The Last Theorem of Pierre de Fermat. A short and Simple Proof.

Of course Mr. Pierre de Fermat did not know the ABC hypothesis, let alone hypothesis Taniyama-Shimura. He simply wrote that there is no solution in integers $x^n + y^n = z^n$ if $n > 2$. He understood the essence of the proof, but did not even begin to uncover it, assuming it is elementary.

Perhaps like this:

Option 1

$$x^n + y^n = z^n \quad (x, y, z, n \in \mathbb{N}),$$

$$\begin{aligned} \text{a) } \sqrt{x^n} &= \sqrt{z^n - y^n} \text{ if } n > 2 \Rightarrow \sqrt{x^n} = x\sqrt{x^{n-2}} \\ \sqrt{y^n} &= \sqrt{z^n - x^n} \text{ if } n > 2 \Rightarrow \sqrt{y^n} = y\sqrt{y^{n-2}} \\ \sqrt{z^n} &= \sqrt{y^n + x^n} \text{ if } n > 2 \Rightarrow \sqrt{z^n} = z\sqrt{z^{n-2}} \end{aligned}$$

$$\begin{aligned} \text{b) } \frac{x\sqrt{x^{n-2}}}{y\sqrt{y^{n-2}}} &= \frac{\sqrt{z^n - y^n}}{\sqrt{z^n - x^n}} \Rightarrow \frac{x}{y} = \frac{\sqrt{y^{n-2}}\sqrt{z^n - y^n}}{\sqrt{x^{n-2}}\sqrt{z^n - x^n}} \\ \frac{z\sqrt{z^{n-2}}}{y\sqrt{y^{n-2}}} &= \frac{\sqrt{x^n + y^n}}{\sqrt{z^n - x^n}} \Rightarrow \frac{z}{y} = \frac{\sqrt{y^{n-2}}\sqrt{x^n + y^n}}{\sqrt{z^{n-2}}\sqrt{z^n - x^n}} \end{aligned}$$

$$\begin{aligned} \text{c) } kx &= \sqrt{y^{n-2}}\sqrt{z^n - y^n} \Rightarrow k = \frac{\sqrt{y^{n-2}}\sqrt{z^n - y^n}}{x} \\ ky &= \sqrt{x^{n-2}}\sqrt{z^n - x^n} \Rightarrow k = \frac{\sqrt{x^{n-2}}\sqrt{z^n - x^n}}{y} = \frac{\sqrt{y^{n-2}}\sqrt{z^n - y^n}}{x} \end{aligned}$$

$$k \neq K$$

$$\Rightarrow Ky = x \Rightarrow K = \frac{x}{y}, \text{ but } (x, y) = 1 \Rightarrow K \notin \mathbb{N} \Rightarrow K = 1 \Rightarrow x = y, \text{ but } x \neq y$$

$$K = 1 \Rightarrow \sqrt{y^{n-2}}\sqrt{z^n - y^n} = \sqrt{x^{n-2}}\sqrt{z^n - x^n} \Rightarrow y^{n-2}x^n = x^{n-2}y^n \Rightarrow \frac{y^n x^n}{y^2} = \frac{x^n y^n}{x^2}$$

$$\Rightarrow x = y \text{ but } x \neq y$$

Q.E.D.

Option 2

$$x^n + y^n = z^n$$

$$\begin{aligned} \text{a) } \sqrt{x^n} &= \sqrt{z^n - y^n} \text{ if } n > 2 \Rightarrow \sqrt{x^n} = x\sqrt{x^{n-2}} \\ \sqrt{y^n} &= \sqrt{z^n - x^n} \text{ if } n > 2 \Rightarrow \sqrt{y^n} = y\sqrt{y^{n-2}} \end{aligned}$$

$$\sqrt{z^n} = \sqrt{x^n + y^n} \text{ if } n \succ 2 \Rightarrow \sqrt{z^n} = z\sqrt{z^{n-2}}$$

$$b) \frac{x\sqrt{x^{n-2}}}{y\sqrt{y^{n-2}}} = \frac{\sqrt{z^n - y^n}}{\sqrt{z^n - x^n}} \Rightarrow \frac{x}{y} = \frac{\sqrt{y^{n-2}}\sqrt{z^n - y^n}}{\sqrt{x^{n-2}}\sqrt{z^n - x^n}}$$

$$c) \frac{x\sqrt{x^{n-2}}}{z\sqrt{z^{n-2}}} = \frac{\sqrt{z^n - y^n}}{\sqrt{y^n + x^n}} \Rightarrow \frac{x}{z} = \frac{\sqrt{z^{n-2}}\sqrt{z^n - y^n}}{\sqrt{x^{n-2}}\sqrt{y^n + x^n}}$$

$$d) (\sqrt{z^n})^2 = (\sqrt{x^n})^2 + (\sqrt{y^n})^2 \Rightarrow \frac{\sqrt{x^n}}{\sqrt{z^n}} = \cos\beta$$

$$\frac{x}{z} = \frac{\sqrt{z^{n-2}}\sqrt{z^n - y^n}}{\sqrt{x^{n-2}}\sqrt{y^n + x^n}} = \frac{\sqrt{z^{n-2}}}{\sqrt{x^{n-2}}} \cos\beta \Rightarrow$$

$$kz = \sqrt{x^{n-2}}, \Rightarrow k = \frac{\sqrt{x^{n-2}}}{z}, (x, z) = 1 \Rightarrow k \notin N \Rightarrow z = \sqrt{x^{n-2}}, \text{ but } (x, z) = 1 \Rightarrow Q.E.D.$$

and:

$$kx = \sqrt{z^{n-2}} \cos\beta \Rightarrow k = \frac{\sqrt{z^{n-2}}\sqrt{x^n}}{x\sqrt{z^n}} \Rightarrow \frac{\sqrt{x^{n-2}}}{z} = \frac{\sqrt{z^{n-2}}\sqrt{x^n}}{x\sqrt{z^n}}, \sqrt{x^{n-2}} \prec \sqrt{z^{n-2}}\sqrt{x^n} \Rightarrow$$

$$k \neq K$$

$$\sqrt{z^{n-2}}\sqrt{x^n} = K\sqrt{x^{n-2}} \Rightarrow K = \frac{\sqrt{z^{n-2}}\sqrt{x^n}}{\sqrt{x^{n-2}}} = \frac{\sqrt{z^{n-2}}}{x} \notin N \Rightarrow K = 1$$

but

$$(x, z) = 1 \Rightarrow Q.E.D.$$

and:

$$x\sqrt{z^n} = Kz \Rightarrow K = \frac{x\sqrt{z^n}}{z} \Rightarrow \frac{x\sqrt{z^n}}{z} = \frac{\sqrt{z^{n-2}}}{x} \Rightarrow x^2\sqrt{z^{n-2}} = \sqrt{z^{n-2}} \Rightarrow x^2 = 1$$

but

$$x \succ 1 \Rightarrow K = 1$$

AND:

$$\text{If } K = 1 \Rightarrow \sqrt{z^{n-2}}\sqrt{x^n} = \sqrt{x^{n-2}} \Rightarrow \frac{\sqrt{z^n}}{z} = \frac{\sqrt{x^{n-2}}}{\sqrt{x^n}} \prec 1 \Rightarrow \frac{\sqrt{z^n}}{z} \prec 1,$$

But $n \succ 2$

Q.E.D.

I am convinced that there can be still be many ways found how to define the relationship between x, y and z, proving that Mr. Fermat is correct.

Also Andrew Beal's hypothesis cannot be forgotten, his genius statement cannot be left without awe. How he managed to do it I cannot comprehend – beautifully and with elegance! This proof confirms that Andrew Beal's hypothesis is true.

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