



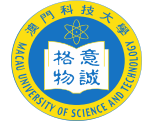
澳門大學  
UNIVERSIDADE DE MACAU  
UNIVERSITY OF MACAU



澳門理工大學  
Universidade Politécnica de Macau  
Macao Polytechnic University



澳門旅遊學院  
INSTITUTO DE FORMAÇÃO TURÍSTICA DE MACAU  
Macao Institute for Tourism Studies



澳門科技大學  
UNIVERSIDADE DE CIÊNCIA E TECNOLOGIA DE MACAU  
MACAU UNIVERSITY OF SCIENCE AND TECHNOLOGY

2023年澳門四高校聯合入學考試 (語言科及數學科)

**2023 Joint Admission Examination for  
Macao Four Higher Education Institutions (Languages and Mathematics)**

考試大綱 Syllabus

數學正卷 Mathematics Standard Paper

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(勾股定理)；三角形、正方形、矩形、菱形及平行四邊形的性質；中位線定理及截距定理。
- (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 factor (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, 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 formula and half-angle formula; 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. Analytic Geometry:

- (A) Rectangular Cartesian coordinate system, distance between two points; point of division of a line segment in a given ratio; the slope and intercepts 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 unknowns.
- (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.

## 常用數學符號表

### A List of Commonly Used Mathematical Symbols and Notations

符號/記號 Symbol/Notation	說明	Description
$\mathbb{R}$	實數集	Set of real numbers
$\mathbb{R}^+$	正實數集	Set of positive real numbers
$\mathbb{Z}$	整數集	Set of integers
$\mathbb{Z}^+$	正整數集	Set of positive integers
$\mathbb{Q}$	有理數集	Set of rational numbers
$x \in A$	$x$ 屬於 $A$	$x$ belongs to $A$
$\{x \in \mathbb{Z}:  x  \leq 3\}$	描述集合的一個方法	A way of describing a set
$A \subseteq B$	$A$ 是 $B$ 的子集	$A$ is a subset of $B$
$A \subset B$	$A$ 是 $B$ 的真子集	$A$ is a proper subset of $B$
$A \cup B$	$A$ 和 $B$ 的併集	$A$ union $B$
$A \cap B$	$A$ 和 $B$ 的交集	$A$ intersection $B$
$A^c$	$A$ 的補集	Complement of $A$
$\emptyset$	空集	Empty set
$\because$	因為	Because
$\therefore$	所以	Therefore
$\equiv$	恆等	Identically equal
$\infty$	無限大	Infinity
$x \propto y$	$x$ 和 $y$ 成正比	$x$ varies directly with $y$
$a^n$	$a$ 的 $n$ 次方	$a$ to the power $n$
$\sqrt[n]{a}$	$a$ 的 $n$ 次方根	$n^{\text{th}}$ root of $a$
$ x $	$x$ 的絕對值	Absolute value of $x$
$\log_b a$	以 $b$ 為底 $a$ 的對數	Logarithm of $a$ to base $b$
$\log a$	$a$ 的常用對數	Common logarithm of $a$
$\ln a$	$a$ 的自然對數	Natural logarithm of $a$
${}_n P_r$	排列記號	Permutation notation
${}_n C_r$	組合記號	Combination notation
$n!$	$n$ 的階乘	$n$ factorial
$\{a_n\}_{n \geq 1}$	數列記號	Sequence notation
$AB$	線段	Line segment
$ AB $	線段長度	Length of a line segment
$\widehat{AB}$	弧段	Arc
$\triangle ABC$	三角形	Triangle
$\angle ABC$	角度	Angle
$\sin \theta$	$\theta$ 的正弦	Sine of $\theta$
$\cos \theta$	$\theta$ 的餘弦	Cosine of $\theta$
$\tan \theta$	$\theta$ 的正切	Tangent of $\theta$
$\sin^{-1} x$	$x$ 的反正弦	Arc sine of $x$
$\cos^{-1} x$	$x$ 的反餘弦	Arc cosine of $x$
$\tan^{-1} x$	$x$ 的反正切	Arc tangent of $x$
$L_1 \parallel L_2$	兩條平行線	Two parallel lines
$L_1 \perp L_2$	兩條垂直線	Two perpendicular lines
$f(x)$	函數或函數值	Function or function value
$P(E)$	事件 $E$ 的概率	Probability of event $E$