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# Riemann Hypothesis

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**ABSTRACT**

In 1859 Bernard Riemann hypothesized that the zeros of the Zeta function only can occur on either the x axis or the line ½+ti for all values of t. This article explains why Riemann's hypothesis (RH) is correct. $Z(s)=\sum_{n=1}^{\infty} n^{-s}$ for a complex numbers.

The basic Zeta function Z(s) above was shown to be analytic for the real part of s greater than 1. Several other forms of the Zeta function were subsequently determined [1]. Attempts to verify RH has attracted many to verify the RH since 1859 without success. This article gives a proof that the RH is correct. [2] gives an extensive list of references of research articles in its list of references demonstrating the historical interest in the character of the Zeta Function. The proof of the RH is remarkably simple but requires a subtle proof given in this article.

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**Riemann Hypothesis Verified**

PROOF OF RH: The proof of the Riemann Hypothesis requires only the basic form of the Zeta function shown in the abstract. We start the proof by assuming there exists a complex number s= a+bi where a is not ½ and b is not zero and s is a zero of the Zeta function. The zeta function converges to 0+0i for s=a+bi by assumption. Because Z(s) converges to 0+0i there exists an n=Nab such that the tail sum of Z(s) from $n=N_{ab}$ to infinity is less than a pre-assigned arbitrary epsilon $e=e_1+e_2i$ where s=a+bi is a zero of the Zeta function. The value of s=a+bi is assumed to be a fixed constant zero of the Zeta function totally dominated by the values of $n=N_{ab}$ to infinity because $N_{ab}$ can be chosen arbitrarily as large as it needs to be for the Zeta function tail from $N_{ab}$ to infinity to be less than an arbitrarily selected epsilon $e=e_1+e_2i$. I.e. there exists an epsilon $e=e_1+e_2i$ smaller than the tail of the Zeta function from n=Nab to infinity independent of the fixed constant values a and b . The domination of a and b by an assigned chosen value of $n=N_{ab}$ suggests that a+bi could be replaced by any values of s=x+yi where x and y are like a+bi not on the x axis or the line x=1/2+y. Therefore, we can repeat the same argument done for a+bi replacing a with x and b with y choosing $N_{xy}$ with the tail of the zeta function from $n=N_{xy}$ to infinity is less than an arbitrarily selected complex epsilon. We conclude that every such choice of x and y is a zero of the Zeta function. I.e. we have proven that assuming the existence of even one zero s=a+bi of the Zeta function where a is not ½ and b is not zero in the xy plane is enough to force all choices of x+yi in the xy coordinate system not on the line x=1/2 and y not zero to be a zero of the Zeta using the same argument used for a+bi. I.e. the existence of just one zero like a+bi forces all x+yi satisfying the same constraints as a+bi to also be a zero of the Zeta function. This is an absurdity. Therefore, there cannot be a zero of the Zeta function in the xy plane where a is not ½ and b is not zero. We conclude that the only possible zeros of the Zeta Function are forced to be on the line y=1/2+ti or on the x axis excluding the origin verifying the RH. Take note that it was necessary to restrict x+yi only to not being the origin where the Zeta function has a pole. That restriction was relaxed only to help the reader see the logic of this proof easier. QED

**References**

1. www.math:ubc:ca/-pugh/RiemannZeta/RemannZetaLong.html
2. Mathworld.Wolfram.com/RiemannZetaFunction zeros.HTML

**Note:** To solve the RH one has to accept the convention that the imaginary number known as the square root of -1 divided by n goes to the real number zero as n goes to infinity and not the complex number 0+0i also known as (0,0) or the origin. The origin is a pole for the Zeta function. There is no proof that i divided by n goes to the real number zero rather than (0,0) or the origin. Two dimensional convergence is not the same as convergence in real numbers because the complex plane has 2 degrees of freedom unlike convergence in the real numbers. If the convention given here is not accepted then one can rightfully claim that the RH is a victim of Goedel's Undecidability Theorems.





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