Proof of Beal’s Conjecture (Condensed Version)
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Abstract:
In all cases both logical and mathematical, it must be possible to substitute identities. In this paper, we present a newly discovered logarithmic identity whose properties demonstrate that division by zero prevents the substitution of identities if and only if it is assumed that “Beal’s Conjecture” is false.

Description:
Beal’s Conjecture can be stated as follows: For positive integers: $a, b, c, x, y, z$, if: $a^x + b^y = c^z$ and: $a, b, c$ are co-prime, then: $x, y, z$ are not all greater than 2.

Proof:
Let: $a, b, c \in \{1,2,3,4 \ldots \}$, $x, y \in \{3,4,5,6 \ldots \}$, $Z \in \{1,3,5,7 \ldots \}$, $z \in \{2,4,6,8 \ldots \}$, $T \in \{2,3,4,5 \ldots \}$, $a^x < b^y < \{c^z, c^2\}$, and let: $a, b, c$ be co-prime, so that the only common factor possible is: $1 = \frac{T}{T}$.
Now, if we assume that “Beal’s Conjecture” is false, then: $Z > 2$, $z > 2$,

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^2)^2} = c^2 = \left(\frac{T}{T}\right) c^2 = T \left(\frac{T}{T}\right) \left(\frac{T}{T}\right)^{-1} \left(\frac{T}{T}\right)^{-1}$$

(1)

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^2)^2} = \left(\frac{T}{T}\right) c^2 = \left(\frac{T}{T}\right) \left(\frac{T}{T}\right)^{-1} \left(\frac{T}{T}\right)^{-1}$$

(2)

and division by zero prevents the substitution of: $\frac{c}{c}$ for: $\frac{T}{T}$ in equations (1) and (2).

Thus, the assumption that “Beal’s Conjecture” is false results in a classic contradiction, because clearly, we can’t divide by zero, yet it must be possible to substitute: $\frac{c}{c}$ for: $\frac{T}{T}$.

However, if we assume that “Beal’s Conjecture” is true, then: $Z = 1$, $z = 2$,

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^1)^2} = c^1 = \left(\frac{T}{T}\right) c^1 = T \left(\frac{T}{T}\right)^1$$

(3)

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^1)^2} = (c^1)^2 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1$$

(4)

and substituting: $\frac{c}{c}$ for: $\frac{T}{T}$ in equations (3) and (4) is not prevented, and results in:

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^1)^2} = c^1 = c \left(\frac{T}{T}\right) c^1 = c \left(\frac{T}{T}\right) c^1 = c \left(\frac{T}{T}\right) c^1$$

(5)

and:

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^xb^y)} = \sqrt{(c^2)^2} = (c^1)^2 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1 = \left(\frac{T}{T}\right) c^1$$

(6)

Thus, we have demonstrated that division by zero prevents the substitution of: $1$ for: $1$ if and only if we assume that “Beal’s Conjecture” is false. Therefore, that assumption must be wrong, and the conjecture has been proved. ■
The logarithmic identities in equations (1) and (2) can be similarly derived as follows:

\[
\left( \frac{T}{T} \right)^c = T \left( \frac{c}{\ln(T)} \right) = T \left( \frac{c}{\ln(T)} \right) = T \left( \frac{c}{\ln(T)} \right) = T \left( \frac{c}{\ln(T)} \right) .
\]

The “Beal equation” can also be represented as the difference:

\[
c^x - b^y = \sqrt{((b^y + c^x)^2 - 4b^y c^x)} = \sqrt{(a^X)^2} = a^x = \left( \frac{T}{a} \right) a^x = T \left( \frac{a}{T} \right) ,
\]

for: \( X \in \{1,3,5,7 \ldots \} \), and:

\[
c^x - b^y = \sqrt{((b^y + c^x)^2 - 4b^y c^x)} = \sqrt{(a^X)^2} = \left( a^x \right)^2 = \left( \left( \frac{T}{a} \right) a^x \right)^2 = \left( T \left( \frac{a}{T} \right) a^x \right)^2 ,
\]

for: \( x \in \{2,4,6,8 \ldots \} \), which demonstrates that any sum or difference of two terms is implicitly a square under a second degree radical.

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