

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:  $a, b, c \in \{1, 2, 3, 4 \dots\}$ ,  $x, y \in \{3, 4, 5, 6 \dots\}$ ,  $Z \in \{1, 3, 5, 7 \dots\}$ ,  $z \in \{2, 4, 6, 8 \dots\}$ ,  $T \in \{2, 3, 4, 5 \dots\}$ ,  
 $a^x < b^y < \{c^z, c^z\}$ , 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:  $Z > 2$  ,  $z > 2$  ,

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

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

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:  $1 = \frac{c}{c}$  for:  $1 = \frac{T}{T}$  .**

However, if we assume that "Beal's Conjecture" is true, then:  $Z = 1$  ,  $z = 2$  ,

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^x b^y)} = \sqrt{(c^1)^2} = c^1 = \left(\frac{T}{T}\right) c^1 = T \left(\frac{c}{T}\right)^1 , \quad (3)$$

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

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

$$a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^x b^y)} = \sqrt{(c^1)^2} = c^1 = \left(\frac{c}{c}\right) c^1 = c \left(\frac{c}{c}\right)^1 \quad (5)$$

$$\text{and: } a^x + b^y = \sqrt{((b^y - a^x)^2 + 4a^x b^y)} = \sqrt{(c^2)^2} = (c^1)^2 = \left(\left(\frac{c}{c}\right) c^1\right)^2 = \left(c \left(\frac{c}{c}\right)^1\right)^2 . \quad (6)$$

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. ■

Notes:

The logarithmic identities in equations (1) and (2) can be similarly derived as follows:

$$\left(\frac{T}{T}\right) c^Z = T \left(\frac{c}{T}\right)^{\frac{\ln\left(\frac{c^Z}{T}\right)}{\ln\left(\frac{c}{T}\right)}} = T \left(\frac{c}{T}\right)^{\frac{\frac{\ln\left(\frac{c^Z}{T}\right)}{\ln(T)} - \frac{\ln(T)}{\ln(T)}}{\frac{\ln\left(\frac{c}{T}\right)}{\ln(T)} - \frac{\ln(T)}{\ln(T)}}} = T \left(\frac{c}{T}\right)^{\frac{\frac{(Z) \ln(c)}{\ln(T)} - 1}{\frac{\ln(c)}{\ln(T)} - 1}} .$$

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

$$c^Z - b^y = \sqrt{((b^y + c^Z)^2 - 4b^y c^Z)} = \sqrt{(a^X)^2} = a^X = \left(\frac{T}{T}\right) a^X = T \left(\frac{a}{T}\right)^{\frac{\frac{(X) \ln(a)}{\ln(T)} - 1}{\frac{\ln(a)}{\ln(T)} - 1}} ,$$

for:  $X \in \{1,3,5,7 \dots\}$  , and:

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

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

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