2020年入學考試大綱

科目：數學正卷

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。

2020 - Admission Examination Syllabus

Subject: Mathematics Standard Paper

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. <u>Trigonometry</u>: relation between degree measure and radian measure; trigonometric functions and trigonometric identities, compound angle formulae and half-angle formulae; the expression $a\cos a\cos\theta + b\sin\theta$ 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. <u>Coordinate Geometry</u>:
    (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. <u>Graphs of functions</u>: 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. <u>Probability and Statistics</u>: 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
$\varnothing$	空集	Empty set
$\because$	因為	Because
$\therefore$	所以	Therefore
$\equiv$	恆等	Identically equal
∞	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^{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
$_nP_r$	排列記號	Permutation notation
$_nC_r$	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
$\overset{\frown}{AB}$	弧段	Arc
ΔABC	三角形	Triangle
$\angle ABC$	角度	Angle
$\sin \theta$	θ 的正弦	Sine of θ
$\cos \theta$	θ 的餘弦	Cosine of θ
$\tan \theta$	θ 的正切	Tangent of θ
$\sin^{-1} x$	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
$L_1 // L_2$	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