Fermat The Last: The Final Proof

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Abstract

After understanding that there is a simple Modular Algebra that can help in understanding Power Problems, and the fact that the FLT can be presented onto the Cartesian Plane via a Symmetric Condition lead to a special construction, 2 methods of proof will be presented:

1) A solving method via equations, can work for any n but of course can be proved solving by radicals the equations till the case $n = 6$, and numerically further on (tha is not elegant at all), but it shows, intuitively, the reason why any case $n > 2$ produce the same known result: no integer triplets can be found.

The aim of this work is to present in another following article another

2) Smarter method based onto my Complicate Modular Algebra (can be already seen onto the picture of the previous proof) proving all the case $n > 3$ simply looking to the properties of the constuction, shown by the involved Sums.

Preface:

Point.1: A new way to understand if a Number P is a Power of an Integer p

Before entering into the proof it is necessary to take a look to what I used to recognise Powers from Numbers:

what I call the Complicate Modulus Algebra, or CMA.

The basic concerning comes from long time ago, the fact that given a integer $P = p^2$ then it is a Square of an Integer p, IF and only IF:

$$P = p^2 = 1 + 3 + 5 + ... + 2p - 1$$

So we can write the Squares of the Integers $(n = 2)$ as:

$$p^2 = \sum_{X=1}^{p} (2X - 1)$$

So in the CMA modular point of view:

if and only if P is the square of $p \in \mathbb{N}$, then we can represent it via a Sum of p Odds, plus *Zero* Rest.

Then we can generalize the concept to all $n - th$ Power of Integers, using the Telescoping Sum Property where I use X instead of i for a good reason you will see hereafter:

$$p^n = \sum_{X=1}^{p} (X^n - (X - 1)^n)$$

Where I've called: $M_{n,X} = (X^n - (X - 1)^n)$ the Complicate Modulus since this function exactly cut numbers are Powers of Integers with Rest Zero.

ON the folowing picture is immediately clear that the slice's thickness Linearly Rise for $n = 2$ just, following the function we call the Compliacte Modulus for Squares: $M_2 = (2X - 1)$

As example, in the following picture How to Cut the Salami of Length $P \in \mathbb{N}$ in the case we take the Complicate Modulus for Square, so $M_2 = (2X - 1)$. Where more in general p is the Integer Root of the Generic Number P we are studying. Or, using the known *Floor* operator:

$$p = \lfloor (P^{1/n}) \rfloor$$

Complicate Modulus Algebra

Case n=2 $\rightarrow$ Complicate Modulus M_2= (2X-1)

a) **P**= Perfect Square
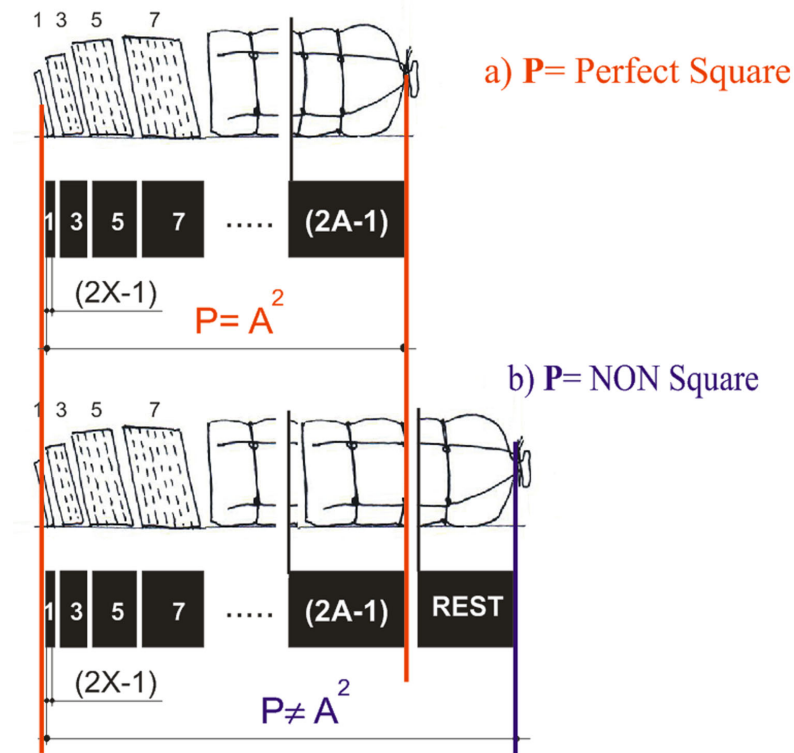
$$P= A^2$$

b) **P**= NON Square

$$P \neq A^2$$

Figure 1: How to recognise a Square of an Integer $P = A^2$ from a Non Square of an Integer $P \neq A^2$ where Rest must be in this case lower than $2A + 1$. Pls ref. to my Vol.1 for more details. $-A-$ take the place of $-p-$ from now due to old choices will be taken by Fermat.

We can see we can distinguish 2 case:

a) P is a perfect Square, so we have No Rest, but iff

b) P is not a perfect Square, than we have a Rest.

This is a very simple modular concept where the Modulus is not just a Number but a known function will be very usefull as sson as we proceed in studying it's properties, expecially because the aim of the enteir work and proof is to NOT use the Abstract Algebra so the very difficoult Abstract Math language of Fields, Rings etc... (of course one know this concept can apply them arriving at the same results).

For more details I've produced a Vol.1 (link at the end) with all you need to understand more on this easy concept.

Point.2: Complicate Modulus Algebra on the Cartesian Plane:

We need now to tap a forgotten gap between Sum and Calculus, and to be short for expert readers:

Fixed an Abscissa $X = A$, it's Ordinate on the Parabola $Y = X^2$, it's equal, from the known Calculus, to the area of it's 1srt derivative, $Y' = 2X$ till $X = A$:
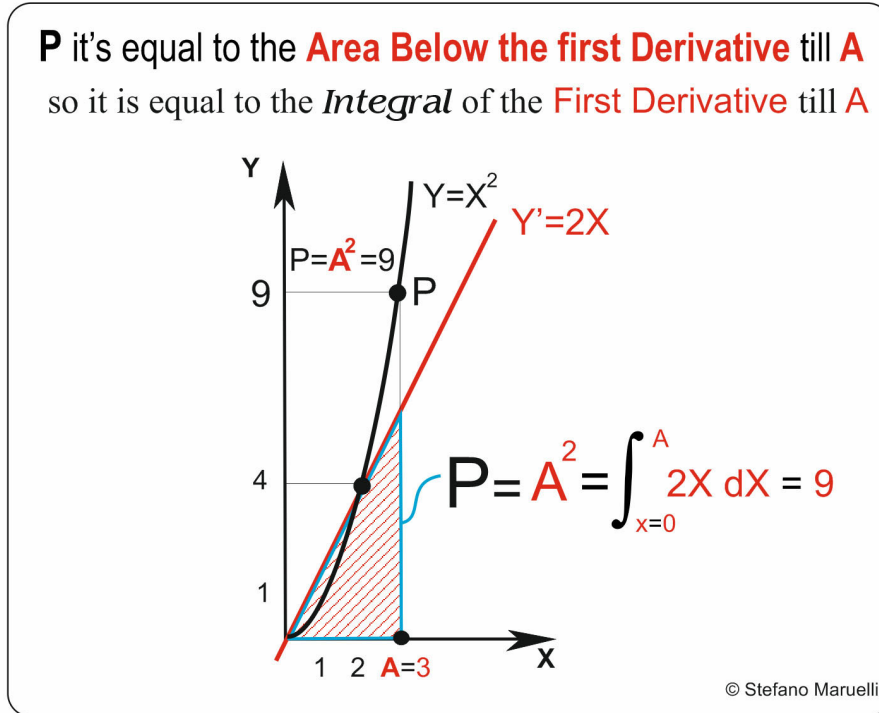

Figure 2: Known Calculus returning the value of Area below the 1st Derivative till an Integer A, it's equal to A^2

In a similar way the Telescoping Sum property, as seen in the most simple example for Square,

via the Complicate Modulus $M_2 = (2X-1)$ produce the Odd Numbers $(1, 3, 5, 7..., 2i-1)$ that can be represented on a Cartesian Plane in the form of **Rectangular Areas** called from now **Gnomons** defined, till a more general definition will be given in the next chapters, by:

$$\textbf{Base}=1 \text{ (fixed value)} : \textbf{Height}= M_2 = (2X - 1)$$

Where the i-th Gnomon's height is $M_{2,i} = (2i - 1)$.

A new reference line, produced by the function $Y = M_{n,X}$ will be usefull to be presented as the 1st integer Derivative.

Representing the Gnomons on the Cartesian plane, and showing how they're connected to the Area of the Derivative of $Y = X^n$ (for example) I need to change the Label's Index, from i to X since i becomes, as told, the i-esim Gnomon we are talking of:

$$A^2 = \sum_{X=1}^{A} (2X - 1)$$

I'll use the uppercase A from now on, since this work started in this way in 2008, from the Fermat's A, B, C letters, of his most famous equation.

Here on the graph you can see how the Gnomons *square* the Linear 1st Derivative $Y' = 2X$, and what I call from now on: the Integer Derivative Function
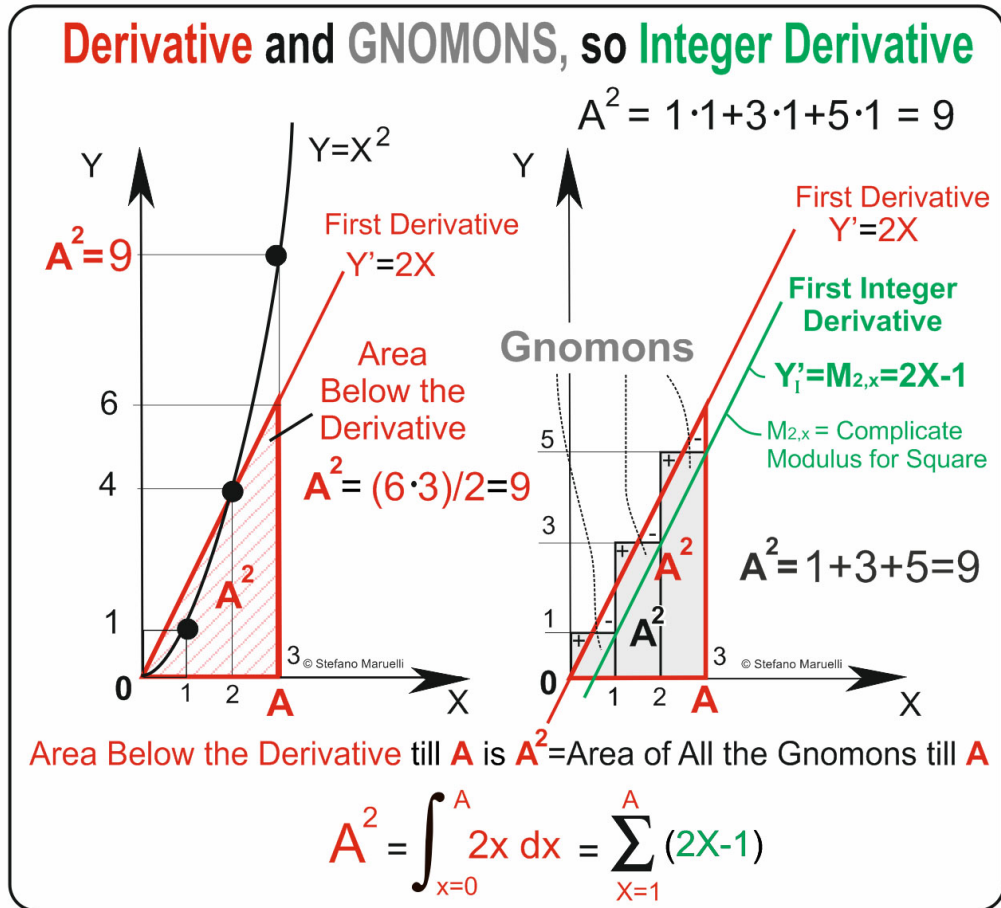

Figure 3: Gnomons squaring the 1st, or following, Derivatives, means they represent the same Area between Same Limits

Here the example of how a power $Y = X^3$, can be represented squaring its derivative $Y' = 3X^2$ via Gnomons (Red Columns width=1), following what I call Complicate Modulus Height (Black Lines):
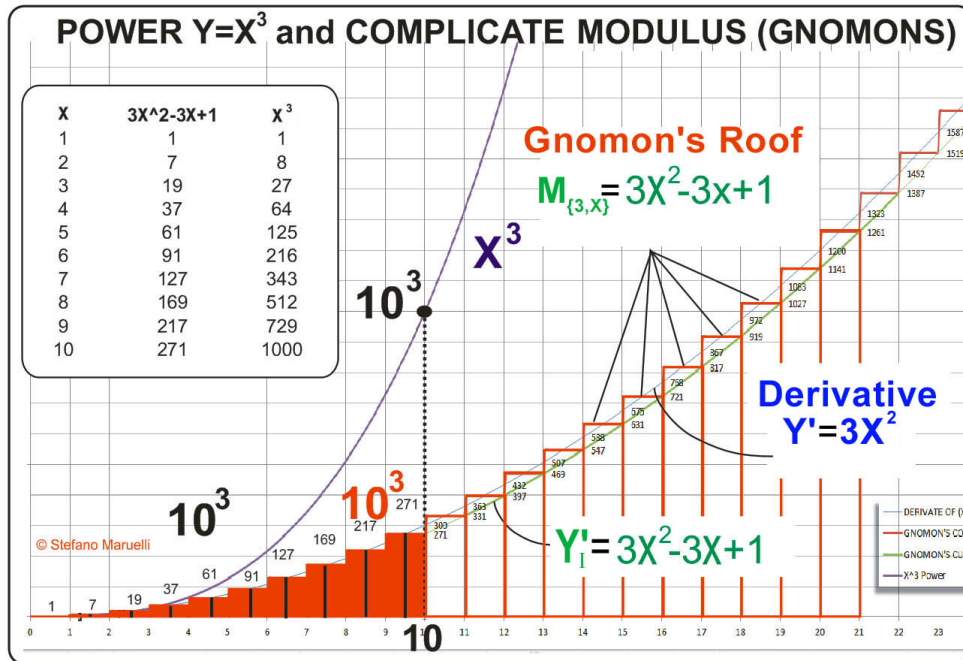

Figure 4: Gnomons squaring the 1st, derivative of $Y = X^3$ thanks to the Telescoping Sum Property.

This characterization of the Prabolas (also of higher degree in the same way) is the key of all my work.

It is clear that the 1st Integer derivative is not other than the Complicate Moduls Function, for Integer Gnomons Step, $Base = 1$, but we immediately generalize the concept for Rational Bases too.

All this will not require proof for expert readers, but I of course give them onto my Vol.1.

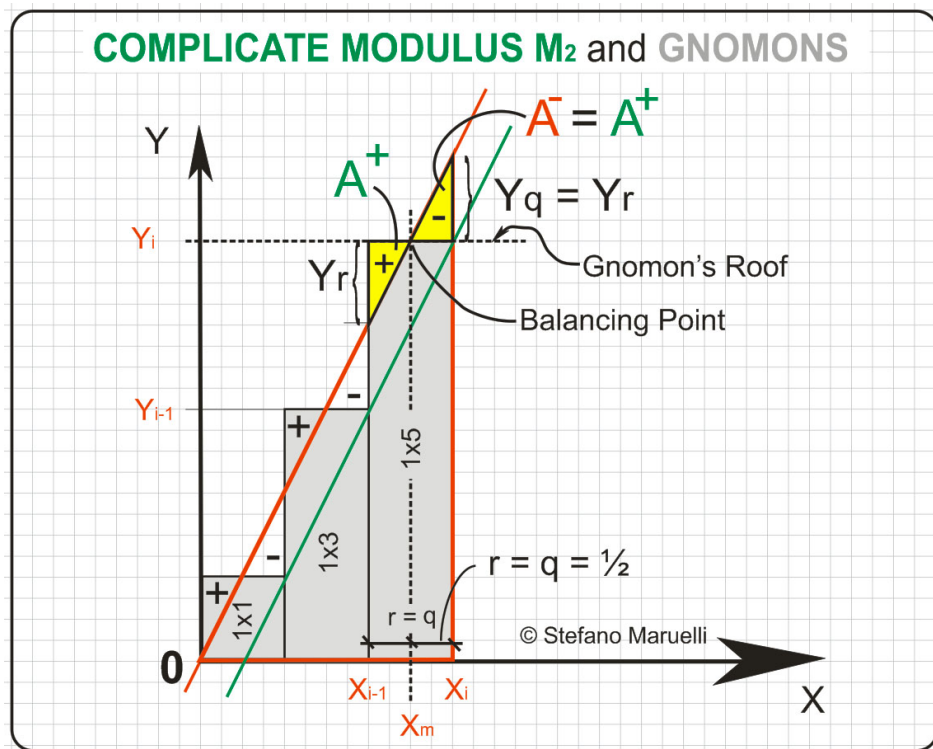## Point 3: Telescoping Sum and the Balancing Point BP

Figure 5: Below the 1st Linear Derivative the Balancing Point BP is exactly in the Middle of any Gnomon, so at a Rational Abscissa $X_{m,i} \in \mathbb{Q} - \mathbb{N}$ if we choose 1 as Base, so as the Integration Step

For $n = 2$ the 1st Derivative is linear, so it's clear what happens:

- it cuts the Roof of the rectangular Gnomons exactly in the middle,

so we have that for each Gnomon: $r = q$ and $Y_r = Y_q$

So the Exceeding area $\mathbb{A}^+$ is exactly equal to the missing Area $\mathbb{A}^-$, not just in value, but also in shape (triangular), so they have both the same Base, here $1/2$ and the same Height, here equal to $Y_r = Y_q = 1$.

It's also clear that the Gnomon's Roof Height is given by the $2X_i - 1$ formula is always an integer Value, for each Integer X_i,

Calling: **Balancing Point** the intersection between the 1st Derivative and the Gnomon's Roof. It has coordinate: (X_{m_i}, Y_i) where, if $X_i - X_{i-1} = 1$:

$$X_{m,i} = \frac{(X_i + X_{i-1})}{2} \implies X_{m,i} \in \mathbb{Q} - \mathbb{N}$$

The fact the the Medium Point $X_{m,i}$ it's equal to the Balancing Point BP is due to the Linear First Derivative.

This is no longer true for $n > 2$, and that is the key we will show will prove the FLT.

But since all what I wrote till now is based on the Telescoping Sum Property, that can be seen as the property of the Curves of the type $Y' = nX^{n-1}$ to be squared by Rectangular Gnomons, so having a certain Point, I've called the Balancing Point BP, that lies on the 1st derivative, and is the one for what:

The Missing Left (Red) Area ($\mathbb{A}^-$) will equate the Exceeding one ($\mathbb{A}^+$).

And of course this comes from an Integral equation compare the two Areas: $\mathbb{A}^+ = \mathbb{A}^-$ I'll show hereafter.

We first start to calculate the Abscissa X_m that satisfy this condition, then we must now discover who is the **Balancing Point** BP , to prove it has Always Irrational Abscissa $X_{m,i}$ if we have a Curved First Derivative, so if $n > 2$.

We aready know now that the Height $Y_{m,i}$ is the Integer (for now) Height of our Gnomons, so it is: $Y_{m,i} = M_{n,x_i}$ that is, for example in the case $n = 3$ equal to:

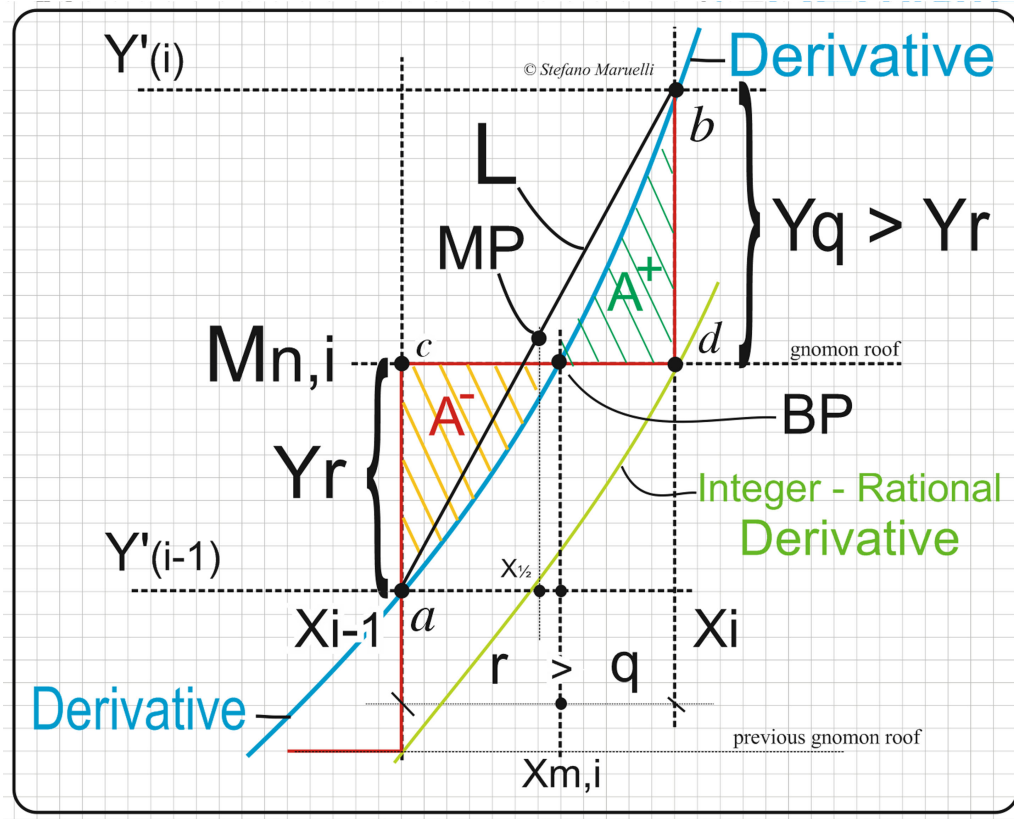$$Y_{3,i} = M_{3,i} = (3X^2 - 3X + 1)_{X=i} = 3X_i^2 - 3X_i + 1$$

Figure 6: Where the Balancing Point is onto a Curved 1st derivative

How to calculate $X_{m,i}$:

To calculate $X_{m,i}$ we have to write and solve the equation: $\mathbb{A}^+ = \mathbb{A}^-$ and we can distinguish in two case: $n = 2$ so when the First Integer derivative $y' = 2X - 1$ is linear, and $n > 2$, so when the First Integer Derivative $Y'_I = (X^n - (X-1)^n)$ is a Curve.

Except for $n = 2$ the 1st Derivative is a curve, so we need to use the Integral to solve the Balancing Equation:

$$\mathbb{A}^+ = \mathbb{A}^-$$

That becomes in general:

$$(X_{m,i} - X_{i-1}) * y_{m_i} - \int_{x_{i-1}}^{x_{m,i}} nx^{n-1} = \int_{x_{m,i}}^{x_i} nx^{n-1} - (x_i - x_{m,i}) * y_{m_i}$$

Still if we know how to solve it, we need to make many other concerning on our

Complicate Modulus Algebra, before prove that $X_{m,i}$ it's always an Irrational if $n > 2$ and that will be the goal of this first part of this paper.

After that we will have all the knowledge necessary to try to prove more complicate problems involving Power's of Integers, like Fermat the Last, but also Euler and Beal too (I've called the Power Problems).

We note that for $n > 2$ due to the Curved derivative, must be $X_m \neq \frac{X_{i-1}+X_i}{2}$ so must be $r > q$.

And to prove $X_{m,i}$ is always an Irrational if $n > 2$ I'll follow 2 ways, both will look in how BP is geometrically fixed.

- the first one involve simple concerning on the relative position of BP respect to known things: the Medium (or Center) Point MP,

- the second one will show that we can pack $X_{m,i}$ between Two Following Integers, and then Between Two Following Rationals depending by the factor $1/K$, and then we can continuously rise K ab infinitum, so we can push the divisor $K \to \infty$ in what is known as Limit,

and just at that point we will rise $X_{m,i}$, therefor it is an Irrational by Dedekind definition. But to do that we need to show how we can play with Rational Gnomons, and this will require a new Chapters hereafter.

This process is known as Dedekind Cut. It sound strange, but I will prove it.

For now what we can immediately see is that:

- due to the Telescoping Sum Property, without making other concerning than the one involving Integer Numbers and Proportional Areas, for any Parabolas $Y = aX^n$ in any Derivative (also the following) the Exceeding Area $\mathbb{A}^+$ will equate the Missing one $\mathbb{A}^-$, ,

- But once we ask how much the value of such areas is the only way, for $n > 2$ to calculate them is to go infinitesimal and make the integral as I'll prove soon, but just after hacking the Sum Operator to let it works with Rational Step too.

Point 4: The Step Sum or how forcing the Sum operator to work with a Scaled Rational Index
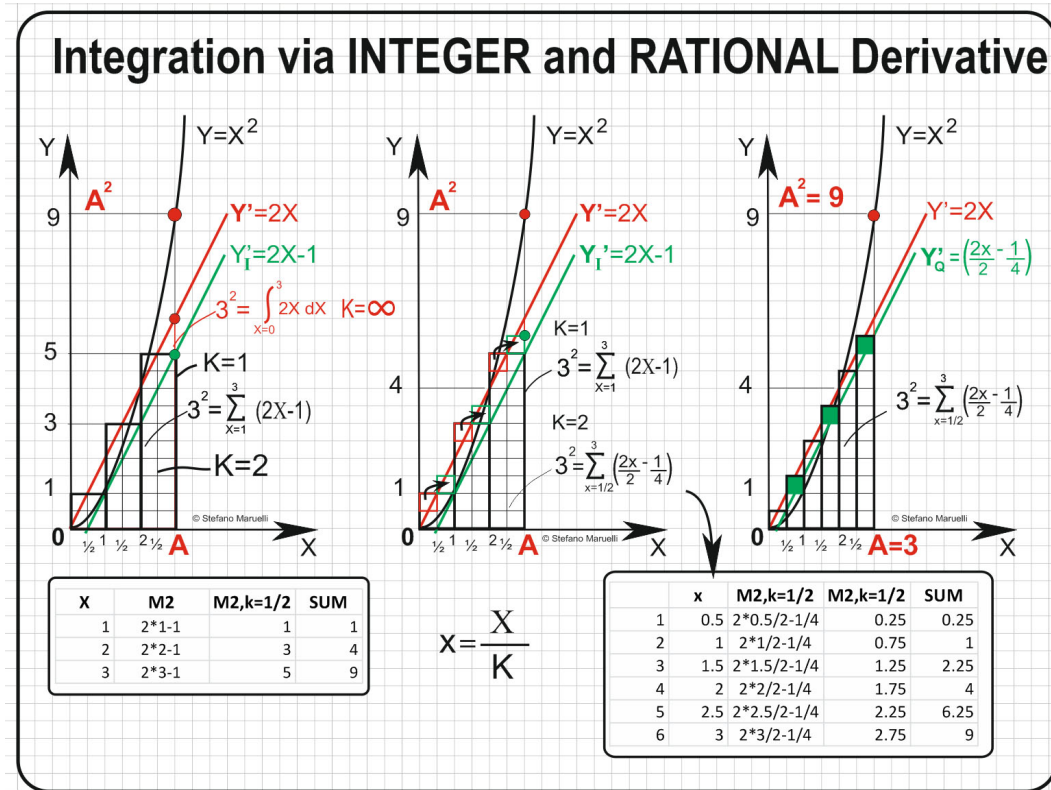

Figure 7: The telescoping Sum property allow one to Use or Cut the Base of the Gnomons respecting just the condition that it must rise the Upper Limit we have, via a finite Number of Step, if we use a finite Sum, or as we will see after, the Integral, if we will push its division to the Limit moving Step=dx

Since we need to prove what in the previous chapters I've called the "Infinite Descent" trough the Convergent Series it's time to *hack* the Sum Operator. And this will be the MAIN POINT of All This WORK.

Is known it is possible to indicate bellow the Sum operator not just a rising Index i equal to an integer, but also an Index i selected by a Function that define just some Special Value that has to be Summed. Most common is the choice of Prime Number only, or just Odd or Even, etc... But always i was considered to be an Integer mute variable just.

And this was a Big Mistake because lie us blind for several hundred years.

what is known is that the $Step = 1$ is the integer difference between two following Integers i and $i + 1$ for example having $Index = 1$, so it is:

$$Step = (i+1) - (i) = 1$$

But it's well known, for example, that is possible to Sum Odds just, or Primes just, or any other value defined by a pre-defined Function it will select Integer Index values $i \in \mathbb{N}$ just. So the value of the Step can be no longer equal to the Index is just an integer Number indicate where the pointer is, from Lower to Upper Limit.

Moreover it's possible, under the conditions will follows, in the special case the Telescoping Sums Property holds true, so for example in case of Parables, so in the case the result of the Sum is $Y = X^n$. We will take for example the Sum:

$$A^2 = \sum_{X=1}^{A} (2X - 1); A \in \mathbb{N}^+$$

I start with the most simple case: $Step = $ Rational Step $= 1/K$ with $K \in \mathbb{N}^+$

Remembering we want to hold the same result A^2 just unsing a more fine Step Sum, having Step $1/K$, now we can introduce a Scale Factor $1/K^2$ and a Multiplier K^2, so we divide all the terms of our Sum by K^2 , but remembering that since we wanna left Unchanged the Result, for the known Sum's Rules we have to multiply by K^2, that is equal to multiply the Upper Limit by K too, so we have:

$$A^2 = \frac{A^2}{K^2} * K^2 = \sum_{X=1}^{A*K} \left(\frac{2X}{K^2} - \frac{1}{K^2} \right)$$

Pls see the Appendix.1 of my Vol.1 to see the collection of Known Sum properties to refresh some of their properties, if necessary.

Now, pls be open mind, and remember what is often done to solve some integral: we make an exchange of variable, so I'll call: $x = X/K$, so changing X with $X = x * K$, if we respect the following conditions:

a) if and only if $a = A/K \in \mathbb{Q}$ so if K perfectly divide the Upper Limit A (since we have to stop there indipendently by the number of Step we did).

- the Upper Limit $A * K$ becomes: $(A/K) * K = A$ (with $K \in \mathbb{N}^+$)

- the Lower Limit $X = 1$ becomes: $x = 1/K$ (a Rational for now) so:

$$A^2 = \sum_{x=1/K}^{(A/K)*K} \left(\frac{2(x * K)}{K^2} - \frac{1}{K^2} \right)$$

Now we can simplify to have our new Step Sum, that moves of a quantity depends on the original Integer Index $X = 1, 2, 3, 4....$ but of a new scaled value x we call Step is $1/K$,

so the Step Sum starts from $1/K$ and moves to the Upper Limit A Step $x = \frac{1}{K}, \frac{2}{K}, \frac{2}{K}, ...\frac{2}{K}, ...A$, that is now allowed to be $A = P/K$ so $A \in \mathbb{Q}^+$:

$$A^2 = \sum_{x=1/K}^{A} \left(\frac{2x}{K} - \frac{1}{K^2} \right)$$

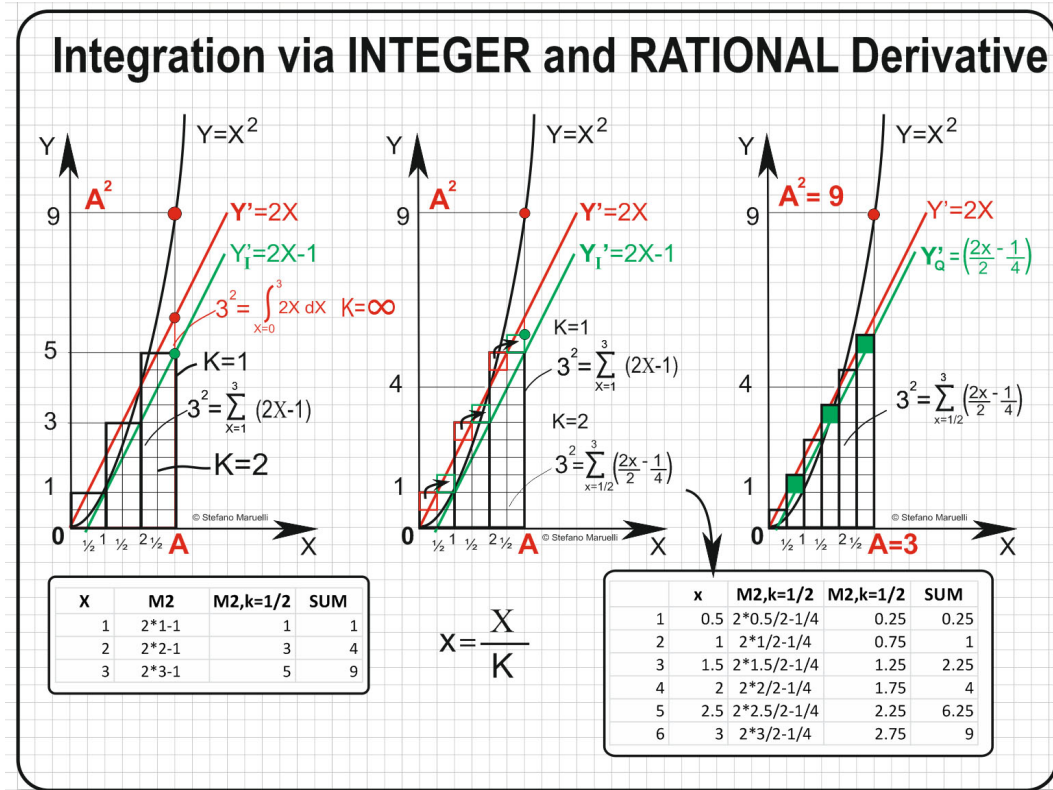He we start with: $A \in \mathbb{N}$ but we can now also use $A = P/K \in \mathbb{Q}$

Figure 8: From this picture I hope it's clear what happens: we are just scaling the abscissa ($K = 2$ in that case), so we divide in 2 Each Base of Each Gnomon and, as consequence, we have to modify each Height respecting the rule: Missing Area equal to the Exceeding one, Living the Result of the Sum Unchanged.

It's intuitive for $n = 2$ since the Linear derivative $Y' = 2X$ helps us to see that for each Gnomon one Red Square $(1/2 * 1/2)$ has to jump right-up on the new, next, Gnomon we created (so from Red it becomes Green).

In this way we preserve the linear Rule of the derivative and of the Integer Derivative, that the following Gnomon has to have an height that is 2 Units bigger than the previous one.

Regardless the Unit we take: $1/2$ as shown here, $1/10$ or $1/10^m$ or in general $1/K^m$ with $K, m \in \mathbb{N}$ for the moment, we always perfectly square the 1st Derivative $Y = 2X$ till a Rational Upper Limit is $A = P/K^m$. Of course we can't square, for the moment, an area is π^2.

Due to Telescping Sum Property all this works also for bigger n, so if we take, as example the case n=3:

$M_n = [X^n - (X - 1)^n]$ becomes: $M_3 = (3X^2 - 3X + 1)$

$$A^3 = \sum_{X=1}^{A} (3X^2 - 3X + 1)$$

Again now we can divide all the terms of our Sum by K^3 , remembering that if we want to left unchanged the result, we have to multiply the Upper limit by K so we have:

$$A^3 = \frac{A^3}{K^3} * K^3 = \sum_{X=1}^{A*K} \left(\frac{3X^2}{K^3} - \frac{3X}{K^3} + \frac{1}{K^3} \right)$$

Now we can call: $x = X/K$, so changing X with $X = x * K$, if we respect the following conditions:

a) if and only if K is a Factor of A, or perfectly divide A

- the Upper limit becomes: $(A/K) * K = A$ (with $K, A \in N^+$)

- the Lower Limit $X = 1$ becomes $x = 1/K$ so:

$$A^3 = \sum_{x=1/K}^{A} \left(\frac{3(x * K)^2}{K^3} - \frac{(x * K)}{K^3} + \frac{1}{K^3} \right)$$

Now we can simplify to have our new Step Sum, that moves Step $1/K$ from $1/K$ to $A = P/K$, so the new Index x will be $x = 1/K, 2/K, 3/K....A$:

$$A^3 = \sum_{x=1/K}^{A} \left(\frac{3x^2}{K} - \frac{3x}{K^2} + \frac{1}{K^3} \right)$$

What is interesting is that K can be any Integer, but not just, as we will see in the next chapters.

Talking for the moment of Integer K it's for so clear that it can be, for example, equal to : $K = k^m$

Example of a Step Sum step 1/10, for a Cube		
A=3	k=10	A^3 = 27
x	M3/k=3x^2/k-3x/k^2+1/k^3	SUM
0.1	0.001	0.001
0.2	0.007	0.008
0.3	0.019	0.027
0.4	0.037	0.064
0.5	0.061	0.125
0.6	0.091	0.216
0.7	0.127	0.343
0.8	0.169	0.512
0.9	0.217	0.729
1	0.271	1
1.1	0.331	1.331
1.2	0.397	1.728
1.3	0.469	2.197
1.4	0.547	2.744
1.5	0.631	3.375
1.6	0.721	4.096
1.7	0.817	4.913
1.8	0.919	5.832
1.9	1.027	6.859
2	1.141	8
2.1	1.261	9.261
2.2	1.387	10.648
2.3	1.519	12.167
2.4	1.657	13.824
2.5	1.801	15.625
2.6	1.951	17.576
2.7	2.107	19.683
2.8	2.269	21.952
2.9	2.437	24.389
3	2.611	27

Figure 9: For those wanna see a table of number: the Cube of 3 calculated with a Step Sum, Step 1/10. From $x = 1/10$ to 3 we Sum 30 Gnomons $M_{3,K=10}$ calculate for each x.

The General RATIONAL Complicate Modulus (or Gnomon's height function) $M_{n,K}$ for all $n-th$ Power of Rational $A = P/K$ becomes:

$$M_{n,K} = \binom{n}{1}\frac{x^{n-1}}{K} - \binom{n}{2}\frac{x^{n-2}}{K^2} + \binom{n}{3}\frac{x^{n-3}}{K^3} - ... + / - \frac{1}{K^n}$$

So we have now a more useful instrument able to work with Rational, since I hope it's clear we with $K = 10$ we can now arrive to an Upper Limit is $0,5$ or $2,7$ or any other rational has 1 decimal digit, only. While if you need more digits, you need just to rise K to K^m with m bigger as you need.
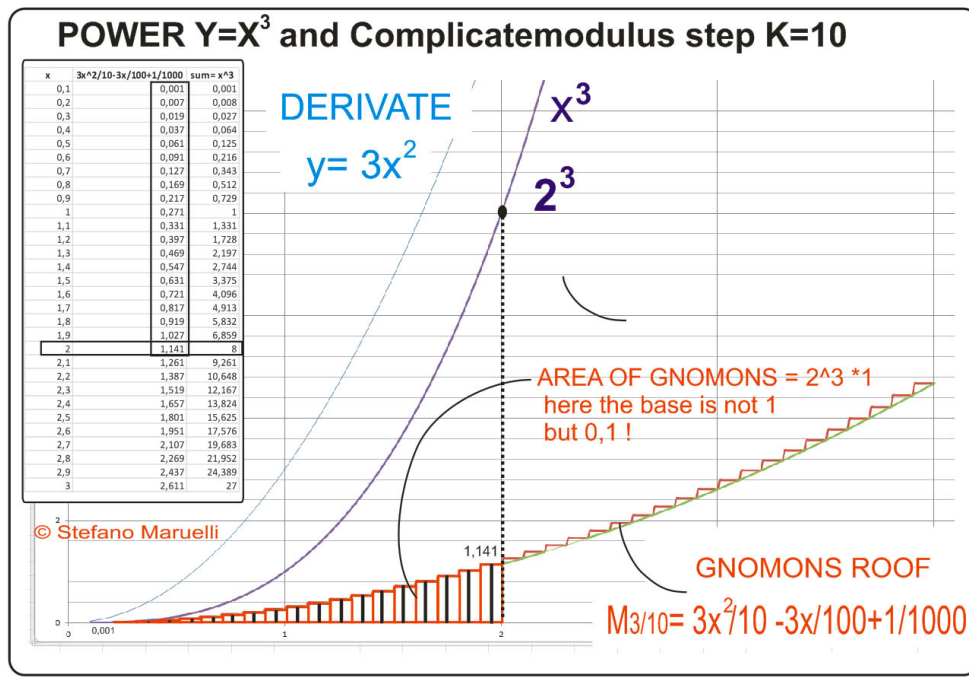
Figure 10: How to make the Cube of 2 with a Step Sum Step 0.1:

$2^3 = 8$ is equal to the sum of the Red Columns

Base $= 0.1$

and the **height** will be $M_{3,K=10}$

$M_{3,10} = 3x^2/10 - 3x/100 + 1/1000$

As we did for the Integers, we can now call the $y'_Q = M_{n,K}$ function: the **Rational Derivative** that works for any $x \in \mathbb{Q}$.

And this property will hold to the limit for $K \to \infty$ too as I will show hereafter.

Point 5: How to prove the Irrationality of $X_{m,i}$ if $n > 2$:

We have now all the basics to calculate $X_{m,i}$ avoding to solve the equation: $\mathbb{A}^+ = \mathbb{A}^-$.

We already know from previous chapters that we can distinguish two case: $n = 2$ so when the 1st Integer Derivative $Y' = 2X - 1$ is linear, and $n > 2$, so when the 1st Integer Derivative Function $Y' = (X^n - (X-1)^n)$ is a Curve.

Solving the Balancing Rule.

$$\mathbb{A}^+ = \mathbb{A}^-$$

is equal to solve the integral equation:

$$(X_{m,i} - X_{i-1}) * y_{m_i} - \int_{x_{i-1}}^{x_{m,i}} nx^{n-1} = \int_{x_{m,i}}^{x_i} nx^{n-1} - (x_i - x_{m,i}) * y_{m_i}$$

Still if we know how to solve it we cannot go so far, since we are not able to solve by radicals the equations of degree more than 5, (except using the graphics algo, or via numerical computation).

So to prove that $X_{m,i}$ it's always an Irrational if $n > 2$ we can summarize all the work we did till here:

We note immediately that for $n > 2$ due to the Curved derivative, must be:

$$X_{m,i} \neq X_{1/2} = \frac{X_{i-1} + X_i}{2}$$

so it must be $r \neq q$ and it is clear due to the Curvature of the 1st derivative is $r > q$ and I'll prove hereafter that is: $X_m \in \mathbb{R} - \mathbb{Q}$ without solving any equations, just due to how Gnomons, and $X_{m,i}$ are defined and built onto the curve.

Having in mind the picture above: we note immediately that for $n > 2$ due to the Curved derivative, must be:

$$X_{m,i} \neq \frac{X_{i-1} + X_i}{2}$$

so must be $r \neq q$ and we will prove $r > q$, and $X_{m,i} \in \mathbb{R} - \mathbb{Q}$ due to how Gnomons are build.

If $X_{i-1} \in \mathbb{Q}$ then $X_i \in \mathbb{Q}$ too because we built $X_i = X_{i-1} + 1/K$ for some $K = k^n \in \mathbb{N}$

For the scaling property we have seen in the previous chapters we can choose for example $K = k^n = 10^n$ with n as big as we want.

So for any n will be:

$\frac{1}{k^n} > \frac{1}{k^{n+1}}$ because it is clear that f.ex. $\frac{1}{10^n} > \frac{1}{10^{n+1}}$

thus rising n, so refining the Step Sum, it's clear that $X_{m,i}$ will be a value packed between Closer and Closer Two Following Rationals for what it is clear that:

$$X_{i-1/k^n} < X_{i-1/k^{n+1}}$$

So we can Rise the Lower Bound X_{i-1/k^n} moving it Right (foreword), while we can Lower the Upper Bound $X_{i,1/k^n}$ moving it backward:

$$X_{i,1/k^n} > X_{i,1/k^{n+1}}$$

and for so, since by definition is, for any $n > 2$:

$$X_{i-1/k^n} < X_{m,i} < X_{i,1/k^n}$$

So $X_{m,i}$ will be risen just via the Infinite Descente is known as Limit:

$$\lim_{n \to \infty} X_{i-1/k^n} = X_{m,i} = \lim_{n \to \infty} X_{i,1/k^n}$$

Thus for the Dedekind Cut Property $X_{m,i} \in \mathbb{R} - \mathbb{Q}$ so it is (for curved 1st Derivative, so from $n = 3$) always an Irrational Value.

And since there are many of them depending on the $n - th$ power we choose, and we can distinguish them, they form the Class of Irrationals defined by the equation $\mathbb{A}^+ = \mathbb{A}^-$ we will see it is not copatible, from $n = 3$ with Fermat's Cut that procuce another type of Irrationals.

While we have to remember that still if $X_{m,i} \in \mathbb{R} - \mathbb{Q}$ the Height of the Gnomon, for Rational divisions, is (in general):

$$(X_{m,i}^n - (X_{m,i} - 1)^n) = n X_{m,i}^{n-1} \in \mathbb{Q} = M_{n,K}$$

where I remember $M_{n,K}$ is, iff we fix $K \in \mathbb{N}$ a Rational too:

$$M_{n,K} = \binom{n}{1} \frac{x^{n-1}}{K} - \binom{n}{2} \frac{x^{n-2}}{K^2} + \binom{n}{3} \frac{x^{n-3}}{K^3} - ... + / - \frac{1}{K^n}$$

Fermat proof in the most elegant way will come understanding that Fermat's Cut will produce for $n > 2$ another type of Irraational, fells on an Abscissa $X_F \neq X_{m,i}$, but it will be a little long way to arrive there...

Point 6: From Step Sum to the Integral:

We enter now in the most interesting part of the Rational Calculus, what is known as the Finite Difference Analysis, passing from the Sum, to the Step Sum, to the Limit, showing that the Telescoping Sum property lead to the Integral, but in an interesting way:

we have no more, as in the Classic Riemann Integral an approximation of via via more close Areas, approximation, since talking of derivative of Parabolas we know we have an invariant: so don't care if we square the derivative with our Gnomons, or rational Gnomons, or via Integral: we always get the same value (under few simple conditions).

I'll aslo show that in a very similar way we can Bound some Irrationals between a Lower and an Upper Integer and then Rational Limits that becomes our Irrational Value just once we push the divisor $K \to \infty$.

From Step Sum to the Integral:

If we keep the Complicate Rational Modulus for Cubes: $M_{3,K} = \frac{3x^2}{K} - \frac{3x}{K^2} + \frac{1}{K^3}$

and we rise K the Area we are calculating (till an integer A) is always the same (A^n) and pushing $K \to \infty$, we have back the well know integral, as shown in this picture:
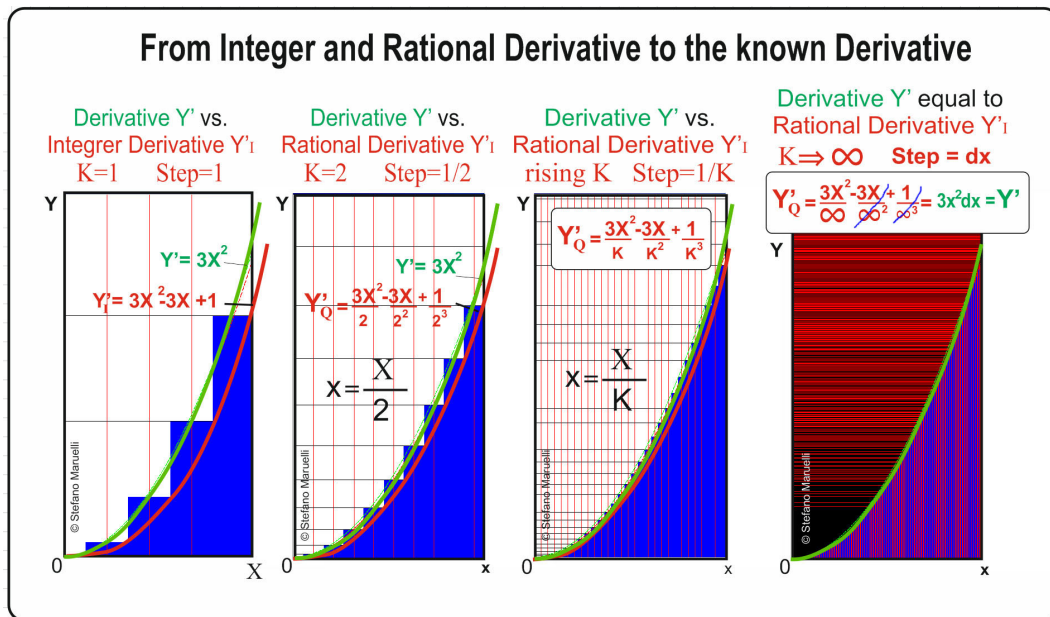

Figure 11: The contribution to the Sum of the Bigger Order of Infinitesimal is now proend to be exaclty *Zero* by this construction since the value of $A \in \mathbb{N}$, so of A^n is well known and Rest the Same independently from the K we choose.

The telescoping Sum Property assure us that Power's of Integers, so all the derivative of $Y = X^n$, can be perfectly squared with columns of any BASE, but as seen due to the fact that we can scale any picture as we want, we can also think to increase the number of Gnomons keeping a littlest base $1/K^m$ instead of 1 (or more under certain conditions), but we can also push $K \to \infty$ to move Step dx, so having back an integral, wothout changeing the result for squared the Area.

Starting from $A \in N^+$ we can write A^n as a Sum, or as a Step Sum or, at the Limit as Integral remembering the exchange of variable $x = X/K$ in each X dependent Term (in this way we cut by K^n the Sum of the terms), and in the Lower Limit (and in this way we multiply by K the number of index, what I call the Step balancing the reduction of the Terms, as shown in the first chapters), having:

$$A^n = \sum_{X=1}^{A} M_n = \sum_{x=\frac{1}{K}}^{A} M_{n,K} = \lim_{K \to \infty} \sum_{x=\frac{1}{K}}^{A} M_{n,K} = \int_0^A nx^{(n-1)}dx$$

Example for $n = 3$, putting $x = X/K$:

$$A^3 = \sum_{X=1}^{A}(3X^2 - 3X + 1) = \sum_{x=1/k}^{A}\left(\frac{3x^2}{K} - \frac{3x}{K^2} + \frac{1}{K^3}\right)$$

Or:

$$A^3 = \lim_{K \to \infty} \sum_{x=1/K}^{A}\left(\frac{3x^2}{K} - \frac{3x}{K^2} + \frac{1}{K^3}\right) = \int_0^A 3x^2 dx = A^3$$

It's easy to prove this Limit with the classic technique, but also note that we have a proof of the Transcendental Law of Homogeneity for $K \to \infty$ that, in this case: $3x/K^2$ and $1/K^3$ are vanishing quantities (are infinitesimal of bigger order) respect to the First Term $3x^2/K$ since it depends just on $f(x)/K$, that is our non vanishing quantity dx

Just to remember how Numbers are organized:
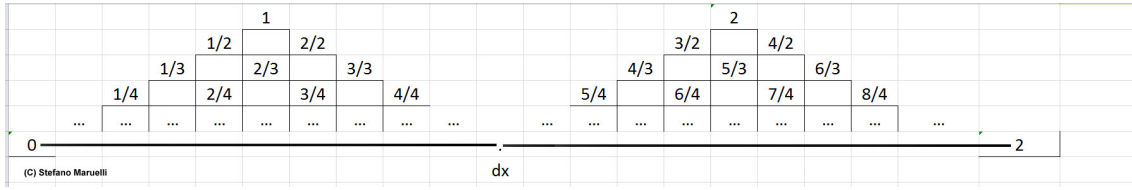
Point 7: Triangular Equality / Inequality:

If $A \in \mathbb{N}^*$ than we have the Triple (or Flat Triangular) Equality case so we can write A^n as :

$$A^n = \sum_{x=1}^{A} M_n = \sum_{x=1/K}^{A} M_{n,K} = \lim_{K \to \infty} \sum_{x=1/K}^{A} M_{n,K} = \int_0^A nx^{n-1} dx$$

It follows that:

If and only If we are working with a Power of an Integer, the result of the Sum / Step Sum / Integral, it is independent from the K we choose:

While remembering that:

$$M_{n,K} = \binom{n}{1}\frac{x^{n-1}}{K} - \binom{n}{2}\frac{x^{n-2}}{K^2} + \binom{n}{3}\frac{x^{n-3}}{K^3} + ... + / - \frac{1}{K^n}$$

If we choose: $A_{\mathbb{Q}} \in \mathbb{Q} - \mathbb{N}$: so if $A = P/K$ with $K > 1$ than we can write A^n just as:

$$A_{\mathbb{Q}}^n = \sum_{x=1/K}^{A_{\mathbb{Q}-\mathbb{N}}} M_{n,K} = \lim_{K \to \infty} \sum_{x=1/K}^{A_{\mathbb{Q}}} M_{n,K} = \int_0^{A_{\mathbb{Q}}} nx^{n-1} dx$$

If $A_{\mathbb{R}} \in \mathbb{R} - \mathbb{Q}$ with $A=$ Irrational, than we can, in general, write $A_{\mathbb{R}}^n$ as:

$$A_{\mathbb{R}}^n = \lim_{K \to \infty} \sum_{x=1/K}^{A_{\mathbb{R}}} M_{n,K} = \int_0^{A_{\mathbb{R}}} nx^{n-1} dx$$

Pls see next Chapt because if the Irrationality of A depends on a known factor there is another equality we will see later on.

With this notations in mind we can for so write the Triangular Inequality:

$$A_{\mathbb{N}^*}^n = \sum_{x=1}^{A_{\mathbb{N}^*}} M_n \leq \sum_{x=1/K}^{A_{\mathbb{Q}}} M_{n,K} \leq \lim_{K \to \infty} \sum_{x=1/K}^{A_{\mathbb{R}}} M_{n,K} = \int_0^{A_{\mathbb{R}}} nx^{n-1} dx$$

Proof in the most simple case $n = 2$:

Given: $a, k \in N^+$ we can write:

$$\sum_{x=1}^{ak} \left(\frac{2x}{k^2} - \frac{1}{k^2} \right) = a^2 = \int_0^a 2x \; dx.$$

Proof:

$$\sum_{x=1}^{ak} \left(\frac{2x}{k^2} - \frac{1}{k^2} \right) = \frac{1}{k^2} * \left\{ \left(2 * \sum_{x=1}^{ak} x \right) - \sum_{x=1}^{ak} 1 \right\} =$$

$$= \frac{1}{k^2} * \{(ak)(ak) + \cancel{ak} - \cancel{ak})\} = \frac{1}{\cancel{k^2}} * (a^2 \cancel{k^2}) = a^2 = \int_0^a 2x \; dx$$

For $n > 2$ it follows in the same way (just with more vanishing Terms). But to understand the fact that there is continuity between the Integer Sum and the Integral, also the Old Mathematician has to digest that:

- The Mute Property of the Index was a False Math Mito, if taken in the sense that it has nothing to tell to us, in fact,

as shown, we can make a change of variable calling $x = X/K$ so we have a K times scaled variable and to Left unchanged the result we can write:

$$A^2 = \sum_{x=1}^{AK} \left(\frac{2x}{K^2} - \frac{1}{K^2} \right) = \sum_{x=1/K}^{A} \left(\frac{2x}{K} - \frac{1}{K^2} \right) =$$

$$= \lim_{K \to \infty} \sum_{x=1/K}^{A} \left(\frac{2x}{K} - \frac{1}{K^2} \right) = \int_0^A 2x \; dx$$

The proof it's immediately given once will be clear that :

- For the Lower Limit, the first $1/K$ step when $K \to \infty$ becomes $1/K = 0$

- $1/K^2$ it's an infinitesimal of Bigger Order respect to $1/K$, than it is zero because of the Identity, not just a vanishing term as the old mathematicians are still thinking !

- For $K | to \infty$ the first term having K as divisor becomes at the Limit, in the standard notation: $1/K = dx$

We have now the Tool Set let us recognize a Power of an Integer (or a Rational) but we need the last step is well known in Abstract Algebra when one consider the Set of Rational, including some Known Irrationals, for example number of the type: $P/\sqrt{2}$ where $P \in \mathbb{N}$ or $P \in \mathbb{Q}$ so working with the set $(\mathbb{Q}, \sqrt{2})$

Point 8: How to work with Irrational Steps

There is a last interesting case: our Step Sum can be able to rise an Irrational Upper Limit $P \in \mathbb{R} - \mathbb{Q}$ just in case the Irrational Factors (be it a single one, or, more in general, an aggregation of Real Numbers we can qualify as an Irrational) can be taken out from the Sum.

This is the key point I'll use later to prove Fermat is right and he has in the hands all the "simple" instruments shown till here to state and prove his Last Theorem.

I invented and I known all this from several years of discussions on several different forums that while it's clear for everybody that (for example) if:

$$P = \pi * A^2$$

we can be written as:

$$P = \pi * A^2 = \pi * \sum_{1}^{A}(2X - 1)$$

I Hope it's not soo complicate to understand that we can carry (for example) the Square Root of π into the Sum Via Exchange of Variable $X = x * \sqrt{\pi}$:

$$P = \pi * A^2 = \pi * \sum_{1}^{A}(2X - 1) = \sum_{1*\sqrt{\pi}}^{A*\sqrt{\pi}}(2x * \sqrt{\pi} - 1 * \pi)$$

Where we move of an Irrational step:

$$1 * \sqrt{\pi}; 2 * \sqrt{\pi}; ...; i * \sqrt{\pi}; ....; A * \sqrt{\pi}$$

x	X=x*pi.greco	(2*B2*RADQ(PI.G.)-1*PI.G.)	SUM	SUM/PI.G.
1	1.772453851	3.141592654	3.141592654	1
2	3.544907702	9.424777961	12.56637061	4
3	5.317361553	15.70796327	28.27433388	9
4	7.089815404	21.99114858	50.26548246	16
5	8.862269255	28.27433388	78.53981634	25
6	10.63472311	34.55751919	113.0973355	36
7	12.40717696	40.8407045	153.93804	49
8	14.17963081	47.1238898	201.0619298	64

Figure 12: Scaling $X = x * \sqrt{\pi}$ with Irrational Steps we get back, in this case, Irrational Gnomons too, but still a Sums till the Upper Limit is the Squares Root, of the Irrational we start from. In the next picture we return to the Scaling of our interest is $x = X/\sqrt{2}$

Sqares Below Y=2X² First Derivative: Y'=4X

*The **First Derivative** is squared by Irrational Gnomons*

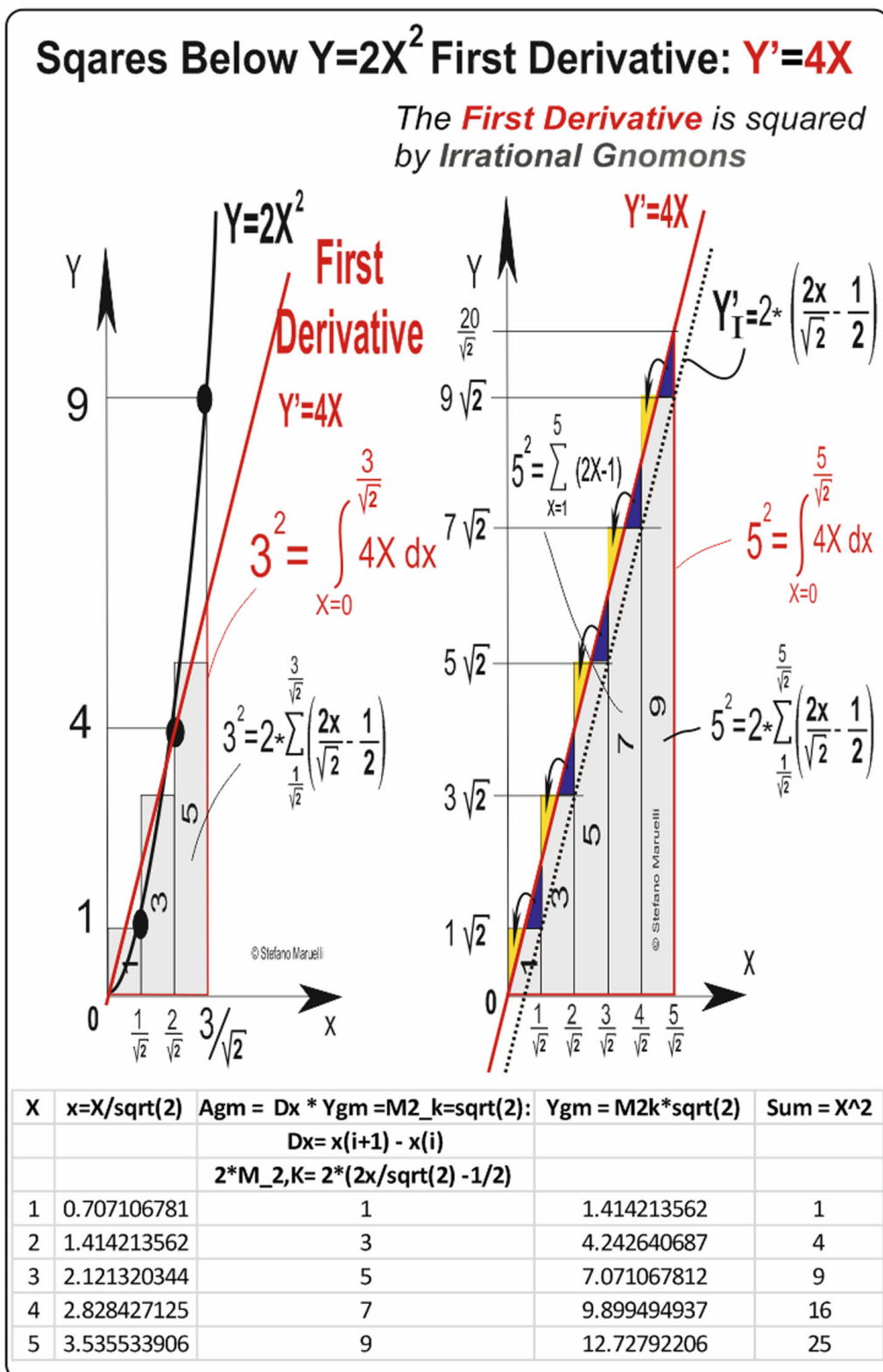| X	x=X/sqrt(2)	Agm = Dx * Ygm =M2_k=sqrt(2): Dx= x(i+1) - x(i) 2*M_2,K= 2*(2x/sqrt(2) -1/2)	Ygm = M2k*sqrt(2)	Sum = X^2
1	0.707106781	1	1.414213562	1
2	1.414213562	3	4.242640687	4
3	2.121320344	5	7.071067812	9
4	2.828427125	7	9.899494937	16
5	3.535533906	9	12.72792206	25

Figure 13: Scaling $x = X/\sqrt{2}$ and working below the 1st derivative of $y = 2nX^{n-1}$ still with Irrational Steps we get back Integer Gnomons and Sums are Squares of integers

Here an example (and proof) of what happens in case we have $K = \sqrt{2}$. Taking $x = X/\sqrt{2}$:

$$P = a^2 = \frac{A^2}{2} = \frac{1}{2}\sum_{1}^{A} 2x - 1 = \sum_{x=1/\sqrt{2}}^{A/\sqrt{2}} \frac{2x}{\sqrt{2}} - \frac{1}{2} =$$

$$= 2 * \sum_{x=1}^{A} \left\{ \left(\frac{2x}{2^{(1/2)}} \cdot \frac{1}{2^{(1/2)}} \right) - \frac{1}{2} \right\}$$

Where $A \in \mathbb{N}$; the Sum has an Integer Number of Summands, but we have a Step that has an Irrational Number width.

We can write:

$$2 * \sum_{x=1}^{a} \left\{ \left(\frac{2x}{2^{(1/2)}} * \frac{1}{2^{(1/2)}} \right) - \frac{1}{2} \right\} = 2 * \sum_{x=1}^{a} \left(\frac{2x}{2} - \frac{1}{2} \right) =$$

$$2 * \left(\sum_{x=1}^{a} x \right) - \sum_{x=1}^{a} 1 = \frac{2a(a+1)}{2} - a = a^2 + a - a = a^2.$$

Another example in case n = 3:

$$2 * \sum_{x=1}^{a} \left\{ 3 * \left(\frac{x}{2^{(1/3)}} \right)^2 * \frac{1}{2^{(1/3)}} - \left(\frac{3x}{2^{(1/3)}} * \frac{1}{2^{(2/3)}} \right) + \frac{1}{2} \right\} = 3 * \sum_{x=1}^{a} x^2 - 3 * \sum_{x=1}^{a} x + \sum_{x=1}^{a} 1 =$$

$$= \frac{3a(a+1)(2a+1)}{6} - \frac{3a(a+1)}{2} + \frac{2a}{2} = \frac{2a^3 + 3a^2 + a - 3a^2 - 3a + 2a}{2} = a^3.$$

This will becomes useful later on when I'll present my Proof of Fermat the Last Theorem.

The point is always the same: If C is an Integer we can rise an Irrational Upper Limit Value, for example $C/2^{1/n}$ making an Integer Number of Step equal to C, at the condition that we use the right Irrational Step $K = 1/2^{1/n}$. So the base of the Gnomons has to perfectly divide the distance x from the origin, here $x = C/2^{1/n}$.

For the same reason is also true, for example that:

$$P = a^2 = \frac{A^2}{2^{2/3}} = \sum_{x=1/2^{1/3}}^{A/2^{1/3}} \left(\frac{2x}{2^{1/3}} - \frac{1}{2^{2/3}} \right)$$

The same for any other Power following just the Power rules.

Finally we have now all the Tools we need to attack the enteir serie of Power Problems still if we don't know Abstract Algebra nor Elliptic functions.

Proof of Fermat's Last Theorem

Preface

Another preamble here to prove FLT via a Geometric Construction leading to a Solving Equation shows, without solving it, the impossible Integer Triplet from $n = 3$

All that just to prove you I perfectly know what I'm doing with my CMA, and to suggest you what can be done using All the Tools I've presented (the most familiar you probably already have or understood at the first reading) because the Final Direct proof via CMA, so using all such tools will left also the expert reader thrilled, or simply thinking I'm an Idiot or a Crank. I've to fight and I received tonns of insults from the Math Comunity where all this work is shown and public from his born in 2008.

The Geometric Proof via equation

Let's consider the equation $C^n =? A^n + B^n$, where, by fixed conditions, $A, B \in \mathbb{N}$ and we want ot investigate if there is an integer C satisfy the Fermat's equality (to avoid the reader confuse what is for sure equal to, and what it's equal to IFF the Fermat's equality holds true, I distinguish from the equal sign = and the unknown equality =? means: we have to prove if it is equal or not, and when.

Now, let's consider the derivative of a parabola $Y = 2X^n$ for what the 1st Derivative is $X' = 2nX^{n-1}$

On the main parabola we fix the Integer points: $(A, 2A^n)$; $(B, 2B^n)$

Iff Fermat equations holds true into the integers then C^n is fixed by the condition Y_F is an Ordinate is at the same distance from $2A^n$ and $2B^n$, so IFF the equation is true into the Integers then $Y_F = C^n$ with C integer too, so the question is If and When we have:

$$Y_F = 2A^n + \Delta =? C^n$$

and:

$$Y_F = 2B^n + \Delta =? C^n$$

with $C \in \mathbb{N}$ and $\Delta = B^n - A^n$ So in the Cartesian plane we have:

Figure 14: How to stick the FLT equation onto the Cartesian plane, example for $n = 3$. We must focus the attention on A,B Integers by our choice and we have to check if the Area till the unknown X_F produce an Area is C^n with $C \in \mathbb{N}$

From where we can now find the point $(X_F, 0)$ for what $X_F = \left(\frac{2A^n + 2B^n}{2}\right)^{1/n}$

Because:

$$Y_F = \int_0^{X_F} 2nx^{n-1} = 2A^n + \Delta = 2B^n - \Delta$$

and then we can define the distance $p = X_F - A$

The condition for a Triplet of Integers, so $C \in \mathbb{N}$ too, it's equal to have $X_F = X_i = \frac{C}{2^{1/n}}$ since the integral till X_i below $y' = 2nx^{n-1}$ is:

$$\int_0^{\frac{C}{2^{1/n}}} 2nx^{n-1} = C^n$$

So Fermat equality it's equal to write $Y_F = C^n$ or $X_F = X_i = \frac{C}{2^{1/n}}$ but it is still unknown if :

$$\int_0^{X_F} 2nx^{n-1} =? \int_0^{\frac{C}{2^{1/n}}} 2nx^{n-1} = C^n$$

That can not be solved directly but require one understood my Complicate Modulus Algebra (seems not digested by Professors I know) the following trick of a system of equations.

Focusing onto the picture, and summarizing what is and what has to be if Fermat equality holds true into the integers (because it's clear that there is always a solution if $C \in \mathbb{R}$), we can (again) see that if we choose $A, B \in \mathbb{N}$:

$X_F = \left(\frac{2A^n + 2B^n}{2}\right)^{1/n}$

$X_i = \frac{C}{2^{1/n}}$

From $C^n = A^n + B^n$ we can write the statement: $C^n =? A^n + B^n$ imply the Symmetric Condition:

$C^n = 2A^n + (B^n - A^n)$ and $C^n = 2B^n - (B^n - A^n)$ where calling

$\Delta = B^n - A^n$ therefore Δ has to be an Integer too, since we choose A, B Integers.

we have:

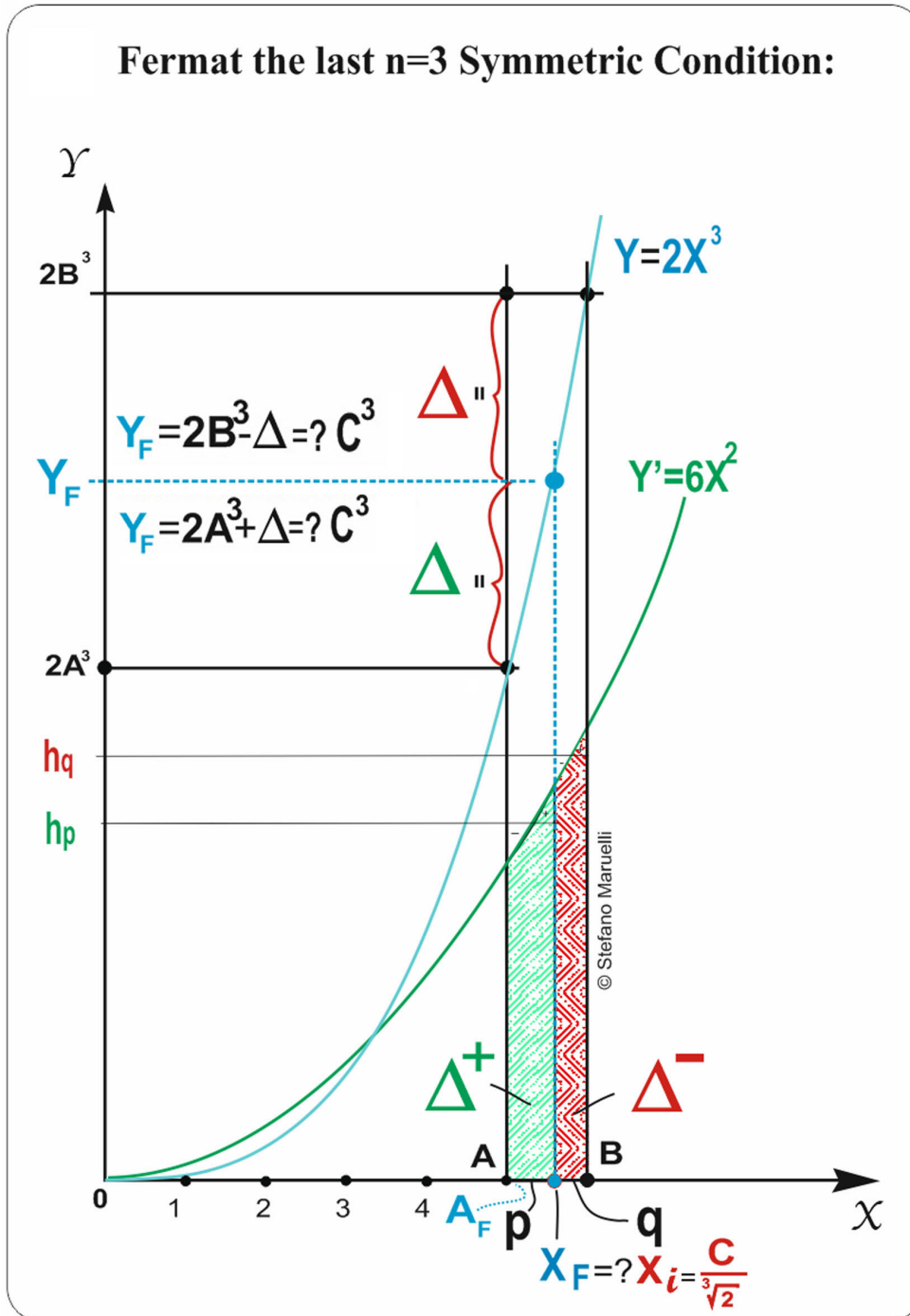$C^n = 2A^n + \Delta$ and $C^n = 2B^n - \Delta$

Figure 15: FLT equation onto the Cartesian plane, $n = 3$. We must focus on A,B Integers by our choice, and the Fact that Δ is both a Distance, and an Area as shown into the picture. And that Δ is equal to a Rectangle $\Delta = p * h_p$ where $p = X_F - A$ and h_p is the Height of the Curve produces the same Exceeding and Missing Area between the Curve and the Top of the equivalent Rectangle. With this construction Fermat fix an Abscissa X_F that at the moment don't tell us if Y_F, so the value of the area till X_F, is or not the n-th power of an Integer C, that is what we will have to prove. But what is immediately well clear is that due to the Curved Derivative: $p > q$ and bot $p, q, p/q \in \mathbb{R} - \mathbb{Q}$ are all Irrationals. While for $n = 2$ the construction is the same, but thanks to the Linear1st Derivative X_F is exactly in the middle so $p = q$ and a Common Step can be found

but Δ is also the rectangular area:

$\Delta = p * hp$ (where, again, $\Delta = B^n - A^n \in \mathbb{N}^+$)

where the base p is:

$p = X_f - A$

And IFF $C^n = A^n + B^n$ with A,B and C integers must be:

$$X_f = \left(\frac{2A^n + 2B^n}{2}\right)^{1/n} = X_i = \frac{C}{2^{1/n}}$$

then $p_F = p_i$ to remember it is unknown and it has to be iff the FLT equality holds true:

$p_F = p_i = \frac{C}{2^{1/n}} - A$

Then p has to be an Irrational only depending by the n-th root of 2, since A, C are integers.

and of course this condition can be respected IF $n = 2$ by the Pythagorean Triplets (we don't need to investigate longer since well know)

simply due to the fact that the product $p * h_p$ has to rationalize and this is possible, simply because of the linear derivative produces a product is: square root of 2 * square root of 2 dependent just so $= 2 =$ Integer

While for n>2 there will be more different power terms of p as I will show later on. In the following picture why Fermat hold for $n = 2$: $X_F = X_B P = X_{1/2}$
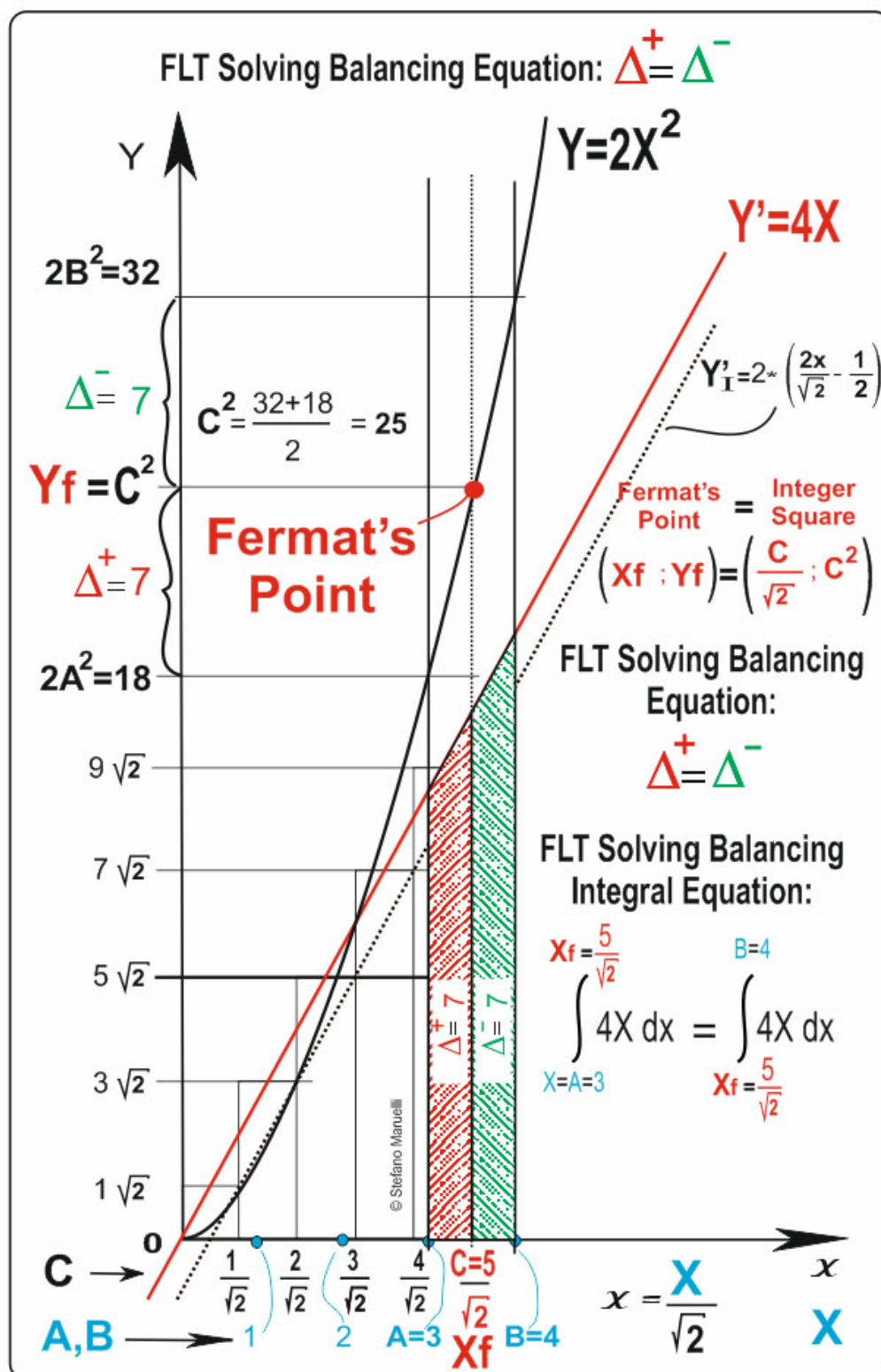
Figure 16: A numerical example of the case $n = 2$ where the Linear 1st Derivative allows the Rationalization of the product $p * h_p$. More info on this case on my Vol.1

Example n=2

1a) $C^2 = 2A^2 - \Delta^+$ means

1b) $A = \sqrt{\frac{C^2 - \Delta^+}{2}}$

But we also know from the picture that:

2) $p = p_F = \frac{C}{\sqrt{(2)}} - A$ then we can rewrite the (1b) as:

1c) $\left(\frac{C}{\sqrt{(2)}} - p \right)^2 = \frac{C^2 - \Delta^+}{2}$

where we now use:

3a) $\Delta = p * h_p$,

where p is the Base, h_p is the Average Height of the Rectangular area square the area Δ (for sure) then

1d) $\left(\frac{C}{\sqrt{2}} - p \right)^2 = \left(\frac{C^2 - p*h_p}{2} \right)$ form where

1e) $\left(\frac{C^2}{2} - 2p\frac{C^2}{2} + p^2 \right) = \left(\frac{C^2 - p*h_p}{2} \right)$ form where

1f) $\left(p^2 - 2p\frac{C^2}{2} \right) = - \left(\frac{p*h_p}{2} \right)$ form where

1g) $p - 2\frac{C^2}{2} + \frac{h_p}{2} = 0$

Where: p is the base, h_p is the Average Height of the rectangulare area is Delta (for sure) that as the Height of the Gnomon is in the form $h_p = 4X_{m,F}$ (sice we are working below the 1st derivative is: $y' = 4x$) can be found via the Integral Balancing Equation:

Left Area=Right Area

$$\int_A^{X_{m,F}} 4x dx = \int_{X_{m,F}}^{X_F} 4x dx$$

Where we apply our hypo: $X_F = X_i = C/2^{1/2}$:

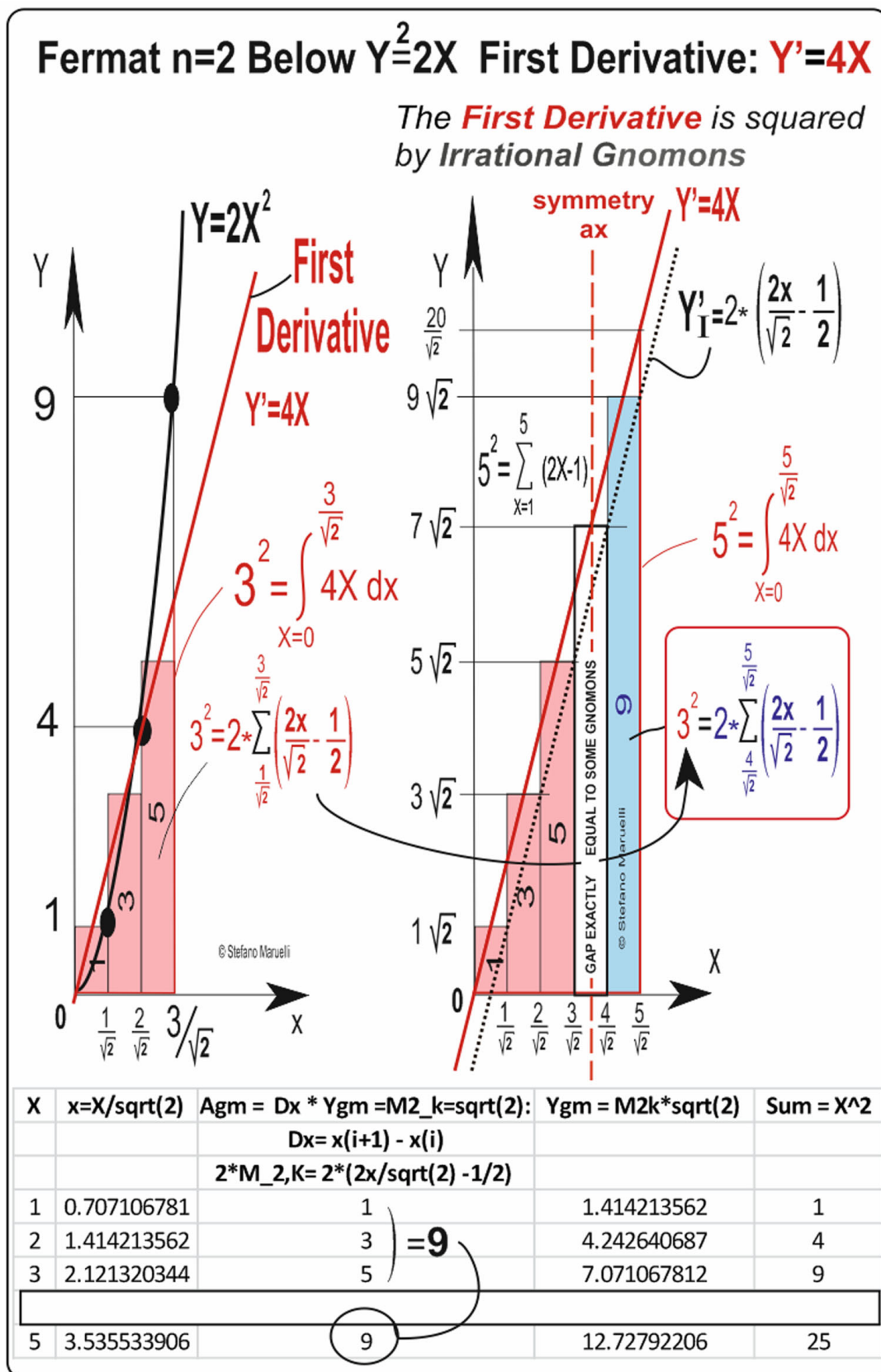$$X_{m,F}^2 - A^2 = \frac{C^2}{2} - X_{m,F}^2$$

So:

Figure 17: Scaling the previous picture with $x = X/\sqrt{2}$ we have the same result. I know this looks strange but you can read my Vol.1 to understand from where this comes. I also add a preview of another more direct and elegant proof, but needs to enter more in this modular, scaled, algebra.

$$X_{m,F} = \left(\frac{C^2 - 2A^2}{2} \right)^{1/2}$$

from where we can now have h_p under Fermat's hypo:

$$h_p = 4X_{m,F} = 4 * \left(\frac{C^2 - 2A^2}{2} \right)^{1/2}$$

Now putting into the (1g) we have:

1g) $p - 2\frac{C^2}{2} + 2 * \left(\frac{C^2 - 2A^2}{2} \right)^{1/2} = 0$

So:

1g) $p = C^2 - 2 * \left(\frac{C^2 - 2A^2}{2} \right)^{1/2}$

This told us that p is an Irrational depending by the Square Root of 2 (so $X_F = X_i$ is a confirmed true Hypo), can have Real solutions at the reasonable condition: $2A^2 < C^2$ as it is since we know f.ex. in the triplet A=3, B=4, C=5 that is $2 * 3^2 < 5^2$

Still if we already know how to find the Pythagorean Triplets, I'll prove this is the Condition under what FLT equation can have a Triplet of Integer parameters, but as you will see hereafter the case $n = 3$ produce no Integer Triplets. FLT equation is also equal to state $\Delta^+ \in \mathbb{N} = \Delta^- \in \mathbb{N}$ so that:

Case n=2

Delta = p*hp = $\left\{ \frac{C}{2^{\frac{1}{2}}} - A \right\} \left\{ \frac{2^{\frac{1}{2}} C^1 \cdot 2}{1} - 2 \left\{ \frac{C}{2^{\frac{1}{2}}} - A \right\} \right\}$ = **integer !**

(c) Stefano Maruelli

$$= \quad \{\{C^2 - 2A^2\}\}$$

Figure 18: This is a check to be sure we have not made some mistake, but also show why Fermat's problem lead to a factorisation problem is unfortunately in $\mathbb{R} - \mathbb{Q} and for so cannot be solved in an easy way.$

IFF (means IF and only IF) there is an integer triplet, the irrationals values vanish and we return to an Integer Δ:

3b) $\Delta = C^2 - 2A^2$

Figure 19: Another way to see the solution: Missing Area is equal to Exceeding one, and of course in case of $C = Odd$ a Central Neutral Gnomon must be present, means the height of the central gnomon is exactly equal to the Ordinate of the 1st derivative for it's central Abscissa

Conclusion for $n = 2$ proven also by a Trigonometric equation

A Triplet of Integers A, B, C is compatible with Fermat's Symmetric Construction

IFF: $n = 2$ for what $X_{BP} = X_F = A + p = X_i = A + \frac{C}{2^{1/2}}$,

so p has to be in a special Set of Known Irrationals depending by the n-th root of 2.

I will also show a more simple geometric proof involving y_i in the case $n = 2$.

I again, and again, remember that is very important to have well clear *whatistrue*, because we know, or fix, them: so (f.ex.) $A, B \in \mathbb{N}$

and what is an *Unknown*, so what some values has to be equal to, if Fermat holds true,

f.ex we have defined by hypo $X_F = X_i$ and therefore $A_F = A$ by imposing Fermat's Symmetric Condition (I discover many years ago),

and for so $p = \frac{C}{2^{1/2}} - A$ holds true IFF Fermat equation holds true with an integer triplet.

because we really know where is X_F by the the construction,

but unfortunately we don't really know if it is $X_F = \frac{C}{2^{1/2}}$ at first sight (till we don't know where too look as reference)

we don't really know if it is equal to the value let the Area till X_F be exactly equal to the Integer C to the n-th power.

But taking a better look to the Symmetric Condition I discover I can better show the Exchange of Variable $x = X/\sqrt{2}$ by representing it, as it is: 2 Systems of Reference Axis, (x, y) and (X, Y) one exactly at 45° to the otherm that correspond to the value given by the Exchange of Variable we need to perform:

$\cos(\alpha) = \frac{1}{\sqrt{2}}$:

The special condition for $n = 2$ is the ony one for what:

$$\sin(\alpha) = \cos(\alpha) = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$$

What is nice in this picture is that I finally found what I'm looking for:

a relation between the Area C^n is given by the sum of Gnomons from 0 to C (on the rotated X,Y) Axis is:

$$C^n = \sum_1^C \left(X^n - (X-1)^n \right) = \sum_1^C M_n$$

and the other one is:

$$\frac{C^n}{2} = \int_0^{\frac{A+B}{2}} 2nx^{n-1} dx$$

that allows us to prove Fermat for any case $n > 2$ via Geometric Concerning, only, and I hope it's very evident from the picture (true just for $n = 2$) where:

- the height y_i of the corner of the last Gnomon of the Sum, calculated for $X = C$, comes observing that:

$$M_{n,C} = \left(X^n - (X-1)^n \right)|_{x=C}$$

once returned into the (x, y) axis, to satisfy Fermat's equation (so y_F height) into the integers has to be: $y_F = y_i$ so remembering what is y_F:

$$y_F = C * \sin(\alpha) + M_{n,C} \cos\alpha = ? y_i$$

And what Y_f has to be, so for $n = 2$ we prove it is :

$y_F = y_i = f\left(\frac{1}{2^{1/2}} \right)$ so:

$$y_F = C * \sin(\alpha) + (2C - 1) * \cos\alpha = y_i = f\left(\frac{1}{2^{1/2}} \right)$$

Where $\cos\alpha$ comes from the triangle formed at the Origin by the x and X axis:

$\cos\alpha = \frac{C/2^{1/n}}{C} = \frac{1}{2^{1/n}}$

while:
$\sin\alpha = \cos\alpha$ just in the case $n = 2$ while for $n > 2$ it comes (for all n) from the Pithagorean theorem:

$$C \sin \alpha = \sqrt{C^2 - (C \cos \alpha)^2}$$

So dividing both side by c^2 it is in the form (just for $n = 2$):

$$\sin \alpha = \sqrt{1 - (\tfrac{1}{2^{1/2}})^2} = \sqrt{\tfrac{2-1}{2}} = \tfrac{1}{\sqrt{2}} = \cos(\alpha)$$

At the same result we can arrive with the identity: $\sin^2 \alpha + \cos^2 \alpha = 1$, but now we are sure that in case the angle differs from 45°, so for any other $n > 2$ we get back 2 different Irrational Numbers are one (squared) the complement to 1 of the square of the other, so they share no common Rational factors, so the sum:

$$y_F = C * \sin(\alpha) + M_n * \cos \alpha$$

is:

$$y_F = C * \sin(\alpha) + M_n * \cos \alpha \neq y_i = h_{X_i} = 2n X_i^{n-1} = f\left(C/2^{1/n}\right)$$

So: $y_F = y_i$ since:

$$y_F = C * \frac{1}{2^{1/2}} + (2C - 1) * \frac{1}{2^{1/2}} = y_i = h_{X_i} = 2 * \frac{A + B}{2 * 2^{1/2}}$$

that taking the picture as reference is:

$$y_F = 5 * \frac{1}{2^{1/2}} + (2 * 5 - 1) * \frac{1}{2^{1/2}} = y_i = h_{X_i} = 2 * \frac{3 + 4}{2 * 2^{1/2}}$$

So:

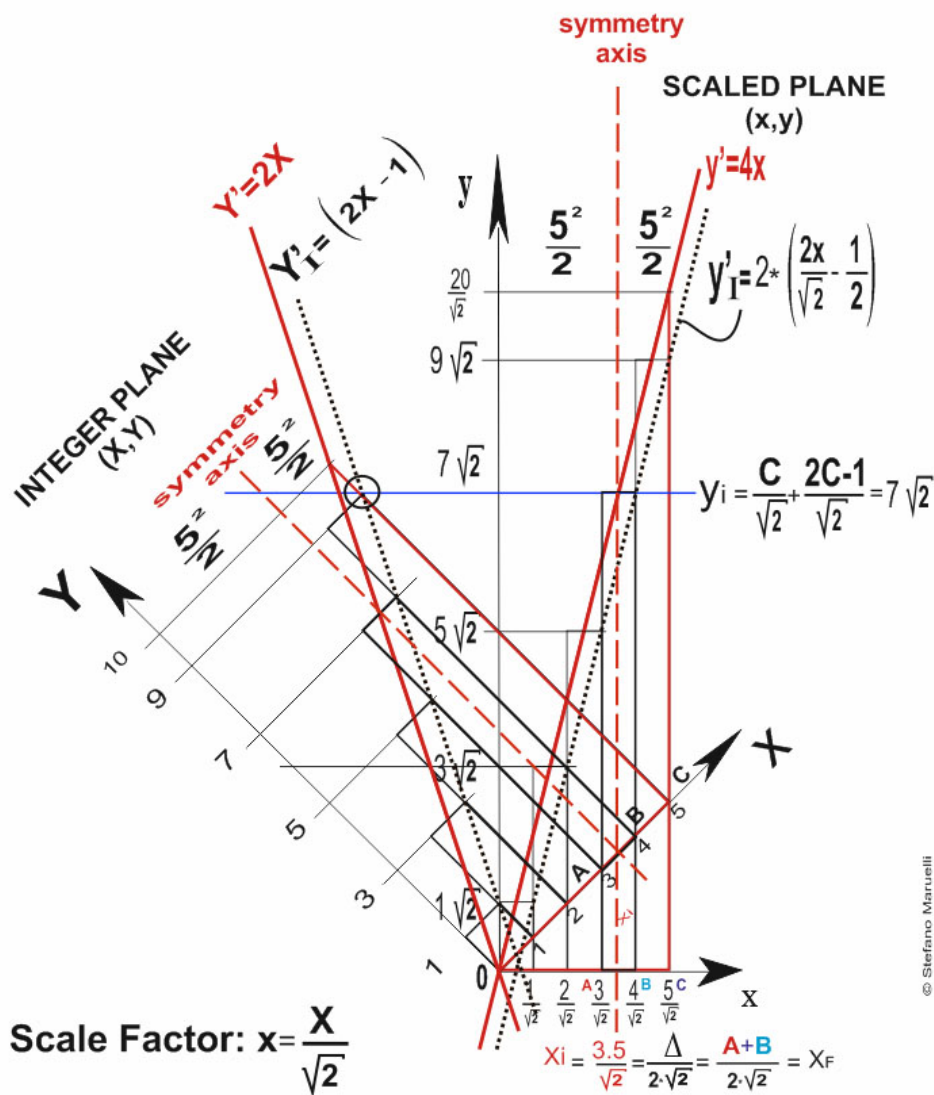$$y_F = 7 * \sqrt{2} = y_i = 7 * \sqrt{2}$$

Figure 20: The exchange of scale $x = X/\sqrt{2}$ is equal to a rotation of the system of axis: what imply the FLT equality is that the Top Right Corner of the area is C^n (in the X, Y reference) is at the same height y_i of the height of the Triangle having area equal to $C^n/2$ in the x, y reference. The final construction with a a numerical example $A = 3$, $B = 4$, $C = 5$ of the case $n = 2$ where y_i represent the solving condition: $y_i = C * \sin(\alpha) + (2C - 1) * \cos \alpha$, or the border of the Gnomon in the (X, Y) plane has to be equal to the height of the 1st derivative in X_F, so here $2X_F = 2X_i = 7 * \sqrt{2}$ in the (x, y) one.

X	x=X/sqrt(2)		M2_k=sqrt(2): M_2,K= 2*(2x/sqrt(2) -1/2)		SUM= x^2
1	0.707106781		1		1
2	1.414213562		3		4
3	2.121320344		5		9
4	2.828427125		7		16
5	3.535533906		9		25

X	X/2	x=X/rad(2)	xx= x/2	2*(2*x/(RADQ(2)))-1/(2)	2*(2*xx/(2*RADQ(2)))-1/(2*4)	SUM = xx^2	
1	0.5	0.707106781	0.353553391	1	0.25	0.25	
2	1	1.414213562	0.707106781	3	0.75	1	
3	1.5	2.121320344	1.060660172	5	1.25	2.25	
4	2	2.828427125	1.414213562	7	1.75	4	
5	2.5	3.535533906	1.767766953	9	2.25	6.25	
	3	4.242640687	2.121320344		2.75	9	A^2=3^2
	3.5	4.949747468	2.474873734		3.25	12.25	X_F=Xi=sqrt(12.25)=3.5 =sqrt(A^2+B^2)/2
	4	5.656854249	2.828427125		3.75	16	B^2=4^2
	4.5	6.363961031	3.181980515		4.25	20.25	
	5	7.071067812	3.535533906		4.75	25	C^2=5^2
				Sum =25 = C^2	Sum =25 = C^2		

X	x=X/sqrt(2)		M2_k=sqrt(2): M_2,K= 2*(2x/sqrt(2) -1/2)		SUM= x^2/2 (to C^2/2)
1	0.707106781		0.5		0.5
2	1.414213562		1.5		2
3	2.121320344		2.5		4.5
4	2.828427125		3.5		8
5	3.535533906		4.5		12.5

X	X/2	x=X/rad(2)	xx= x/2	(2*x/(RADQ(2)))-1/(2)	(2*xx/(2*RADQ(2)))-1/(2*4)	SUM= xx^2/2 (to C^2/2)	
1	0.5	0.707106781	0.353553391	0.5	0.125	0.125	
2	1	1.414213562	0.707106781	1.5	0.375	0.5	
3	1.5	2.121320344	1.060660172	2.5	0.625	1.125	
4	2	2.828427125	1.414213562	3.5	0.875	2	
5	2.5	3.535533906	1.767766953	4.5	1.125	3.125	
	3	4.242640687	2.121320344		1.375	4.5	A^2/2=3^2/2
	3.5	4.949747468	2.474873734		1.625	6.125	X_F=Xi=sqrt(2*6.125)=3.5 =sqrt(A^2+B^2)/
	4	5.656854249	2.828427125		1.875	8	B^2/2=4^2/2
	4.5	6.363961031	3.181980515		2.125	10.125	
	5	7.071067812	3.535533906		2.375	12.5	C^2/2=5^2/2
				SUM= 12.25 = C^2/2	SUM= 12.25 = C^2/2		

Figure 21: We can see on a table in the case $n = 2$ why and what satisfy the equality

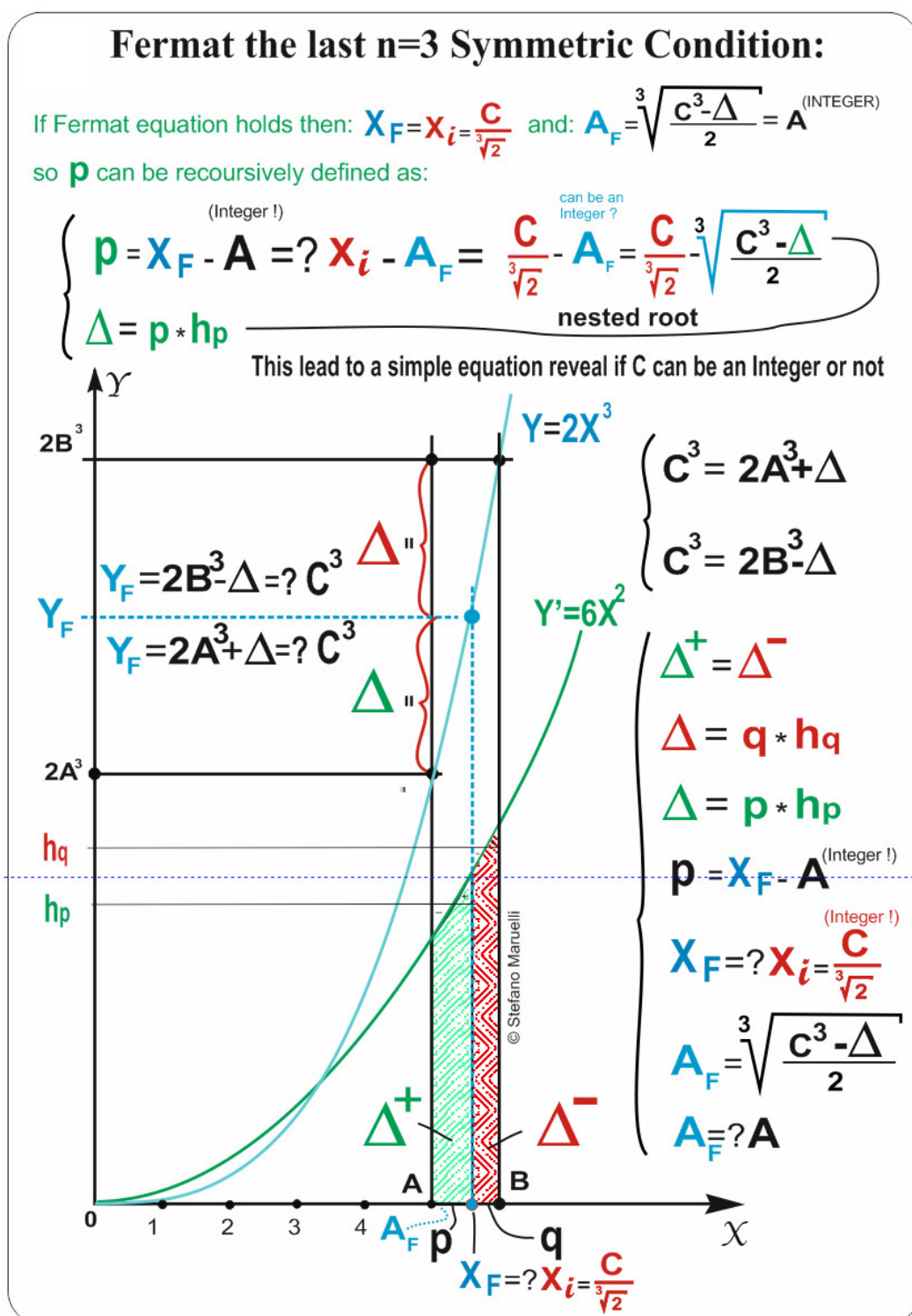In the next page what for $n = 3$ on the Cartesian plane, and the proof via equations.

Figure 22: I know mathematicians will not like this kind of messy picture that put the FLT equation and the proof all together onto the Cartesian plane, example for $n = 3$ but let one to have all under his eyes, in the same picture

Fermat the Last in the case n=3 onto the Cartesian Plane

From $n = 3$ the 1st derivative is a curve, so more you go right more the curve is steep, so I will prove X_F can not longer be equal to X_i because if we fix them equals we arrive to a solving equation for Δ that lead to Complex solutions just, and this proves $X_F \neq X_i$, so that Fermat was right.

But the elegant proof I think at this moment also the esxpert reader can miss is that if $p > q$ and all $p, q, P/q \in \mathbb{R} - \mathbb{Q}$ there is no way to balance as in the Figure 19, where a Central Neutral Gnomon is present, because once we keep a certain number $p' \in \mathbb{N} + 1+$ a certain number $q' \in \mathbb{N}$ then or both p', q' are Odd or Both Even, means they have to share the common factor $1/2$, so the Number of Step can be duplicated , means we can move step $1/2$ as we did for $n = 2$, while it is clear that X_F shares no lonerg this common factor

We must remember what happens to the Gnomons when the Derivative is a Curve: $X_{m,i}$ is no longer in the Middle of the Base of the Gnomon for a simple geometrical fact, and it's no longer a Rational Number. I've proved that: $p > q$ with $p, q \in \mathbb{R} - \mathbb{Q}$ presenting this picture we need to have well in mind to make the final right conclusions.
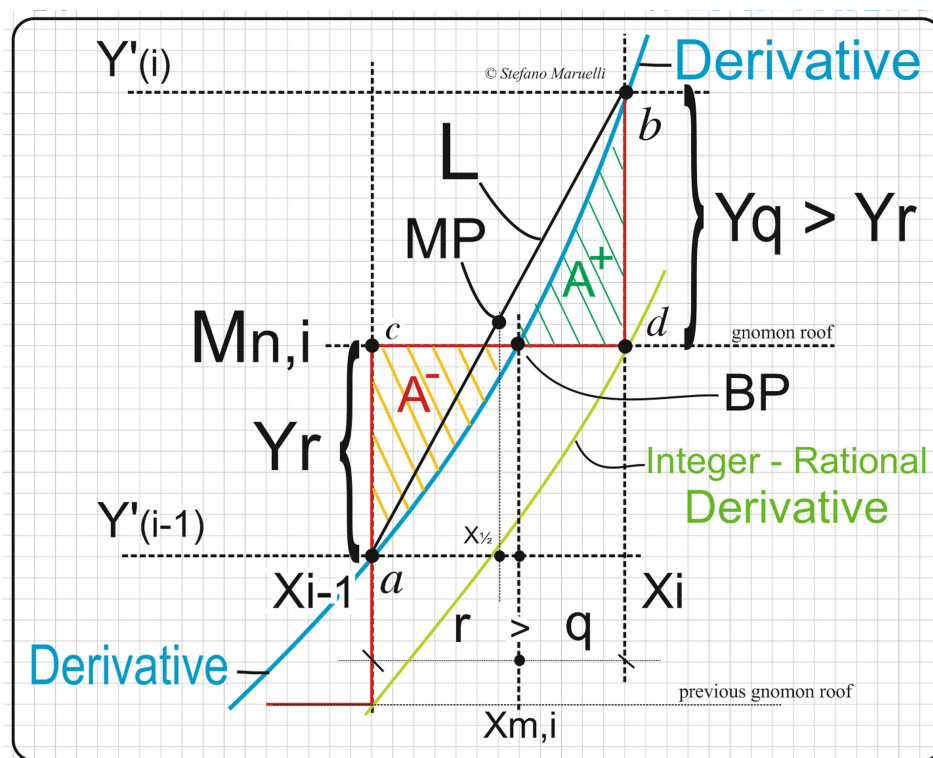

Figure 23: From $n = 3$ the 1st Derivative is no longer a line. So since curved $X_{m,i} > X_{MP=1/2}$ so $p > q$ with $p, q \ in \mathbb{R} - \mathbb{Q}$

For what I remember $X_{m,i} \neq \frac{X_{i-1}+X_i}{2}$ because:

$$X_{i-1/k^n} < X_{m,i} < X_{i,1/k^n}$$

So $X_{m,i}$ will be risen just via the Infinite Descente is known as Limit:

$$\lim_{n\to\infty} X_{i-1/k^n} = X_{m,i} = \lim_{n\to\infty} X_{i,1/k^n}$$

Fermat the Last in the case n=3 proved by a 2th degree equation has no Real solutions

In the first proof given by Gauss for $n = 3$ he don't use this Geometryc concerning, but Fermat was the first to discover the Infinite Descent, here is represented by an infinite number of step dx, it is necessary to rise the Irrational Limit if X_F that produce the irrational C. lead to Fermat's equality from $n = 3$ in case we choose A, B integers.

Always on the cartesian plane, below the 1st Derivative of $2nx^{n-1}$ we can write, for the Symmetric condition, as for $n = 2$:

1a) $C^3 = 2A^3 + \Delta^+$ means

1b) $A = \left(\frac{C^3 - \Delta^+}{2}\right)^{1/3}$

But we also know from the picture that to let $C \in \mathbb{N}$ must be:

2) $p = \frac{C}{2^{1/3}} - A$ from where: $\frac{C}{2^{1/3}} - p = A$

And also:

3a) $\Delta^+ = p * hp$

So putting the (1b) into the (2) we have:

$\left(\frac{C}{2^{1/3}} - p\right) = \left(\frac{C^3 - \Delta^+}{2}\right)^{1/3}$ so cubing both terms:

1c) $\left(\frac{C}{2^{1/3}} - p\right)^3 = \frac{C^3 - \Delta^+}{2}$

The after recalling the (3a) $\Delta^+ = p * h_p$, putting this into the (1g) we have:

1d) $\left(\frac{C}{2^{1/3}} - p\right)^3 = \left(\frac{C^3 - p*h_p}{2}\right)$

form where

1e) $\left(\frac{C^3}{2} - \frac{3C^2 p}{2^{2/3}} + \frac{3C p^2}{2^{1/3}} - p^3\right) = \left(\frac{C^3 - p*h_p}{2}\right)$

or:

1f) $\left(-\frac{3C^2 p}{2^{2/3}} + \frac{3C p^2}{2^{1/3}} - p^3\right) = -\left(\frac{p*h_p}{2}\right)$

from where h_p :

1g) $\frac{h_p}{2} = p^2 - \frac{3Cp}{2^{1/3}} + \frac{3C^2}{2^{2/3}}$

Where from $n = 3$ the longer develop of the cube (so the curved 1st derivative)

produces different powers of p, and 2 (I hope I well remember that Fermat was looking for the Power of 2 problem, not jet solved, for an unkonwn reason):

where again:

3a) $\Delta^+ = p * hp$

Where: p is the base, h_p is the Average Height of the rectangulare area is Delta for sure) that as the Height of the Gnomon is in the form $h_p = 6X^2_{m,F}$ (since we are working below the 1st derivative is: $y' = 6x^2$) can be found via the Integral Balancing Equation:

Left Area=Right Area

$$\int_A^{X_{m,\Delta^+}} 6x^2 dx = \int_{X_{m,\Delta^+}}^{X_F} 6x^2 dx$$

Where we apply our hypo: $X_F = X_i = \frac{C}{2^{1/3}}$:

$$X^3_{m,\Delta^+} - A^3 = \frac{C^3}{2} - X^3_{m,\Delta^+}$$

So:

$$X_{m,\Delta^+} = \left(\frac{C^3 - 2A^3}{2}\right)^{1/3}$$

from where we can now have h_p under Fermat's hypo:

$$h_p = 6X^2_{m,\Delta^+} = 6 * \left(\frac{C^3 - 2A^3}{2}\right)^{2/3}$$

recalling the (1g) :

1g) $\frac{h_p}{2} = p^2 - \frac{3Cp}{2^{1/3}} + \frac{3C^2}{2^{2/3}}$

Note: we have to immediately to say that this looks very different from a 1st Derivative $y' = 2nx^{n-1}$ or Gnomon's Heigt is:

$M_{3,K=2^{1/3}} = \frac{3x^2}{2^{1/3}} - \frac{3x}{2^{2/3}} + \frac{1}{2}$

So we have:

1h) $p^2 - \frac{3Cp}{2^{1/3}} + \frac{3C^2}{2^{2/3}} - 3 * \left(\frac{C^3 - 2A^3}{2}\right)^{2/3} = 0$

that is a simple 2th degree equation we can solve in A to show it has no Integer, nor Real solutions that means our hypo $X_F = X_i$ is FLASE, so Fermat is right (at the moment for n=3):

Input

$$\text{solve}\left(p^2 - \left(3\,C\,\left(\frac{p}{2\left(\frac{1}{3}\right)} \right) \right) + \left(3\left(\frac{C^2}{2^{\frac{2}{3}}} \right) \right) - 3\left(\frac{C^3 - 2\,A^3}{2} \right)^{\frac{2}{3}} = 0, A \right)$$

Soluzione 1

$$A = \sqrt[3]{-\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^{\frac{3}{2}} + \frac{C^3}{2}}, 4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 \geq 0$$

Soluzione 2

$$A = \sqrt[3]{\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^{\frac{3}{2}} + \frac{C^3}{2}}, 4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 \geq 0$$

Soluzione 3

$$A = \sqrt[3]{\frac{-\sqrt{-4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 + C^3}}{2}}, -4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 \geq 0$$

Soluzione 4

$$A = \sqrt[3]{\frac{\sqrt{-4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 + C^3}}{2}}, -4\left(-\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{p^2}{3} \right)^3 \geq 0$$

Figure 24: A simple 2th degree equation proves FLT for $n = 3$ since the root of a negative number is not a Real number

It is not hard to see that it cannot have solutions into the integers since $C >> p$ then the inner root of a Negative Number assure us the absurdum we are looking for (I hope !).

To be fully sure of that, we can also repeat the same process starting from $C^n = 2B^n - \Delta^-$ for what the final concerning due to the all positive signs in the inner root leave us less doubt. And in case we have another equation for checking the result is $p + q = B - A$.

Hereafter FLT equation lead to this factorisation (in $\mathbb{R} - \mathbb{Q}$) can be true just in case 2 (only) of the 3 variable are Integers :

Figure 25: The resulting formula, check, in case of A,B,C Integers it's clearly not in $\mathbb{N}$, and the same happens for bigger n because of the curved 1st Deriative have, so different powers of 2 in the result . Purists, and I'm sure Mr Wiles too, will jump on the chair, but that's it !

I know this from long time but I've missed the proof because I really forgot to show who really is p, versus what it must be to let $C \in \mathbb{N}$ produce an area C^n with Δ integer too.

Last step is to prove that the case $n = 3$ can be used as example for all the $n > 3$ cases, but I hope it's already clear what we need to prove: under the curved derivative X_F is fixed by construction in an Irrational Value is not equal to $X_i = \frac{C}{2^{1/n}}$, because if we fix $X_F = X_i$, still with numbers respect the condition $C^n > 2A^n$ we always arrive to a solving equation has Imaginary roots only.

But since it is not possible to write and check any equation (one for each n) we need to go deeper in understanding why, by construction, $X_F \neq X_i$ so why a Right Border of a Gnomon (under Fermat conditions) can never be fixed by the condition $X_i = \frac{C}{2^{1/n}}$, and the better understanding of the Case $n = 2$ is necessary to show what the exchange of variable $x = \frac{X}{2^{1/n}}$ lead to. Hereafter as second check the proof using q.

For the same reason $\Delta^+ = \Delta^-$ let us make the same procedure to find $\Delta^- = q * h_q$

1a) $C^3 = 2B^3 - \Delta^-$ means

1b) $B = \left(\frac{C^3 + \Delta}{2}\right)^{1/3}$

But we also know from the picture that to let $C \in \mathbb{N}$ must be:

2) $q = B - \frac{C}{2^{1/3}}$

So putting the (1b) into the (2), and cubing to remove the cubic root, we have:

1c) $\left(q + \frac{C}{2^{1/3}}\right)^3 = \frac{C^3 + \Delta}{2}$

Where from $n = 3$ the longer develop of the cube (so the curved 1st derivative) produces different powers of q, and 2 :

where

3a) $\Delta^- = q * h_q$

Where: q is the base, h_p is the Average Height of the Rectangular Area is Δ^- for sure) that as the Height of the Gnomon is in the form $h_q = 6X_{m,F}^2$ (sice we are working below the 1st derivative is: $y' = 6x^2$) can be found via the Integral Balancing Equation:

Left Area=Right Area

$$\int_{X_F}^{X_{m,\Delta^-}} 6x^2 dx = \int_{X_{m,\Delta^-}}^{B} 6x^2 dx$$

Where we apply our hypo: $X_F = X_i = \frac{C}{2^{1/3}}$:

$$X_{m,\Delta^-}^3 - \frac{C^3}{2} = B^3 - X_{m,\Delta^-}^3$$

So:

$$X_{m,\Delta^-} = \left(\frac{C^3 + 2B^3}{2}\right)^{1/3}$$

from where we can now have h_q under Fermat's hypo:

$$h_q = 6X_{m,\Delta^-}^2 = 6 * \left(\frac{C^3 + 2B^3}{2}\right)^{2/3}$$

The after recalling some other formula, putting this into the (1g) we will arrive to the 2th degree solvable equation.

1d) $\left(q + \frac{C}{2^{1/3}}\right)^3 = \frac{C^3 + q*h_q}{2}$

form where

1e) $\left(p^3 + \frac{3C^2 q}{2^{2/3}} + \frac{3C q^2}{2^{1/3}} + \frac{C^3}{2}\right) = \left(\frac{C^3 + q*h_q}{2}\right)$

or:

1f) $\left(q^3 + \frac{3C^2 q}{2^{2/3}} + \frac{3C q^2}{2^{1/3}}\right) = \left(\frac{q*h_q}{2}\right)$

from where h_p :

1g) $\frac{h_q}{2} = q^2 + \frac{3C^2}{2^{2/3}} + \frac{3Cq}{2^{1/3}}$

that lead to a simple 2th degree equation we can solve in A to show it has no Integer, nor Real solutions that means our hypo $X_F = X_i$ is FLASE, so Fermat is right (at the moment for n=3):

1h) $q^2 + \frac{3Cq}{2^{1/3}} + \frac{3C^2}{2^{2/3}} - 3 * \left(\frac{C^3 + 2B^3}{4}\right)^{2/3} = 0$

That is a 2th degree equation has no solutions for $B \in \mathbb{N}$ because of the square root of anoter negative number (as for A in the previous trip)::
To check twince all this we have also:
1a) $p + q = B - A$ but this will be only waste time !

For $n = 4$ thanks to the AI helps we have:

$q^4 + 5q^{2/5} + 10q^{2/5} + 22q^{4/5} + 10q^{3/5} + 5q^{4/5} = 12 \cdot 6(5 + 2\sqrt[5]{4})^{4/5} q^4 + 2\sqrt[5]{5}Cq^3 + 2\sqrt[5]{10}C^2 q^2 + 2\sqrt[5]{10}C^3 q + 2\sqrt[5]{5}C^4$

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$$\text{solve}\left(q^2 + \left(3\,C\left(\frac{p}{2\left(\frac{1}{3}\right)}\right)\right) + \left(3\left(\frac{C^2}{2^{\frac{2}{3}}}\right)\right) - 3\left(\frac{C^3 + 2\,B^3}{2}\right)^{\frac{2}{3}} = 0, B\right)$$

Soluzione 1

$$B = \sqrt[3]{-\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^{\frac{3}{2}} - \frac{C^3}{2}, 4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 \geq 0}$$

Soluzione 2

$$B = \sqrt[3]{\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^{\frac{3}{2}} - \frac{C^3}{2}, 4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 \geq 0}$$

Soluzione 3

$$B = \sqrt[3]{\frac{-\sqrt{-4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 - C^3}}{2}, -4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 \geq 0}$$

Soluzione 4

$$B = \sqrt[3]{\frac{\sqrt{-4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 - C^3}}{2}, -4\left(\frac{3\,C\,p}{2} + \frac{C^2}{2^{\frac{2}{3}}} + \frac{q^2}{3}\right)^3 \geq 0}$$

Figure 26: Another more clear simple 2th degree equation proves FLT for $n = 3$ since the inner root of a negative number is not a Real Number

Conclusion:

As shown in the geometric construction on the Cartesian plane for all $n > 1$ a Triplet of Integers is compatible with Fermat's Symmetric Construction IFF y_i is an Irrational Number depending just by the n-th root of 2, but while for $n = 2$ the Geometric Construction under a Linear Derivative shows an Infinite Number of Solutions are possible, from $n = 3$ due to the curved derivative X_F has a distance p from A and q from B, that is $p > q$ for what $p, q, p/q \in \mathbb{R} - \mathbb{Q}$ are all Irrationals and non compatible with the hypo $X_F = X_i$ as shown by the equation.

Unfortunately while for $n = 2$ the linear derivative and the condition $\sin(\alpha) = \cos(\alpha)$ produce a simple geometric construction, so a simple geometric proof too,

the trigonometric version for the curved derivative ($n > 2$ is not so easy to be extended as I did for the equation, so I'm still working further on such conclusion.

But I'm in the hope now mathematicins will be more interested to study what follow by my Complucate Modulus Algebra Concerning and Proof I produce several years ago, that show via new modular concerning the impossibility of a integer triplet from $n = 3$ because the Shift on the Sum, on a curved derivative is like trying to couple two different non Coupable Gear (so having theet in an irrational ratio), because it is simply impossible to ajust Limits and terms, at the same time, to let the two Sums are Left and Right Hand, equal both sides.

Preview of FLT Proof via CMA :

A very direct and elegant proof for the FLT, do not involve computation, comes putting at work my Complicate Modulus Algebra, so all what was shown into my Vol.1 The Two Hand Clock. And it's just question of Sum and Limits and a simple modular concept I produce without Abstract Algebra concepts.

The same Hypo: $A, B, C \in \mathbb{N}$ so A^n, B^n and C^n can be rewritten in Sums (using $n = 3$ as example). X instead of i is used for a good reason will be clear to the good reader, then we ask if can be possible the FLT equality for some triplet (and for so the $=$? sing rest in any non proven true statement, while the $=$ will appear when we are sure of the equality (holds true once we left one of the 3 free to be an Irrational too):

$$A^3 =? C^3 - B^3$$

Step.1: Transforming Powers in SUMs (pls ref. my Vol.1):

$$A^3 =? \sum_{X=1}^{C}(3X^2 - 3X + 1) - \sum_{X=1}^{B}(3X^2 - 3X + 1) =? \sum_{X=B+1}^{C}(3X^2 - 3X + 1) \quad (0)$$

Step.2: Applying the Shifting of the Limits Rule we have:

$$A^3 = \sum_{X=1}^{A}(3X^2 - 3X + 1) =? \sum_{X=1}^{C-B}(3(X + B)^2 - 3(X + B) + 1)$$

But since nothing has to change if we are working into the integers, we can now Force the Right Hand Sum to work with Rational Steps:

Step.3a: Going Rational, using my Step Sum property, there must be an intger K for what $x = X/K$ lead to the equality (pls ref. my Vol.1):

$$A^3 = \sum_{X=1}^{A}(3X^2 - 3X + 1) =? \sum_{x=1/K}^{C-B}\left(\frac{3(x + B)^2}{K} - \frac{3(x + B)}{K^2} + \frac{1}{K^3}\right)$$

Fact: we know that there exist a Real $C_{\mathbb{R}-\mathbb{Q}}$ from now to be short into the formulas: $C_{\mathbb{R}}$ for what $C' = (A^n + B^n)^{1/n}$ so that pushing the Sum to the limit we can Always have the equality:
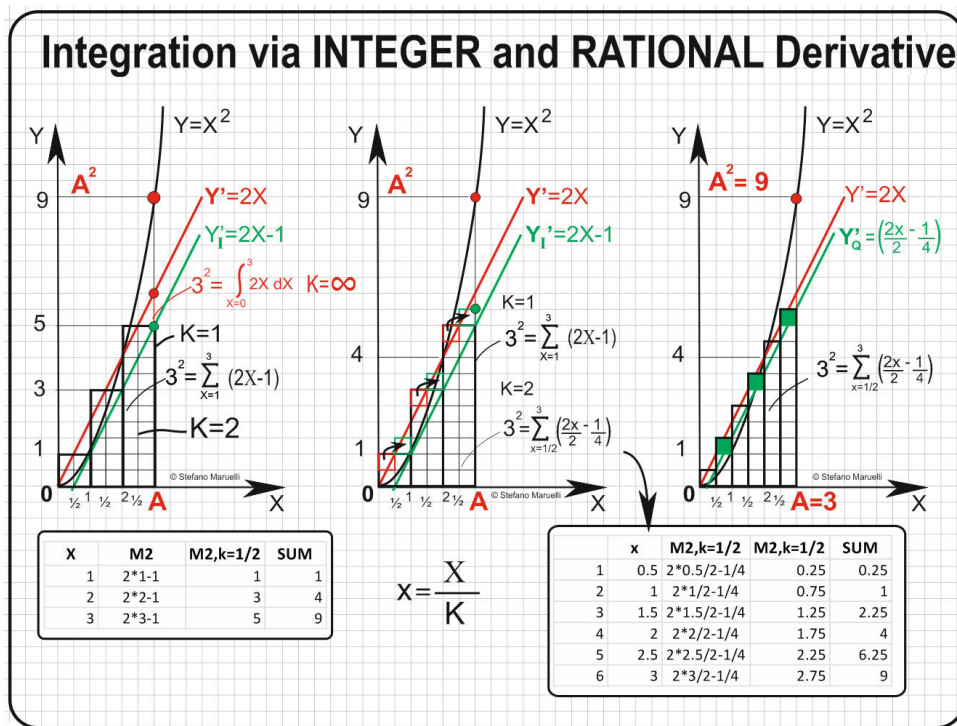
Figure 27: A new concept to be digested: for parables and polinomyal under certain condition we can use a scaled Sum, via scaling the Step of the Sum it is no longerg a mute i but a talking $x = X/K$
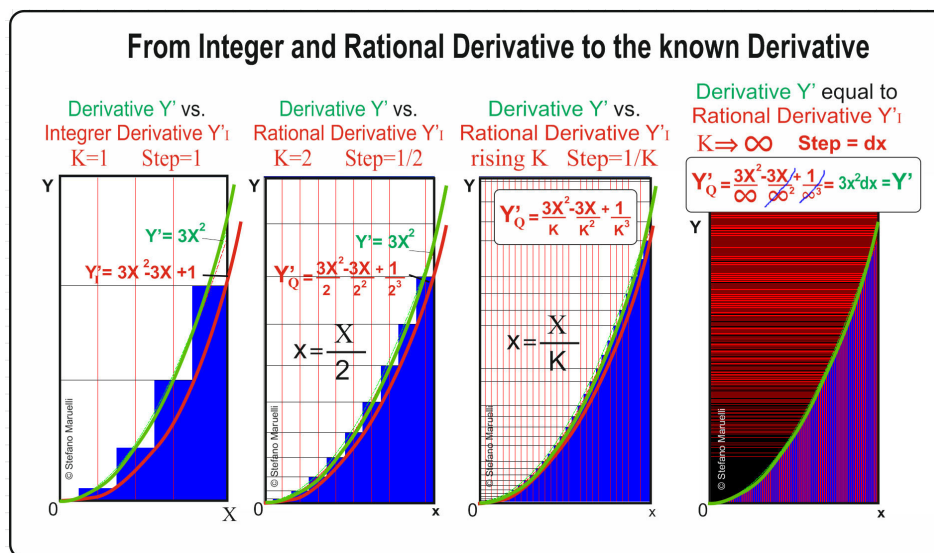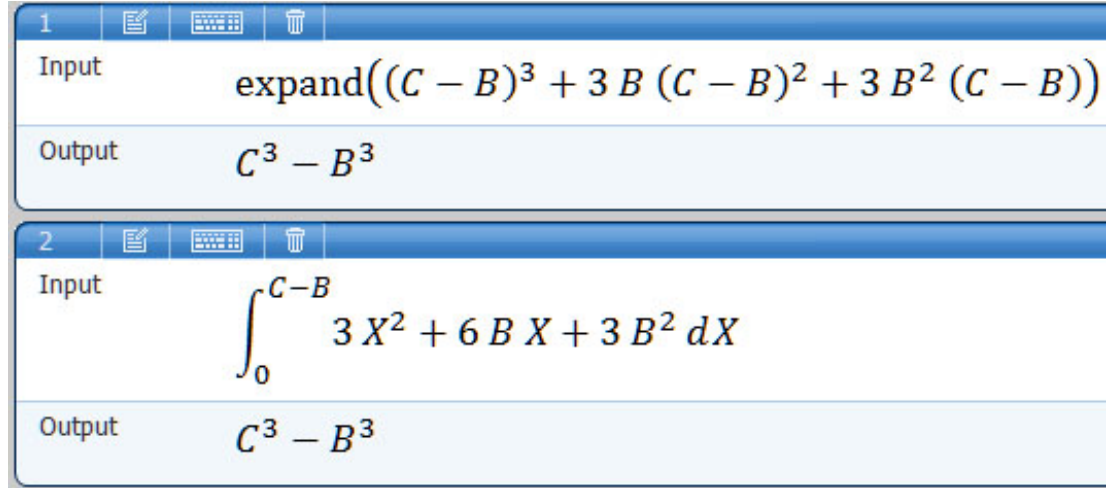

Figure 28: How to push the Step Sum to the Limit for $K \to \infty$

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Step.3b: Going to the Limit:

$$A^3 = \lim_{K\to\infty.so.C_\mathbb{Q}\to C} \sum_{x=1/K}^{C_\mathbb{R}-B} \left(\frac{3(x+B)^2}{K} - \frac{3(x+B)}{K^2} + \frac{1}{K^3}\right) =$$

$$= \int_0^{C_\mathbb{R}-B} (3x^2+6Bx+3B^2)dx = (x^3+3Bx^2-3xB^2)|_{0,C-B} = \int_B^{C'} 3x^2 dx = x^3|_{C_\mathbb{R},B} = C_\mathbb{R}^3 - B^3$$

1			
Input	$\text{expand}\big((C-B)^3 + 3B(C-B)^2 + 3B^2(C-B)\big)$		
Output	$C^3 - B^3$		

2			
Input	$\int_0^{C-B} 3X^2 + 6BX + 3B^2\, dX$		
Output	$C^3 - B^3$		

Figure 29: $C^3 - B^3$ written in known algebra, or via Integral checked by Mathematica program

While with a Rational $C_{\mathbb{Q}-\mathbb{N}} = P/K$ (from now $C_\mathbb{Q}$), for any integer K we have (for any $n > 2$)

the inequality must be clear if $C_\mathbb{Q} < C_\mathbb{R} < C_\mathbb{Q} + 1/K$:

$$\sum_{x=1/K}^{C_\mathbb{Q}-B} \left(\frac{3(x+B)^2}{K} - \frac{3(x+B)}{K^2} + \frac{1}{K^3}\right) < A^3 = \sum_{X=1}^{A}(3X^2 - 3X + 1) =$$

$$\lim_{K\to\infty} \sum_{x=1/K}^{C_\mathbb{R}-B} \left(\frac{3(x+B)^2}{K} - \frac{3(x+B)}{K^2} + \frac{1}{K^3}\right) < \sum_{x=1/K}^{C_\mathbb{Q}+1/K-B} \left(\frac{3(x+B)^2}{K} - \frac{3(x+B)}{K^2} + \frac{1}{K^3}\right)$$

Whithout giving you more details I will give in a next paper, once one understood my geometric construction I hope also one understood that this is because:

LOOKING TO WHAT HAPPENS TO THE STEP SUMS ONCE WE RISE THE INTERNAL TERMS, vs THE NEXT STEP

FLT-N3-LEFT-HAND as GENUINE CUBE of A via STEP SUM Step= K
K=5

X	x=X/A	Right Modulus for CUBES $3x^2/K-3x/K^2+1/K^3$	GENUINE CUBE of x SUM
1	0.2	0.008	0.008
2	0.4	0.056	0.064
3	0.6	0.152	0.216
4	0.8	0.296	0.512
5	1	0.488	1
6	1.2	0.728	1.728
7	1.4	1.016	2.744
8	1.6	1.352	4.096
9	1.8	1.736	5.832
10	2	2.168	8
11	2.2	2.648	10.648
12	2.4	3.176	13.824
13	2.6	3.752	17.576
14	2.8	4.376	21.952
15	3	5.048	27
16	3.2	5.768	32.768
17	3.4	6.536	39.304
18	3.6	7.352	46.656
19	3.8	8.216	54.872
20	4	9.128	64
21	4.2	10.088	74.088
22	4.4	11.096	85.184
23	4.6	12.152	97.336
24	4.8	13.256	110.592
25	5	14.408	125

Rising Internal Terms of 1/K
K=5

X	x=X/A	Right Modulus for CUBES $3(x+B)^2-3(x+B)+1$	SUM
1	0.2	22.328	22.328
2	0.4	23.816	46.144
3	0.6	25.352	71.496
4	0.8	26.936	98.432
5	1	28.568	127

GENUINE CUBE of $(A+1/K)^3$ via STEP SUM Step= K
K=5

X	x=X/A	Right Modulus for CUBES $3(x)^2/K-3(x)/K^2+1/K^3$	Cube of x (+1/k)
1	0.2	0.008	0.008
2	0.4	0.056	0.064
3	0.6	0.152	0.216
4	0.8	0.296	0.512
5	1	0.488	1
6	1.2	0.728	1.728
7	1.4	1.016	2.744
8	1.6	1.352	4.096
9	1.8	1.736	5.832
10	2	2.168	8
11	2.2	2.648	10.648
12	2.4	3.176	13.824
13	2.6	3.752	17.576
14	2.8	4.376	21.952
15	3	5.048	27
16	3.2	5.768	32.768
17	3.4	6.536	39.304
18	3.6	7.352	46.656
19	3.8	8.216	54.872
20	4	9.128	64
21	4.2	10.088	74.088
22	4.4	11.096	85.184
23	4.6	12.152	97.336
24	4.8	13.256	110.592
25	5	© Stefano Maruelli 14.408	125
26	5.2	15.608	140.608

Figure 30: If we try to make a the Step Sum till a Rational we arrive short, and at the next step too long and thi indipendently by the K we choose till at the limit we rise our targhet that means we are trying to rise an irrational via rational step for what: $C_{\mathbb{Q}} < C_{\mathbb{R}} < C_{\mathbb{Q}} + 1/K$

while onto (X,Y) reference we have a finite number of Gnomons (so we can use a classic Sum), onto the Scaled System (x, y) we need the Integral that moves step dx to rise an area bellow the curved derivative (is for example for $n = 3$ $y' = 6X^2$),

till the unknown X_F is for sure an Irrational (since $p > q$ and for what we will prove in the new paper as soon as ready),

so we have to move step dx till any Real Right Border, so any Upper Irrational Limit, can be risen by the Integral, only, while with a simple known Sum, just, we can rise an Integer Upper Limit, just, or via Step Sum we normally rise a Rational, just, and in just some special case, as shown in Vol.1, we can rise a known Irrational too, but just scaling the Sum of a known quantity allow to arrive to an X_i is the X_F Fermat condition fix, as I will better show).

But the more smiple answer with my CMA is that it is not possible to arrange the Right side Sum to have same limit and terms if $n > 2$ because terms behave NON linearly, while index moves linearly so there is no way (except via integral) to transform the shifted Sum into a genuine power of an integer.

And in the Irrational version with the change of scale $x = X/2^{1/n}$ will be shown too in my next work, and into the Vol.2 will discuss Euler and Beal problems too.
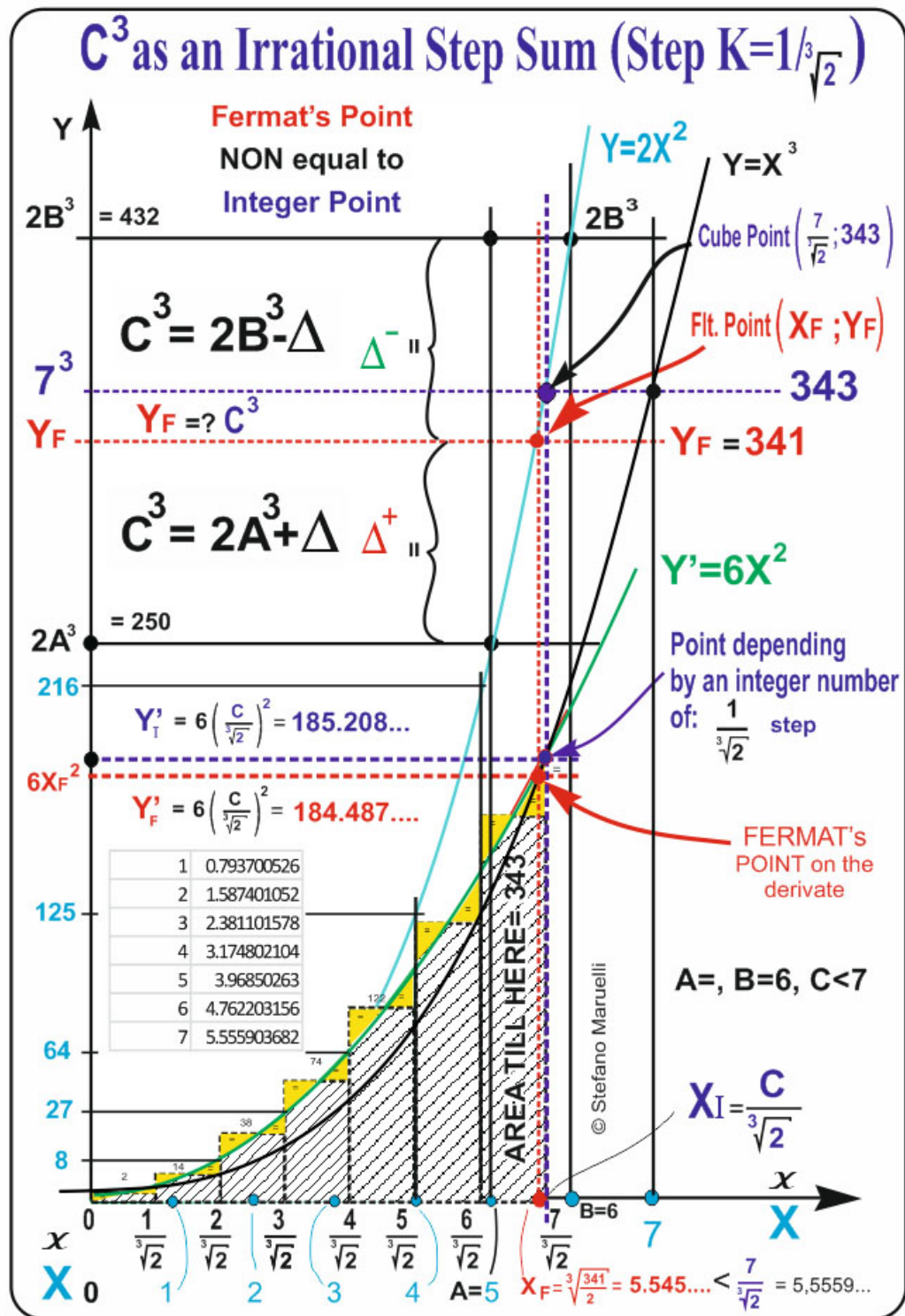
to be continued... asap

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Figure 31: Just for $n = 2$ the Derivative is Linear and for so produce the fact that for some triplets A, B, C the Medium Height produce an Abscissa it's $X_F = X_I = C/\sqrt{2}$, that is the same to say: $1/2$ is a Common Factor of A, B, C, while from $n = 3$ the curvede derivative let the equation be impossible in the integers. Here an example for $n = 3$ and the quasi triplet 5,6,7.

Reference Section :

Sorry to say that because of the simple Math I use, the only reference it is usefull but to inderstand more on my CMA, is my Vol.1 you can ask me, or find it on Academia.edu or onto the web at my blog once again at work.

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