



澳門大學  
UNIVERSIDADE DE MACAU  
UNIVERSITY OF MACAU



澳門理工學院  
Instituto Politécnico de Macau  
Macao Polytechnic Institute



旅遊學院  
INSTITUTO DE FORMAÇÃO TURÍSTICA  
Institute for Tourism Studies



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UNIVERSIDADE DE CIÊNCIA E TECNOLOGIA DE MACAU  
MACAU UNIVERSITY OF SCIENCE AND TECHNOLOGY

澳門四高校聯合入學考試（語言科及數學科）

**Joint Admission Examination for Macao Four Higher Education Institutions  
(Languages and Mathematics)**

考試大綱 Syllabus

Mathematics 數學正卷



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考試時間：兩小時

1. 基本概念：實數系統；集合和子集的概念；集合的運算：併集、交集和補集。偉恩（Venn）圖。數學歸納法。
2. 百分數：百分數的意義及其在日常生活中的應用；盈利和虧蝕、折扣、單利息和複利息、增長及折舊。
3. 變分：比、比例；正變、反變、聯變及部分變。
4. 多項式及有理分式：多項式的運算，長除法及綜合除法；因式分解：因式定理及餘式定理，最高公因式（H.C.F.）及最低公倍式（L.C.M.）；平方差公式，立方和（立方差）公式，部分分式。
5. 二次方程及二次函數：一元二次方程的解與判別式的關係，二次公式；根與係數的關係；二次函數的極值 - 配方法的應用。
6. 指數及根式：指數定律；根式的簡化與運算。
7. 代數不等式：代數不等式和絕對不等式的運算及其解集；解一元一次或二元一次不等式組，包括用幾何方法求解；在線性規劃問題的應用。
8. 對數函數與指數函數：對數的性質，換底公式，自然指數函數；在增長及衰變過程的應用（包括連續複利息）；解指數方程及對數方程。
9. 非線性方程：解分式方程及無理方程。
10. 排列與組合：基本概念，二項式定理。



11. 數列：等差數列、等比數列及前  $n$  項和；等比數列無限項之和。
12. 直線圖形及圓：
- (A) 直線圖形：三角形及凸多邊形內角和；直線及角的性質和定理；相似三角形、全等三角形；畢氏定理；正方形、矩形、菱形及平行四邊形的性質；中點定理及截線定理。
- (B) 圓：圓、弦及弧的性質；圓心角、圓周角、圓內接四邊形、外接圓；弧長及扇形面積。
13. 三角：角度制及弧度制的關係；三角函數與三角恆等式，複角公式及半角公式；式子  $a\cos\theta + b\sin\theta$  與輔助角公式；三角形面積；正弦定律，餘弦定律；反三角函數的定義；含一個未知數的三角方程求解。
14. 解析幾何：
- (A) 直角座標系，兩點的距離，線段的定比分點；直線的斜率及截距，直線方程的不同表達式；兩線平行與垂直。解不多於三個未知數的線性方程組。
- (B) 圓的標準方程、一般方程、圖形和性質；橢圓、雙曲線、拋物線的定義和標準方程、圖形和性質。直線與圓錐曲線的相交。
15. 函數圖形：一次、二次及三次函數，有理函數、對數及指數函數，正弦、餘弦及正切函數的描繪；對稱、平移、伸展、收縮及反射等技巧的運用。
16. 概率和統計：隨機試驗，結果與事件；概率加法規則和乘法規則；集中趨勢的度量：算術平均數，眾數及中位數；離散度的度量：極差，方差及標準差。



Examination Duration: 2 hours

1. Fundamental Concepts: real number system; concept of sets and subsets; set operations: union, intersection and complement. Venn diagrams. Mathematical induction.
2. Percentage: its meaning and applications to daily life problems. Profit and loss, discount, simple and compound interest, growth and depreciation.
3. Variations: ratio, proportion; direct, inverse, joint and partial variations.
4. Polynomial and Rational Fraction: manipulation of polynomials, long division and synthetic division, factorization of polynomials: the factor theorem and the remainder theorem; highest common factors (H.C.F.) and least common multiple (L.C.M.); formula for the difference of two squares, formulae for the sum of two cubes and the difference of two cubes; partial fractions.
5. Quadratic Equations and Quadratic Functions: the relation between the solution of a quadratic equation in one variable and its discriminant, the quadratic formula; relations between roots and coefficients; the extreme value of a quadratic function – applying the method of completing the square.
6. Indices and Surds: laws of indices; simplification and operations of surds.
7. Algebraic Inequalities: manipulation of algebraic inequalities and absolute inequalities, and their solution sets; solving system of linear inequalities in one or two variables, including graphical solutions; applications to linear programming problems.
8. Logarithmic and Exponential Functions: properties of logarithms, change of bases of logarithms; natural exponential functions; applications in growth and decay processes (including continuous compounding of interest); solving equations of indices and equations of logarithms.
9. Nonlinear equations: solving fractional equations and irrational equations.
10. Permutation and Combination: basic concepts, binomial theorem.



11. Sequences: arithmetic sequence, geometric sequence, and sum of the first  $n$  terms; sum of geometric sequence with an infinite number of terms.
12. Rectilinear Figures and Circles:
  - (A) Rectilinear Figures: the sum of interior angles of triangles and convex polygons; properties and theorems of lines and angles; similar triangles, congruent triangles; Pythagoras' theorem; properties of squares, rectangles, rhombuses, and parallelograms; mid-point theorem and intercept theorem.
  - (B) Circles: properties of circles, arcs and chords; angles of chord, angles of circumference, cyclic quadrilaterals, circumcircles; arc lengths and area of sectors.
13. Trigonometry: relation between degree measure and radian measure; trigonometric functions and trigonometric identities, compound angle formulae and half-angle formulae; the expression  $a\cos\theta + b\sin\theta$  and the auxiliary angle formula; area of a triangle; the Sine Law, the Cosine Law; the definitions of inverse trigonometric functions; solving trigonometric equations in one unknown.
14. Coordinate Geometry:
  - (A) Rectangular Cartesian coordinate system, distance between two points; point of division of a line segment in a given ratio; the slope and intercept of a straight line, different forms of equations of a straight line; parallel and perpendicular lines. Solving system of linear equations with at most three variables.
  - (B) The standard form of a circle, its general form, its graph and its properties; the definitions and standard forms of ellipse, hyperbola, and parabola, their graphs and their properties. Intersection of lines and conic.
15. Graphs of functions: sketching of linear, quadratic, cubic, rational, logarithmic, exponential, sine, cosine, and tangent functions; application of the techniques of symmetry, translation, stretching, shrinking, and reflection.
16. Probability and Statistics: random experiment, outcomes and events; addition rule and multiplication rule of probabilities; measures of central tendency: mean, mode, and median; measures of dispersion: range, variance and standard deviation.