

## 北京理工大学外国留学生本科入学考试大纲科目：数学

### 一、考试目标

- 1.考查中学数学的基础知识、基本技能和思维能力、运算能力；
- 2.运用有关数学知识分析问题和解决问题的能力；
- 3.达到学习微积分课程的基本能力。

### 二、考试形式

- 1.考试整体安排：时间100分钟，总分100分；
- 2.题型及其分数占比：填空题和选择题:占总分55%左右，解答题占总分45%左右；
- 3.各部分内容在试卷中的分数占比：代数约55%，平面几何约25%，三角函数约20%。

### 三、考试内容

#### (一) 代数部分

##### 1.函数、不等式

- (1) 理解集合及其表示，掌握子集、交集、并集、补集的概念，了解空集和全集的意义，了解属于、包含、相等关系的意义，能掌握有关的术语和符号，能正确表示一些简单的集合。
- (2) 掌握不等式的性质，会对不等式进行基本的书写和简单的运算。
- (3) 掌握一元一次不等式(组)、一元二次不等式的解法，会解简单的分式不等式，了解区间的概念；了解绝对值不等式的性质，会解简单的绝对值不等式。
- (4) 理解函数的概念，能求一些基本种类函数的定义域。
- (5) 理解一次函数的概念，掌握它的图像和性质，会求其解析式；理解二次函数的概念，掌握它的图像和性质，会求其解析式及最大值或最小值，能灵活运用二次函数的性质解决有关问题。
- (6) 理解指数与对数的概念，掌握有关的性质和运算法则。
- (7) 理解指数函数、对数函数的概念，掌握它们的图像和性质，解决与之相关的问题。
- (8) 了解反函数的概念及互为反函数的函数图象间的关系，会求一些简单函数的反函数。
- (9) 掌握函数的奇偶性和单调性的概念以及它们图象特征，能判断一些简单函数单调性；会求一些特殊函数的最大值和最小值。

##### 2.数列

- (1) 了解与数列有关的概念。
- (2) 理解等差数列与等比数列的概念，掌握等差数列与等比数列的通项及前n项和的

公式，并运用公式解决有关问题。

(3) 了解数列极限的意义，掌握极限的四则运算法则，会求公比的绝对值小于1的无穷等比数列前n项和的极限。

### 3. 平面向量

(1) 理解平面向量的概念，理解向量的加法、减法、实数与向量的乘法的定义和几何意义。

(2) 掌握向量的坐标表示法，向量与向量的数量积的定义，掌握他们的运算法则，并且能应用它们解决一些简单问题。

(3) 掌握平面内两点间的距离公式，线段的中点公式，并能熟练运用，掌握平移公式。

### 4. 排列组合、二项式定理

(1) 了解分类计数原理和分步计数原理，了解排列组合的概念，会用排列、组合的计算公式，会解排列、组合的简单应用题。

(2) 掌握二项式定理和二项式系数的性质，并能用它们计算一些简单问题。

#### (二) 平面几何部分

##### 1. 直线

(1) 掌握直线的倾斜角和斜率的概念、过两点的直线的斜率公式，掌握两条直线的平行和垂直的判断办法。

(2) 熟练掌握直线方程的点斜式、两点式和一般式，会求两条直线的交点，掌握点到直线距离公式。

##### 2. 曲线与方程

(1) 曲线和方程：掌握直角坐标系中的曲线与方程的关系和轨迹的概念，能够根据所给条件，选择适当的坐标系求曲线方程，并画出方程所表示的曲线。

(2) 圆：掌握圆的标准方程和一般方程，熟练掌握直线与圆的位置关系。

(3) 椭圆：掌握椭圆的标准方程和几何性质，能用定义解决一些问题。

(4) 双曲线：掌握双曲线的标准方程和几何性质，能用定义解决一些问题。

(5) 抛物线：掌握抛物线的标准方程和几何性质，能用定义解决一些问题。

#### (三) 三角函数部分

##### 1. 三角比值

(1) 了解正角、负角、零角的概念，理解象限角和终边相同的角的概念，理解弧度的意义，并能正确地进行弧度和角度的换算。

(2) 掌握任意角三角比值的定义，三角比值的符号，同角三角比的基本关系式与诱导公式。

(3) 掌握两角和与差的余弦、正弦、正切公式，二倍角的正弦、余弦和正切公式，会应用它

们进行行计算、化简和证明。通过公式的推导，了了解其内在联系，培养逻辑推理能力力。

(4) 掌握正弦定理、余弦定理和三角角形面面积公式，并应用用这些公式解斜三角角形。

## 2.三角角函数的图像和性质

(1) 掌握正弦函数、余弦函数的图像和性质，会用用它们解决有关问题；了了解正切函数的图像和性质。

(2) 了了解函数 $y=A\sin(\omega x+\varphi)$ 与 $y=\sin x$ 的图像之间的关系，会求函数 $y=A\sin(\omega x+\varphi)$ 的周期、最大大值和最小小值。

## Syllabus of Entrance Test for Foreign Students Applying for BIT

Subject: Math

### I. Objectives

1. Examine the basic knowledge, basic skills, thinking ability and calculation ability of middle school mathematics;
2. Test the ability to analyze and solve problems with relevant mathematical knowledge;
3. Check whether exam taker has basic abilities to learn calculus.

### II. Forms

1. Overall arrangement of the exam: 100 minutes, with a total score of 100;
2. The proportion of question types and their fractions: filling-in and multiple-choice questions take about 55% of the total score, and free response problems take about 45% of the total score;
3. The proportion of each part's score in the test paper: about 55% for algebra, about 25% for plane geometry, and about 20% for trigonometric functions.

### III. Contents

#### 1. Algebra

##### (1). Functions and inequalities

a. understand the set and its notation, grasp the concepts of subset, intersection, union and complement, understand the meaning of empty set and complete set, understand the meaning of belonging to, including, and equal relation, master relevant terms and symbols, and correctly represent some simple sets.

b. master the properties of inequalities, can perform basic writing and simple operation on inequalities.

c. master the solutions of linear inequalities (systems) and quadratic inequalities containing one variable, can solve simple fractional inequalities, and understand the concept of intervals; know about what is an absolute value inequality, and can solve a simple absolute value inequality.

d. understand the concept of functions and be able to find the domain of some basic kinds of functions.

e. understand the concept of linear function, grasp its figure and properties, can find its analytic expression; understand the concept of quadratic function, grasp its figure and properties, can find its analytic expression and maximum or minimum value, can flexibly use the properties of quadratic function to solve related problems.

f. understand the concepts of exponents and logarithms, grasp the relevant properties and algorithms.

g. understand the concepts of exponential function and logarithmic function, grasp their figures and properties, and solve the related problems.

h. understand the concept of inverse functions and the relationship between the inverse functions of each other, can find the inverse functions of some simple functions.

i. master the concepts of parity and monotonicity of functions and their figure features, and judge the monotonicity of some simple functions; be able to find the maxima and minima of some particular functions.

(2). Sequences

- a. understand the concepts related to sequence.
- b. understand the concepts of arithmetic sequence and geometric sequence, master the general terms of arithmetic sequence and geometric sequence and the formula of the sum of the first  $n$  terms, and use the formula to solve relevant problems.
- c. understand the meaning of sequence limit, master the four operation rules of limit, and be able to find the limit of the sum of the first  $n$  terms of infinite geometric sequence whose absolute value of common ratio is less than 1.

(3). 2-D Vectors

- a. understand the concept of plane vectors, the definition and geometric meaning of addition, subtraction, multiplication of real numbers and vectors.
- b. master the coordinate notation of vectors, the definition of the dot product of vectors, master their algorithms, and can apply them to solve some simple problems.
- c. master the distance formula between two points in a plane and the formula for the midpoint of a line segment, and master the translation formula.

(4). Permutation and combination, binomial theorem

- a. understand the principle of classification and step counting, understand the concept of permutation and combination, can use the calculation formula of permutation and combination, and can solve the simple word problems of permutation and combination.
- b. master the properties of binomial theorem and binomial coefficient, and use them to calculate some simple problems.

2. Geometry

(1). Straight line

- a. master the concept of inclination angle and slope of a line, the slope formula of a line passing two points, and the method of judging the parallel and perpendicular relation of two lines.
- b. proficient in point-slope, two-point and general equations of line equations, able to find the intersection of two lines, and master the distance formula from point to line.

(2). Conic curves and their equations

- a. curves and equations: master the relationship between curves and equations in the cartesian coordinate system and the concept of trajectories, be able to select the appropriate coordinate system to solve the curve equation according to the given conditions, and draw the curve represented by the equation.
- b. circle: master the standard equation and general equation of a circle, and master the position relationship between a line and a circle.
- c. ellipse: master the standard equation and geometric properties of ellipse, and can solve some problems by definition.
- d. hyperbola: master the standard equations and geometric properties of hyperbola, and can solve some problems by definition.
- e. parabola: master the standard equations and geometric properties of parabola, and can solve some problems by definition.

3. Trigonometry

(1). The triangle ratio

- a. understand the concept of positive angle, negative angle, zero angle, understand the concept of

quadrant angle and coterminal side angle, understand the meaning of radians, and can correctly convert radians and angles.

b. master the definition of triangle ratio of any angle, the symbol of triangle ratio, and the basic relation and induction formula of triangle ratios.

c. master the cosine, sine and tangent formulas of the sum and difference of two angles, and can use them to calculate, simplify and prove. Through the derivation of formula, understand its internal connection, develop logical reasoning ability.

d. master sine law, cosine law and triangle area formula, and apply these formulas to solve oblique triangle.

(2). The graphs and properties of trig functions

a. master the figures and properties of sine and cosine functions, and can use them to solve relevant problems; know about the graphs and properties of tangent functions.

b. understand the relationship between the function  $y=A\sin(\omega x+\varphi)$  and the graph  $y=\sin x$ , and know the period, maximum and minimum values of the function  $y=A\sin(\omega x+\varphi)$ .