Proof of the Beal Conjecture through the Fundamental Theorem of Arithmetic

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Abstract: This paper gives a proof of the Beal conjecture through the Fundamental Theorem of Arithmetic.

Theorem: If $Ax+By = Cz$, where A, C, x, y and z are positive integers and $x, y, z > 2$, then A, B and C must have a common prime factor.

Proof:

According to the Fundamental Theorem of Arithmetic, every integer greater than 1 is either a prime itself or is the product of prime numbers. This means that A, and C are either a prime itself or the product of prime numbers. Since A, and C are raised to exponential powers greater than 2 that means that A, B, and C are going to be the products of prime numbers themselves or the products of other numbers that can be broken down as the product of primes. A, and C cannot be equal to 1 because 1 is not a prime number, and 1 will always be 1 no matter what value of an exponent you raise it to. This means that the lowest common prime factor that A and C can have is 2.

1. Starting off with the Fundamental Theorem of Arithmetic we are told that every integer greater than 1 is either a prime number itself or is the product of prime numbers. **[1]**

2. Prime numbers are defined as positive integers that are divisible only by themselves and 1 only. By definition, this means that 2 is the smallest prime number. **[2]**

3. By **[1]** we can say that A, and C are either prime numbers or the product of prime numbers.

4. The exponents $x, y, z > 2$ so the values of the exponents can be any positive integer as long as it is greater than or equal to 3.

5. The exponents of a number say how many times to use the number in multiplication. This means that Ax says to multiply A by itself x times, By says to multiply B by itself y times, and Cz says to multiply C by itself z times.

6. With respect to **4** the minimum values that x, and z can be is 3.

7. With respect to **2]** the minimum values that A, or C can be is 2.

8. The common prime factor that can exist between the positive integers of A, and C in the equation $Ax+By=Cz$ are $A, B, C \geq 2$

9. A, and C must have a common prime factor. According to **2** the lowest common prime factor that can exist is 2.

References:

[1] http://mathworld.wolfram.com/FundamentalTheoremofArithmetic.html

[2] http://www.mathsisfun.com/definitions/prime-number.html

[3] http://www.mathsisfun.com/definitions/exponent.html