

國立中山大學應用數學系

學術演講

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講題：From the Basel Problem to David Hilbert's 8th Problem

時間：2026/06/18 (Thursday) 11:10 ~ 12:00

地點：理 SC4009-1 教室

茶會：10:30

Abstract

The famous Basel problem was posed by Pietro Mengoli in 1644. More precisely, the problem asks for the value of the infinite series

$$(1) \quad \sum_{k=1}^{\infty} \frac{1}{k^2} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$$

This problem puzzled mathematicians for many years until it was solved by Leonhard Euler in 1735 at the age of 28.

In this talk, the speaker will present two different methods for evaluating the series (1).

In 1859, Bernhard Riemann was elected to the Berlin Academy of Sciences at the age of 32. In recognition of this honor, Riemann wrote his celebrated eight-page paper, "On the Number of Primes Less Than a Given Magnitude". This short paper opened the door to major developments in mathematics by revealing a deep connection between the distribution of prime numbers and the zeros of the series

$$(2) \quad \zeta(s) = \sum_{k=1}^{\infty} \frac{1}{k^s} = 1 + \frac{1}{2^s} + \frac{1}{3^s} + \cdots$$

Riemann used analytic continuation to extend the definition of $\zeta(s)$ to all complex numbers $s \in \mathbb{C}$ (except for a simple pole at $s = 1$). This function is now known as the Riemann zeta function. It is known that the series (2) converges absolutely when $\operatorname{Re}(s) > 1$ and that $\zeta(s)$ has no zeros in the half-plane $\{s \in \mathbb{C} : \operatorname{Re}(s) > 1\}$. Riemann conjectured that all nontrivial zeros of $\zeta(s)$ lie on the critical line

$$\operatorname{Re}(s) = \frac{1}{2}$$

This statement is the famous Riemann hypothesis, one of the most important open problems in mathematics.

In 1900, David Hilbert, one of the most influential mathematicians of the late nineteenth and early twentieth centuries, presented 23 problems at the International Congress of Mathematicians in Paris. The first part of the eighth problem is the Riemann hypothesis. The speaker will conclude with a brief introduction to this topic.

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