** | 7.4.1 Define intercepts of a line. | ✓ | | |
| | 7.4.2 Derive equations of line in slope-intercept, point-slope, two-point, intercepts, symmetric, and normal forms. | | ✓ | |
| | 7.4.3 Show linear equation in two variables represents a straight line. | | ✓ | |
| | 7.4.4 Reduce general form of line equation to other standard forms. | | | ✓ |
| **7.5 Distance of a point from a Line** | 7.5.1 Recognize a point with respect to position of a line. | ✓ | | |
| | 7.5.2 Find perpendicular distance from a point to a line. | | | ✓ |

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| | 7.5.3 Find distance between two parallel lines. | | | ✓ |
| **7.6 Angle Between Lines** | 7.6.1 Find angle between two intersecting straight lines. | | | ✓ |
| | 7.6.2 Find family of lines through intersection of two lines. | | | ✓ |
| | 7.6.3 Calculate triangle angles when slopes of sides are given. | | | ✓ |
| **7.7 Concurrency** | 7.7.1 Find condition of concurrency of three straight lines. | | ✓ | |
| | 7.7.2 Find equation of median, altitude, and right bisector of a triangle. | | | ✓ |
| | 7.7.3 Show concurrency of medians, altitudes, and right bisectors. | | ✓ | |
| **7.8 Area of Triangular Region** | 7.8.1 Find area of a triangle given vertices. | | | ✓ |
| **7.9 Homogeneous Equations** | 7.9.1 Recognize homogeneous linear & quadratic equations in two variables. | ✓ | | |
| | 7.9.2 Investigate that 2nd degree homogeneous equation represents a pair of lines through origin and find acute angle between them. | | ✓ | |
| | **Circle** | | | |
| **8.1 Conics** | 8.1.1 Define conics and identify members: circle, parabola, ellipse, hyperbola. | ✓ | | |
| **8.2 Circle and its Standard Form of Equation** | 8.2.1 Define circle. | ✓ | | |
| | 8.2.2 Derive standard equation (x−h)2+(y−k)2=r2(x-h)^2+(y-k)^2=r^2. | | ✓ | |
| **8.3 General Form of an Equation of a Circle** | 8.3.1 Recognize general equation x2+y2+2gx+2fy+c=0x^2+y^2+2gx+2fy+c=0. | ✓ | | |
| | 8.3.2 Find centre and radius from general equation. | | | ✓ |
| **8.4 Equation of Circle under given Conditions** | 8.4.1 Find circle through three non-collinear points. | | | ✓ |
| | 8.4.2 Find circle through two points with centre on a given line. | | | ✓ |
| | 8.4.3 Find circle through two points with tangent known at one point. | | | ✓ |
| | 8.4.4 Find circle through two points and touching a given line. | | | ✓ |
| **8.5 Tangent and Normal** | 8.5.1 Find condition when a line intersects a circle. | | ✓ | |
| | 8.5.2 Find condition when a line touches a circle. | | ✓ | |
| | 8.5.3 Find tangent equation in slope form. | | | ✓ |

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| | 8.5.4 Find tangent & normal equations at a point on a circle. | | | ✓ |
| | 8.5.5 Find tangent length from an external point. | | | ✓ |
| | 8.5.6 Prove two tangents from an external point are equal. | | ✓ | |
| **8.6 Properties of Circle** | 8.6.1 Prove perpendicular from centre to chord bisects the chord. | | ✓ | |
| | 8.6.2 Prove perpendicular bisector of chord passes through centre. | | ✓ | |
| | 8.6.3 Prove line from centre to midpoint of chord is perpendicular to chord. | | ✓ | |
| | 8.6.4 Prove congruent chords are equidistant from centre (and converse). | | ✓ | |
| | 8.6.5 Prove central angle theorem (minor arc vs major arc). | | ✓ | |
| | 8.6.6 Prove angle in semicircle is right angle. | | ✓ | |
| | 8.6.7 Prove perpendicular at end of radial segment is tangent. | | ✓ | |
| | 8.6.8 Prove tangent at a point is perpendicular to radius. | | ✓ | |
| | **Parabola, Ellipse and Hyperbola** | | | |
| **9.1 Parabola** | 9.1.1 Define parabola & its elements (focus, directrix, eccentricity, vertex, focal chord, latus rectum). | ✓ | | |
| **9.2 General Form of Equation of a Parabola** | 9.2.1 Derive general form of parabola equation. | | ✓ | |
| **9.3 Standard Form of Equation of a Parabola** | 9.3.1 Derive standard equations, sketch graphs, find elements. | | ✓ | |
| | 9.3.2 Find parabola equation with given elements (focus & vertex, focus & directrix, vertex & directrix, vertex & points). | | | ✓ |
| **9.4 Equations of Tangent and Normal (Parabola)** | 9.4.1 Recognize tangent & normal to parabola. | ✓ | | |
| | 9.4.2 Find condition for line to be tangent; write tangent in slope form. | | ✓ | |
| | 9.4.3 Find tangent & normal equations at a point. | | | ✓ |
| **9.5 Application of Parabola** | 9.5.1 Solve suspension & reflection problems. | | | ✓ |
| **9.6 Ellipse** | 9.6.1 Define ellipse & its elements. | ✓ | | |
| | 9.6.2 Explain circle as special case of ellipse. | | ✓ | |
| **9.7 Standard Form of Equation of an Ellipse** | 9.7.1 Derive standard form of ellipse, identify elements. | | ✓ | |

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| | 9.7.2 Find ellipse equation with given elements (axes, points, foci/vertices/latus rectum, etc.). | | | ✓ |
| | 9.7.3 Convert equation to standard ellipse form, find elements, sketch graph. | | | ✓ |
| **9.8 Equation of Tangent and Normal (Ellipse)** | 9.8.1 Recognize tangent & normal to ellipse. | ✓ | | |
| | 9.8.2 Find ellipse–line intersections & tangency condition. | | ✓ | |
| | 9.8.3 Find tangent in slope form. | | | ✓ |
| | 9.8.4 Find tangent & normal equations at a point. | | | ✓ |
| **9.9 Hyperbola** | 9.9.1 Define hyperbola & its elements. | ✓ | | |
| **9.10 Standard Form of Equation of Hyperbola** | 9.10.1 Derive standard form, identify elements. | | ✓ | |
| | 9.10.2 Find hyperbola equation with given elements (axes, points, eccentricity & recta, focus/directrix). | | | ✓ |
| | 9.10.3 Convert equation to standard hyperbola form, find elements, sketch graph. | | | ✓ |
| **9.11 Equation of Tangent and Normal (Hyperbola)** | 9.11.1 Recognize tangent & normal to hyperbola. | ✓ | | |
| | 9.11.2 Find intersections with line & tangency condition. | | ✓ | |
| | 9.11.3 Find tangent in slope form. | | | ✓ |
| | 9.11.4 Find tangent & normal equations at a point. | | | ✓ |
| **9.12 Translation and Rotation of Axes** | 9.12.1 Define translation & rotation of axes (examples). | ✓ | | |
| | 9.12.2 Derive transformation equations for translation & rotation. | | ✓ | |
| | 9.12.3 Transform equation using translation or rotation. | | | ✓ |
| | 9.12.4 Find new origin & axes relative to old. | | ✓ | |
| | 9.12.5 Find the angle through which the axes be rotated about the origin so that the product term $xy$ is removed from the transformed equation. | | | ✓ |
| | **Differential Equations** | | | |
| **10.1 Introduction** | 10.1.1 Define ODE, order, degree, solution (general & particular). | ✓ | | |
| **10.2 Formation of Differential Equations** | 10.2.1 Demonstrate concept of forming a DE. | | ✓ | |

| Unit | Student Learning Outcomes | K | U | A |
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| **10.3 Solution of Differential Equations** | 10.3.1 Solve first-order, first-degree DEs (separable, homogeneous, reducible to homogeneous). | | | ✓ |
| | 10.3.2 Solve real-life problems with DEs. | | | ✓ |
| **10.4 Orthogonal Trajectories** | 10.4.1 Define & find orthogonal trajectories (rectangular coordinates). | | ✓ | |
| | 10.4.2 Use MAPLE graphic commands to view curves & orthogonal trajectories. | | | ✓ |
| | **Partial Differentiation** | | | |
| **11.1 Differentiation of Function of Two Variables** | 11.1.1 Define a function of two variables. | ✓ | | |
| | 11.1.2 Define partial derivative. | ✓ | | |
| | 11.1.3 Find partial derivatives of a function of two variables. | | | ✓ |
| **11.2 Euler's Theorem** | 11.2.1 Define a homogeneous function of degree n. | ✓ | | |
| | 11.2.2 State and prove Euler's theorem on homogeneous functions. | | ✓ | |
| | 11.2.3 Verify Euler's theorem for homogeneous functions of different degrees (simple cases). | | | ✓ |
| | 11.2.4 Use MAPLE command diff to find partial derivatives. | | | ✓ |
| | **Introduction to Numerical Methods** | | | |
| **12.1 Numerical Solution of Non-linear Equations** | 12.1.1 Describe importance of numerical methods. | ✓ | | |
| | 12.1.2 Explain the basic principles of solving a non-linear equation in one variable. | | ✓ | |
| | 12.1.3 Calculate real roots of a non-linear equation in one variable by bisection method, regula-falsi method, and Newton-Raphson method. | | | ✓ |
| | 12.1.4 Use MAPLE command fsolve to find numerical solution of an equation and demonstrate through examples. | | | ✓ |
| **12.2 Numerical Quadrature** | 12.2.1 Define numerical quadrature. | ✓ | | |
| | 12.2.2 Apply Trapezoidal rule and Simpson's rule to compute approximate value of definite integrals without error terms. | | | ✓ |
| | 12.2.3 Use MAPLE commands trapezoid and simpson to evaluate integrals numerically with examples. | | | ✓ |

# Ziauddin University Examination Board
## Scheme of Assessment
## Mathematics XII

**Maximum marks: 100**

### Section "A"

**Multiple Choice Questions (MCQs)** **(20 x 1 = 20)**
Attempt 20 MCQs. Each MCQ carries equal marks.

### Section "B"

**Short Answer Questions** **(10 x 4 = 40)**
Attempt any 10 out of 14 questions. Each question carries equal marks.

### Section "C"

**Detailed Answer Questions** **(5 x 8 = 40)**
Attempt any 5 out of 8 questions. Each question carries equal marks.

# Ziauddin University Examination Board
# Mathematics XII
# Table of Specification [TOS]

| S.No | Domains | Weightage in Evaluation 100% | MCQs 1 mark each | Short Answers 4 marks each | Detailed Answers 8 marks each |
|---|---|---|---|---|---|
| 1 | Introduction to Symbolic Package MAPLE | 1% | 1 | 0 | 0 |
| 2 | Functions and Limits | 10% | 2 | 1 | 1 |
| 3 | Differentiation | 10% | 2 | 1 | 1 |
| 4 | Higher Order Derivatives and Applications | 13% | 2 | 2 | 1 |
| 5 | Differentiation of Vector Functions | 4% | 2 | 1 | 0 |
| 6 | Integration | 13% | 2 | 2 | 1 |
| 7 | Plane Analytic Geometry: Straight Line | 10% | 2 | 1 | 1 |
| 8 | Circle | 10% | 2 | 1 | 1 |
| 9 | Parabola, Ellipse and Hyperbola | 13% | 2 | 2 | 1 |
| 10 | Differential Equations | 9% | 1 | 1 | 1 |
| 11 | Partial Differentiation | 4% | 1 | 1 | 0 |
| 12 | Introduction to Numerical Methods | 4% | 1 | 1 | 0 |
| **Total # of Questions asked** | | | **20** | **14** | **8** |
| **Total # of Questions to be attempted** | | | **20** | **10** | **5** |
| **Maximum marks attainable** | | | **20 marks** | **40 marks** | **40 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?

| | |
|---|---|
| | • What does this mean?<br>• What expectations are there?<br>• What information can you infer from…?<br>• What is the main idea of …?<br>• What restrictions would you add?<br>• What seems likely?<br>• What seems to be …?<br>• What would happen if …?<br>• What might happen if …?<br>• Which are the facts?<br>• Which statements support …? |
| **Apply**<br><br>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.<br><br>**Question Stems**<br><br>• Can you group by characteristics such as …?<br>• Choose the best statements that apply...<br>• Clarify why …<br>• Do you know of another instance where …?<br>• Draw a story map...<br>• Explain why a character acted in the way that he did...<br>• From the information given, can you develop a set of instructions about …?<br>• How would you develop …?<br>• How would you change …?<br>• How would you demonstrate…? | **Analyse**<br><br>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.<br><br>**Question Stems**<br><br>• Can you distinguish between …?<br>• Can you explain what must have happened when …?<br>• Determine the point of view, bias, values, or intent underlying the presented material...<br>• Discuss the pros and cons of …<br>• How can you classify … according to …?<br>• How can you compare the different parts?<br>• How can you sort the different parts…?<br>• How is … connected to …?<br>• How is … similar to …?<br>• How would you categorise…?<br>• How would you explain...? |

| | |
|---|---|
| • How would you develop?<br><br>• How would you explain …?<br>• How would you modify …?<br>• How would you present…?<br>• How would you solve … ?<br>• Identify the results of …<br>• Illustrate the …<br>• Judge the effects of … What would result …?<br>• Predict what would happen if …<br>• Tell how much change there would be if …<br>• Tell what would happen if …<br>• What actions would you take to perform …?<br>• What do you think could have happened next?<br>• What examples can you find that ?<br>• What other way would you choose to …?<br>• What questions would you ask of …?<br>• What was the main idea …?<br>• What would the result be if …?<br>• Which factors would you change if …?<br>• Who do you think…?<br>• Why does this work?<br>• Write a brief outline …<br>• Write in your own words … | • What could the ending have been if ... had taken place?<br>• State the point of view of …<br>• What are some of the problems of …?<br>• What assumptions …?<br>• What can you infer about…?<br>• What can you point out about ?<br>• What conclusions …?<br>• What do you see as other possible outcomes?<br>• What does the author assume?<br>• What explanation do you have for …?<br>• What ideas justify the conclusion?<br>• What ideas validate…?<br>• What is the analysis of …?<br>• What is the function of …?<br>• What is the problem with …?<br>• What motive is there?<br>• What persuasive technique is used?<br>• What statement is relevant?<br>• What was the turning point?<br>• What were some of the motives behind …?<br>• What's fact? Opinion?<br>• What's the main idea?<br>• What's the relationship between?<br>• Which events could not have happened?<br>• Why did … changes occur?<br>• Why do you think ? |

# BLOOM'S 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 |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| 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 | | | | |

# HSSC PART II EXAMINATION
# MARKS BREAKUP GRID FOR EXAMINATION 2025

## GROUP: PRE-MEDICAL

| SUBJECT | THEORY | PBA | TOTAL |
|---|---|---|---|
| ENGLISH | 100 | - | 100 |
| URDU NORMAL / SINDHI NORMAL | 100 | - | 100 |
| PAKISTAN STUDIES | 50 | - | 50 |
| PHYSICS | 85 | 15 | 100 |
| CHEMISTRY | 85 | 15 | 100 |
| BIOLOGY | 85 | 15 | 100 |
| TOTAL | 505 | 45 | 550 |

## GROUP: PRE-ENGINEERING

| SUBJECT | THEORY | PBA | 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: GENERAL SCIENCE

| SUBJECT | THEORY | PBA | 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

| SUBJECT | THEORY | PBA | TOTAL |
|---|---|---|---|
| ENGLISH | 100 | - | 100 |
| URDU NORMAL / SINDHI NORMAL | 100 | - | 100 |
| PAKISTAN STUDIES | 50 | - | 50 |
| ECONOMICS | 75 | - | 75 |
| P.O.C | 75 | - | 75 |
| ACCOUNTING | 100 | -- | 100 |
| BUSINESS MATHEMATICS | 50 | | 50 |
| TOTAL | 550 | --- | 550 |

# GROUP: HUMANITIES

**(Any Three Electives)**

| SUBJECT | THEORY | PBA | TOTAL |
|---|---|---|---|
| ENGLISH | 100 | - | 100 |
| URDU NORMAL / SINDHI NORMAL | 100 | - | 100 |
| PAKISTAN STUDIES | 50 | - | 50 |
| COMPUTER SCIENCE | 75 | 25 | 100 |
| ISLAMIC STUDIES | 100 | | 100 |
| MATHEMATICS | 100 | - | 100 |
| SOCIOLOGY | 100 | -- | 100 |
| ECONOMICS | 100 | | 100 |
| EDUCATION | 100 | | 100 |
| CIVICS | 100 | | 100 |
| NURSING | 85 | 15 | 100 |
| TOTAL | 550 | --- | 550 |

# GROUP: MEDICAL TECHNOLOGY

| SUBJECT | THEORY | PBA | TOTAL |
|---|---|---|---|
| ENGLISH | 100 | - | 100 |
| URDU NORMAL / SINDHI NORMAL | 100 | - | 100 |
| PAKISTAN STUDIES | 50 | - | 50 |
| MICROBIOLOGY | 85 | 15 | 100 |
| CHEMICAL PATHOLOGY & SEROLOGY | 85 | 15 | 100 |
| ELEMENTARY CHEMISTRY & CHEMICAL PATHOLOGY | 85 | 15 | 100 |
| TOTAL | 505 | 45 | 550 |