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Conditional Equation's of Beal Conjecture

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Abstract:
This paper introduces two conditional equations which are termed as CE-1 and CE-2 in this paper. The CE-1 and CE-2 equations give a constant result for the variables of beal conjecture and show condition for its occurrence .This paper also includes proof of validity of beal conjecture which is shown by deriving CE-1 and CE-2 from beal conjecture equation.

Keywords: *conditional equations (CE-1 and CE-2), Beal conjecture, prime numbers, ferman-catalan conjecture (FCC), number theory*

1. Introduction

Beal conjecture states that if $a^x + b^y = c^z$ with a, b, c having a common prime factor then x,y,z>2. It was formulated by Andrew beal. Although maudlin [1] also presented it as a generalization of Fermat's last theorem. Beal conjecture can also be concluded as that all Ferman Catalon Conjecture solutions use 2 as an exponent.

Darmon and Granville [2] have also worked in this kind of problem while investigating integer solutions of the super elliptic equation $z^m = F(x,y)$

Where F is a homogeneous polynomial with integer coefficients of the generalized Fermat equation $Ax^p + By^q + Cz^r$

beal conjecture is concerned with the common prime factor for positive integers and their exponents greater than 2. If $a^x + b^y = c^z$, where a, b, c, x, y and z are positive integers and x, y and z are all greater than 2, then A, B and C must have a common prime factor.

Ex:

		Common Prime Factor
$2^3 + 2^3 = 2^4$	=>	2
$2^9 + 8^3 = 4^5$	=>	2
$3^3 + 6^3 = 3^5$	=>	3
$3^9 + 54^3 = 3^{11}$	=>	3
$27^4 + 162^3 = 9^7$	=>	3
$7^6 + 7^7 = 98^3$	=>	7
$33^5 + 66^5 = 33^6$	=>	11
$34^5 + 51^4 = 85^4$	=>	17
$19^4 + 38^3 = 57^3$	=>	19

Table 1

2. Conditional Equations (CE-1 and CE-2)

If the equation $a^x + b^y = c^z$ satisfies beal conjecture then

CE-1: $(x-2)\log a + (y-2)\log b - (z-2)\log c = K(\pm\log 2)$

CE-2: 2log $(c/ab) = k(\pm\log 2)$

Where k=0, 1, 2, 3…n integers and $(\pm\log 2)$ is a constant(error correcting constant). Any one or both of the above equations must be satisfied IF BEAL CONJECTURE IS TRUE.

However the result of CE-1 and CE-2 can be stated as a multiple of $(\pm\log 2)$.

From the below table a, b, c, x, y, z are variables of the equation $a^x + b^y = c^z$ satisfying beal conjecture.

Sl.no,	a	b	c	x	y	z	$k(\pm log2)$ for CE-1	$k(\pm log2)$ for CE-2	Satisfying equation
1	2	2	2	3	3	4	0*log2	2*(-log2)	both
2	2	8	4	9	3	5	4*log2	4*(-log2)	both
3	3	6	3	3	3	5	1*log2	5*(-log2)	both
4	3	54	3	9	3	11	9*log2	12*(-log2)	both
5	27	162	9	4	3	7	1*log2	18*(-log2)	both
6	7	7	98	6	7	3	19*log2	2*(-log2)	both
7	33	66	33	5	5	6	13*log2	12*(-log2)	both
8	34	51	85	5	4	4	14*log2	9*(-log2)	both
9	19	38	57	4	3	3	8*log2	7*(-log2)	both

Table 2: Table showing solution of beal conjecture using CE-1 and CE-2

3. Derivation of conditional equations CE-1 and CE-2 using beal conjecture.

From beal conjecture we have

$a^x + b^y = c^z$.. (1)

Let x=k1+2,y=k2+2,z=k3+2 and k1,k2,k3 are any variables such that x,y,z>2 and satisfying beal conjecture **.**

Let $\log a^x + \log b^y - \log c^z = K(\pm\log 2)$.. (2)

(From above table 3, SL.NO 1 contents the above equation (2) is possible,

Now solution of equation 1 using CE-1 is k=0

Substituting the above in equation 2, we can write equation (2) as

$\log a^{k1+2} + \log b^{k2+2} - \log c^{k3+2}$=0.$(\pm\log 2)$ [∵ k=0]

Now, $\log a^{k1+2} + \log b^{k2+2}$= $\log c^{k3+2}$

(k1+2)loga+(k2+2)logb=(k3+2)logc

k1loga+2loga+k2logb+2logb=k3logc+2logc

k1loga+k2logb-k3logc=2(logc-loga-logb)

k1loga+k2logb-k3logc=2log(c/ab).. (3)

Now solving for k1, k2, k3, We get $(x-2) = k1$, $(y-2) = k2$, $(z-2)$=k3

Substituting these values in equation (3) we get

$(x-2)\log a + (y-2)\log b - (z-2)\log c$=2log (c/ab)... (4)

Now equation (4) can be resolved into two parts

i.e. $(x-2)\log a + (y-2)\log b - (z-2)\log c = K(\pm\log 2)$.. (5)

And 2log (c/ab)=K($\pm$log2)........................... (6) k=$0,1,2,3 \ldots n$ integers

Where ($\pm$log2) is a constant, it can be also called as error correcting constant.

Equation 5 and 6 are conditional equations CE-1 and CE-2, any one of them or both of them must be satisfied if beal conjecture is true.

4. Conclusion

1. CE-1 and CE-2 results a constant $K(\pm\log 2)$ only if beal conjecture is true, i.e. it also shows condition for occurrence of beal conjecture.
2. Derivation of CE-1 and CE-2 from beal conjecture is a valid proof for existence of beal conjecture.
3. The result of CE-1 and CE-2 can be stated as a multiple of$(\pm\log 2)$.

5. References

1. D.R. maudlin=”a generalization of flt:beal conjecture and prize problem “in notices of AMS 1997.
2. H. Darmon and A. Granville, “On the equations ZS =F(x, y)_and Ax. + By. = Cz. ”, in Bull. London Math. Soc., 27, 1995, pp. 513-543.