Nature works the way Number works

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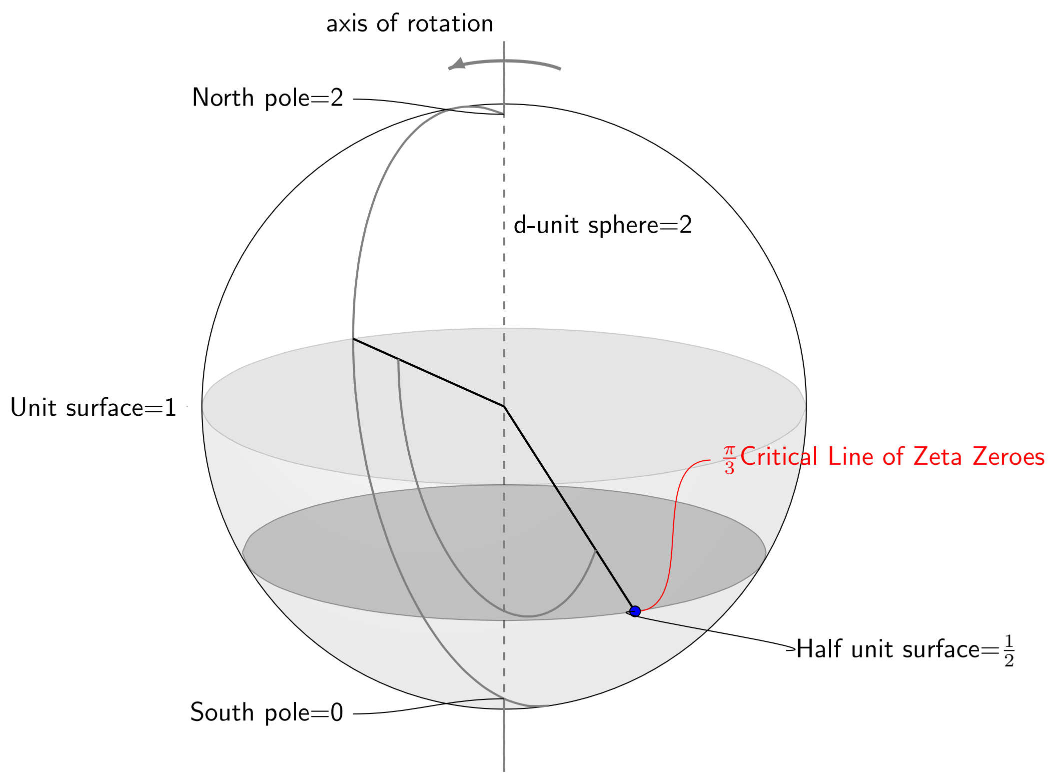
Abstract

Based on Eulers formula a concept of dually unit or d-unit circle is discovered. Continuing with, Riemann hypothesis is proved from different angles, Zeta values are renormalised to remove the poles of Zeta function and relationships between numbers and primes is discovered. Other unsolved prime conjectures are also proved with the help of theorems of numbers and number theory. Imaginary number i can be defined such a way that it eases the complex logarithm without needing branch cuts. Pi can also be a base to natural logarithm and complement complex logarithm.Grand integrated scale is discovered which can reconcile the scale difference between very big and very small. Complex constants derived from complex logarithm following Goldbach partition theorem and Eulers Sum to product and product to unity can explain lot of mysteries in the universe.



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1 A narrative description of my journey to numbers world

Purpose of writing this article is scaling the gap between quantum scale and middle scale or cosmic scale and middle scale. We know that there is a huge scale gap between classical mechanics and Quantum Mechanics and also between general relativity and Quantum mechanics. Instead of doing something to fix this gap we rely upon existing theories and math which we know are incomplete. We interpret math presuming that nature is scale invariant although the same can be interpreted the other way. At the grandest scale spacetime maybe scale invariant over time in long run but the proven fact is nature is quantized or spacetime is discrete in short run. Both general relativity and quantum mechanics have got gravitational constant and planck constant respectively working as a scale factor. But is that sufficient? I mean can a single constant fit into all the underlying dimensions. Why I am asking so? I would not have asked this type of questions if I would not have solved most of the number theory problems and see that numbers collectively do not fit into one particular scale rather they have got six scale factors like six Goldbach partitions. Numbers are said to be the foundation of mathematics together with mathematical logic. Although Russell Paradox put a question mark on the logic of mathematics, my answer to Russell Paradox is the barber will train a man from all other mans who does not shave themselves to become a barber and the barber 1 will get himself shaved by the barber 2. This way logic gives birth to numbers and mathematics cannot be pure logic without numbers. Both numbers and logic are inseparable parts of mathematics. Physics also require numbers to describe the physical phenomena around us. In general relativity equation we see number 3 pops up to take care of the three spatial dimensions pressure on energy density. In Planck's law we see an integer is required to save us from the ultraviolet catastrophe. Are this numbers safe to use such a way. I mean to say when this numbers are not properly scaled itself how can they fit into the given equations scale accurately. Numbers are not so innocent we think of them. And the kingpin of all the mischievous numbers is number 2. It is behind all the quantum weirdness observed in wave particle duality, measurement problem, quantum entanglement and what not. From Dark energy to Quantum gravity wherever we face a problem at the deepest root we will see that number 2 is somehow involved. So is the situation of pure mathematics too. Riemann hypothesis remained unsolved for more than 150 years just because we don't understand the number 2 yet. I will take you through the detour of my journey to numbers world.

1.1 Into the Duality

[Refer section (2)] I remember the day when I was brushing up my high school maths knowledge and I came to know about Euler's formula first time. Initially I was not getting fully convinced with Eulers unit circle concept as it does not give us concentric circles representing every natural numbers. Euler's formula do not jumps like the numbers instead it rotates the numbers around the same unit circle. An Idea came to my mind, what if I find a way which will give me a jump to another number and come back again to Unit circle. I took the help of trigonometric form of complex number. I looked into the table of sine and cosine and was searching for the argument which will give me a modulus of 2 on half unit circle. I found the angle pi by 3 give a modulus of 2 on half unit circle. Then I thought that using the same logic I'll be able to get a modulus of 3 on one-third unit circle. But I could not find a modulus of 3 on one-third unit circle. I was not aware of Fermat's last theorem. Later when I came to know about Fermat's last theorem, I understood the reason why it is not possible to get a modulus of 3 on one-third unit circle. It is because before we reach a modulus of 3 we will have a 2 pi rotation on the unit circle and as such we will never reach a modulus of 3 on one-third unit circle. When Fermat was writing in the margin that he has the proof of his own last theorem I guess he was talking something similar to my approach of proving his last theorem by mathematical induction. I wondered if a modulus of 3 is not there then why we don't face any problem in getting a fractional modulus like one third, one fifth and so on. I found answer to this question later when I came to know about Cantors theorem. Cantor has given a nice proof why there are much more ordinal numbers than cardinal numbers. I was able to find the value of Zeta 1 (Sum of unit fractions) which is just double of Zeta (-1) (Sum of natural numbers). This proves another version of cantor's theorem numerically that there shall be more unit fractions than natural numbers because unit fractions can be equivalently written two different ways.

1.2 On the proofs of Riemann Hypothesis

[Refer section (5)] Immediately after discovery of mathematical duality I started trying to solve Riemann hypothesis. Here also Euler's initial work on Zeta function helped me a lot. I started with Euler original product form. Although Euler product form does not involve imaginary numbers I called it into the product form based on the fact that Zeta function has got analytical continuity in the complex domain. Now Eulers product form of Zeta function in exponential form of complex numbers can be zero if and only if, any of the factors can be shown equals to zero. Manipulating this way each term of Zeta function can be equated to Eulers formula in unit circle. One step ahead I have shown the sum of all the arguments in a one of such factors equals Pi and the sum of the entire radius equals 1. Apparently this may sound illegal but that's the logic of infinite sum. If one accepts Euler's formula then he cannot oppose to this type of manipulation. This way it was possible to solve the argument and radius which will be responsible for non trivial zeros of Zeta function. It was also possible to prove Riemann hypothesis using the alternate product form. The only new thing I had to apply here was when multiplying a positive complex number with a negative complex number we can subtract the lower argument from the higher one. But I knew that apparently such a easy proof will not be accepted although it involved almost an years time to figure it out. I thought I will proof Riemann hypothesis using Riemanns own functional equation. Here it took little more time but at the end I succeeded. And the success came using Gauss's pi function instead of gamma function for factorial. The proof came after removal of pole at Zeta 1. One can ask why I used $\Pi(2-s)$ instead of $\Pi(-s)$ as a replacement of $\Gamma(1-s)$ my reply is the choice of origin. Gausss pi function having one unit higher range over Gamma function both sides (equivalently 2 units) is more suitable in this particular region of Zeta function. Gauss's pi function also has the potential of taking care of factorial of negative integers which is a limitation of Gamma function.

1.3 On the infinite product and sum of Zeta values

[Refer section (6)] I believed that Zeta pole could be removed using Euler's induction method too. I started from there where Euler left. I took infinite product of positive Zeta values both from the side of sum of numbers and the side of product of primes. This gave me the value of Zeta 1 = 1. Apart from this I got a nice relation between the sum of fractions and the product of primes reciprocals. Similar concept I used to calculate Zeta(-1). I got second root of Zeta(-1) equals half apart from the known one. Also I got a nice relationship between sum of numbers and the product of primes which I used to formulate fundamental formula of numbers. All this manipulation may not be permissible in conventional mathematics but it does make complete sense when we apply the deeper logic applied by Euler, Cantor, Ramanujan's while dealing with infinity.

1.4 On the proofs of other Prime Conjectures

[Refer section (8)] Subsequently I used fundamental formula of numbers to solve other Prime conjectures like Goldbach conjecture, twin prime conjecture, Legendre's conjecture, Oppermans conjecture, Collatz conjecture etc. Here the central concept was using the fundamental formula of numbers extensively and check whether the given conjectures violate the formula or breaks the pattern or not. If the pattern is preserved then the conjecture passes the test. All the conjectures survived although few of them were thought to be false. All these were an elementary proof in an elegant way. One can bring a more rigorous proof using sieve theory, prime generating functions or any better algorithm. One small clarification for the readers: While checking the pattern frequently I used the phrase the expression cannot be factorised. There I actually mean that the expression cannot be factorised algebraically. It should not be construed as the expression is not solvable or numerically it cannot be factorised.

1.5 On the complex logarithm simplified

[Refer section (9)] Even after solving these conjectures I was having a feel that I was missing something. Mathematical duality is ok, specialty of number 2 is understood, prime numbers take birth at Zeta zeros, Zeta zeros fall on the half line in complex plane all this are ok but someone said to solve Riemann hypothesis one has to introduce new mathematics. So far my work does not give anything new. Intuitively I was not clear even with my own proof. Almost a months time elapsed I emptied all my thoughts. When I came back to revisit my work, the first thing struck my mind that I have not used the mysterious Euler's formula yet, although it have more potential. Imaginary number i remained still mysterious to me. I thought I will do something with imaginary number i as it cannot remain undefined eternally. I needed to understand how can I define imaginary number i such a way that it vanishes or it becomes real like i squared. I had realised that Zeta function has properties of continuous logarithmic function. Just like natural logarithm of 1 give us zero we get zeros of Zeta function on the half line which is the base of all bases. Can we extend the concept of Zeta function to complex logarithm just like Riemann extended Euler's Zeta function to the whole Complex plane? This will unify complex numbers, complex logarithm and number theory. In fact Roger Cotes showed that complex logarithm will involve a complex number later Euler used the concept in exponential form. I thought I will be doing the opposite. I will use Euler's formula to do complex logarithm. But I failed perhaps because I was getting lost in Cantors paradise. I took u turn and concentrated on how to find out i. I knew that Zeta function have a close relation with eta function which is again nothing but alternate Zeta function. Eta of 1 results natural logarithm of 2. It was the first solution to i (Although that time I didn't knew that I will get another 2 solution to i). Gradually I found the second and third root of i using the same methods. Plugging the different values of i into Euler's formula I discovered the scale natural exponential scale proceeds and gives birth to prime numbers at higher frequencies. While working on this I was getting a feel that pi is equally mysterious from the perspective of complex logarithm. I solved the mystery of pi based Complex logarithm too with my crooked manipulating algorithm. Needless to say that these simplified techniques of complex logarithm will have tremendous application in the field of mathematics and the whole of science. I take the privilege of suggesting the abbreviation RSL (Really simple logarithm) for naming the function while writing the script programmatically.

1.6 On the Grand unified scale

[Refer section (11)] To be sure I needed some natural signature. The percentage of dark energy always hinted me that it could be a mathematical constant in the form of natural logarithm of 2 because numerically they are same and negative sign of dark energy resembles infinite rotation in the Eulers unit circle via Eulers formula. Natural logarithm of the redshift scale factor of expansion (1000 time) gives approximately 10 times of natural logarithm of 2. String theorists treat this as extra dimensions but deeper I went stronger I felt that nature is scale variant in short run so that time itself remain eternally open in long run. This was not enough. I took double natural logarithm of 2 and found that the value is arbitrarily close to a thousandth part of a years time in earthly scale. This way Natural logarithm of 2 is also bridging the scale of the solar system and the universal cosmic scale. These two natural signatures prompted me that I have cracked the imaginary number i. Good news! is'nt it. The second root of i gave me a complex constant which time period entropy correction takes place and the same time scale cosmological changes happen. Einstein should be happy now knowing that his initial idea of eternal universe is true. There may be Big bounces when we plug the Infinite series of natural logarithm of 2 in his cosmological constant and the universe become ultimate perpetual machine which has a built in mechanism of entropy correction through prime cosmic events like death and birth of stars, galaxies etc. The universe runs eternally and will continuously run so for infinite amount of time. Let me take a deep breath after conceiving all this painful ideas. In fact the idea was if all the numbers can have maximum six Goldbach prime partition then can all the numbers have six prime constants, pretty clear and logical. The painful part was connecting the jigsaw puzzles to figure out exact six complex constants.These six constants six exponent parts and their reciprocals then give us 72 constants in an integrated scale of very big numbers as well as very small numbers. Why parts alone, why not multiples of those complex following the cyclotomic behavior. The number of multiples cannot be same as that of the exponent parts, as because leaving the domain of Zeta 1 we have now entered the domain of Zeta (-1). Three multiples other than 2 (which is default value) give us another 36 more constants. Altogether the constant count goes to 120. As prime numbers get more spaced out across the number line, so also the multiple factors are more spaced out than the scale of six parts of six complex constants. The highest multiple give us the scale which can solve Cosmological Constant Problem or Vacuum Catastrophe because numerically it is near the same orders of magnitude that QM utterly worstly predicted for zero pint energy which results scale difference of the order of 10^{120}. We should extensively use this grand unified scale to fix the scale gap in general relativity and quantum mechanics whenever required. I have a thought experiment for wave unction collapse or quantum decoherence in double slit experiment. In a regular double slit experiment with slit detectors on if we simultaneously measure the spin of the passing by particles then we will see that the spin of the particles passed through one slit is just opposite of the spin of the particles passed through the other slit restoring the wave pattern. What does that prove? Quantum uncertainty can be eliminated by way of setting the apparatus and deterministic measurement can be made. To prove that Quantum entanglement is local and do not violate special relativity I have another thought experiment. Let's form a triangle selecting 3 cities randomly from the ATLAS. Labs in city (A,B), (B,C), (C,A) will entangle a pair of particles each among themselves and they will hold the entanglement to ensure that they are synced among themselves. With this 3 pair of particles in entanglement and synced in time if now any two Labs try to entangle another pair of particle they wont succeed and they may end up breaking the entanglement of all the particles. This shall prove that entanglement is local and do not violate No Faster than light principle.

2 Eulers formula, the unit circle, the unit sphere

[Read with section (1.1)] $z = r(\cos x + i \sin x)$ is the trigonometric form of complex numbers. Using Eulers formula $e^{ix} = \cos x + i \sin x$ we can write $z = re^{ix}$. Putting $x = \pi$ in Eulers formula we get , $e^{i\pi} = -1$.Putting $x = \frac{\pi}{2}$ we get $e^{\frac{i\pi}{2}} = i$. So the general equation of the points lying on unit circle $|z| = |e^{ix}| = 1$. But that's not all. If $x = \frac{\pi}{3}$ in trigonometric form then $z = cos(\frac{\pi}{3}) + i.sin(\frac{\pi}{3}) = \frac{1}{2}(\sqrt{3} + i)$.So $|z| = r = \sqrt{(\frac{\sqrt{3}}{2})^2 + (\frac{1}{2})^2} = \frac{1}{2}.\sqrt{4} = \frac{1}{2}.2 = 1$.So another equation of the points lying on unit circle $\mathbf{|z| = |\frac{1}{2}e^{ix}| = 1}$. Although both the equation are of unit circle, usefulness of $\mathbf{|z| = |\frac{1}{2}e^{ix}| = 1}$ is greater than $|z| = |e^{ix}| = 1$ as $\mathbf{|z| = |\frac{1}{2}e^{ix}| = 1}$ bifurcates mathematical singularity and introduces unavoidable mathematical duality particularly in studies of Zeta function. $\mathbf{|z| = |\frac{1}{2}e^{ix}| = 1}$ can be regarded as d-unit circle. When Unit circle in complex plane is stereo-graphically projected to unit sphere the points within the area of unit circle gets mapped to southern hemisphere, the points on the unit circle gets mapped to equatorial plane, the points outside the unit circle gets mapped to northern hemisphere. d-unit circle can be also be easily projected to Riemann sphere.

3 Euler the Grandfather of Zeta function

In 1737, Leonard Euler published a paper where he derived a tricky formula that pointed to a wonderful connection between the infinite sum of the reciprocals of all natural integers (Zeta function in its simplest form) and all prime numbers.

$$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + ... = \frac{2.3.5.7.11....}{1.2.4.6.8....}$$

Now:

$$1 + \left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^4 ... = \frac{2}{1}$$

$$1 + \left(\frac{1}{3}\right) + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^4 ... = \frac{3}{2}$$

$\vdots$

Euler product form of Zeta function when $s > 1$:

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \left(1 + \frac{1}{p^s} + \frac{1}{p^{2s}} + \frac{1}{p^{3s}} + \frac{1}{p^{4s}} ...\right)$$

Equivalent to:

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \frac{1}{1 - P^{-s}}$$

To carry out the multiplication on the right, we need to pick up exactly one term from every sum that is a factor in the product and, since every integer admits a unique prime factorization, the reciprocal of every integer will be obtained in this manner - each exactly once.

In the year of 1896 - Jacques Hadamard and Charles Jean de la Valle-Poussin independently prove the prime number theorem which essentially says that if there exists a limit to the ratio of primes upto a given number and that numbers natural logarithm, that should be equal to 1. When I started reading about number theory I wondered that if number theory is proved then what is left. The biggest job is done. I questioned myself why Zeta function cannot be defined at 1. Calculus has got set of rules for checking convergence of any infinite series, sometime especially when we are enclosing infinities to unity, those rules falls short to check the convergence of infinite series. In spite of that Euler was successful proving sum to product form and calculated Zeta values for some numbers by hand only. Leopold Kronecker proved and interpreted Euler's formulas is the outcome of passing to the right-sided limit as $s \to 1^+$. I decided I will stick to Grandpa Eulers approach in attacking the problem.

4 Riemann the father of Zeta function

Riemann showed that Zeta function have the property of analytic continuation in the whole complex plane except for s=1 where the Zeta function has its pole. Riemann Hypothesis is all about non trivial zeros of Zeta function. There are trivial zeros which occur at every negative even integer. There are no zeros for $s > 1$. All other zeros lies at a critical strip $0 < s < 1$. In this critical strip he conjectured that all non trivial zeros lies on a critical line of the form of $z = \frac{1}{2} \pm iy$ i.e. the real part of all those complex numbers equals $\frac{1}{2}$.The Zeta function satisfies Riemann's functional equation :

$$\zeta(s) = 2^s \pi^{(s-1)} \sin\left(\frac{\pi s}{2}\right) \Gamma(1-s)\zeta(1-s)$$

5 Proof of Riemann Hypothesis

[Read with section (1.2)] In this section we shall prove Riemann Hypothesis from different angles.

5.1 Proof using Riemanns functional equation

Multiplying both side of functional equation by $(s-1)$ we get

$$(1-s)\zeta(s) = 2^s \pi^{(s-1)} \sin\left(\frac{\pi s}{2}\right) (1-s)\Gamma(1-s)\zeta(1-s)$$

Putting $(1-s)\Gamma(1-s) = \Gamma(2-s)$ we get:

$$\zeta(1-s) = \frac{(1-s)\zeta(s)}{2^s \pi^{(s-1)} \sin\left(\frac{\pi}{2}\right) \Gamma(2-s)}$$

$s \to 1$we get: $\because \lim_{s \to 1}(s-1)\zeta(s) = 1 \therefore (1-s)\zeta(s) = -1$ and $\Gamma(2-1) = \Gamma(1) = 1$

$$\zeta(0) = \frac{-1}{2^1 \pi^0 \sin\left(\frac{\pi}{2}\right)} = -\frac{1}{2}$$

Examining the functional equation we shall observe that the pole of Zeta function at $Re(s) = 1$ is solely attributable to the pole of gamma function. In the critical strip $0 < s < 1$ Gauss's Pi function or the factorial function holds equally good if not better in Mellin transformation of exponential function. We can remove the pole of Zeta function by way of not using gamma function at the simple pole. Using Gauss's Pi function instead of Gamma function for factorial we can rewrite the functional equation as follows:

$$\zeta(s) = 2^s \pi^{(s-1)} \sin\left(\frac{\pi s}{2}\right) \Pi(2-s)\zeta(1-s)$$

Putting $s = 1$we get:

$$\zeta(1) = 2^1 \pi^{(1-1)} \sin\left(\frac{\pi}{2}\right) \Pi(2-1)\zeta(0) = 1$$

The Zeta function is now defined on entire $\mathbb{C}$, and as such it becomes an entire function. In complex analysis, Liouville's theorem states that every bounded entire function must be constant. That is, every holomorphic function f for which there exists a positive number M such that $|f(z)| \leq M$ for all z in $\mathbb{C}$ is constant. Entire Zeta function is constant as none of the values of Zeta function do not exceed $M = \zeta(2) = \frac{\pi^2}{6}$.Maximum modulus principle further requires that non constant holomorphic functions attain maximum modulus on the boundary of the unit circle. Constant Entire Zeta function duly complies with Maximum modulus principle as it reaches Maximum modulus $\frac{\pi^2}{6}$ outside the unit circle i.e. on the boundary of the double unit circle. Gauss's Mean Value Theorem requires that in case a function is bounded in some neighborhood, then its mean value shall occur at the center of the unit circle drawn on the neighborhood. $|\zeta(0)| = \frac{1}{2}$ is the mean modulus of entire Zeta function. Inverse of maximum modulus principle implies points on half unit circle give the minimum modulus or zeros of Zeta function. Minimum modulus principle requires holomorphic functions having all non zero values shall attain minimum modulus on the boundary of the unit circle. Having lots of zero values holomorphic Zeta function do not attain minimum modulus on the boundary of the unit circle rather points on half unit circle gives the minimum modulus or zeros of Zeta function. Everything put together it implies that points on the half unit circle will mostly be the zeros of the Zeta function which all have $\pm\frac{1}{2}$ as real part as Riemann rightly hypothesized.

Putting $s = \frac{1}{2}$ in $\zeta(s) = 2^s \pi^{(s-1)} \sin\left(\frac{\pi s}{2}\right) \Pi(2-s)\zeta(1-s)$

$$\boxed{\begin{gathered}
\zeta\left(\frac{1}{2}\right) = 2^{\frac{1}{2}} \pi^{(1-\frac{1}{2})} \sin\left(\frac{\pi}{2.2}\right) \Pi\left(\frac{3}{2}\right) \zeta\left(\frac{1}{2}\right) \\
\zeta\left(\frac{1}{2}\right)\left(1 + \frac{3\sqrt{2.\pi.\pi}}{4.\sqrt{2}}\right) = 0 \\
\zeta\left(\frac{1}{2}\right)\left(1 + \frac{3\pi}{4}\right) = 0 \\
\zeta\left(\frac{1}{2}\right) = 0
\end{gathered}}$$

Therefore principal value of $\zeta(\frac{1}{2})$ is zero and Riemann Hypothesis holds good.

5.2 Proof using Eulers original product form

Eulers Product form of Zeta Function in Eulers exponential form of complex numbers is as follows:

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \left(1 + re^{i\theta} + r^2 e^{i2\theta} + r^3 e^{i3\theta}...\right)$$

Now any such factor $\left(1 + re^{i\theta} + r^2 e^{i2\theta} + r^3 e^{i3\theta}...\right)$ will be zero if

$$\left(re^{i\theta} + r^2 e^{i2\theta} + r^3 e^{i3\theta}...\right) = -1 = e^{i\pi}$$

Comparing both side of the equation and equating left side to right side on the unit circle we can say:

$$\boxed{\theta + 2\theta + 3\theta + 4\theta... = \pi}$$

$$\boxed{r + r^2 + r^3 + r^4.... = 1}$$

We can solve θ and r as follows:

$$\boxed{\begin{aligned} \theta + 2\theta + 3\theta + 4\theta... &= \pi \\ \theta(1+2+3+4...) &= \pi \\ \theta.\zeta(-1) &= \pi \\ \theta.\frac{-1}{12} &= \pi \\ \theta &= -12\pi \end{aligned} \qquad \begin{aligned} r + r^2 + r^3 + r^4.... &= 1 \\ r(1 + r + r^2 + r^3 + r^4....) &= 1 \\ r\frac{1}{1-r} &= 1 \\ r &= 1 - r \\ r &= \frac{1}{2} \end{aligned}}$$

We can determine the real part of the non trivial zeros of Zeta function as follows:

$$\boxed{r\cos\theta = \frac{1}{2}\cos(-12\pi) = \frac{1}{2}}$$

Therefore Principal value of $\zeta(\frac{1}{2})$ will be zero, hence Riemann Hypothesis is proved.

5.3 Proof using alternate product form

Eulers alternate Product form of Zeta Function in Eulers exponential form of complex numbers is as follows:

$$\sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \left(\frac{1}{1 - \frac{1}{re^{i\theta}}} \right) = \prod_p \left(\frac{re^{i\theta}}{re^{i\theta} - 1} \right)$$

Multiplying both numerator and denominator by $re^{i\theta} + 1$we get:

$$\sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p \left(\frac{re^{i\theta}(re^{i\theta} + 1)}{(re^{i\theta} - 1)(re^{i\theta} + 1)} \right)$$

Now any such factor $\left(\frac{re^{i\theta}(re^{i\theta}+1)}{(r^2 e^{i2\theta}-1)} \right)$ will be zero if $re^{i\theta}(re^{i\theta} + 1)$ is zero:

$$\boxed{\begin{aligned} re^{i\theta}(re^{i\theta} + 1) &= 0 \\ re^{i\theta}(re^{i\theta} - e^{i\pi}) &= 0 \\ r^2 e^{i2\theta} - re^{i(\pi-\theta)*} &= 0 \\ r^2 e^{i2\theta} &= re^{i(\pi-\theta)} \end{aligned}}$$

We can solve θ and r as follows:

$$\boxed{\begin{array}{rrrr} 2\theta = & (\pi - \theta) & r^2 = & r \\ 3\theta = & \pi & \frac{r^2}{r} = & \frac{r}{r} \\ \theta = & \frac{\pi}{3} & r = & 1 \end{array}}$$

* As there is -1 the sign of θ get a minus in the second quadrant.

We can determine the real part of the non trivial zeros of Zeta function as follows:

$$\boxed{r\cos\theta = 1.\cos(\tfrac{\pi}{3}) = \tfrac{1}{2}}$$

Therefore Principal value of $\zeta(\frac{1}{2})$ will be zero, and Riemann Hypothesis is proved.

6 Infinite product or sum of Zeta values

[Read with section (1.3)]

6.1 Infinite product of positive Zeta values converges

$$\zeta(1) = 1 + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}... = \left(1 + \frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3}...\right)\left(1 + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\left(1 + \frac{1}{5^1} + \frac{1}{5^2}...\right)...$$

$$\zeta(2) = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2}... = \left(1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\left(1 + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)\left(1 + \frac{1}{5^2} + \frac{1}{5^4}...\right)...$$

$$\zeta(3) = 1 + \frac{1}{2^3} + \frac{1}{3^3} + \frac{1}{4^3}... = \left(1 + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\left(1 + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\left(1 + \frac{1}{5^3} + \frac{1}{5^6}...\right)...$$

$\vdots$

From the side of infinite sum of negative exponents of all natural integers:

$$\begin{aligned}
&\zeta(1)\zeta(2)\zeta(3)...\\
&= \left(1 + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}...\right)\left(1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2}...\right)\left(1 + \frac{1}{2^3} + \frac{1}{3^3} + \frac{1}{4^3}...\right)...\\
&= 1 + \left(\frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3}...\right) + \left(\frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right) + \left(\frac{1}{4^1} + \frac{1}{4^2} + \frac{1}{4^3}...\right)...\\
&= 1 + 1 + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1} + \frac{1}{5^1} + \frac{1}{6^1} + \frac{1}{7^1} + \frac{1}{8^1} + \frac{1}{9^1}...\\
&= 1 + \zeta(1)
\end{aligned}$$

$\vdots$

From the side of infinite product of sum of negative exponents of all primes:

$$\begin{aligned}
&\zeta(1)\zeta(2)\zeta(3)... =\\
&\left(1 + \frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3}...\right)\left(1 + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\left(1 + \frac{1}{5^1} + \frac{1}{5^2} + \frac{1}{5^3}...\right)...\\
&\left(1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\left(1 + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)\left(1 + \frac{1}{5^2} + \frac{1}{5^4} + \frac{1}{5^6}...\right)...\\
&\left(1 + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\left(1 + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\left(1 + \frac{1}{5^3} + \frac{1}{5^6} + \frac{1}{5^9}...\right)...
\end{aligned}$$

$\vdots$

$$\begin{aligned}
&= \left(1 + 1\right)\left(1 + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\left(1 + \frac{1}{5^1} + \frac{1}{5^2} + \frac{1}{5^3}...\right)...\\
&\left(1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\left(1 + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)\left(1 + \frac{1}{5^2} + \frac{1}{5^4} + \frac{1}{5^6}...\right)...\\
&\left(1 + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\left(1 + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\left(1 + \frac{1}{5^3} + \frac{1}{5^6} + \frac{1}{5^9}...\right)...
\end{aligned}$$

$\vdots$

continued to next page....

continued from last page....

Simultaneously halfing and doubling each factor and writing it sum of two equivalent forms

$$= 2\left(\frac{1}{2}\left(1 + \frac{\frac{1}{3}}{1-\frac{1}{3}} + 1 + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\right)\left(\frac{1}{2}\left(1 + \frac{\frac{1}{5}}{1-\frac{1}{5}} + 1 + \frac{1}{5^1} + \frac{1}{5^2} + \frac{1}{5^3}...\right)\right)...$$

$$\left(\frac{1}{2}\left(1 + \frac{\frac{1}{4}}{1-\frac{1}{4}} + 1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\right)\left(\frac{1}{2}\left(1 + \frac{\frac{1}{9}}{1-\frac{1}{9}} + 1 + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)..\right)$$

$$\left(\frac{1}{2}\left(1 + \frac{\frac{1}{8}}{1-\frac{1}{8}} + 1 + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\left(\frac{1}{2}\left(1 + \frac{\frac{1}{27}}{1-\frac{1}{27}} + 1 + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\right)...\right.$$

$\vdots$

$$= 2\left(\frac{1}{2}\left(1 + \frac{1}{2} + 1 + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\right)\left(\frac{1}{2}\left(1 + \frac{1}{4} + 1 + \frac{1}{5^1} + \frac{1}{5^2} + \frac{1}{5^3}...\right)\right)...$$

$$\left(\frac{1}{2}\left(1 + \frac{1}{3} + 1 + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\left(\frac{1}{2}\left(1 + \frac{1}{8} + 1 + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)\right)...\right.$$

$$\left(\frac{1}{2}\left(1 + \frac{1}{7} + 1 + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\left(\frac{1}{2}\left(1 + \frac{1}{26} + 1 + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\right)...\right.$$

$\vdots$

$$= 2\left(1 + \frac{1}{2}\left(\frac{1}{2} + \frac{1}{3^1} + \frac{1}{3^2} + \frac{1}{3^3}...\right)\right)\left(1 + \frac{1}{2}\left(\frac{1}{4} + \frac{1}{5^1} + \frac{1}{5^2} + \frac{1}{5^3}...\right)\right)...$$

$$\left(1 + \frac{1}{2}\left(\frac{1}{3} + \frac{1}{2^2} + \frac{1}{2^4} + \frac{1}{2^6}...\right)\right)\left(1 + \frac{1}{2}\left(\frac{1}{8} + \frac{1}{3^2} + \frac{1}{3^4} + \frac{1}{3^6}...\right)\right)...$$

$$\left(1 + \frac{1}{2}\left(\frac{1}{7} + \frac{1}{2^3} + \frac{1}{2^6} + \frac{1}{2^9}...\right)\right)\left(1 + \frac{1}{2}\left(\frac{1}{26} + \frac{1}{3^3} + \frac{1}{3^6} + \frac{1}{3^9}...\right)\right)...$$

$\vdots$

$$= 2\left(1 + \frac{1}{2}\left(\frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}... + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}...\right)\right)$$

$$= 2\left(1 + \frac{1}{2}\left(2\zeta(1) - 2\right)\right)$$

$$= 2(1 - 1 + \zeta(1))$$

$$= 2\zeta(1)$$

Now comparing two identities:

$$\boxed{1 + \zeta(1) = 2\zeta(1))}$$

$$\boxed{\zeta(1) = 1}$$

Hence Infinite product of positive Zeta values converges to 2

6.2 Infinite product of negative Zeta values converges

$$\zeta(-1) = 1 + 2^1 + 3^1 + 4^1 + 5^1 ... = \left(1 + 2 + 2^2 + 2^3 ...\right)\left(1 + 3 + 3^2 + 3^3 ...\right)\left(1 + 5 + 5^2 + 5^3 ...\right)...$$

$$\zeta(-2) = 1 + 2^2 + 3^2 + 4^2 + 5^2 ... = \left(1 + 2^2 + 2^4 + 2^6 ...\right)\left(1 + 3^2 + 3^4 + 3^6 ...\right)\left(1 + 5^2 + 5^4 + 5^6 ...\right)...$$

$$\zeta(-3) = 1 + 2^3 + 3^3 + 4^3 + 5^3 ... = \left(1 + 2^3 + 2^6 + 2^9 ...\right)\left(1 + 3^3 + 3^6 + 3^9 ...\right)\left(1 + 5^3 + 5^6 + 5^9 ...\right)...$$

$$\vdots$$

From the side of infinite sum of negative exponents of all natural integers:

$$\begin{aligned}
&\zeta(-1)\zeta(-2)\zeta(-3)...\\
&= \left(1 + 2^1 + 3^1 + 4^1 + 5^1 ...\right)\left(1 + 2^2 + 3^2 + 4^2 + 5^2 ...\right)\left(1 + 2^3 + 3^3 + 4^3 + 5^3 ...\right)...\\
&= 1 + \left(2 + 2^2 + 2^3 ...\right) + \left(3 + 3^2 + 3^3 ...\right) + \left(4 + 4^2 + 4^3 ...\right)...\\
&= 1 + \left(1 + 2 + 2^2 + 2^3 ... - 1\right) + \left(1 + 3 + 3^2 + 3^3 ... - 1\right) + \left(1 + 4 + 4^2 + 4^3 ... - 1\right)...\\
&= 1 + \left(-\frac{1}{1} - 1\right) + \left(-\frac{1}{2} - 1\right) + \left(-\frac{1}{3} - 1\right) + \left(-\frac{1}{4} - 1\right)...\\
&= 1 - \left(\left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} ...\right) + 1 + 1 + 1 + 1 ...\right)\\
&= 1 - \left(\zeta(1) + \zeta(0)\right)\\
&= 1 - \left(1 - \frac{1}{2}\right)\\
&= \frac{1}{2}
\end{aligned}$$

From the side of infinite product of sum of negative exponents of all primes:

$$\begin{aligned}
&\zeta(-1)\zeta(-2)\zeta(-3)... =\\
&\left(1 + 2 + 2^2 + 2^3 ...\right)\left(1 + 3 + 3^2 + 3^3 ...\right)\left(1 + 5 + 5^2 + 5^3 ...\right)...\\
&\left(1 + 2^2 + 2^4 + 2^6 ...\right)\left(1 + 3^2 + 3^4 + 3^6 ...\right)\left(1 + 5^2 + 5^4 + 5^6 ...\right)...\\
&\left(1 + 2^3 + 2^6 + 2^9 ...\right)\left(1 + 3^3 + 3^6 + 3^9 ...\right)\left(1 + 5^3 + 5^6 + 5^9 ...\right)...\\
&\vdots\\
&= 1 + 2^1 + 3^1 + 4^1 + 5^1 ...\\
&= \zeta(-1)
\end{aligned}$$

Therefore $\boxed{\zeta(-1) = \frac{1}{2}}$ must be the second root of $\zeta(-1)$ apart from the known one $\zeta(-1) = \frac{-1}{12}$.

Using Gauss's Pi function instead of Gamma function on the d-unit circle we can rewrite the functional equation as follows:

$$\zeta(s) = 2^s \pi^{(s-1)} \sin\left(\frac{\pi s}{2}\right) \Pi(s-2)\zeta(1-s)$$

Putting $s = -1$we get:

$$\zeta(-1) = 2^{-1} \pi^{(-1-1)} \sin\left(\frac{-\pi}{2}\right) \lfloor\!\underline{\ -3}\, \zeta(2) = \frac{1}{2}$$

To proof Ramanujans Way

$$\begin{aligned}
\sigma &= \boxed{1+2+3+4+5+6+7+8+9.....} \\
2\sigma &= \boxed{0+1+2+3+4+5+6+7+8+9...} + 1+1+1+1+1+1+1+1...*
\end{aligned}$$

Subtracting the bottom from the top one we get:

$$\begin{aligned}
&-\sigma = 0+1+1+1+1+1+1+1+1... + 1+1+1+1+1+1+1... \\
&\sigma = -(1+1+1+1+1+1+1+1+1+1........) \\
&\sigma = \frac{1}{2}
\end{aligned}$$

*The second part is calculated subtracting bottom from the top before doubling.

6.3 Infinite product of All Zeta values converges

$$\boxed{\zeta(-1)\zeta(-2)\zeta(-3)...\zeta(1)\zeta(2)\zeta(3)... = \zeta(-1).2.\zeta(1) = \frac{1}{2}.2.1 = 1}$$

6.4 Infinite sum of Positive Zeta values converges

$$\begin{aligned}
&\zeta(1) = 1 + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}... \\
&\zeta(2) = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2}... \\
&\zeta(3) = 1 + \frac{1}{2^3} + \frac{1}{3^3} + \frac{1}{4^3}... \\
&\vdots \\
&\zeta(1) + \zeta(2) + \zeta(3)... \\
&= \left(1 + \frac{1}{2^1} + \frac{1}{3^1} + \frac{1}{4^1}...\right) + \left(1+1+1+1+...\right) \\
&= \zeta(1) + \zeta(0) = 1 - \frac{1}{2} = \frac{1}{2} \\
&\boxed{\zeta(1) + \zeta(2) + \zeta(3)... = \frac{1}{2}}
\end{aligned}$$

6.5 Infinite sum of Negative Zeta values converges

$$\zeta(-1) = 1 + 2^1 + 3^1 + 4^1 + 5^1...$$
$$\zeta(-2) = 1 + 2^2 + 3^2 + 4^2 + 5^2...$$
$$\zeta(-3) = 1 + 2^3 + 3^3 + 4^3 + 5^3...$$
$$\vdots$$
$$\zeta(-1) + \zeta(-2) + \zeta(-3)...$$
$$= \left(1 + 2^1 + 3^1 + 4^1 + 5^1...\right) + \left(1 + 1 + 1 + 1 + ...\right)$$
$$= \zeta(-1) + \zeta(0) = \frac{1}{2} - \frac{1}{2} = 0$$
$$\boxed{\zeta(-1) + \zeta(-2) + \zeta(-3)... = \zeta(-1) + \zeta(0) = 0}$$

6.6 Infinite sum of All Zeta values converges

$$\boxed{\zeta(-1) + \zeta(-2) + \zeta(-3)... + \zeta(1) + \zeta(2) + \zeta(3)... = 0 + \frac{1}{2} = \frac{1}{2}}$$

6.7 Primes product = 2.Sum of numbers

We know :

$$\zeta(-1) = \zeta(1) + \zeta(0)$$
$$or \left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}...\right) + \left(1 + 1 + 1 + 1 + ...\right) = \frac{1}{2}$$
$$or \left(1 + 1\right) + \left(1 + \frac{1}{2}\right) + \left(1 + \frac{1}{3}\right) + \left(1 + \frac{1}{4}\right) + ... = \frac{1}{2}$$
$$or \left(\frac{2}{1} + \frac{3}{2} + \frac{4}{3} + \frac{5}{4} + \frac{6}{5}...\right) = \frac{1}{2}$$

LCM of the denominators can be shown to equal the square root of primes product.

Reversing the numerator sequence can shown to equal the sum of integers.

$$or \left(\frac{1 + 2 + 3 + 4 + 5 + 6 + 7...*}{2.3.5.7.11... **}\right) = \frac{1}{2}$$
$$or 2. \sum_{N=1}^{\infty} N = \prod_{i=1}^{\infty} P_i$$

*Series of terms written in reverse order.

**Product of All numbers can be written as 2 series of infinite product of all prime powers

**One arises from individual numbers and another from the number series.

$$LCM = \prod_{i=1}^{\infty} P_i^1.P_i^2.P_i^3.P_i^4.P_i^5.P_i^6...P_i^1.P_i^2.P_i^3.P_i^4.P_i^5.P_i^6...$$
$$LCM = \prod_{i=1}^{\infty} P_i^{(1+2+3+4+5+6+7...)+(1+2+3+4+5+6+7...)}...$$
$$LCM = \prod_{i=1}^{\infty} P_i^{\frac{1}{2}+\frac{1}{2}}...$$
$$LCM = 2.3.5.7.11...$$

6.8 Fundamental formula of integers

Primes product = 2.Sum of numbers can be generalized to all even numbers as Zeta function all the poles being removed now shows bijectively holomorphic property and as such become absolutely analytic or literally an entire function. $2.\sum_{N=1}^{\infty} N = \prod_{i=1}^{\infty} P_i$ is open ended and self replicating. Similarly $\sum_{N=1}^{\infty} N = \prod_{i=2}^{\infty} P_i$ is self sufficient. We can pick partial series, truncate series to get even and odd numbers.

* $2.\sum_{N=1}^{\infty} N = \prod_{i=1}^{\infty} P_i$ can be regarded as Fundamental formula of all even numbers.
* $\sum_{N=1}^{\infty} N = \prod_{i=2}^{\infty} P_i$ can be regarded as Fundamental formula of all odd numbers excluding primes.
* $\sum_{N=1}^{\infty} N = P_i$ can be regarded as Fundamental formula of all primes.

7 Zeta results confirms Cantors theory

We have seen both sum and product of positive Zeta values are greater than sum and product of negative Zeta values. This actually proves Cantors theory numerically. If negative Zeta values are associated with the set of natural numbers then positive Zeta values reflects the set of real numbers. The numerical inequality between sum and product of both proves that there are more more ordinal numbers than cardinal numbers.

8 Proof of other unsolved problems

[Read with section (1.4)] In the light of identities derived most of the unsolved prime conjectures turns obvious as follows:

8.1 Goldbach Binary/Even Conjecture

If we take two odd prime in the left hand side of fundamental formula of even numbers then retaining the fundamental pattern both the side have a highest common factor of 2. That means all the even numbers can be expressed as sum of at least 1 pair of primes i.e. 2 primes and if we multiply both side by 2 then some even numbers can be expressed as sum of 2 pair of primes i.e. 4 primes. Overall an even number can be expressed as sum of maximum 2+2+2=6 primes one pair each in half unit, unit and d-unit circle. However immediately after 3 pairs of prime one pi rotation completes (* perhaps that is the reason we are not allowed to think more than 3 spatial and one temporal dimension) and the prime partition sequence breaks, i.e. beyond d-unit circle it starts over and over again cyclically along the number line. Ramanujans derived value $2\zeta(-1) = -\frac{2}{12} = -\frac{1}{6}$ actually indicates that limit (*perhaps this is the reason we see mostly 6 electrons in the outermost shell although in the electron cloud it can pop in and out from and to half unit, unit and d-unit circle. Perhaps this is the reason we see maximum 6 generation of particles either quarks, leptons, bosons although all 6 are not yet discovered).

$$2(p_1 + p_2) = 2.p_3...$$
$$4(p_1 + p_2 + p_3 + p_4) = 2.2.p_5.p_6...$$
$$8(p_1 + p_2 + p_3 + p_4 + p_5 + p_6) = 2.2.2.p_7.p_8.p_9...$$

*This part of the document do neither form part of the proof nor the authors personal views to be considered seriously. Its just an addendum to the document.

8.2 Goldbach Tarnary/Odd Conjecture

In case of odd number also we can have combination of 3 and 6 primes. Beyond that no more prime partition is possible.

$$(p_1 + p_2 + p_3) = 3.p_4...$$
$$(p_1 + p_2 + p_3 + p_4 + p_5 + p_6) = 3.p_7.p_8...$$

8.3 Polignac prime conjectures

8.3.1 Twin prime conjecture

Lets test whether prime gap of 2 preserves the fundamental formula of numbers.

$p^2 + 2p = p(p + 2)$

adding 2 both side will turn both side into prime as $p^2 + 2p + 2$ cannot be factorised.

$p^2 + 2p + 2 = p(p + 2) + 2$

$p^2 + 2p + 2 = p_1.p_2$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be infinite number of twin primes.

8.3.2 Cousin prime conjecture

Lets test whether prime gap of 4 preserves the fundamental formula of numbers.

$p^2 + 4p = p(p + 4)$

adding 1 both side will turn both side into prime as $p^2 + 4p + 1$ cannot be factorised.

$p^2 + 4p + 1 = p(p + 4) + 1$

$p^2 + 4p + 1 = p_1.p_2$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be infinite number of cousin primes.

8.3.3 Sexy prime conjecture

Lets test whether prime gap of 6 preserves the fundamental formula of numbers.

$p^2 + 6p = p(p + 6)$

adding 1 both side will turn both side into prime as $p^2 + 6p + 1$ cannot be factorised.

$p^2 + 6p + 1 = p(p + 6) + 1$

$p^2 + 6p + 1 = p_1.p_2$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be infinite number of cousin primes.

8.3.4 Other Polignac prime conjectures

Similarly all other polignac primes of the form of p+2n shall be there infinitely.

8.4 Sophie Germain prime conjecture

Lets test whether prime gap of 2p preserves the fundamental formula of numbers which will generate sophie germain prime pairs.

$2p^2 = p(2p)$

adding 1 both side will turn both side into prime as $2p^2 + 1$ cannot be factorised.

$2p^2 + 1 = p(2p) + 1$

$2p^2 + 1 = p_1.p_2$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be infinite number of Sophie Germain primes.

8.5 Landau's prime conjecture

We need to check whether there shall always be infinite number of $N^2 + 1$ primes.

$N^2 + 1 = N^2 + 1$

Adding N and multiplying both side by 2 will turn both side into an even number.

$2(N^2 + N + 1) = 2.(N^2 + N + 1)$

dividing by 2 both side will turn it into prime as $N^2 + N + 1$ cannot be factorised.

$(N^2 + N + 1) = P$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall always be infinite number of $N^2 + 1$ primes.

8.6 Legendre's prime conjecture

Lets take sum of two successive numbers square and test whether they conform to the fundamental formula of numbers.

$N^2 + N^2 + 2N + 1 = N^2 + (N + 1)^2$

adding 1 both side will turn both side into an even number.

$2(N^2 + N + 1) = 2.P$

dividing by 2 both side will turn it into prime as $N^2 + N + 1$ cannot be factorised.

$(N^2 + N + 1) = P$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall always be a prime between two successive numbers square.

8.7 Brocard's prime conjecture

As square of a prime and square of its successor both have identical powers they shall have a highest common factor of 4 in $4(p_1 + p_2 + p_3 + p_4...) = 2.2.p_5.p_6...$, and there shall be at least four primes between them as Brocard conjectured.

8.8 Opperman's prime conjecture

Lets test whether gap of N between $N(N - 1)$ and N^2 preserves the fundamental formula of numbers which will give us the count of primes between the pairs.

$N^2 - N + N^2 = N(N - 1) + N^2$

adding 3N+1 both side will turn both side into an even number.

$2(N^2 + N + 1) = 2.(N^2 + N + 1)$

dividing by 2 both side will turn it into prime as $N^2 + N + 1$ cannot be factorised.

$(N^2 + N + 1) = P$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be atleast one prime between $N(N-1)$ and N^2 as Opperman conjectured.

Lets test whether gap of N between $N(N + 1)$ and N^2 preserves the fundamental formula of numbers which will give us the count of primes between the pairs.

$N^2 + N + N^2 = N(N+1) + N^2$

adding N+2 both side will turn both side into an even number.

$2(N^2 + N + 1) = 2.(N^2 + N + 1)$

dividing by 2 both side will turn it into prime as $N^2 + N + 1$ cannot be factorised.

$(N^2 + N + 1) = P$

And this has happened without violating fundamental formula of prime numbers.

As the form is preserved there shall be atleast one prime between N^2 and $N(N+1)$ as Opperman conjectured.

8.9 Collatz conjecture

As fundamental formula of numbers is proved to be continuous, Collatz conjectured operations on any number shall always end 1 being the singularity. Hence Collatz conjecture is proved to be trivial.

9 Complex logarithm simplified

[Read with section (1.5)] Thanks to Roger cots who first time used i in complex logarithm. Thanks to euler who extended it to exponential function and tied i, pi and exponential function to unity in his famous formula. Now taking lead from both of their work and applying results of Zeta function which are simultaneously continuous logarithmic function and continuous exponential function we can redefine Complex number and complex logarithm as follows.

9.1 First root of i

In d-unit circle we have seen $|\mathbf{z}| = |\mathbf{\frac{1}{2}e^{ix}}| = \mathbf{1}$ is another form of unit circle. We can rewrite :

$$z = \frac{1}{2}e^{ix} = 1 = \frac{1}{2}e^{\ln 2}$$

we can say :

$$e^{ix} = e^{ln2}$$

taking logarithm both side :

$$ix = ln(2)$$

setting x=1 :

$$\boxed{ln(2) = e^{ln(ln(2))} = e^{ln(i)} = i \approx e^{-\frac{1}{e}} \approx 2^{-\frac{1}{2}} \approx e - 2*}$$

or

$$\boxed{ln(2)^{\frac{1}{ln(ln(2))}} = i^{\frac{1}{ln(i)}} = e \approx -\frac{1}{ln(i)} \approx 2 + i*}$$

we get two more identity like $e^{i\pi} + 1 = 0$:

$$\boxed{\frac{11}{30} + ln(i) = 0 = \frac{30}{11} + \frac{1}{ln(i)}}$$

again we know $i^2 = -1$, taking log both side

$$\boxed{\ln(-1) = 2\ln i = 2ln(ln(2))}$$

* computed value(even wolfram alpha can't be that match accurate as the nature, there may be slight difference based on the devices capabilities) therefore matches our definition.

Example 1 *Find natural logarithm of -5 using first root of i*

$$\ln(-5) = \ln(-1) + \ln(5) = 2ln(ln(2)) + \ln(5) = 0.876412071(approx)$$

Example 2 *Find natural logarithm of -5i using first root of i*

$$\ln(-5i) = \ln(-1) + \ln(5) + \ln(i) = 2ln(ln(2)) + \ln(5) + ln(ln(2)) = 0.509899151(approx)$$

Example 3 *Find natural logarithm of 5-5i using first root of i*

$$\ln(5 - 5i) = \ln(5) + \ln(-1) + \ln(5) + \ln(i) = \ln(5) + 2ln(ln(2)) + \ln(5) + ln(ln(2)) = 2.119337063(approx)$$

Example 4 *Transform the complex number 2+9i using first root of i.*

$$e^{2+9i} = e^{2+9X0.693147181} = e^{8.238324625} = 3783.196723(approx)$$

9.2 Middle scale constants from 1st root of i and its 6 Goldbach partitions

Puting the value of i in Eulers identity we get constants of the middle scale.

Constant 1

$$\boxed{e^{i\pi} = e^{ln(2).\pi} = 8.824977827 = e^{2.17758609}...(approx)}$$

Constant 2

$$\boxed{e^{i\frac{\pi}{2}} = e^{\frac{ln(2).\pi}{2}} = 2.970686424 = e^{1.088793045}...(approx)}$$

Constant 3

$$\boxed{e^{i\frac{\pi}{3}} = e^{\frac{ln(2).\pi}{3}} = 2.066511728 = e^{0.72586203}...(approx)}$$

Constant 4

$$\boxed{e^{i\frac{\pi}{4}} = e^{\frac{ln(2).\pi}{4}} = 1.723567934 = e^{0.544396523}...(approx)}$$

Constant 5

$$\boxed{e^{i\frac{\pi}{5}} = e^{\frac{ln(2).\pi}{5}} = 1.545762348 = e^{0.435517218}...(approx)}$$

Constant 6

$$\boxed{e^{i\frac{\pi}{6}} = e^{\frac{ln(2).\pi}{6}} = 1.437536687 = e^{0.362931015}...(approx)}$$

Constant 7

$$\boxed{\frac{1}{e^{i\pi}} = \frac{1}{e^{ln(2).\pi}} = 0.113314732 = e^{-2.17758609}...(approx)}$$

Constant 8

$$\boxed{\frac{1}{e^{i\frac{\pi}{2}}} = \frac{1}{e^{\frac{ln(2).\pi}{2}}} = 0.336622537 = e^{-1.088793045}...(approx)}$$

Constant 9

$$\boxed{\frac{1}{e^{i\frac{\pi}{3}}} = \frac{1}{e^{\frac{ln(2).\pi}{3}}} = 0.483907246 = e^{-0.72586203}...(approx)}$$

Constant 10

$$\boxed{\frac{1}{e^{i\frac{\pi}{4}}} = \frac{1}{e^{\frac{ln(2).\pi}{4}}} = 0.58019181 = e^{-0.544396523}...(approx)}$$

Constant 11

$$\boxed{\frac{1}{e^{i\frac{\pi}{5}}} = \frac{1}{e^{\frac{ln(2).\pi}{5}}} = 0.646929977 = e^{-0.435517218}...(approx)}$$

Constant 12

$$\boxed{\frac{1}{e^{i\frac{\pi}{6}}} = \frac{1}{e^{\frac{ln(2).\pi}{6}}} = 0.69563442 = e^{-0.362931015}...(approx)}$$

9.3 Second root of i

From $i^2 = -1$ we know that i shall have at least two roots or values, one we have already defined, another we need to find out. We know that at $\frac{\pi}{3}$ Zeta function (which is bijectively holomorphic and deals with both complex exponential and its inverse i.e. complex logarithm) attains zero. Let us use Eulers formula to define another possible value of i as Eulers formula deals with unity which comes from the product of exponential and its inverse i.e. logarithm.

Lets assume:

$e^{i\frac{\pi}{3}} = z$

taking natural log both side :

$\dfrac{i\pi}{3} = ln(z)$

Lets set:$ln(z) = i + \dfrac{1}{3}$

$i\pi = 1 + 3i$

$i(\pi - 3) = 1$

$\boxed{i = \dfrac{1}{\pi - 3}}$

$\boxed{\pi* = 3 + \dfrac{1}{i}}$

we get two more identity like $e^{i\pi} + 1 = 0$:

$\boxed{ln(i) - \dfrac{43}{22} = 0 = \dfrac{1}{ln(i)} - \dfrac{22}{43}}$

again we know $i^2 = -1$, taking log both side

$\boxed{\ln(-1) = 2\ln i = 2ln\left(\dfrac{1}{\pi - 3}\right)}$

* computed value (even wolfram alpha can't be that match accurate as the nature, there may be slight difference based on the devices capabilities) therefore matches our definition.

Example 5 *Find natural logarithm of -5 using second root of i*

$$\ln(-5) = \ln(-1) + \ln(5) = 2ln\left(\frac{1}{\pi - 3}\right) + \ln(5) = 5.519039873(approx)$$

Example 6 *Find natural logarithm of -5i using second root of i*

$$\ln(-5i) = \ln(-1) + \ln(5) + \ln(i) = 2ln\left(\frac{1}{\pi - 3}\right) + \ln(5) + ln\left(\frac{1}{\pi - 3}\right) = 7.473840854(approx)$$

Example 7 *Find natural logarithm of 5-5i using second root of i*

$$\ln(5 - 5i) = \ln(5) + \ln(-1) + \ln(5) + \ln(i) = \ln(5) + 2ln\left(\frac{1}{\pi - 3}\right) + \ln(5) + ln\left(\frac{1}{\pi - 3}\right) = 9.083278766(approx)$$

Example 8 *Transform the complex number 3+i using second root of i.*

$$e^{3+i} = e^{3+1X7.06251330593105} = e^{10.0625133059311} = 23447.3627750323(approx)$$

9.4 Large/Small scale constants from 2nd root of i and its 6 Goldbach partitions

Putting the value of i in Eulers identity we get large constants applicable for cosmic scale and their reciprocals are useful constants to deal with quantum world.

Constant 13

$$\boxed{e^{i\pi} = e^{\frac{\pi}{\pi-3}} = 4,324,402,934 = e^{22.18753992}...(approx)}*$$

Constant 14

$$\boxed{e^{i\frac{\pi}{2}} = e^{\frac{\pi}{2(\pi-3)}} = 65,760 = e^{11.09376703}...(approx)}$$

Constant 15

$$\boxed{e^{i\frac{\pi}{3}} = e^{\frac{\pi}{3(\pi-3)}} = 1,629 = e^{7.395721609}...(approx)}$$

Constant 16

$$\boxed{e^{i\frac{\pi}{4}} = e^{\frac{\pi}{4(\pi-3)}} = 256.4375 = e^{5.54688497}...(approx)}$$

Constant 17

$$\boxed{e^{i\frac{\pi}{5}} = e^{\frac{\pi}{5(\pi-3)}} = 40.36339539 = e^{3.69792332}...(approx)}$$

Constant 18

$$\boxed{e^{i\frac{\pi}{6}} = e^{\frac{\pi}{6(\pi-3)}} = 256.4375 = e^{5.54688497}...(approx)}$$

Constant 19

$$\boxed{\frac{1}{e^{i\pi}} = \frac{1}{e^{\frac{\pi}{\pi-3}}} = 2.31E-10 = e^{-22.18753992}...(approx)}$$

Constant 20

$$\boxed{\frac{1}{e^{i\frac{\pi}{2}}} = \frac{1}{e^{\frac{\pi}{2(\pi-3)}}} = 1.52E-05 = e^{-11.09376703}...(approx)}$$

Constant 21

$$\boxed{\frac{1}{e^{i\frac{\pi}{3}}} = \frac{1}{e^{\frac{\pi}{3(\pi-3)}}} = 6.14E-04 = e^{-7.395721609}...(approx)}$$

Constant 22

$$\boxed{\frac{1}{e^{i\frac{\pi}{4}}} = \frac{1}{e^{\frac{\pi}{4(\pi-3)}}} = 0.0039 = e^{-5.54688497}...(approx)}$$

Constant 23

$$\boxed{\frac{1}{e^{i\frac{\pi}{5}}} = \frac{1}{e^{\frac{\pi}{5(\pi-3)}}} = 0.011825371 = e^{-4.437507984}...(approx)}$$

Constant 24

$$\boxed{\frac{1}{e^{i\frac{\pi}{6}}} = \frac{1}{e^{\frac{\pi}{6(\pi-3)}}} = 0.024774923 = e^{-3.69792332}...(approx)}$$

* This constant is a product of physical constants (dimensionless) as follows:

$$\frac{\text{2.mass of electron.speed of light squared.charles ideal gas constant}}{\text{boltzman constant}} \approx e^{\frac{\pi}{(\pi-3)}}$$

9.5 Third and final root of i

Can there be a third root of i, why not? Three sides of a triangle can enclose a circle, value of pi is just little more than 3, we see 3 generation of stars in the universe, there are 3 generation of matter in the standard model, spatially we cannot imagine more than three dimensions. Let us use Eulers formula to define another possible value of i as Eulers formula deals with unity which comes from the product of exponential and its inverse i.e. logarithm.

Lets assume:

$e^{i\frac{\pi}{3}} = z$

taking natural log both side :

$\frac{i\pi}{3} = ln(z)$

Lets set:$ln(z) = \frac{2\pi}{3(\pi-3)} - \frac{1}{2(\pi-3)}$

$i\pi = \frac{4\pi-3}{2(\pi-3)}$

$$\boxed{i = \frac{4\pi-3}{2\pi(\pi-3)}}$$

$$\boxed{\pi* = 3 + \frac{9}{6i}}$$

we get two more identity like $e^{i\pi}+1=0$:

$$\boxed{ln(i) - \frac{19}{8} = 0 = \frac{1}{ln(i)} - \frac{8}{19}}$$

again we know $i^2 = -1$, taking log both side

$$\boxed{\ln(-1) = 2\ln i = 2ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right)}$$

* computed value (even wolfram alpha can't be that match accurate as the nature, there may be slight difference based on the devices capabilities) therefore matches our definition.

Example 9 *Find natural logarithm of -5 using third root of i*

$$\ln(-5) = \ln(-1) + \ln(5) = 2ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right) + \ln(5) = 6.359793515(approx)$$

Example 10 *Find natural logarithm of -5i using third root of i*

$$\ln(-5i) = \ln(-1) + \ln(5) + \ln(i) = 2ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right) + \ln(5) + ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right) = 8.734971317(approx)$$

Example 11 *Find natural logarithm of 5-5i using third root of i*

$$\ln(5-5i) = \ln(5)+\ln(-1)+\ln(5)+\ln(i) = \ln(5)+2ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right)+\ln(5)+ln\left(\frac{4\pi-3}{2\pi(\pi-3)}\right) = 10.34440923(approx)$$

Example 12 *Transform the complex number 3+i using third root of i.*

$$e^{3+i} = e^{3+1\text{X}10.7529249} = e^{13.7529249} = 939332.598(approx)$$

9.6 Extra Large/Small scale constants from 3rd root of i and its 6 Goldbach partitions

Putting the value of i in Eulers identity we get large constants applicable for cosmic scale and their reciprocals are useful constants to deal with quantum world.

Constant 25

$$\boxed{e^{i\pi} = e^{\frac{4\pi-3}{2(\pi-3)}} = 4.68853E+14 = e^{33.7813104}...(approx)}$$

Constant 26

$$\boxed{e^{i\frac{\pi}{2}} = e^{\frac{4\pi-3}{4(\pi-3)}} = 21653007.96 = e^{16.89065494}...(approx)}$$

Constant 27

$$\boxed{e^{i\frac{\pi}{3}} = e^{\frac{4\pi-3}{6(\pi-3)}} = 77686.488314 = e^{11.26043663}...(approx)}$$

Constant 28

$$\boxed{e^{i\frac{\pi}{4}} = e^{\frac{4\pi-3}{8(\pi-3)}} = 4653.279269 = e^{8.445327469}...(approx)}$$

Constant 29

$$\boxed{e^{i\frac{\pi}{5}} = e^{\frac{4\pi-3}{10(\pi-3)}} = 859.4236373 = e^{6.756261975}...(approx)}$$

Constant 30

$$\boxed{e^{i\frac{\pi}{6}} = e^{\frac{4\pi-3}{12(\pi-3)}} = 278.7229598 = e^{5.630218313}...(approx)}$$

Constant 31

$$\boxed{\frac{1}{e^{i\pi}} = \frac{1}{e^{\frac{4\pi-3}{2(\pi-3)}}} = 2.13287E-15 = e^{-33.7813104}...(approx)}$$

Constant 32

$$\boxed{\frac{1}{e^{i\frac{\pi}{2}}} = \frac{1}{e^{\frac{4\pi-3}{4(\pi-3)}}} = 4.6183E-08 = e^{-16.89065494}...(approx)}$$

Constant 33

$$\boxed{\frac{1}{e^{i\frac{\pi}{3}}} = \frac{1}{e^{\frac{4\pi-3}{6(\pi-3)}}} = 1.28723E-05 = e^{-11.26043663}...(approx)}$$

Constant 34

$$\boxed{\frac{1}{e^{i\frac{\pi}{4}}} = \frac{1}{e^{\frac{4\pi-3}{8(\pi-3)}}} = 0.000214902 = e^{-8.445327469}...(approx)}$$

Constant 35

$$\boxed{\frac{1}{e^{i\frac{\pi}{5}}} = \frac{1}{e^{\frac{4\pi-3}{10(\pi-3)}}} = 0.001163571 = e^{-6.756261975}...(approx)}$$

Constant 36

$$\boxed{\frac{1}{e^{i\frac{\pi}{6}}} = \frac{1}{e^{\frac{4\pi-3}{12(\pi-3)}}} = 0.003587792 = e^{-5.630218313}...(approx)}$$

10 Pi based logarithm

One thing to notice is that pi is intricately associated with e. We view pi mostly associated to circles, what it has to do with logarithm? Can it also be a base to complex logarithm? Although base pi logarithm are not common but this can be handy in complex logarithm. We know:

$$
\begin{aligned}
& ln(2).\frac{\pi}{4} \\
&= \ln e^{\frac{ln(2)}{4}}.\pi \\
&= \left(\frac{1}{1} - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \cdots\right)\left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{11} - \frac{1}{13} + \cdots\right) \\
&= \left(1 + \frac{1}{\lfloor 3} - \frac{1}{\lfloor 5} + \frac{1}{\lfloor 7} - \cdots\right) + \left(1 + \frac{1}{\lfloor 2} + \frac{1}{\lfloor 4} + \frac{1}{\lfloor 6} + \cdots\right) - \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \cdots\right) \\
&= \left(1 - \frac{i^3}{\lfloor 3} + \frac{i^5}{\lfloor 5} - \frac{i^7}{\lfloor 7} - \cdots\right) + \left(1 - \frac{i^2}{\lfloor 2} + \frac{i^4}{\lfloor 4} - \frac{i^6}{\lfloor 6} + \cdots\right) - \frac{1}{1 - \frac{1}{2}} \\
&= \sin(i) + \cos(i) - 2
\end{aligned}
$$

Lets set:$\pi = \sin(i) + \cos(i)$ and replacing $\pi - 2 = \ln(\pi)$ we can write

$$\frac{\ln\left(e^{\frac{ln(2)}{4}}\right)}{\ln(\pi)} = \frac{1}{\pi} = \pi^{-1} \text{Lets set:} e^{\frac{ln(2)}{4}} = \pi^{\pi^{je}} \text{ we can write } \boxed{\pi^{je} = -1}$$

10.1 Middle scale constants from 3 roots of j and its 6 Goldbach partitions

Similar to 3 roots of i, there can be 3 roots of j which will give another complex logarithmic scales. I will not make the readers crazy anymore with this nasty mind-boggling staff. I am writing directly the scales because it feels so boring writing the same staff again and again. Do not ask me how I got it? Same head spinning and mind twisting algorithms. Better I will ask my readers to undergo these processes themselves little bit to have a better feel of my work on complex logarithm. Remember that you will get always hints from the transcendental parts of pi to set i similar to transcendental parts of e. My inspiration for trying this was recursive nature of Zeta function, Mandelbrot fractal, Rogers Ramanujan continued fraction, Ramanujan's infinite radicals, Ramanujan's Sum etc.

Constant 37

$$\boxed{\pi^{je} = \pi^{\frac{e}{e-2}.e} = 130089.9289 = e^{11.77598125}...(approx)}$$

Constant 38

$$\boxed{\pi^{\frac{je}{2}} = \pi^{\frac{\frac{e}{e-2}.e}{2}} = 360.6798149 = e^{5.887990625}...(approx)}$$

Constant 39

$$\boxed{\pi^{\frac{je}{3}} = \pi^{\frac{\frac{e}{e-2}.e}{3}} = 50.66964856 = e^{3.925327084}...(approx)}$$

Constant 40

$$\boxed{\pi^{\frac{je}{4}} = \pi^{\frac{\frac{e}{e-2}.e}{4}} = 18.99157221 = e^{2.943995313}...(approx)}$$

Constant 41

$$\boxed{\pi^{\frac{je}{5}} = \pi^{\frac{\frac{e}{e-2}.e}{5}} = 10.54019717 = e^{2.35519625}...(approx)}$$

Constant 42

$$\boxed{\pi^{\frac{je}{6}} = \pi^{\frac{\frac{e}{e-2}.e}{6}} = 7.118261625 = e^{1.962663542}...(approx)}$$

Constant 43

$$\boxed{\pi^{je} = \pi^{ln(2\pi).e} = 304.5755639 = e^{5.718919214}...(approx)}$$

Constant 44

$$\boxed{\pi^{\frac{je}{2}} = \pi^{\frac{ln(2\pi).e}{2}} = 17.4520934 = e^{2.859459607}...(approx)}$$

Constant 45

$$\boxed{\pi^{\frac{je}{3}} = \pi^{\frac{ln(2\pi).e}{3}} = 6.728191629 = e^{1.906306405}...(approx)}$$

Constant 46

$$\boxed{\pi^{\frac{je}{4}} = \pi^{\frac{ln(2\pi).e}{4}} = 4.177570274 = e^{1.429729803}...(approx)}$$

Constant 47

$$\boxed{\pi^{\frac{je}{5}} = \pi^{\frac{ln(2\pi).e}{5}} = 3.1386220 = e^{1.143783843}...(approx)}$$

Constant 48

$$\boxed{\pi^{\frac{je}{6}} = \pi^{\frac{ln(2\pi).e}{6}} = 2.5938758 = e^{0.953153202}...(approx)}$$

Constant 49

$$\boxed{\pi^{je} = \pi^{\frac{1}{\ln(2)}.e} = 89.05301963 = e^{4.489231919}...(approx)}$$

Constant 50

$$\boxed{\pi^{\frac{je}{2}} = \pi^{\frac{\frac{1}{\ln(2)}.e}{2}} = 9.436790748 = e^{2.244615959}...(approx)}$$

Constant 51

$$\boxed{\pi^{\frac{je}{3}} = \pi^{\frac{\frac{1}{\ln(2)}.e}{3}} = 4.465631508 = e^{1.49641064}...(approx)}$$

Constant 52

$$\boxed{\pi^{\frac{je}{4}} = \pi^{\frac{\frac{1}{\ln(2)}.e}{4}} = 3.071935994 = e^{1.12230798}...(approx)}$$

Constant 53

$$\boxed{\pi^{\frac{je}{5}} = \pi^{\frac{\frac{1}{\ln(2)}.e}{5}} = 2.4543118 = e^{0.897846384}...(approx)}$$

Constant 54

$$\boxed{\pi^{\frac{je}{6}} = \pi^{\frac{\frac{1}{\ln(2)}.e}{6}} = 2.1132041 = e^{0.74820532}...(approx)}$$

Constant 55

$$\boxed{\frac{1}{\pi^{je}} = \frac{1}{\pi^{\frac{e}{e-2}.e}} = 7.68699E-06 = e^{-11.77598125}...(approx)}$$

Constant 56

$$\boxed{\frac{1}{\pi^{\frac{je}{2}}} = \frac{1}{\pi^{\frac{\frac{e}{e-2}.e}{2}}} = 0.0027725429 = e^{-5.887990625}...(approx)}$$

Constant 57

$$\boxed{\frac{1}{\pi^{\frac{je}{3}}} = \frac{1}{\pi^{\frac{\frac{e}{e-2}.e}{3}}} = 0.019735681 = e^{-3.925327084}...(approx)}$$

Constant 58

$$\boxed{\frac{1}{\pi^{\frac{je}{4}}} = \frac{1}{\pi^{\frac{\frac{e}{e-2}.e}{4}}} = 0.052654935 = e^{-2.943995313}...(approx)}$$

Constant 59

$$\boxed{\frac{1}{\pi^{\frac{je}{5}}} = \frac{1}{\pi^{\frac{\frac{e}{e-2}.e}{5}}} = 0.094875 = e^{-2.35519625}...(approx)}$$

Constant 60

$$\boxed{\frac{1}{\pi^{\frac{je}{6}}} = \frac{1}{\pi^{\frac{\frac{e}{e-2}.e}{6}}} = 0.140484 = e^{-1.962663542}...(approx)}$$

Constant 61

$$\boxed{\frac{1}{\pi^{je}} = \frac{1}{\pi^{ln(2\pi).e}} = 0.003283257 = e^{-5.718919214}...(approx)}$$

Constant 62

$$\boxed{\frac{1}{\pi^{\frac{je}{2}}} = \frac{1}{\pi^{\frac{ln(2\pi).e}{2}}} = 0.057299716 = e^{-2.859459607}...(approx)}$$

Constant 63

$$\boxed{\frac{1}{\pi^{\frac{je}{3}}} = \frac{1}{\pi^{\frac{ln(2\pi).e}{3}}} = 0.148628347 = e^{-1.906306405}...(approx)}$$

Constant 64

$$\boxed{\frac{1}{\pi^{\frac{je}{4}}} = \frac{1}{\pi^{\frac{ln(2\pi).e}{4}}} = 0.239373591 = e^{-1.429729803}...(approx)}$$

Constant 65

$$\boxed{\frac{1}{\pi^{\frac{je}{5}}} = \frac{1}{\pi^{\frac{ln(2\pi).e}{5}}} = 0.318611 = e^{-1.143783843}...(approx)}$$

Constant 66

$$\boxed{\frac{1}{\pi^{\frac{je}{6}}} = \frac{1}{\pi^{\frac{ln(2\pi).e}{6}}} = 0.385523 = e^{-0.953153202}...(approx)}$$

Constant 67

$$\boxed{\frac{1}{\pi^{je}} = \frac{1}{\pi^{\frac{1}{\ln(2)}.e}} = 0.011229265 = e^{-4.489231919}...(approx)}$$

Constant 68

$$\boxed{\frac{1}{\pi^{\frac{je}{2}}} = \frac{1}{\pi^{\frac{\frac{1}{\ln(2)}.e}{2}}} = 0.105968229 = e^{-2.244615959}...(approx)}$$

Constant 69

$$\boxed{\frac{1}{\pi^{\frac{je}{3}}} = \frac{1}{\pi^{\frac{\frac{1}{\ln(2)}.e}{3}}} = 0.223932494 = e^{-1.49641064}...(approx)}$$

Constant 70

$$\boxed{\frac{1}{\pi^{\frac{je}{4}}} = \frac{1}{\pi^{\frac{\frac{1}{\ln(2)}.e}{4}}} = 0.325527616 = e^{-1.12230798}...(approx)}$$

Constant 71

$$\boxed{\frac{1}{\pi^{\frac{je}{5}}} = \frac{1}{\pi^{\frac{\frac{1}{\ln(2)}.e}{5}}} = 0.407446 = e^{-0.897846384}...(approx)}$$

Constant 72

$$\boxed{\frac{1}{\pi^{\frac{je}{6}}} = \frac{1}{\pi^{\frac{\frac{1}{\ln(2)}.e}{6}}} = 0.473215 = e^{-0.74820532}...(approx)}$$

10.2 Super Large/Small scale constants from 3 multiples of 6 roots of i and j

Like 6 Goldbach partitions when applied to 3 roots of i and j each in Eulers formula give us large scale constants, we can get few more Super Large/Small scale constants taking 3 multiples (powers of 2) 3 roots of i and j each in Eulers formula.

Constant 73

$$\boxed{e^{2i\pi} = e^{2.ln(2).\pi} = 77.88023365 = e^{4.35517218061}...(approx)}$$

Constant 74

$$\boxed{e^{3i\pi} = e^{3.ln(2).\pi} = 687.2913351 = e^{6.532758271}...(approx)}$$

Constant 75

$$\boxed{e^{4i\pi} = e^{4.ln(2).\pi} = 6065.330793 = e^{8.71034436121}...(approx)}$$

Constant 76

$$\boxed{e^{8i\pi} = e^{8.ln(2).\pi} = 36788237.63 = e^{17.42068872243}...(approx)}$$

Constant 77

$$\boxed{\frac{1}{e^{2i\pi}} = \frac{1}{e^{2.ln(2).\pi}} = 0.012840229 = e^{-4.35517218061}...(approx)}$$

Constant 78

$$\boxed{\frac{1}{e^{3i\pi}} = \frac{1}{e^{3.ln(2).\pi}} = 0.001454987 = e^{-6.532758271}...(approx)}$$

Constant 79

$$\boxed{\frac{1}{e^{4i\pi}} = \frac{1}{e^{4.ln(2).\pi}} = 0.000164871 = e^{-8.71034436121}...(approx)}$$

Constant 80

$$\boxed{\frac{1}{e^{8i\pi}} = \frac{1}{e^{8.ln(2).\pi}} = 2.71826E-08 = e^{-17.42068872243}...(approx)}$$

Constant 81

$$\boxed{e^{2i\pi} = e^{\frac{2\pi}{\pi-3}} = 1.87005E+19 = e^{44.37507983559}...(approx)}$$

Constant 82

$$\boxed{e^{3i\pi} = e^{\frac{3\pi}{\pi-3}} = 8.08683E+28 = e^{66.56261975}...(approx)}$$

Constant 83

$$\boxed{e^{4i\pi} = e^{\frac{4\pi}{\pi-3}} = 3.49707E+38 = e^{88.75015967117}...(approx)}$$

Constant 84

$$\boxed{e^{8i\pi} = e^{\frac{8\pi}{\pi-3}} = 1.22295E+77 = e^{177.50031934235}...(approx)}$$

Constant 85

$$\boxed{\frac{1}{e^{2i\pi}} = \frac{1}{e^{\frac{2\pi}{\pi-3}}} = 5.34746E-20 = e^{-44.37507983559}...(approx)}$$

Constant 86

$$\boxed{\frac{1}{e^{3i\pi}} = \frac{1}{e^{\frac{3\pi}{\pi-3}}} = 1.23658E-29 = e^{-66.56261975}...(approx)}$$

Constant 87

$$\boxed{\frac{1}{e^{4i\pi}} = \frac{1}{e^{\frac{4\pi}{\pi-3}}} = 2.85953E-39 = e^{-88.75015967117}...(approx)}$$

Constant 88

$$\boxed{\frac{1}{e^{8i\pi}} = \frac{1}{e^{\frac{8\pi}{\pi-3}}} = 8.17694E-78-29 = e^{-177.50031934235}...(approx)}$$

Constant 89

$$\boxed{e^{2i\pi} = e^{\frac{8\pi-6}{2(\pi-3)}} = 2.19823E+29 = e^{67.56261975338}...(approx)}$$

Constant 90

$$\boxed{e^{3i\pi} = e^{\frac{12\pi-9}{2(\pi-3)}} = 1.03065E+44 = e^{101.3439296}...(approx)}$$

Constant 91

$$\boxed{e^{4i\pi} = e^{\frac{16\pi-12}{2(\pi-3)}} = 4.83221E+58 = e^{135.12523950676}...(approx)}$$

Constant 92

$$\boxed{e^{8i\pi} = e^{\frac{32\pi-24}{2(\pi-3)}} = 2.335E+117 = e^{270.25047901352}...(approx)}$$

Constant 93

$$\boxed{\frac{1}{e^{2i\pi}} = \frac{1}{e^{\frac{8\pi-6}{2(\pi-3)}}} = 4.54912E-30 = e^{-67.56261975338}...(approx)}$$

Constant 94

$$\boxed{\frac{1}{e^{3i\pi}} = \frac{1}{e^{\frac{12\pi-9}{2(\pi-3)}}} = 9.70265E-45 = e^{-101.3439296}...(approx)}$$

Constant 95

$$\boxed{\frac{1}{e^{4i\pi}} = \frac{1}{e^{\frac{16\pi-12}{2(\pi-3)}}} = 2.06945E-59 = e^{-135.12523950676}...(approx)}$$

Constant 96

$$\boxed{\frac{1}{e^{8i\pi}} = \frac{1}{e^{\frac{32\pi-24}{2(\pi-3)}}} = 4.2826E-118 = e^{-270.25047901352}...(approx)}$$

Constant 97

$$\boxed{\pi^{2je} = \pi^{\frac{2e}{e-2}.e} = 16923389590 = e^{23.55196250143}...(approx)}$$

Constant 98

$$\boxed{\pi^{3je} = \pi^{\frac{3e}{e-2}.e} = 2.20156E+15 = e^{35.32794375}...(approx)}$$

Constant 99

$$\boxed{\pi^{4je} = \pi^{\frac{4e}{e-2}.e} = 2.86401E+20 = e^{47.10392500286}...(approx)}$$

Constant 100

$$\boxed{\pi^{8je} = \pi^{\frac{8e}{e-2}.e} = 8.20256E+40 = e^{94.20785000573}...(approx)}$$

Constant 101

$$\boxed{\pi^{2je} = \pi^{ln(2\pi).2e} = 92766.27413 = e^{11.43783842738}...(approx)}$$

Constant 102

$$\boxed{\pi^{3je} = \pi^{ln(2\pi).3e} = 28254340.25 = e^{17.15675764}...(approx)}$$

Constant 103

$$\boxed{\pi^{4je} = \pi^{ln(2\pi).4e} = 8605581616 = e^{22.87567685475}...(approx)}$$

Constant 104

$$\boxed{\pi^{8je} = \pi^{ln(2\pi).8e} = 7.4056E+19 = e^{45.75135370950}...(approx)}$$

Constant 105

$$\boxed{\pi^{2je} = \pi^{\frac{1}{\ln{(2)}}.2e} = 7930.440305 = e^{8.97846383703}...(approx)}$$

Constant 106

$$\boxed{\pi^{3je} = \pi^{\frac{1}{\ln{(2)}}.3e} = 706229.6561 = e^{13.46769576}...(approx)}$$

Constant 107

$$\boxed{\pi^{4je} = \pi^{\frac{1}{\ln{(2)}}.4e} = 62891883.43 = e^{17.95692767406}...(approx)}$$

Constant 108

$$\boxed{\pi^{8je} = \pi^{\frac{1}{\ln{(2)}}.8e} = 3.95539E + 15 = e^{35.91385534812}...(approx)}$$

Constant 109

$$\boxed{\frac{1}{\pi^{2je}} = \frac{1}{\pi^{\frac{e}{e-2}.2e}} = 5.90898E - 11 = e^{-23.55196250143}...(approx)}$$

Constant 110

$$\boxed{\frac{1}{\pi^{3je}} = \frac{1}{\pi^{\frac{e}{e-2}.3e}} = 4.54223E - 16 = e^{-35.32794375}...(approx)}$$

Constant 111

$$\boxed{\frac{1}{\pi^{4je}} = \frac{1}{\pi^{\frac{e}{e-2}.4e}} = 3.49161E - 21 = e^{-47.10392500286}...(approx)}$$

Constant 112

$$\boxed{\frac{1}{\pi^{8je}} = \frac{1}{\pi^{\frac{e}{e-2}.8e}} = 1.21913E - 41 = e^{-94.20785000573}...(approx)}$$

Constant 113

$$\boxed{\frac{1}{\pi^{2je}} = \frac{1}{\pi^{ln(2\pi).2e}} = 1.07798E - 05 = e^{-11.43783842738}...(approx)}$$

Constant 114

$$\boxed{\frac{1}{\pi^{3je}} = \frac{1}{\pi^{ln(2\pi).3e}} = 3.53928E - 08 = e^{-17.15675764}...(approx)}$$

Constant 115

$$\boxed{\frac{1}{\pi^{4je}} = \frac{1}{\pi^{ln(2\pi).4e}} = 1.16204E - 10 = e^{-22.87567685475}...(approx)}$$

Constant 116

$$\boxed{\frac{1}{\pi^{8je}} = \frac{1}{\pi^{ln(2\pi).8e}} = 1.35033E - 20 = e^{-45.75135370950}...(approx)}$$

Constant 117

$$\boxed{\frac{1}{\pi^{2je}} = \frac{1}{\pi^{\frac{1}{\ln{(2)}}.2e}} = 0.000126096 = e^{-8.97846383703}...(approx)}$$

Constant 118

$$\boxed{\frac{1}{\pi^{3je}} = \frac{1}{\pi^{\frac{1}{\ln{(2)}}.3e}} = 1.41597E - 06 = e^{-13.46769576}...(approx)}$$

Constant 119

$$\boxed{\frac{1}{\pi^{4je}} = \frac{1}{\pi^{\frac{1}{\ln{(2)}}.4e}} = 1.59003E - 08 = e^{-17.95692767406}...(approx)}$$

Constant 120

$$\boxed{\frac{1}{\pi^{8je}} = \frac{1}{\pi^{\frac{1}{\ln{(2)}}.8e}} = 2.5282E - 16 = e^{-35.91385534812}...(approx)}$$

11 Grand integrated scale and Grand Unified Scale

[Read with section (1.6)] In nature around us we see things grow or decay exponentially. In calculus e is the magic number whose derivative and integration is itself. Thats why we took e as the base of natural logarithm and we analyze very big data related to nature in natural logarithmic scale. How immensely big numbers can be scaled down to that small number e. Wherever infinitely big as well as infinitesimally small numbers are involved nature do not follow natural logarithmic scale i.e. $e^1, e^2, e^3, e^4, e^5, e^6, e^7$... or inversely $\frac{1}{e^1}, \frac{1}{e^2}, \frac{1}{e^3}, \frac{1}{e^4}, \frac{1}{e^5}, \frac{1}{e^6}, \frac{1}{e^7}$... will not give us 5 sigma answer,rather we will be off by 4 sigma. Howsoever strange it may sound it is real and it is logical too. Here nature plays number theory. Believe it or not a truly invariant scale will be as given in the following table. I propose that, we shall call it Grand integrated scale as it integrates infinity to unity. Natural logarithmic scale is just the linear trend line to Grand integrated scale. In middle scale this is not felt. In very large or very small scale the smooth exponential/natural do not fit the trend line, step up or step down in the ladder becomes inevitable.

SL	Formula	i/j	g_1	g_2	g_3	g_4	g_5	g_6
1	$e^{\frac{i\pi}{g_p}}$	$\ln(2)$	$e^{2.18}$	$e^{1.09}$	$e^{0.73}$	$e^{0.54}$	$e^{0.44}$	$e^{0.36}$
2	$\pi^{\frac{je}{g_p}}$	$\frac{1}{\ln(2)}$	$e^{4.49}$	$e^{2.24}$	$e^{1.5}$	$e^{1.12}$	$e^{0.9}$	$e^{0.75}$
3	$\pi^{\frac{je}{g_p}}$	$\ln(2\pi)$	$e^{5.72}$	$e^{2.86}$	$e^{1.91}$	$e^{1.43}$	$e^{1.14}$	$e^{0.95}$
4	$\pi^{\frac{je}{g_p}}$	$\frac{e}{e-2}$	$e^{11.78}$	$e^{5.89}$	$e^{3.93}$	$e^{2.94}$	$e^{2.36}$	$e^{1.96}$
5	$e^{\frac{i\pi}{g_p}}$	$\frac{1}{\pi-3}$	$e^{22.19}$	$e^{11.09}$	$e^{7.4}$	$e^{5.55}$	$e^{4.44}$	$e^{3.7}$
6	$e^{\frac{i\pi}{g_p}}$	$\frac{4\pi-3}{2\pi(\pi-3)}$	$e^{33.78}$	$e^{16.89}$	$e^{11.26}$	$e^{8.45}$	$e^{6.76}$	$e^{5.63}$

Table 1: Tabulated value of Grand integrated scale for all 6 parts of all 6 complex constants

The above grand integrated scale when scaled up by multiple of 2, 4 and 8 gives Grand Unified Scale as follows.

SL	Formula	i/j	g_2	g_3	g_4	g_8
1	$e^{i\pi g_m}$	$\ln(2)$	$e^{4.36}$	$e^{6.53}$	$e^{8.71}$	$e^{17.42}$
2	π^{jeg_m}	$\frac{1}{\ln(2)}$	$e^{8.98}$	$e^{13.46}$	$e^{17.96}$	$e^{35.91}$
3	π^{jeg_m}	$\ln(2\pi)$	$e^{11.44}$	$e^{17.15}$	$e^{22.87}$	$e^{45.75}$
4	π^{jeg_m}	$\frac{e}{e-2}$	$e^{23.55}$	$e^{35.32}$	$e^{47.10}$	$e^{94.21}$
5	$e^{i\pi g_m}$	$\frac{1}{\pi-3}$	$e^{44.38}$	$e^{66.56}$	$e^{88.75}$	$e^{177.5}$
6	$e^{i\pi g_m}$	$\frac{4\pi-3}{2\pi(\pi-3)}$	$e^{67.56}$	$e^{101.34}$	$e^{135.12}$	$e^{270.25}$

Table 2: Tabulated value of Grand unified scale for all 3 multiples of all 6 complex constants

12 On the application of really simple logarithm

Theoretical physicists will benefit the most out this new mathematics as they will get a better insight to rewrite the physics written so far whether in the form of quantum mechanics or astrophysics or cosmology. Apart from solving many of the unsolved physics as hinted above, RSL scale will give us the data points to search for interesting events that happens in nature directly for example in astronomy if we plot available astronomical data in this scale we will see that supernova trend line coincides the RSL scale. Surely it can be applied to today's technologies to further optimise it. Internet security can be strengthened by way of strengthening RSA algorithm. Quantum computing can be boosted further so that it overtakes digital computing. Who can say where the road goes, may be with the understanding of RH and RSL we invent new lean technology tomorrow to optimise usage of prime natural resources which is depleting day by day. We can take one step forward towards becoming type 1 civilisation in Kardashev scale and gradually move along the scale. Weather control, climate control shall become reality. I am sounding too much like sci-fi movies. Lets stop it here. Anything further realistic comes to my mind, surely I will bring it in my next paper.

13 Conclusion

Nature is dual and infinite by nature. We human created other numbers to put a limit to the concept of infinity; we divided numbers according to its divisibility into three types i.e. odd, even and primes. But following the legacy of number 2 all these 3 types of numbers carries the same dual and infinite nature and it passes on these characteristics in cycles of generations / groups. Truly nature works the way number works.

a As shown mathematically in the section (2) read with section (1.1) , Duality of nature is established as absolute reality.

b As shown mathematically in the section (5) read with section (1.2) , Riemann hypothesis stands proved.

c As shown mathematically in the section (6) read with section (1.3) , It is shown that infinite sum and product of Zeta values converges.

d As shown mathematically in the section (8) read with section (1.4) , other prime conjectures like Goldbach conjecture, twin prime conjecture etc. stands proved.

e As shown mathematically in the section (9) read with section (1.5) , Complex logarithm is redefined following the definition of imaginary number i and Euler's formula which shall reduce multivalued function into six principal constants and their 6 parts, 3 multiples each following Goldbach partition theorem and Eulers unit circle concepts.

f As shown mathematically in the section (11) read with section (1.6) , Grand Unified scale is built which can explain lot of unsolved mysteries of nature.

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14 Bibilography

These articles, you tube channels, wikipedia pages were referred extensively.

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