1st slide

Hello,

My name is Keseli Timur and I am going to defend the project on Facorial of fractions and the Gamma Function.

Factorials were first introduced by different cultures in India, the Middle East between 300 BCE and 500 CE, presumably mostly in religios purposes and since then they were used to solve combinatorics problems. However, only since late 15th century the factorials have been studied fully and

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200 years later Leonhard Euler formulated the extension of the factorial function to the gamma function, which can find the factorial of any real number.

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This project was made for educational purposes and I showed the way to naturally expand the factorial function domain from natural numbers to the real numbers. Besides that I also showed the connection with the Harmonic Series and the history of its application in modern physics theory, the String Theory.

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So, our main goal was to show a natural derivation of the factorial function which could take as an input not just natural numbers, but also real number, so we want to expand the domain of the function.

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In order to get to the goal we had several challenges: firstly, we had to define the domain expansion, secondly, find a natural expansion of the factorial fanction and then we showed the connection with the harmonic series and the gamma function’s application in physics.

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So, the factorial of a natural number N is defined as a product of all natural numbers from 1 up to N. If we try to graph the factorial, we see that we get a discrete function, where points are not connected. But we need to find a continuous function, since we want to find all the factorial values inbetween these points.

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So, one thing that we can do is just draw any line that goes though all the discrete points and call it an expansion but surely we can’t call it a true expansion. How do we know which curve is right? Well, you see the factorial function grows almost at expanantial rate and even faster and doesn’t flatten out, because factorials are repeated multiplacation and every next factorial you multiply a cumulative effect of other numbers you’ve already multiplied.

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So, the solution to this problem is taking the logarithm of the factorial, which transforms multiplication into sum.

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Now having one formula, formula 1, we can easily conclude that the natural logarithm of any factorial after N can be found by formula 2.

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So we yield the formula and it’s defined as the Gamma Function which has a setback of our derived formula by 1.

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Now we can use this formula to calculate positive and negative farctions

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In this project we also derived an equation which shows the connection between the Gamma function and the Harmonic series.

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In 1968 Gibriele Veneziano showed the application of the Gamma Function in physics and

In 1970 three scientists, Leonard Susskind, Yoichiro Nambu and Holger Nielsen gave the explanation, in which elementary particles were deemed as tiny, vibrating strings, and the Gamma Function could describe nucleus interactions.

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So, we managed to describe a natural way to derive the Gamma Function and interpolate factorial function, showed the relationship with the Harmonic series and described the application in modern physics

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