An Ephemeral Approach to Solving Fermat's Last Theory

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Abstract-Hypothesis:

We will show for the equation **$A^P + B^P = C^P$**, Sophie Germain Case 1: **$3^\infty(A + B - C) \equiv 0 \text{ Mod } P^\infty$**

And for Sophie Germain Case 2: one of the 3 variables **A, B or C $\equiv 0 \text{ Mod } P^\infty$**

These intricate ideas will be elucidated in depth on the following pages.

While FLT was proved quite some time ago by Wiles/Taylor, it remains out of reach for the vast majority of mathematicians, due to the need of a strong background in modularity theory for *elliptic* curves, and other arcane branches of Number Theory. Thus most mathematicians are hoping for a proof that is a little easier to comprehend using Diophantine equations. This paper is intended to satisfy that need.

I have tried hard to making the writing light and entertaining. Writing this paper was like writing a book, a tremendous amount of blood, sweat and tears went into it's construction. Thousands of hours of math work. Do not feel the need to try to rush thru it, three subsequent readings of perhaps an hour each should allow complete absorption of this creative work of mathematics art.

Separate proofs will be presented for Sophie Germain Case 1 and Sophie Germain Case 2. For those uneducated in Sophie Germain's work, the two cases are rather simple to understand. For the formula $A^P + B^P = C^P$,

Case 1: None of the coprime variables A, B or C will have a factor of P.
Case 2: One of the coprime variables A, B or C will have a factor of P.

In my lexicon SGC1 represents Sophie Germain Case 1, and SGC2 represents Sophie Germain Case 2.

For SGC1, I will use an iterative approach to show that there are an infinite number of factors of P in the sum of A + B - C

For SGC2, this second proof will also be iterative, showing an infinite number of factors of P in one of the three variables A, B or C

It is noted here, that from what I gather reading historical records Pierre Fermat favored an iterative proof method in many of his proofs. Of course anyone well versed in FLT (*Fermat's Last Theory*) is aware that the proof for the case N=4, used the iterative method referred to as Infinite Descent, as the 3 variables A, B and C descend with each iteration towards zero. We may consider the proof in this exposition perhaps as a proof by Infinite Ascent, as the variables A, B and C must approach infinity.

In my earlier 9th proof attempt, which I wrote up several months ago, I used a metaphor of climbing Mount Everest liberally throughout the proof in various places, and I will reuse much of that proof in this new document. I hope you find the reading of this proof entertaining and sparkling. Or at least you may find it more entertaining and sparkling than your average Diophantine proof you may find on arXiv.

For quite certainly, it is highly conceivable that others could have discovered a similar proof years before, but due to an inability to promote their ideas to the world at large, a proof would have gone unnoticed. Note, mathematics manipulation is only a way to pass the time for me, my true skills lie in music creation and engineering, thus you may find my notations somewhat arcane, for which I apologize in advance.

Basic knowledge regarding the exponent value. For any case of $A^N + B^N = C^N$, where N is >=3, it is relatively easy to show that it is only necessary to prove FLT for prime number exponents. Additionally, it is only necessary to prove FLT for A, B and C being coprime for obvious reasons. For even number value exponents, any that are composite and have an odd number factor will be provable by the odd number having a prime number factor, and if N = 4, 8, 16, 32 etcetera, Fermat's proof for N =4 by Infinite Descent serves as the simple basis of a proof. I will not elaborate on the statements in this paragraph, as the proofs are very simple and can be viewed on a 1000 different web portals.

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Conventions used in this Paper:

Please note that instead of using the congruence operator of 3 parallel lines, I will instead be using a standard equality operator, for all modulus equations, as was the practice used regularly in the somewhat distant past. This will save me considerable mouse clicks during the creation of this document.

The abbreviation FLT will be used to indicate Fermat's Last Theory.

In the last 20 years of working on this theory, I have become accustomed to using a Symmetrical Form of the presentation of FLT, as follows: $A^P + B^P + C^P = 0$, this form has the benefit of reducing the amount of analysis when dealing with a symmetrical problem such as FLT. It should be mentioned the first Mathematician to seriously do some work on this problem other than Pierre Fermat himself was Leonard Euler, and he wrote his proof for the case N = 3 in the Symmetrical form as well. At times I may switch over to the non-symmetrical standard form of $A^P + B^P = C^P$, when the NSF (*non-Symmetrical Form*) may yield better clarity in an explanation.

Finally, the variables A, B and C are broken down into factors A_1, A_2, B_1, B_2, C_1 and C_2. The subscripts help to organize the factoring and memorizing of these 6 variables.

FOUNDATION THEORY, Necessary to Gain Basic Skills to understanding Fermat's Last Theorem

Note, there is a certain amount of repetition in this section, and some of the final forms referred to as "Presentation of D", may be not actually be required to be absorbed for a clear understanding of the two final SGC proofs, but are of interest in gaining a solid foothold into the fundamentals, none-the-less.

These next few pages will give the basic equational tools and gear necessary for climbing to the peak of the Mount Everest of math problems. Note the Himalaya's peaks are many and this Sherpa can only explore a limited number of them. I have found two routes to the summit, from which an inspiring view and feeling well being may spring. The climb is not without ardor, and to try to push to quickly to the summit may find one out of breath, and a fuzzy mind. Thus it is essential to accumulate these basic equational tools and commit them to memory. In further documents in this proof, the level of detail that will be expressed DEPENDS on a deep internal mathematics absorption of this foundational base.

At the completion of this portion of the proof we will be at Base Camp, and prepared to ascend to the heights of Everest.

The starting point will be defining the problem. It is normally defined as follows:

$$X^N + Y^N = Z^N$$

With X, Y and Z being positive integer values, and N being an integer value >= 3. That there exist no possible solutions.

A proof for the case for N = 4 was shown by Fermat in a margin of his copy of Arithmetica, and later published by his son, after his death. Adjacent to the short detailed proof which makes use of the technique of Infinite Descent, is a comment that there are no solutions for any other higher exponent than 2, and that the margin of the paper is to small to hold this proof. Hard to say one way or another if he had a rock solid proof.

Anyway moving on, if N is any power of 2 >= 4 the proof would also hold, based upon simple algebraic use of exponent rules. Using similar reasoning, we can prove that any odd number exponent which is a composite number, will also hold true, if we can establish a proof for either of the factors for that composite number. And of course any even number which is a product of an odd prime number or odd composite number will also be “covered” by a proof for prime numbers which are >=3.

Based upon the above, and my personal preferences, we may rewrite the starting point equation as:

$$A^P + B^P = C^P$$

In this presentation, the exponent P represents a prime number >=3, and A, B and C as coprime integers.
The fundamental reasoning that A, B and C are considered as coprime, is that if A and B had a common factor, then C would also, and then we could remove this factor from all 3 variables, and rewrite.

Again based upon personal preference we may rewrite the equation in the symmetrical form as:

$$A^P + B^P + C^P = 0$$

In this presentation, we presume one of the 3 variables A, B and C must be negative. For convenience sake we will assume that C has a negative value. It should be noted that Euler was the first mathematician to find a proof for the case P = 3, and his proof used the symmetrical form. In other words, good historical precedent to proceed along this approach vector to the solution.

At this point maybe good to throw in some philosophy (*OH NOOOOOOO!*) Oh yes, consider the following.

This proof could also be for two negative numbers and one positive number, and be equally valid. And if we conveniently ignore the trivial solution aspect, the potential values and polarities of ***negative, zero and positive*** sort of make up a spectrum analogy of the human race coloration and sexual orientation. (*Note, this paper may be burned in "Fahrenheit 451ish fashion" in some fundamentalist republic provinces, and produce lots of heat, and additional* CO_2 *for our sky*.) So much for my comedic relief, back to reality.

Sophie Germain around the year 1800 was working on a number of mathematical and physics problems, her work on Fermat's Last Theorem has had a profound effect on the understanding of the underlying aspects of the problem. And her definition of Case 1 and Case 2 analysis of the famous equation is a starting point in understanding the two fundamental analysis approaches which must be employed.

Case 1, is when **none** of the integer variables A, B or C contains a factor of P.

Case 2, is when **one** of the integer variables A, B or C contains a factor of P.

Other than this simple branching aspect of the proof definition, no other aspects of Sophie Germain's extensive work on Fermat's Last Theory are utilized, in this exposition.

FACTORING $A^P + B^P + C^P = 0$

Consider $G^N + H^N$ and $G^N - H^N$ each consists of two factors as follows:

$G^N + H^N = (G + H)(G^{N-1} - G^{N-2}H + G^{N-3}H^2 - \dots\dots\dots + G^2H^{N-3} - GH^{N-2} + H^{N-1})$

Note, alternating sign polarities in factor 2

$G^N - H^N = (G - H)(G^{N-1} + G^{N-2}H + G^{N-3}H^2 + \dots\dots\dots + G^2H^{N-3} + GH^{N-2} + H^{N-1})$

Note, same polarities in factor 2

Note, writing out the above right side factor 2 is time consuming to write, so as a shortcut, we may consider using the following functions instead:

$f_a(G, H, P) = (G^{N-1} - G^{N-2}H + G^{N-3}H^2 - \dots\dots\dots + G^2H^{N-3} - GH^{N-2} + H^{N-1})$
(f_a being the additive function factor of $G^N + H^N$)

$f_s(G, H, P) = (G^{N-1} + G^{N-2}H + G^{N-3}H^2 + \ldots\ldots\ldots + G^2H^{N-3} + GH^{N-2} + H^{N-1})$
(f_s being the subtractive function factor of $G^N - H^N$)

While working in the symmetrical presentation of Fermat's Last Theory I do not show the subscript "a" or "s", since all factoring work is from an additive point of view.

We may now expand the presentation form for Sophie Germain Case 1, using the above factoring *Concepts*.

$A_1^PA_2^P + B_1^PB_2^P + C_1^PC_2^P = 0$ (*Specific to SGC1*)
where $A_1^P = -(B + C)$ and $A_2^P = f(B, C, P)$
and $B_1^P = -(A + C)$ and $B_2^P = f(A, C, P)$
and $C_1^P = -(A + B)$ and $C_2^P = f(A, B, P)$

Similarly, we may expand the presentation for Sophie Germain Case 2:

$A_1^PA_2^P + B_1^PB_2^P + \mathbf{P_1^P}C_1^PC_2^P = 0$ (*Specific to SGC2*)
where $A_1^P = -(B + C)$ and $A_2^P = f(B, C, P)$
and $B_1^P = -(A + C)$ and $B_2^P = f(A, C, P)$
and $\mathbf{P^{P-1}}C_1^P = -(A + B)$ and $\mathbf{P}C_2^P = f(A, B, P)$

At this point, I suppose a simple presentation that can be written out on a blackboard for the class is needed. Let's look at the simpler case of SGC1 first, for P=5.

$A^5 + B^5 + C^5 = 0 = (A+B)(A^4 – A^3B + A^2B^2 -A^3B + B^4) + C^5$

and we could rewrite this as $(A+B)(A^4 – A^3B + A^2B^2 -A^3B + B^4) = -C^5$

The above form looks pretty basic, of course if we used the typical non-symmetrical presentation form instead of $-C^5$ we would simply have C^5. At this point you may wonder, why deal with a symmetrical form at all, which has positive and negative integer variables. Well, when the algebraic juggling gets super complex, using a somewhat simpler form helps to keep the polarity errors from creeping in to the analysis. Of course at this point in the exposition, everything is pretty simple. When we get to the trinomial expansion of $(A + B + C)^P$, the symmetrical form starts to look more appealing.

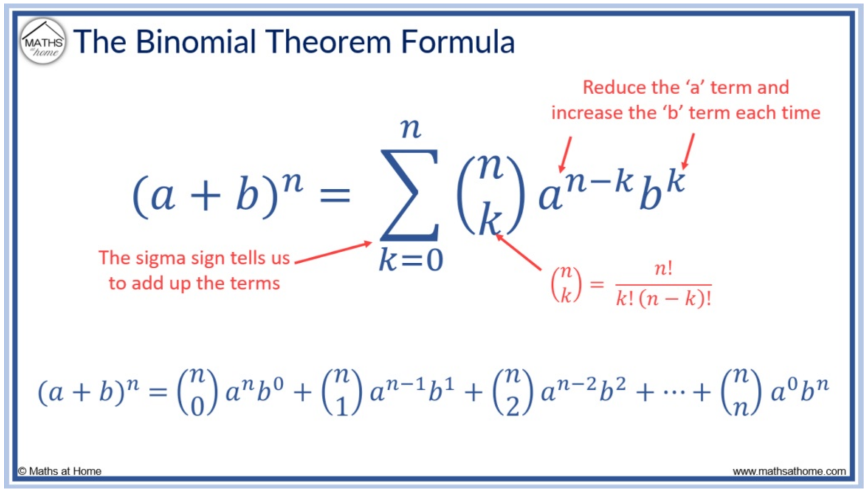
Binomial Expansion of $(a+b)^P$

When $(a+b)^P$ goes thru binomial expansion, the expanded form may be presented/condensed as:

$a^P + P\,(f(a,b)) + b^P$ *(with $P\,(f(a,b))$ representing the sum of all center terms)*

Basically, all of the center term coefficients will have a prime factor of P.

This may be understood by absorbing the basic standard formula for Binomial Expansion which is noted to the right:



Maybe a little too abstract? Let's try a few prime exponent examples to add light to the concept.

$(a+b)^3 = a^3 + 3a^2b + 3\,ab^2 + b^3$
$(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

If you study the coefficient formula for a bit (*shown in Red Text above*), it will make sense, that all of the center term coefficients must have a prime factor of P, since a prime factor of n occurs in the numerator and can not occur in the denominator for all center term coefficients.

Below is Pascal's triangle from Wiki which shows all of the term coefficients up to exponent 7:
(*It's a classic math diagram!*) The center term coefficient prime factors are obvious for 3, 5 and 7.

$$
\begin{array}{c}
1\\
1 \quad 1\\
1 \quad 2 \quad 1\\
1 \quad 3 \quad 3 \quad 1\\
1 \quad 4 \quad 6 \quad 4 \quad 1\\
1 \quad 5 \quad 10 \quad 10 \quad 5 \quad 1\\
1 \quad 6 \quad 15 \quad 20 \quad 15 \quad 6 \quad 1\\
1 \quad 7 \quad 21 \quad 35 \quad 35 \quad 21 \quad 7 \quad 1
\end{array}
$$

Trinomial Expansion of $(A+B+C)^P$

Now for Trinomial Expansion, pretty much the same applies, but we will now have to start thinking somewhat geometrically, but with supportive algebraic logic.

$(A + B + C)^3 =$ *(first diagrams, exponent = 3)*

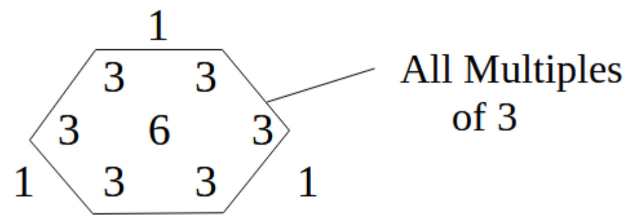
$(A + B + C)^5 =$ *(following diagram, exponent = 5)*

C^3

$3AC^2 + 3BC^2$

$3A^2C + 6ABC + 3B^2C$

$A^3 + 3A^2B + 3AB^2 + B^3$



C^5

$5AC^4 + 5BC^4$

10 20 10

10 30 30 10

5 20 30 20 5

A^5 5 10 10 5 B^5

Conceptually blended for ease of Presentation

From the above rather un-artistic graphics we can gain a foothold into Trinomial expansion coefficients, that they all appear to be multiples of the prime exponent.

Formulaically expressed as:

$(A + B + C)^P = A^P + B^P + C^P + P\,(f(A,B,C,P))$

Where $P\,(f(A,B,C,P))$ is a unique positive integer value function representing the sum of all center terms.

Thus we observe the 3 corner terms have coefficients of 1, and all of the center coefficients are multiples of prime exponent value P.

The graphical view is nice, maybe algebraically you may understand that since all non-corner ***perimeter*** binomial expansions have factors of prime P, when we can multiply any horizontal binomial center row coefficients by the outer perimeter angled vertical row coefficients then all interior term coefficients must also contain a factor of prime P.

Perhaps at this point a more tangible proof of the center none-perimeter coefficients is needed. Supposing we rewrite the starting point equation in this analysis as follows:

$(A + B + C)^P = ((A+B) + C)^P$ and next simply apply Binomial Expansion to (A+B) and C.

In this case, if we consider Q = 5, and the second row from the bottom, we will see that the coefficient elements will all be multiples of 5. Then once we expand (A+B), all of these coefficients will be multiplied by the factor 5. QED.

Since the summation of A^P, B^P and C^P is supposedly zero, we may now remove the 3 corner elements from the isosceles matrix.

With the 3 Corner Values of A^P, B^P and C^P removed, we find that all remaining elements are divisible by P, additional a careful observation of a typical binomial expansion shows that the sum of the center terms is also divisible by a + b, therefore we can now show that the expansion of $(A + B + C)^P$ has the following 4 factors:

P (A+B) (B+C) and (C+A)

Then based upon the knowledge that $(A + B + C)^P$ must have an initial value which can be raised to the P exponent to sum to $(A + B + C)^P$, we may determine that (A+B+C) must have an alternate form of:

$A + B + C = P\,A_1\,B_1\,C_1\,K$

Additionally, the various presentations of A + B + C may be given a single variable designation of **D** to simplify reference to this important variable in the FLT analysis. The new variable K is an unknown arbitrary integer which is related to center term residue when dividing $(A + B + C)^P$ by $P\,A_1\,B_1\,C_1$.

For the case $P = 3$, K is equal to 1. For higher order prime exponents the computation of K as a formula derived from A, B and C becomes more and more difficult as the exponent increases. Yet we do not need to know the exact value of K, only that it is an integer, and it should have several factors of P.

Restating:

$$D = A + B + C = P\, A_1\, B_1\, C_1\, K$$

Still there are many more Presentations of D, which we will be required to be fluent in, as we forge our way to Base Camp.

Presentations of D:

Perhaps the **most important presentation of D** is as follows, thru substitution:

$$A + B + C = \frac{(A + B) + (B + C) + (A + C)}{2} = \frac{C_1^P + A_1^P + B_1^P}{-2}$$

(*Note, above form specific to SGC1*)

Although the -2 in the suffix of the far right presentation, appears out of place, it's required to be a negative. Not too hard to show that, if you go back to the beginning of the proof.

This particular form is instrumental to the final proof for SGC2 since it is factorable, and after factoring new transforms are possible which lead directly to the actual proofs, which will be explored in later sections of this document.

These forms can also be expressed in relation to SGC2 as:

$$A + B + C = \frac{(A + B) + (B + C) + (A + C)}{2} = \frac{\mathbf{P^{P-1}}C_1^P + A_1^P + B_1^P}{-2}$$

It may be noted that this form is less factorable, than the form for SGC1, however $A_1^P + B_1^P$ can be factored!

And there yet remain a few more forms of D, which will be useful gear as we approach Base Camp:

$A_1^P = -(B + C)$ **$A + (B + C) = A - A_1^P$** **Similar substitutions for B and C arrive at:**

$A + B + C = A - A_1^P = B - B_1^P = C - C_1^P$ *This form for **SGC1*** *and*

$A + B + C = A - A_1^P = B - B_1^P = C - \mathbf{P^{P-1}}C_1^P$ *This form for **SGC2***

Now these last forms have a use of proving some detail about A_2, B_2 and C_2 for SGC1 as follows:

$A - A_1^P = A_1 (A_2 - A_1^{P-1})$ *Of course same considerations for B and C*

Based upon a deep intuitive understanding of Fermat's Little Theorem, we can show that:

$A^P = A \text{ Mod } P$ and less well expounded: $A^{P-1} = 1 \text{ Mod } P$
(*see my short succinct Reference paper on Extensions to Fermats's Little Theorem*.)

From the above we can prove for SGC1 that A_2, B_2 and $C_2 = 1$ Mod P, and for SGC2 if we assume C has the factor P then A_2 and B_2 = 1 Mod P and C_2 is an undefined Modulus of P.

Below supporting lemma was written abut 18 months ago, and demonstrates that no common factors can exist between A_1 and A_2 other than P, and similarly for variables B and C. It also shows that if P is a factor of A_1, then it must also be a factor of A_2.

It is somewhat intuitive that A_1 can not be divided into A_2, this lemma helps to show this from a fundamental level.

T3 lemma — Binomial Expansion & Subduction of $J^P + K^P$

It is generally well known in number theory, proper factoring of $J^P + K^P$, and limits of prime cofactors when J and K are coprime. However this common knowledge is repeated below in a somewhat abbreviated form. I use the term Subduction here, as an indication of the application of subtractive and deductive reasoning processes.

And obviously, the same method of proof would apply to $J^P - K^P$

Similar to the form on pages 1 to 4, $J^{P-1} - J^{P-2} K + J^{P-3} K^2 \ldots K^{P-1}$ is simply represented by $f(J,K)$.

For the case P=5 as an example, it is given

$J^P + K^P$ Factors Into:

$$(J+K)(J^4 - J^3K + J^2K^2 - JK^3 + K^4)$$

However (J+K) can not have any prime co-factor within $(J^4 - J^3K + J^2K^2 - JK^3 + K^4)$ except P as follows,

If attempting to divide J+K into $(J^4 - J^3K + J^2K^2 - JK^3 + K^4)$, *(this detailed on pg 6 to right)*

```
J+K Long Division              Coefficients only shown
                               1    -1    1    -1    1
  Subtr J³(J+K)* 1             1     1
                               ---------
                               0    -2
  Subtr J²K(J+K)* -2                -2   -2
                                    -----------
                                    0     3
  Subt JK²(J+K)* 3                        3     3
                                          -----------
                                          0    -4
  Subt K3(J+K)* -4                              -4    -4
                                                ------------
                                                 0     5
```

Here the remainder (*AKA residue*) is $5K^4$. Similarly, by successive J+K factor subtraction (*long division*), the remaining may be shown alternately as $5J^4$ or $5J^2K^2$.

The remainder is not fully divisible into J+K.

However it is easy to show any prime cofactors would need to exist between J+K and (*with symmetrical form*) $5J^2K^2$,

Thus $\dfrac{5J^2K^2}{J+K}$ would have to have these cofactors.

The only cofactor can be P (*or 5 in this case*).
J^2 and K^2 can not contain any cofactors to J+K, by reciprocity.
Such that $\dfrac{J+K}{JK}$ can not have any cofactors since
it can be rewritten/understood that K is stated to be relatively prime (*coprime*) to J.

Then due to the simplicity of the subduction process:

$\dfrac{PJK}{J+K}$ may only have a single cofactor of P.

Thus J^P+K^P can only be factored as:

Case 1: $(J+K) \cdot f(J,K)$ with no common factor P
Or Case 2: $(J+K) \cdot f(J,K)$ with a common factor P

With $f(J,K)$ only able to contain a single factor of P

Detailed example of long division by J+K shown below, for clarity of understanding:

$$J^4 - J^3K + J^2K^2 - JK^3 + K^4 \ / \ (J + K)$$

$$\begin{array}{l} \quad J^4 - J^3K + J^2K^2 - JK^3 + K^4 \\ - \ J^3 (J+K) \\ \hline \quad - 2J^3K + J^2K^2 \\ \quad + \ 2J^2K (J+K) \qquad \textit{(note, -1 * -1 = +1)} \\ \hline \qquad 3J^2K^2 - JK^3 \\ \qquad - 3JK^2 (J+K) \\ \hline \qquad\quad - 4JK^3 + K^4 \\ \qquad\quad + \ 4K^3 (J+K) \qquad \textit{(note, -1 * -1 = +1)} \\ \hline \qquad\qquad 5K^4 \end{array}$$

Thus showing that P, in this case 5, is the only remainder when divided by J + K, similarly if dividing right to left the remainder will be $5J^4$, and if dividing symmetrically from both ends simultaneously, the result will be $5J^2K^2$. In all 3 cases, the only possible cofactor to J +K is 5 in essence P.

This T3 Lemma is fundamentally written to show that there are no possible common factors between A_1, A_2, B_1, B_2, C_1 and C_2 except the possibility of a factor of P.

I coined the term “Subduction” as being Subtraction/Deduction combined.

It should be somewhat obvious from the above analysis that if $J^P + K^P$ can not have a *single* factor of P, since both factors of it must contain a factor of P. Of course J + K could contain multiple factors of P, but $f_A(J,K,P)$ may only contain a single factor of P.

The long division presented above, dividing J + K into $f_A(J,K,P)$, can be done from left to right, right to left or may simultaneously be approached from both left and right sides. Although it is clearly intuitively obvious that J+K can not divided into $f_A(J,K,P)$ with the exception of factor P, this Lemma drives the point home using Long Division.

My first writeup on this in my NoteBook was for the case P = 7, with the Long division approached from both left and right sides simultaneously. Quite naturally, the residue was $7J^3K^{3.}$

Identification of Solutions of Fermat’s Last Theorem

Proof of Fermat’s Last Theory, Iterative Proof for Sophie Germain Case 1

From the base camp, it is necessary to survey the peak of Mount Everest, cold and at an altitude which appears daunting. This Sherpa will guide you up the shortest discovered path over the last 350 years. Before leaving we must review our gear and tools, which we developed in the foundational work previously explored. Based upon an analysis of: $A^P + B^P + C^P = 0$, with P being the prime exponent >=3, our toolbox contains the following equations:

$A_1^P = -(B + C)$ $\qquad$ $B_1^P = -(A + C)$ $\qquad$ $C_1^P = -(A + B)$

$A_2^P = f(B, C, P) = (B^{P-1} - B^{P-2}C + B^{P-3}C^2 - \dots\dots\dots + B^2C^{P-3} - BC^{P-2} + C^{P-1})$

$B_2^P = f(A, C, P) = (A^{P-1} - A^{P-2}C + A^{P-3}C^2 - \dots\dots\dots + A^2C^{P-3} - AC^{P-2} + C^{P-1})$

$C_2^P = f(A, B, P) = (A^{P-1} - A^{P-2}B + A^{P-3}B^2 - \dots\dots\dots + A^2B^{P-3} - AB^{P-2} + B^{P-1})$

Presentations of D

$$A + B + C = P A_1 B_1 C_1 K = \frac{(A + B) + (B + C) + (A + C)}{2} = \frac{C_1^P + A_1^P + B_1^P}{-2}$$

$$A + B + C = A - A_1^P = A_1(A_2 - A_1^{P-1}) = B - B_1^P = B_1(B_2 - B_1^{P-1}) = C - C_1^P = C_1(C_2 - C_1^{P-1})$$

Since we have packed all our gear and our oxygen tanks for the trek to the summit, the climb will now commence. If you have unwisely jumped to this departure point, without putting in the time to make yourself fit at Base Camp, please return to the Base Camp and acclimate yourself to the thin oxygen, and you may commence the climb at the next session.

A workout at Base Camp will make the above groups of equations trivial in your mind, and this is a necessary mental state to prevent oxygen deprivation and dizziness at the high altitudes we will be ascending to.

We will use several presentations of D for this proof: D_1, D_2 and the set D_{4A}, D_{4B} and D_{4C}

First we will show that $A_1 + B_1 + C_1$, can be represented as 0 Mod P.

Next we will show that the factor P can occur an infinite number of times within $3^{\infty}(A + B + C)$

$A + B + C$ = Form D_1 $\quad$ $P\,A_1\,B_1\,C_1\,K$ = Form D_2 $\quad$ $-0.5\,(A_1^P + B_1^P + C_1^P)$ = Form D_3

$A_1(A_2 - A_1^{P-1})$ = Form D_{4A} $\quad$ $B_1(B_2 - B_1^{P-1})$ = Form D_{4B} $\quad$ $C_1(C_2 - C_1^{P-1})$ = Form D_{4C}

Note sum of all forms the same: Form D_1 = Form D_2 = Form D_3 = Form D_{4A} = Form D_{4B} = Form D_{4C}, all equal to $A + B + C$

Let us inspect form D_{4A}, $\quad A_1(A_2 - A_1^{P-1})$

Since SGC1 conforms to the rule that none of the variables A, B or C may contain the factor P, we can the break the equation into two parts and show: $A_1 \quad x \quad (A_2 - A_1^{P-1})$ $\quad$ *A_1 = Part 1 $\quad$ and $\quad$ A_2 = Part 2*

Since form D_2 (*$P\,A_1\,B_1\,C_1\,K$*) has a factor of P, then since A_1 (part 1) **may not** have a factor of P, and therefore $A_2 - A_1^{P-1}$ (part 2) **must** have a factor of P.

And we may rewrite form D_{4A} in Modulus form as **A_1 (0 Mod P)**

Additionally, since per Fermat's Little Theorem A_1^{P-1} is equal to 1 Mod P, we can draw the conclusion the that A_2 must be equal to 1 Mod P as well. And of course all of the understanding for form D_{4A}, applies equally to forms D_{4B} and D_{4C}, based upon the symmetry of these 3 presentations of D.

Now since A_2, B_2 and C_2 all equal 1 Mod P, we may write $A + B + C = A_1A_2 + B_1B_2 + C_1C_2 = (A_1 + B_1 + C_1)(1 \text{ Mod } P) = 0 \text{ Mod } P$

And since in the presentation of $(A_1 + B_1 + C_1)(1 \text{ Mod } P) = 0 \text{ Mod } P$, we can only have a LHS equation factor with a factor of P within $(A_1 + B_1 + C_1)$, therefore we can only conclude that $\mathbf{A_1 + B_1 + C_1 = 0 \text{ Mod } P}$

$3^{\infty}(A + B + C)$

The above equation has a lovely form, with 3^{∞} as a factor. Well we are up pretty high on the Mount Everest trek, so maybe you are getting fuzzy brain from lack of oxygen. As your Sherpa, let me assure you, this is a real value, you need to readjust your oxygen if you are feeling uncertain and confused. OK, a 2 minute break and then we continue the ascent.

Again let us consider form D_{4A}, $A_1(A_2 – A_1^{P-1})$

We have shown that $A_2 – A_1^{P-1} = 0$ Mod 5, and by symmetry the same for forms D_{4B} and D_{4C}.

Therefore we may rewrite form D_{4A} as: $A_1(0 \text{ Mod } P)$
And we can rewrite D_{4B} as $B_1(0 \text{ Mod } P)$, and rewrite D_{4C} as $C_1(0 \text{ Mod } P)$.

If we add these 3 presentations of D together, we will have $3(A + B + C)$ (*Form D_1*)

This can be written as:

$$A_1(0 \text{ Mod } P) + B_1(0 \text{ Mod } P) + C_1(0 \text{ Mod } P) = 3(A + B + C)$$

Then we may algebraically recombine as $(A_1 + B_1 + C_1)(0 \text{ Mod } P) = 3(A + B + C)$

Now we must recall in the first section of this SGC1 proof we showed that $A_1 + B_1 + C_1 = 0 \text{ Mod } P$

So now we can see that for the equation $(A_1 + B_1 + C_1)(0 \text{ Mod } P) = 3(A + B + C)$ we will have 2 factors of P on the LHS of the equation, so it is logical to conclude that the RHS of the equation must contain 2 factors of P.

Bearing in mind that $D_1 = D_2 = D_3 = D_{4A} = D_{4B} = D_{4C}$, we must come to the conclusion that if we again take the three presentations of D_4, we will then have 3 factors of P within 9(A+B+C), and of course of we multiply by 3 again there will be 4 factors of P within 27(A+B+C). This pattern can obviously be repeated ad infinitum, to show that for SGC1,

A+B+C must contain an infinitude of factors of P

This concludes the iterative proof of SGC1. On to the next section.

Identification of Solutions of Fermat's Last Theorem

Proof of Fermat's Last Theory, Iterative Proof for Sophie Germain Case 2

Since we stipulate that one of the 3 variables A, B or C has a factor of P for the SGC2 (*Sophie Germain Case 2*) proof to FLT, the formula's below are adapted to that form. We will assume that variable C contains the factor P, and that it is distributed as follows, $\mathbf{C = P\, C_1\, C_2}$, thus:

$$A^P + B^P + C^P = 0$$

$$A_1^P = -\,(B + C) \qquad B_1^P = -\,(A + C) \qquad \mathbf{P^{P-1}}\, C_1^P = -\,(A + B)$$

$$A_2^P = f\,(B, C, P) = (\, B^{P-1} - B^{P-2}C + B^{P-3}C^2 - \ldots\ldots\ldots + B^2C^{P-3} - BC^{P-2} + C^{P-1}\,)$$

$$B_2^P = f\,(A, C, P) = (\, A^{P-1} - A^{P-2}C + A^{P-3}C^2 - \ldots\ldots\ldots + A^2C^{P-3} - AC^{P-2} + C^{P-1}\,)$$

$$\mathbf{P}\, C_2^P = f\,(A, B, P) = (\, A^{P-1} - A^{P-2}B + A^{P-3}B^2 - \ldots\ldots\ldots + A^2B^{P-3} - AB^{P-2} + B^{P-1}\,)$$

$$A + B + C = P\, A_1\, B_1\, C_1\, K = \frac{(A + B) + (B + C) + (A + C)}{2} = \frac{\mathbf{P^{P-1}}C_1^P + A_1^P + B_1^P}{-\,2}$$

Keeping in our mind the proof for SGC1 previously studied, we may recall that in the denominator of the following presentation of D we have a factor of 2. I have additionally, shown the SGC2 presentation of it to the right of it:

$$\frac{C_1^P + A_1^P + B_1^P}{-\,2} \qquad\qquad \frac{P^{P-1}C_1^P + A_1^P + B_1^P}{-\,2}$$

The factor of P, will be shown to be infinite within C_1 …...

OK, now let us proceed: $\dfrac{P^{P-1}C_1^P + A_1^P + B_1^P}{-\,2}$

We note that $A_1^P + B_1^P$ will be divisible by $A_1 + B_1$, and this is the first step in the proof which may be referred to as a Powers of P proof.

Next we may understand that $A_1 + B_1$ must contain the factor P. (*At this point I might suggest that any presentation use the case of P = 5, for clarity of thought. This could be written out on a classroom blackboard, whiteboard, or on a pad of paper, if you are working independently.)*

Since $A_1 + B_1$ must have a factor of P, then indeed $A_1^P + B_1^P$ divided by $A_1 + B_1$ must also contain a factor of P, as explained in our *foundational work* document on FLT, regarding SGC2.

Thus $A_1^P + B_1^P$ can not have a single factor of P, it must contain 2 factors of P at a minimum.

Note:
$A_1^{P-1} - A_1^{P-2}B_1 + A_1^{P-3}B_1^2 - \ldots\ldots\ldots + A_1^2B_1^{P-3} - A_1B_1^{P-2} + B_1^{P-1}$
will have P addend products, and will thus have a factor of P, since $A_1 = - B_1$ Mod P
A simple example of $2^5 + 3^5$ will demonstrate this 32 + 243 = 275, which is divisible by 25.
You may need to think this thru a few times before you absorb the 2 factors of P concept completely.

Since we have established now that D must contain 2 factors of P, we can look at other presentations of D as: $P A_1 B_1 C_1 K$ and $A_1A_2 + B_1B_2 + PC_1C_2$

Clearly $P A_1 B_1 C_1 K$ must necessarily contain 2 factors of P, with C_1 having one factor and P having the other factor.

However inspection of $A_1A_2 + B_1B_2 + PC_1C_2$ yields an interesting concept which is that $A_1A_2 + B_1B_2$ must also contain 2 factors of P. The significance of this is that since A_2 and B_2 must be equal to 1 Mod P which is explained in the SGC1 proof, and thus we may present the following formula:

$$A_1A_2 + B_1B_2 = (A_1 + B_1)(1 \text{ Mod } P)$$

From this equation we may observe and conclude that $A_1 + B_1$ must have 2 factors of P, in other words must have the factor $P^{2.}$,

If we iterate this new understanding into the formulaic presentation of D:

$$\frac{P^{P-1}C_1^P \quad + \quad A_1^P \quad + \quad B_1^P}{-\ 2}$$

We now find that there are 3 factors of P present within it.

As we apply this looping iteration between the three presentations of D noted below:

$$\frac{P^{P-1}C_1^P + A_1^P + B_1^P}{-2} \qquad P\,A_1\,B_1\,C_1\,K \qquad \text{and} \qquad A_1A_2 + B_1B_2 + PC_1C_2$$

We must come to the only logical conclusion, which is that we may loop Ad Infinitum, and with each loop another power of P will present itself, thus completing the proof for SGC2, using the Iterative Powers of P Method.

CLARIFICATION NOTE:
The "driving function" that makes the loop iterate, will be explained here.

The fact that $A_1^P + B_1^P$ always has an additional factor of P in the $f(A_1, B_1, P)$ factor of the $A_1^P + B_1^P$ expansion, in comparison to the formula $A_1A_2 + B_1B_2$, means that there can never be a balance in the two presentations of D, thus shifting from the one presentation and back to the other presentation of D continually advances the number of iterations of the factor P, which must ultimately present itself within the variable C_1.

Speculation on Limitations of the Human Mind

In my research over the last year, I have noted some distinct interest in the topic of unexplored math realms due to limitations of the human mind, as well as the question of if alien minds (*from other planets in the universe*) might be able to venture into these uncharted mathematical realms, which our human minds are not able to cope with. In this short exposition I will identify a proof to FLT which I feel is reasonably solid, but our earthly minds can not accept, for several reasons, which I will elaborate, before introducing you to this short and mentally stimulating proof.

I view a three space model of the human experience, in that there is reality, spirituality, and somewhere between the two mathematics. When we are absorbing and analyzing math, we are fundamentally using spacial reasoning skills developed over the last 5 million years, and not much in the way of spiritual tools. Consider our fore-bearers swinging from tree to tree in the forest. It is in this environment, that others have posited the idea that the need for extreme accuracy in flying thru space between trees honed our spacial reasoning skills to a high degree. Evolutionary forces would logically have caused brains with less well developed spacial reasoning skills to miss the landing mark on the nearby tree, fallen to the ground dead, and the result would be a gene pool with improved brain skills to develop. These improved brain reasoning skills would lead to symbolic and visual processing neural pathway improvements leading to high level language, and written symbolic processing of math, science, agriculture and various other endeavors of the human race.

If in the computation of the tree to tree jump was not done to 99.9% precision, then eventually a primate would fail to survive. Thus our gene pool evolution highly discourages risky behavior. To illustrate this concept a little more clearly consider, risk analysis of males and females. It is well understood that males are more willing to accept a risky situation than females. There is simple evolutionary rationale. If there is perhaps a 5:1 ratio of males to females and a female dies, this ends the gene pool, if on the other hand if a males dies the female can still be inseminated by a remaining male. An of course the reverse is not true, if the ratio of males to females was to be reversed. Therefore pressure from the gene pool, has caused females to be less risk tolerant, in comparison to males.

If an earthly mind with perhaps another 5 million years of evolution in a civilized society looks at a math problem, the risk assessment associated with ancient activities millions of years in the past, is far less likely to cloud their judgement. Instead the spiritual analysis of deep aspects which are not easily integrated into a mathematics problem assessment may be applied with impunity. In other words a more symmetrical approach to a deep mathematics problem may be achieved using the simple reasoning skills associated with spacial reasoning as well as the more convoluted reasoning skills associated with the spiritual realm.

The following deep abstraction analysis, appears deeply flawed, but in it's simplicity, perhaps there is value:

$A^5 + B^5 = C^5$ can be factored in several ways, for instance $(C – B)\ (C^4 + C^3B + C^2B^2 + CB^3 + C^4)$ is one of the three ways it can be factored, as elaborated in Base Camp. And note C-B and $C^4 + C^3B + C^2B^2 + CB^3 + C^4$ are coprime, and thus $C\text{-}B = A_1^5$ and $A_2^5 = C^4 + C^3B + C^2B^2 + CB^3 + C^4$

If there is a non-trivial solution and we multiply the 3 variables A, B and C times integer 2, based upon our normal algebraic rules of manipulation, we will have another solution to FLT, albeit with non-coprime factors.

We could write then $2^5(A^5 + B^5 - C^5) = 0$, also $(2A)^5 + (2B)^5 - (2C)^5 = 0$

With this second right side form, let us see what happens when we factor the equation.

$(2C – 2B)\ (2^4C^4 + 2^4C^3B + 2^4C^2B^2 + 2^4CB^3 + 2^4C^4)$

We can not longer show $2C – 2B = A_1^5$ and $2^4C^4 + 2^4C^3B + 2^4C^2B^2 + 2^4CB^3 + 2^4C^4 = A_2^5$

Our previous integer values for A_1^5 have become an irrational root of 2, and the same can be said of $A_2^{5.}$

But if we consider the Pythagorean version of FLT, $A^2 + B^2 = C^{2,}$ we will quickly realize that adding a 2^2 factor multiplier allows for

the C-B factor and the C+B factor to take on a single value of 2^1, which supports the validity of this simple analsys.

When analyzing this briefly, looking at it from the corner of our minds eye, it appears conceptually well developed, but further inspection causes us to doubt our mathematical senses, which have the origin in the trees, and require a 99.9% rigorous solidity to any proof we analyze. Our scientific mind derives from our earthly experience, but earthly experience is not driving the mathematical mind entirely, there is also a tiny spiritual aspect to it. This realm and aspect of mathematical proofs are not easily explored. Perhaps proofs such as the flawed one just introduced of this nebulous nature, are worthy in this regard.

My choice of the method descriptive name (*Non-Zero Intercept*) is very abstract, and can not be put into words unfortunately. In my humble opinion, an alien civilization might perhaps accept this nebulous proof as valid, (*fundamentally due to the symmetry*).
One of the additional developments in the proof would be the recognition that if the multiplier is 2^5 rather than simply 2, it would be easy to prove that an infinite number of integer possibilities would exist as non-trivial solutions, however there would be infinity squared non-trivial solutions with irrational values for A, B and C. and suppose we divide infinity by infinity squared, well this is simply zero. Abstract logic, maybe of alien origin?

In a way, it is a most beautiful organic solution to the FLT problem. Please accept my apologies for this highly speculative introspection of the space between the reality and spiritual realms, which is mathematics.

ADDENDUM

-A- STATEMENTS of EXPANSIONS of FERMAT'S LITTLE THEOREM:

$A^P = A \text{ Mod } P$, is a typical way of writing Fermat's Little Theorem, it therefore thru induction it holds that $A^{P-1} = 1 \text{ Mod } P$. And now since $A^0 = 1 \text{ Mod } P$ and $A^{P-1} = 1 \text{ Mod } P$, we can determine the periodicity which is P-1, thus we may write

$$A^{K(P-1)+1} = A \text{ Mod } P$$

If we look at a simplified case of P = 5, we can understand that A Mod P will occur at N = 0, 5, 9, 13, 17 … as K is incremented. The best way to attain great clarity of this concept is to observe some "output" from a few Libre Office worksheets, presented below:

Modulus of Prime Number 3
Periodicity is 3 - 1

N = 13	0	**1**	**2**
N = 12	0	1	1
N = 11	0	**1**	**2**
N = 10	0	1	1
N = 9	0	**1**	**2**
N = 8	0	1	1
N = 7	0	**1**	**2**
N = 6	0	1	1
N = 5	0	**1**	**2**
N = 4	0	1	1
N = 3	0	**1**	**2**
N = 2	0	1	1
N = 1	0	**1**	**2**
N = 0	0	1	1

Modulus of Prime Number 5
Periodicity is 5 - 1

N = 13	0	**1**	**2**	**3**	**4**
N = 12	0	1	1	1	1
N = 11	0	1	3	2	4
N = 10	0	1	4	4	1
N = 9	0	**1**	**2**	**3**	**4**
N = 8	0	1	1	1	1
N = 7	0	1	3	2	4
N = 6	0	1	4	4	1
N = 5	0	**1**	**2**	**3**	**4**
N = 4	0	1	1	1	1
N = 3	0	1	3	2	4
N = 2	0	1	4	4	1
N = 1	0	**1**	**2**	**3**	**4**
N = 0	0	1	1	1	1

Modulus of Prime Number 7
Periodicity is 7 - 1

N = 13	0	**1**	**2**	**3**	**4**	**5**	**6**
N = 12	0	1	1	1	1	1	1
N = 11	0	1	4	5	2	3	6
N = 10	0	1	2	4	4	2	1
N = 9	0	1	1	6	1	6	6
N = 8	0	1	4	2	2	4	1
N = 7	0	**1**	**2**	**3**	**4**	**5**	**6**
N = 6	0	1	1	1	1	1	1
N = 5	0	1	4	5	2	3	6
N = 4	0	1	2	4	4	2	1
N = 3	0	1	1	6	1	6	6
N = 2	0	1	4	2	2	4	1
N = 1	0	**1**	**2**	**3**	**4**	**5**	**6**
N = 0	0	1	1	1	1	1	1

Modulus of Prime Number 11

Periodicity is 11 - 1

N = 21	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
N = 20	0	1	1	1	1	1	1	1	1	1	1
N = 19	0	1	6	4	3	9	2	8	7	5	10
N = 18	0	1	3	5	9	4	4	9	5	3	1
N = 17	0	1	7	9	5	3	8	6	2	4	10
N = 16	0	1	9	3	4	5	5	4	3	9	1
N = 15	0	1	10	1	1	1	10	10	10	1	10
N = 14	0	1	5	4	3	9	9	3	4	5	1
N = 13	0	1	8	5	9	4	7	2	6	3	10
N = 12	0	1	4	9	5	3	3	5	9	4	1
N = 11	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
N = 10	0	1	1	1	1	1	1	1	1	1	1
N = 9	0	1	6	4	3	9	2	8	7	5	10
N = 8	0	1	3	5	9	4	4	9	5	3	1
N = 7	0	1	7	9	5	3	8	6	2	4	10
N = 6	0	1	9	3	4	5	5	4	3	9	1
N = 5	0	1	10	1	1	1	10	10	10	1	10
N = 4	0	1	5	4	3	9	9	3	4	5	1
N = 3	0	1	8	5	9	4	7	2	6	3	10
N = 2	0	1	4	9	5	3	3	5	9	4	1
N = 1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
N = 0	0	1	1	1	1	1	1	1	1	1	1

Modulus of Prime Number 13

Periodicity is 13 - 1

N = 25	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
N = 24	0	1	1	1	1	1	1	1	1	1	1	1	1
N = 23	0	1	7	9	10	8	11	2	5	3	4	6	12
N = 22	0	1	10	3	9	12	4	4	12	9	3	10	1
N = 21	0	1	5	1	12	5	5	8	8	1	12	8	12
N = 20	0	1	9	9	3	1	3	3	1	3	9	9	1
N = 19	0	1	11	3	4	8	7	6	5	9	10	2	12
N = 18	0	1	12	1	1	12	12	12	12	1	1	12	1
N = 17	0	1	6	9	10	5	2	11	8	3	4	7	12
N = 16	0	1	3	3	9	1	9	9	1	9	3	3	1
N = 15	0	1	8	1	12	8	8	5	5	1	12	5	12
N = 14	0	1	4	9	3	12	10	10	12	3	9	4	1
N = 13	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
N = 12	0	1	1	1	1	1	1	1	1	1	1	1	1
N = 11	0	1	7	9	10	8	11	2	5	3	4	6	12
N = 10	0	1	10	3	9	12	4	4	12	9	3	10	1
N = 9	0	1	5	1	12	5	5	8	8	1	12	8	12
N = 8	0	1	9	9	3	1	3	3	1	3	9	9	1
N = 7	0	1	11	3	4	8	7	6	5	9	10	2	12
N = 6	0	1	12	1	1	12	12	12	12	1	1	12	1
N = 5	0	1	6	9	10	5	2	11	8	3	4	7	12
N = 4	0	1	3	3	9	1	9	9	1	9	3	3	1
N = 3	0	1	8	1	12	8	8	5	5	1	12	5	12
N = 2	0	1	4	9	3	12	10	10	12	3	9	4	1
N = 1	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
N = 0	0	1	1	1	1	1	1	1	1	1	1	1	1

Now Let's consider the composite number 5 x 7 = 35
You may note that periodicity is the lowest common denominator of 5-1 and 7-1, which is 12. And that for the 12^{th} and 24^{th} rows that the Modulus of 35 is only **1** if the input parameter **A** is coprime to both 5 and 7.

N																																			
37	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**																										
36	1	1	1	1	15	1	21	1	1																										
35	1	18	12	9	10	6	28	22	4																										
34	1	9	4	11	30	1	14	29	16																										
33	1	22	13	29	20	6	7	8	29																										
32	1	11	16	16	25	1	21	1	11																										
31	1	23	17	4	5	6	28	22	9																										
30	1	29	29	1	15	1	14	29	1																										
29	1	32	33	9	10	6	7	8	4																										
28	1	16	11	11	30	1	21	1	16																										
27	1	8	27	29	20	6	28	22	29																										
26	1	4	9	16	25	1	14	29	11																										
25	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**0**
24	1	1	1	1	15	1	21	1	1	15	1	1	1	21	15	1	1	1	1	15	21	1	1	1	15	1	1	21	1	15	1	1	1	1	0
23	1	18	12	9	10	6	28	22	4	5	16	3	27	14	15	11	33	2	24	20	21	8	32	19	30	31	13	7	29	25	26	23	17	34	0
22	1	9	4	11	30	1	14	29	16	25	11	9	29	21	15	16	4	4	16	15	21	29	9	11	25	16	29	14	1	30	11	4	9	1	0
21	1	22	13	29	20	6	7	8	29	20	1	27	13	14	15	1	27	8	34	20	21	22	8	34	15	6	27	28	29	15	6	22	13	34	0
20	1	11	16	16	25	1	21	1	11	30	16	11	1	21	15	11	16	16	11	15	21	1	11	16	30	11	1	21	1	25	16	16	11	1	0
19	1	23	17	4	5	6	28	22	9	10	11	33	27	14	15	16	3	32	19	20	21	8	2	24	25	26	13	7	29	30	31	18	12	34	0
18	1	29	29	1	15	1	14	29	1	15	1	29	29	21	15	1	29	29	1	15	21	29	29	1	15	1	29	14	1	15	1	29	29	1	0
17	1	32	33	9	10	6	7	8	4	5	16	17	13	14	15	11	12	23	24	20	21	22	18	19	30	31	27	28	29	25	26	2	3	34	0
16	1	16	11	11	30	1	21	1	16	25	11	16	1	21	15	16	11	11	16	15	21	1	16	11	25	16	1	21	1	30	11	11	16	1	0
15	1	8	27	29	20	6	28	22	29	20	1	13	27	14	15	1	13	22	34	20	21	8	22	34	15	6	13	7	29	15	6	8	27	34	0
14	1	4	9	16	25	1	14	29	11	30	16	4	29	21	15	11	9	9	11	15	21	29	4	16	30	11	29	14	1	25	16	9	4	1	0
13	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**0**
12	1	1	1	1	15	1	21	1	1	15	1	1	1	21	15	1	1	1	1	15	21	1	1	1	15	1	1	21	1	15	1	1	1	1	0
11	1	18	12	9	10	6	28	22	4	5	16	3	27	14	15	11	33	2	24	20	21	8	32	19	30	31	13	7	29	25	26	23	17	34	0
10	1	9	4	11	30	1	14	29	16	25	11	9	29	21	15	16	4	4	16	15	21	29	9	11	25	16	29	14	1	30	11	4	9	1	0
9	1	22	13	29	20	6	7	8	29	20	1	27	13	14	15	1	27	8	34	20	21	22	8	34	15	6	27	28	29	15	6	22	13	34	0
8	1	11	16	16	25	1	21	1	11	30	16	11	1	21	15	11	16	16	11	15	21	1	11	16	30	11	1	21	1	25	16	16	11	1	0
7	1	23	17	4	5	6	28	22	9	10	11	33	27	14	15	16	3	32	19	20	21	8	2	24	25	26	13	7	29	30	31	18	12	34	0
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5	1	32	33	9	10	6	7	8	4	5	16	17	13	14	15	11	12	23	24	20	21	22	18	19	30	31	27	28	29	25	26	2	3	34	0
4	1	16	11	11	30	1	21	1	16	25	11	16	1	21	15	16	11	11	16	15	21	1	16	11	25	16	1	21	1	30	11	11	16	1	0

3	1	8	27	29	20	6	28	22	29	20	1	13	27	14	15	1	13	22	34	20	21	8	22	34	15	6	13	7	29	15	6	8	27	34	0
2	1	4	9	16	25	1	14	29	11	30	16	4	29	21	15	11	9	9	11	15	21	29	4	16	30	11	29	14	1	25	16	9	4	1	0
1	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**
N																																			

It's quite mind numbing I suppose. But we can understand the basics of Composite number Exponential Modulus when simply inspecting the above table, and we can thru induction state the extend these concepts to other composite scenarios.

-B- NSF (*Non-Symmetrical Form*) Reference Structural Formulas for Future Reference

Since you may wish to convert this proof from the Symmetrical Form to the more typical Non-Symmetrical Form of FLT, which is $A^P + B^P = C^P$, the fundamental equations are rewritten below for the Non-Symmetrical Form.

$A_1^P = (C - B) \qquad B_1^P = (C - A) \qquad C_1^P = (A + B)$

f_S *is the* ***S****ubtractive function for the factors of* A_2 *and* B_2

f_A *is the* ***A****dditive function for the factors of* C_2

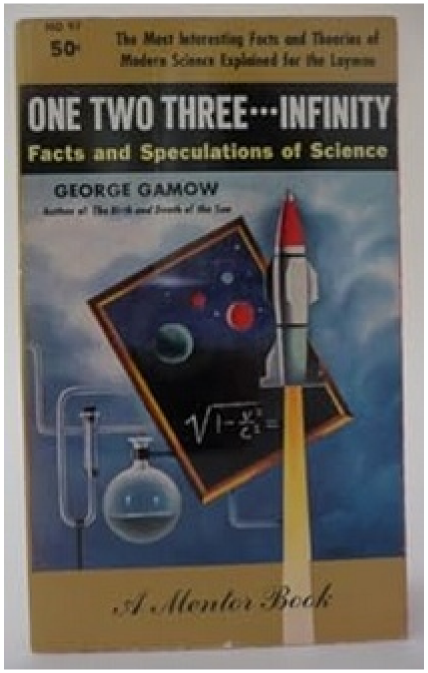
$$A_2^P = f_S\,(C, B, P) = (\,B^{P-1} + B^{P-2}C + B^{P-3}C^2 + \ldots\ldots\ldots + B^2C^{P-3} + BC^{P-2} + C^{P-1}\,)$$
$$B_2^P = f_S\,(C, A, P) = (\,A^{P-1} + A^{P-2}C + A^{P-3}C^2 + \ldots\ldots\ldots + A^2C^{P-3} + AC^{P-2} + C^{P-1}\,)$$
$$C_2^P = f_A\,(A, B, P) = (\,A^{P-1} - A^{P-2}B + A^{P-3}B^2 - \ldots\ldots\ldots + A^2B^{P-3} - AB^{P-2} + B^{P-1}\,)$$

<u>Presentations of D</u>

$$A + B - C = P\,A_1\,B_1\,C_1\,K = \frac{(A + B) - (C - B) - (C - A)}{2} = \frac{A_1^P + B_1^P - C_1^P}{-2}$$

$$A + B - C = A - A_1^P = A_1(A_2 - A_1^{P-1}) = B - B_1^P = B_1(B_2 - B_1^{P-1}) = C_1^P - C = C_1(C_1^{P-1} - C)$$

-C- References and Suggested Reading



George Gamow, “One Two Three, Infinity”, 1959
A plain look at the outer-universe, the inner-universe, the expansion of space time, and infinity. Out-of-print, for quite a few years now, good luck finding a copy.

Mathematicians thru history whose work is foundational to this exposition.
Wikipedia Links:

Diophantus

Euclid

Pythagoras of Samos

Al-Khwarizmi

Pierre Fermat

Blaise Pascal

Leonard Euler

Sophie Germain

-D- For the near future, I may be contacted by email at: D.Ross.Randolph345@Gmail.com Feel free to establish contact.

-E- Epilogue

David Hilbert, esteemed mathematician quote:
“*A mathematical theory is not to be considered complete, until you have made it so clear that you can explain it to the first man whom you meet on the street*.”

The above quote, capsulizes my fundamental presentation style in this mathematical exposition. Keeping the connection to our reality intact, while analyzing high difficulty abstract reasoning problems, I feel is a necessary aspect of the design of our consciousness, and without we falter.

My thoughts wander far and wide in diverse areas of existence and transcendendant states, so limiting the epilogue to key focused aspects is a bit of a throttling back of my natural desire to expostulate without bounds, but I will none-the-less reign in my tendencies, in this final portion of this document.

This work of mathematical art has consumed many hours of the last 17 months, although I had been dabbling with the Fermat equation for the better part of 40 years when I was idle, and wished for a way to keep my mind focused away from some stressful situation, I had not really thought it possible to find a solution. When some 17 months ago I felt it would perhaps be possible to find a solution, I purchased several notebooks, which I used to record various methods/approaches to proving the theory. However each time I felt a method would lead to a solid proof, and I recorded it on the computer, I would find a month or so later a flaw in the proof. This paper, is the result of perhaps 10 prior proof papers I had written, with various flaws in them. Eventually I determined and then decided that an iterative proof would be necessary, to solve this highly symmetrical and quizzical equation.

The SGC1 problem, continued to plague me, many months after finding a solid iterative algebraic solution to SGC2.

Just recently tonite May 21st, 2024, I replaced the flawed Geometric proof attempt for SGC1 with an iterative proof, in some respects similar to the SGC2 proof from several months ago.

Some interesting musings, regarding SGC1 have earned the right to be included in this epilogue, such as:

The most beautiful method to algebraically solve it, using the Symmetrical Form, would approach from the following perspective:

$A_1 + B_1 + C_1 = 0 \text{ Mod } PA_1B_1C_1$ (*easily proven*)
This can then thru a complex algebraic analysis lead to; $A_1 + B_1 + C_1 = 0$
From here another complex algebraic analysis may lead to a solution to FLT for SGC1.

I had about 2 pages of badly written notes, regarding the first giant step, and some mental notes how to transition to the final proof, however as I attempted to transcribe from my notebook the lemma for $A_1 + B_1 + C_1 = 0$, I found myself unable to really comprehend my notes, there was insufficient detail in the notes, I spent a few hours, and went to sleep, and to work as an engineer the next day, with a viewpoint that I would resurrect the complicated lemma in the next 30 days or so.

And most recently within the last week, I had worked on another complex algebraic SGC1 approach vector, derived from the MDDG musings I had been focusing on, I came to a stand-still when attempting to prove the following point in the overall proof:

$$2^{P-1} - 1 = 0 \text{ Mod } 3P \neq 0 \text{ Mod } 3P^2$$

I believe that the above formula is proved to be correct, by a proof to FLT, I was trying to do the reverse of course. In my email to myself, I referred to this equation as a "pivot point" in the proof. I showed it to be true for cases 5, 7, 11, 13. I did not test for higher value prime exponents. Note, in the case P = 3, not really true since 3P = 9 and $2^{P-1} - 1 = 3$. P=3 is a special origin case. And of course for P = 2, the equation is nonsensical, almost like a Lewis Carrol analysis, from the famous highly imaginative author and mathematician.

And now for the metaphysical "Icing on the Cake" a cold, stark look at the ABC (*Art Beal Conjecture*) on the Generalized proof of Fermat's Last Equation.

This problem revolves around the concept, that if we take the exponent P, and instead use 3 different exponents for the variables A, B and C we have an equation which presents itself very similar to Fermat's famous one:

$$A^X + B^Y + C^Z = 0 \qquad \text{(\textit{assuming C is negative})}$$

Similar basic rules apply, non-trivial proof, and exponents X, Y and Z must be greater than or equal to 3.

The funky part of this is that there is in May 2024 a $\$1 \times 10^6$ USD monetary award associated with proving this simple equation has no solutions. Apparently a daunting task, many have tried, many have failed. To prove it you will need to be published in an academically peer reviewed document, and your academic peers need to be satisfied with your million dollar proof. Should this be the case you may be awarded the $1M USD by the American Mathematical Society (www.ams.org). There have been plenty of academic papers published with exceedingly complex and droll presentations, I pity the poor academic peers who find it necessary to review these papers, prior to awarding a cool million dollars to the prospective, somewhat insane mathematicians who write these papers. On my own part as a quixotic engineer with a penchant for non-conventional solutions to convoluted engineering problems I hold no such limitations as feeling the need to get published in a highbrow peer reviewed publication, which no one really wants to read anyway! Hehehehe (*laugh out loud to yourself here*)

OK, maybe too much color and floweriness of presentation, I apologize to you highly educated, upper class mathematicians, please excuse me, just adding a bit of humor.

Ah this end proofs really abstract, so maybe no one besides myself will understand it anyway, as it introduces sets of numbers which are *existant* and *non-existant*. While I worked this out about 3 weeks ago, I had a lot of mental imagery which will be tough to convey with words, anyway I try to keep up with my feeble and ephemeral presentation attempt.

White space, drifting in the clouds.

We will approach this problem from a point of view that there is a universe with many solutions or maybe just one non-trivial solution to the ABC. And in this universe we find an Existent set of integers for which the ABC can be shown to be true.

Now suppose we start using some algebra which works the same way in this other math universe as it does in our own plain and orderly universe. Bear in mind that in our own math universe the set of non-trivial numeric solutions to FLT is non-existant.

$A^P + B^P + C^P$ multiplied by $(A^{P-X} + B^{P-Y} + C^{P-Z})$ - (Cross Products) would be equal to $A_0^X + B_0^Y + C_0^Z = 0$
non-existant *existant* *questioning the existance*

Note, I have introduced a new word and spelling as ***existant****, and it's usage is related to Diophantine set theory.*

The middle term in this conglomeration of sets and formulas can be shown to exist for any values of the *non-existant* FLT numeric set combined with the *questionable existance* ABC numeric set.

So in simplified terms, we may present as follows:

non-existant Integer set LOGICAL AND *existant Integer set* LOGICAL EQUALS *non-existant Integer set*

This concludes the abstract proof of the ABC.

For the math purist:
One of the purist aspects, is that there can never be a singularity solution of a highly symmetrical Diophantine equation, and this helps to clarify the logic and reasoning in the above proof. We would need to consider that there would be an infinite number of FLT solutions and an infinite number of ABC solutions, and that the central existant term in the equation has great flexibility to match up the two ends of the analytical presentation which are shown to be non-existant. And this simple idea of an infinite number of solutions, should there be a solution to FLT, drives the analytical engine of the proof. You may understand it yourself, but ask yourself this: "W*ould any credentialed and accredited reviewer accept the ephemeral logic?*"

OK, if you take 30 seconds and realize $A_0 \neq A$, and similar logic for B and C, it's easy to see a logic flaw, given our earthly intelligence boundaries. So let's consider a less abstruse pathway to the ABC which I feel is perhaps the shortest possible proof.

First realize this would be 4 separate proofs, FLT is one, then if X ≠ Y ≠ Z would be another, then two other proofs for if X = Y ≠ Z, and another for X ≠ Y = Z. The last one has symmetry of course to prove X ≠ Z = Y. The proof for the case X ≠ Y ≠ Z is breadcrumbed below:

STEP 1-
Prove thru major extensions to Fermat's Little theorem that if $A^X + B^Y - C^Z = 0$, that it must also be true the $A + B – C = 0$. Quite a few pages to do this, but it's a shortcut method compared to a previous method I had been delving into for the last few months.

STEP 2-
Show thru some *simpler** algebra that A, B and C can not be coprime. This step is pretty easy, if you give it a little thought, for 15 minutes.

* Simpler, compared to step 1.

For the other two mid-cases, partial factoring of the equation is possible, however this will not make the solutions for these cases any easier to reach.

If the above AB Conjecture approach appears nonsensical in a fundamental way, then it probably is impractical to approach the AB Conjecture in any mathematically meaningful way. Very preliminary after all.