

Life, the Universe, and Math: 42 Proven to be the Sum of 3 Cubes

$$42 = (-80538738812075974)^3 + 80435758145817515^3 + 12602123297335631^3$$

Back in April, 2019, the "Sum of Three Cubes" problem was solved for the number **33**. The problem can be stated as: $k = x^3 + y^3 + z^3$, where k is an integer.

For example,
 $29 = 3^3 + 1^3 + 1^3$
 $26 = 114,844,365^3 + 110,902,301^3 + (-142,254,8403)^3$.

Equations of this form, $k = x^3 + y^3 + z^3$, where k is between **1** and **100** are called *Diophantine Equations*, and are named after the Greek mathematician **Diophantus of Alexandria** who lived around **250 AD**.

Starting in the **1950s**, mathematicians began working on solving Diophantine equations, and they found solutions for all the numbers except **33** and **42**.

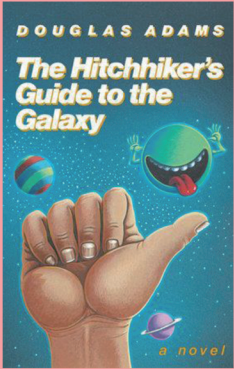
That's where things stood until **April 2019**, when **Andrew Booker** of the University of Bristol created a new computer algorithm to solve the problem for the number **33** that examined the number line in both directions all the way up to 99 quadrillion. That's **99,000,000,000,000,000**.

The answer Booker found for **33** is:
 $8866128975287528^3 + (-8778405442862239)^3 + (-2736111468807040)^3$

But, **42** remained unsolved.

The mystery of 42

"The answer to the ultimate question of life, the universe and everything is 42."
-- Douglas Adams, *The Hitchhiker's Guide to the Galaxy*



As for the number 42, it has become famous since **Douglas Adams** wrote in *The Hitchhiker's Guide to the Galaxy*: "The answer to the ultimate question of life, the universe and everything is 42." In the book, a supercomputer named Deep Thought spends **7.5 million years** pondering the ultimate question, unfortunately once it finds an answer, no one can remember what the question was. The answer, however, is "42".

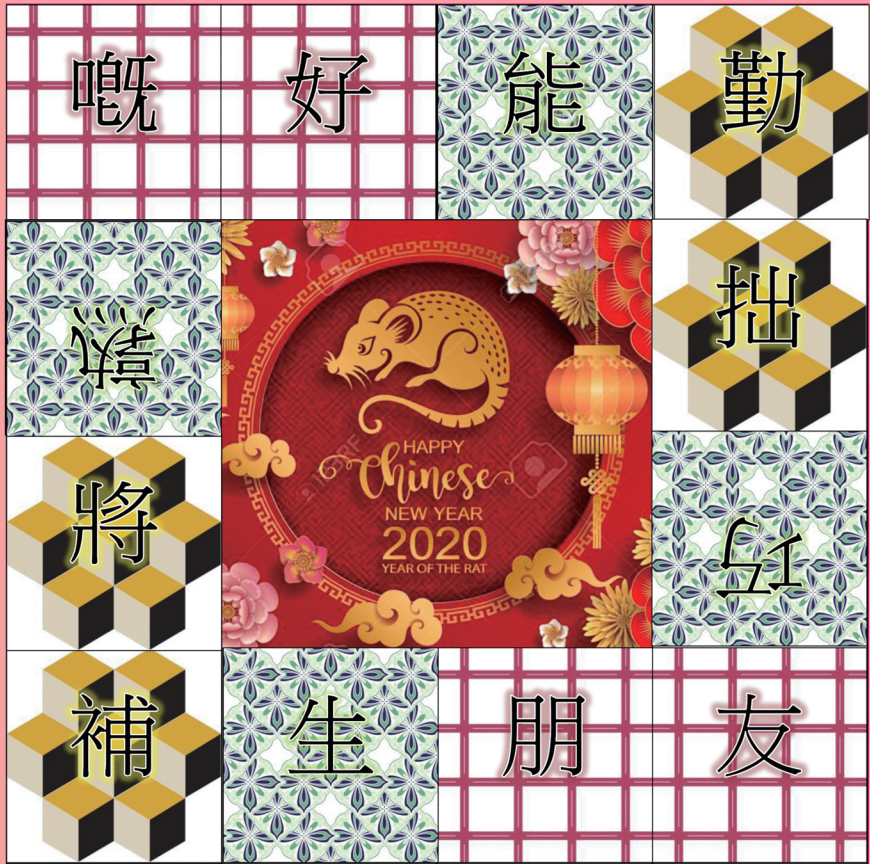
The fall of 42

Andrew Booker knew he was going to have to go greater than **99 quadrillion** to find a solution to **42**, and he teamed up with Massachusetts Institute of Technology mathematician Andrew Sutherland, who hooked him up with Charity Engine. Charity Engine is a crowdsourced "worldwide computer" comprised of some **500,000** home computers around the world.

Charity Engine uses a computer's idle processing power, and it took **1 million** hours of processing time to solve the Diophantine Equation where k is equal to **42**. The answer is:
 $(-80538738812075974)^3 + (80435758145817515)^3 + (12602123297335631)^3 = 42$.

If you're thinking that the question of the meaning of life has been answered, ponder this: between the numbers **100** and **1,000**, the sum of three cubes problem hasn't been solved for the numbers: **114, 165, 390, 579, 627, 633, 732, 906, 921** and **975**.

Source: interestingengineering.com



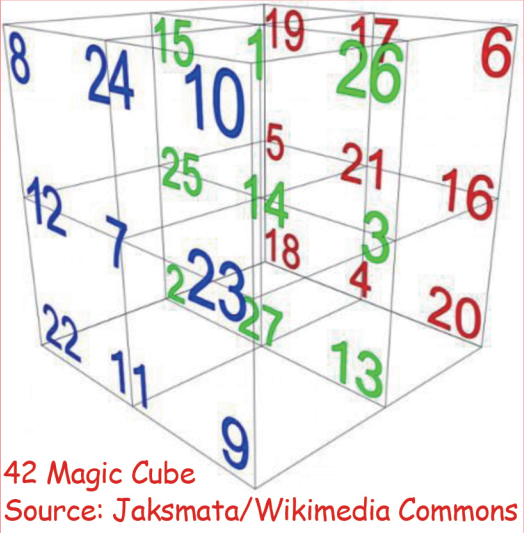
So, what is it with the number 42?

You can create a *magic square* whose sum is **42**:

42 Magic Square
Source: Marcia Wendorf

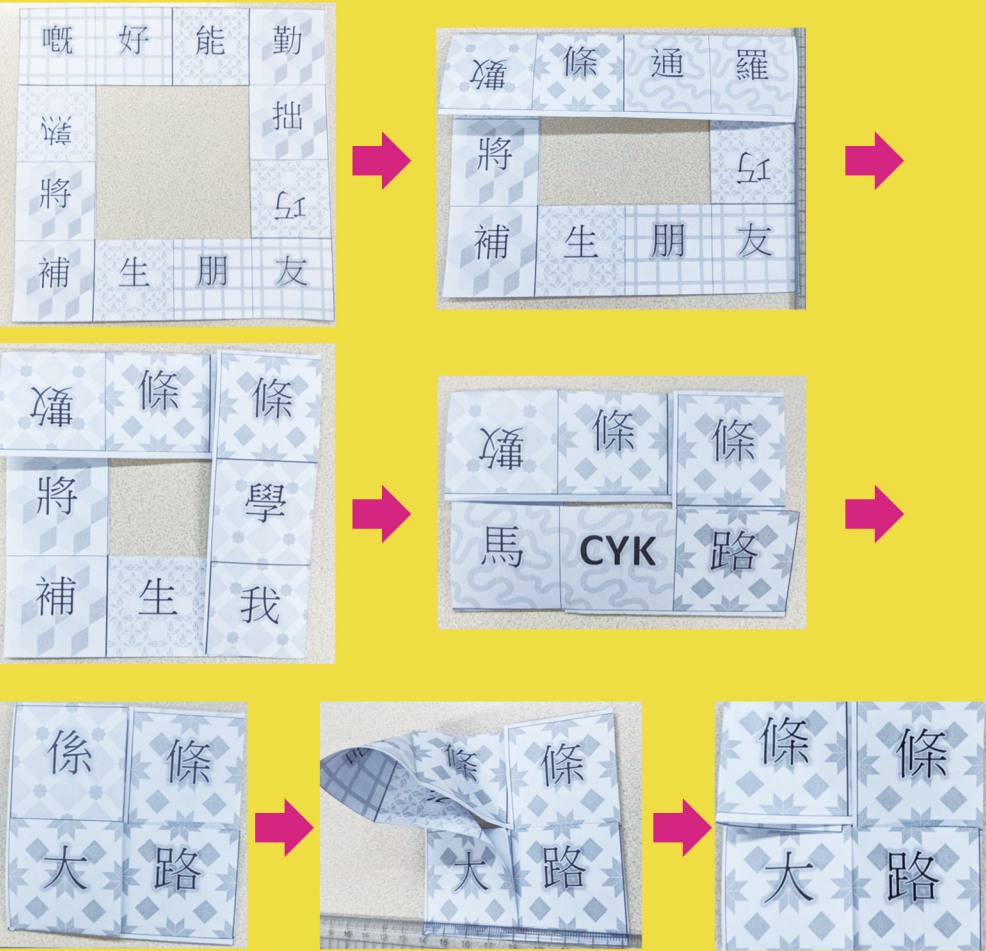
17	10	15	→ 42
12	14	16	→ 42
13	18	11	→ 42
↓ 42	↓ 42	↓ 42	↘ 42

And, there is a magic cube whose vertices add up to **42**:



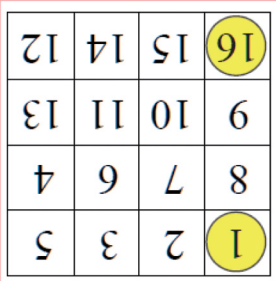
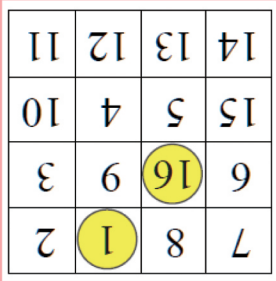
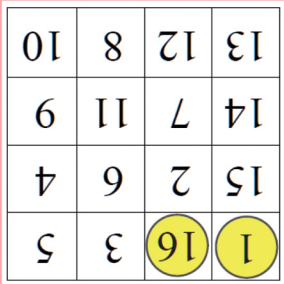
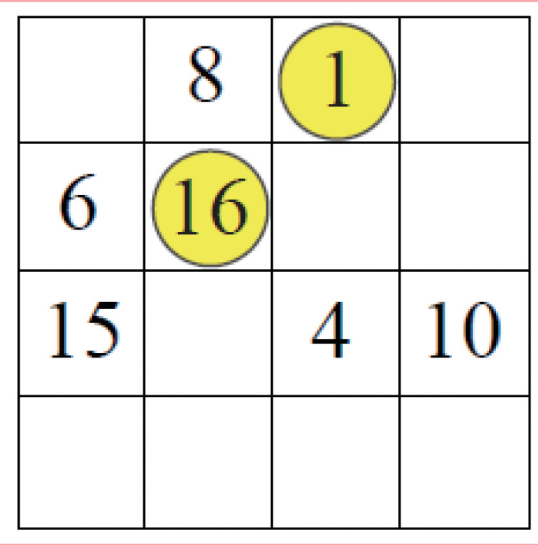
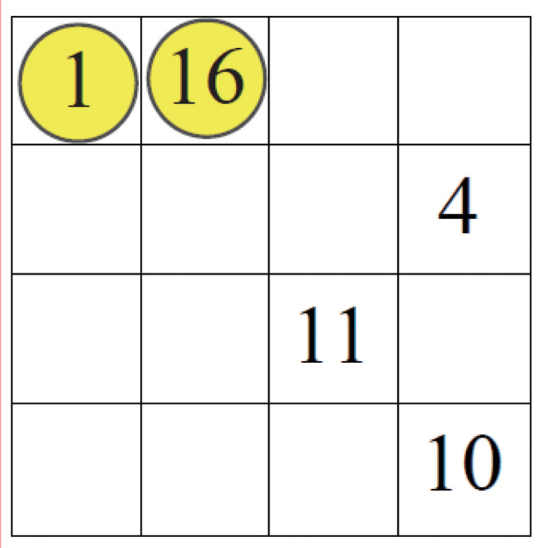
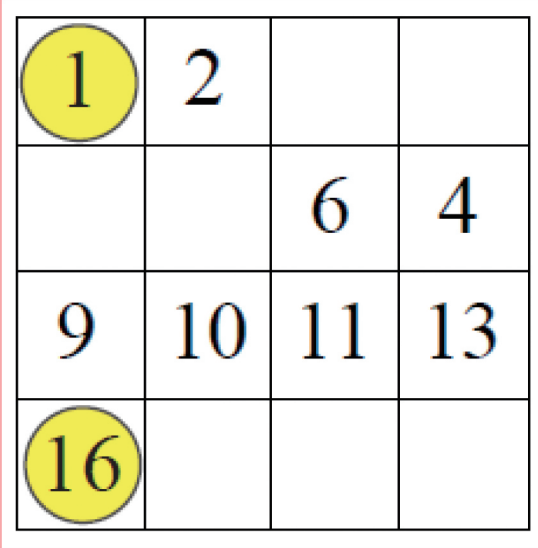
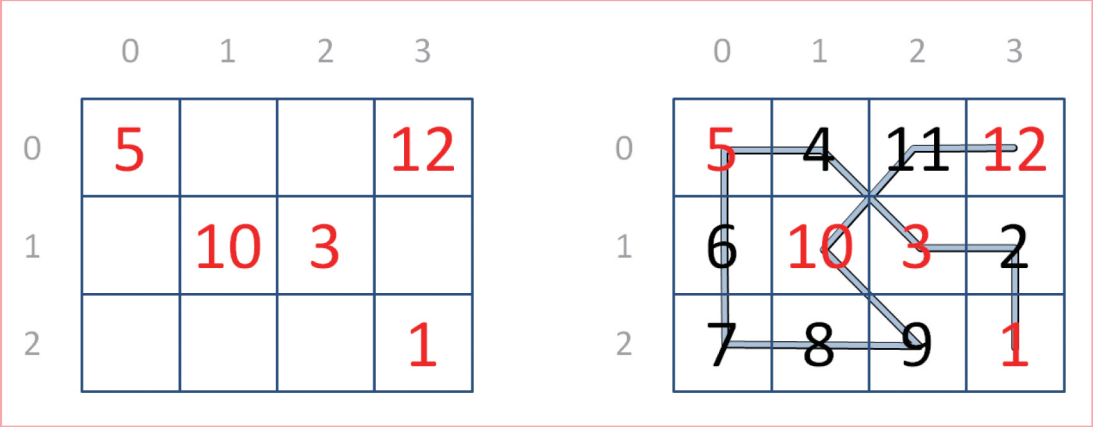
42 Magic Cube
Source: Jaksmata/Wikimedia Commons

Forgotten flexigon



Hidato

Fill the grid with the numbers 1 to 16 to make a non-stop connecting path. You may connect the numbers horizontally, vertically or diagonally. The start and finish numbers (the '1' and '16') are printed as circles.



MATH DUN

The numbers 19 and 20 got into a fight.

21.



MATHGAZINE