Angles Associated with Primes Numbers

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Abstract

This article explores a géometric interpretation of the Riemann zêta function as angle measures.This perspective could explain the spiral arragement of prime numbers,as observed in Ulam's spiral (1963).

1.Connection with th Prime number Theorem :

$P(x) = \frac{x}{Ln\, x} \quad TNP$

$x_n = e^{n^s} \quad n \in IN^* \quad s > 1$

$P(e^{n^s}) = \frac{e^{n^s}}{Ln(e^{n^s})} = \frac{e^{n^s}}{n^s}.$

$\frac{P(e^{n^s})}{e^{n^s}} = \frac{1}{n^s}$

$\sum_1^{+\infty} \frac{P(e^{n^s})}{n^s} = \sum_1^{+\infty} \frac{1}{n^s} = z\hat{e}ta\ (s).$

Conclusion 1 : $\boldsymbol{z\hat{e}ta\ (s) = \sum_1^{+\infty} \frac{P(e^{n^s})}{n^s}}$.

2. Geometric in interpetation in terms of angles

In an orthogonal coordinate system,consider the ratio $\frac{P(x)}{x}$ represents the tangente of the angle α formed betwee P(x) and the x- axis :

$Tan(\alpha_n) = \frac{P(e^{n^s})}{e^{n^s}} = \frac{1}{n^s}$

$Tan(\alpha_n) = \alpha_n$ wen α_n very small

$\alpha_n \simeq \frac{1}{n^s}$

Conclusion 2 : $\boldsymbol{z\hat{e}ta\ (s) = \sum_1^{+\infty} \frac{1}{n^s} = \sum_1^{+\infty} \alpha_n}$

The terms of zêta function can be interpred as measures of well-regular angles,which may explain why prime numbers are arranged in spiral (stansislaw Ulam,1963)

Références

- Baranski, K., & Misiurewicz, M. (2010). Omega-limit sets for the Stein-Ulam spiral map. *Top. Proc. 36*, 145-172.