Fermat's Last Theorem Proved on Half of a Page

"5% of the people think; 10% of the people think that they think; and the other 85% would rather die than think."----Thomas Edison

"The simplest solution is usually the best solution"---Albert Einstein

Abstract

Fermat's last theorem has been proved on half of a page. The approach used in the proof is exemplified by the following system: If a system functions properly and one wants to determine if the same system will function properly with changes in the system, one will first determine the necessary conditions which allow the system to function properly, and then guided by the necessary conditions, one will determine if the changes will allow the system to function properly. So also, if one wants to prove that there are no solutions for the equation $c^n = a^n + b^n$ when $n > 2$, one should first determine why there are solutions when $n = 2$, and note the necessary condition in the solution for $n = 2$. The necessary condition in the solutions for $n = 2$ will guide one to determine if there are solutions when $n > 2$. The proof in this paper is based on the identity $(a^2 + b^2)/c^2 = 1$ for a Pythagorean triple a, b, c, where $a, b,$ and c are relatively prime positive integers. It is shown by contradiction that the uniqueness of the $n = 2$ identity excludes all other n-values, n > 2, from satisfying the equation $c^n = a^n + b^n$. One will first show that if $n = 2$, $c^n = a^n + b^n$ holds, noting the necessary condition in the solution; followed by showing that if $n > 2$ (n an integer), $c^n = a^n + b^n$ does not hold. The proof is very simple, and even high school students can learn it. The approach used in the proof has applications in science, engineering, medicine, research, business, and any properly working system when desired changes are to be made in the system. Perhaps, the proof in this paper is the proof that Fermat wished there were enough margin for it in his paper. With respect to prizes, if the prize for a 150-page proof were $715,000, then the prize for a half-page proof (considering the advantages) using inverse proportion, would be $214,500,000.

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Step 1: $c^n = a^n + b^n$;

$$\frac{a^n + b^n}{c^n} = \frac{c^n}{c^n};$$

$$\boxed{\frac{a^n + b^n}{c^n} = 1} \quad \text{(A)}$$

(A) is the necessary condition for $c^n = a^n + b^n$ to be true. or to have solutions.
(The ratio $(a^n + b^n)$ to $c^n = 1$)

Step 2: If $n = 2$, $\frac{a^n + b^n}{c^n} = \frac{a^2 + b^2}{c^2} = 1$ is true for a Pythagorean triple a, b, c, (Example: For the integers $3, 4, 5$, $\frac{a^2 + b^2}{c^2} = 1$ $(3^2 + 4^2)/5^2 = 25/25 = 1$)
Thus, if $n = 2$,the necessary condition $(a^n + b^n)/c^n = 1$ is satisfied and $c^n = a^n + b^n$ is true or has solutions.

Step 3: One will next show that if $n > 2$, the necessary condition , $\frac{a^n + b^n}{c^n} = 1$, is never satisfied.

Step 4: Proof for $n > 2$ by contradiction

If $n > 2$, and one assumes that $\frac{a^n + b^n}{c^n} = 1$,

then $\frac{a^n + b^n}{c^n} = \frac{a^2 + b^2}{c^2}$ (B)

(By the transitive equality property, since $\frac{a^2 + b^2}{c^2} = 1$). From (B),and equating the exponents, $n > 2 = 2$ is false, since an integer greater than 2 cannot be equal to 2). Hence, the assumption that $\frac{a^n + b^n}{c^n} = 1$, if $n > 2$, is false.

Step 5: Therefore, $\frac{a^n + b^n}{c^n}$ is not equal to 1.
$(\frac{a^n + b^n}{c^n} \neq 1)$ if $n > 2$. Since the necessary condition $\frac{a^n + b^n}{c^n} = 1$, is not satisfied if $n > 2$, the equation $c^n = a^n + b^n$ has no solutions if $n > 2$.
Therefore $c^n = a^n + b^n$ has solutions only if $n = 2$ and does not have solutions if $n > 2$.
The proof is complete.

Conclusion

Fermat's last theorem has been proved on half of a page. One first determined why there are solutions when $n = 2$ .The necessary condition in the solutions for $n = 2$ guided one to determine if there are solutions when $n > 2$. The necessary condition is $(a^n + b^n)/c^n = 1$, where a, b, and c are relatively prime positive integers. This necessary condition is satisfied only if $n = 2$, to produce $(a^2 + b^2)/c^2 = 1$. If $n > 2$, the necessary $(a^n + b^n)/c^n = 1$ is never satisfied. It was shown by contradiction that the uniqueness of the $n = 2$ identity excludes all other n-values, $n > 2$, from satisfying the equation $c^n = a^n + b^n$. The proof is very simple, and even high school students can learn it. The approach used in the proof has applications in science, engineering, medicine, research, business, and any properly working system when desired changes are to be made in the system. Perhaps, the proof in this paper is the proof that Fermat wished there were enough margin for it in his paper. The proof in this paper is the Version 3 proof of the author's previous paper with the title "Fermat's Last Theorem Proved on a Single Page", viXra:1605.0195. It is being published alone because it is the simplest proof version and consequently, perhaps ,the best proof for all times.

Question: Why did it take over 300 years for the above proof to show up?
Adonten