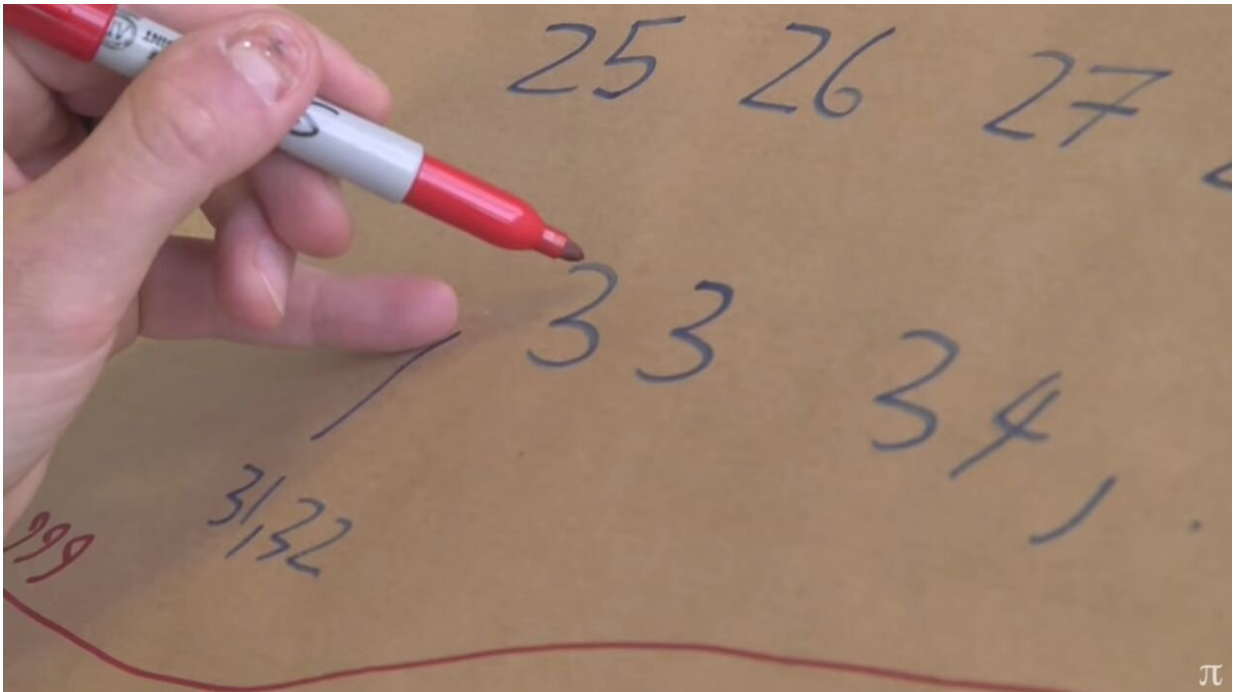


# Sum of three cubes for 42 finally solved—using real life planetary computer

September 6 2019

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Hot on the heels of the ground-breaking 'Sum-Of-Three-Cubes' solution for the number 33, a team led by the University of Bristol and Massachusetts Institute of Technology (MIT) has solved the final piece of the famous 65-year-old maths puzzle with an answer for the most elusive number of all—42.

The original problem, set in 1954 at the University of Cambridge, looked for Solutions of the Diophantine Equation  $x^3+y^3+z^3=k$ , with  $k$  being all the numbers from one to 100.

Beyond the easily found small solutions, the problem soon became intractable as the more interesting answers—if indeed they existed—could not possibly be calculated, so vast were the numbers required.

But slowly, over many years, each value of  $k$  was eventually solved for (or proved unsolvable), thanks to sophisticated techniques and modern computers—except the last two, the most difficult of all; 33 and 42.

Fast forward to 2019 and Professor Andrew Booker's mathematical ingenuity plus weeks on a university supercomputer finally found an answer for 33, meaning that the last [number](#) outstanding in this decades-old conundrum, the toughest nut to crack, was that firm favourite of Douglas Adams fans everywhere.

However, solving 42 was another level of complexity. Professor Booker turned to MIT maths professor Andrew Sutherland, a world record breaker with massively parallel computations, and—as if by further cosmic coincidence—secured the services of a planetary computing platform reminiscent of "Deep Thought", the giant machine which gives the answer 42 in Hitchhiker's Guide to the Galaxy.

Professors Booker and Sutherland's solution for 42 would be found by using Charity Engine; a 'worldwide computer' that harnesses idle, unused computing power from over 500,000 home PCs to create a crowd-sourced, super-green platform made entirely from otherwise wasted capacity.

The [answer](#), which took over a million hours of calculating to prove, is

as follows:

$X = -80538738812075974$   $Y = 80435758145817515$   $Z = 12602123297335631$

And with these almost infinitely improbable numbers, the famous Solutions of the Diophantine Equation (1954) may finally be laid to rest for every value of  $k$  from one to 100—even 42.

Professor Booker, who is based at the University of Bristol's School of Mathematics, said: "I feel relieved. In this game it's impossible to be sure that you'll find something. It's a bit like trying to predict earthquakes, in that we have only rough probabilities to go by.

"So, we might find what we're looking for with a few months of searching, or it might be that the [solution](#) isn't found for another century."

**More information:** Andrew R. Booker, Cracking the problem with 33, *Research in Number Theory* (2019). [DOI: 10.1007/s40993-019-0162-1](https://doi.org/10.1007/s40993-019-0162-1)

Provided by University of Bristol

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