THE 2023 YOUNG MATHEMATICAL STORY AUTHOR (YMSA) COMPETITION

THE CINDY NEUSCHWANDER AWARD

(THE 12-15 YEARS OLD CATEGORY)

WINNER

'The $1000 Burger' by Sophie Han (12 years old)

at Taipei European School (Taiwan)

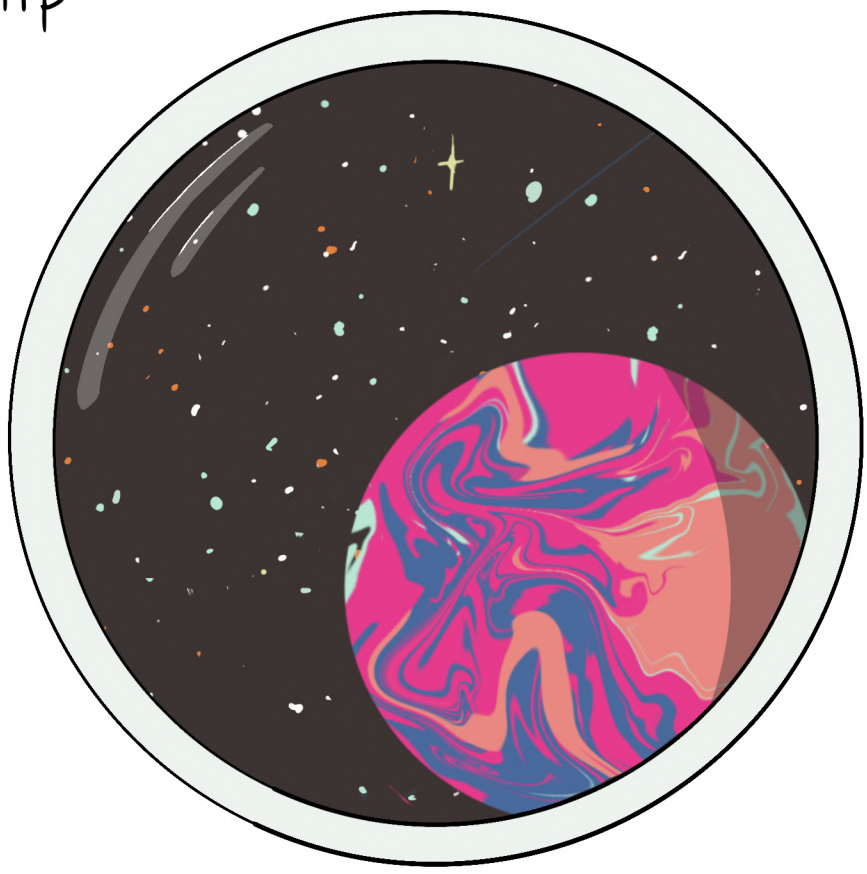
You can read the author's inspiration for the story and the judges' comments on:

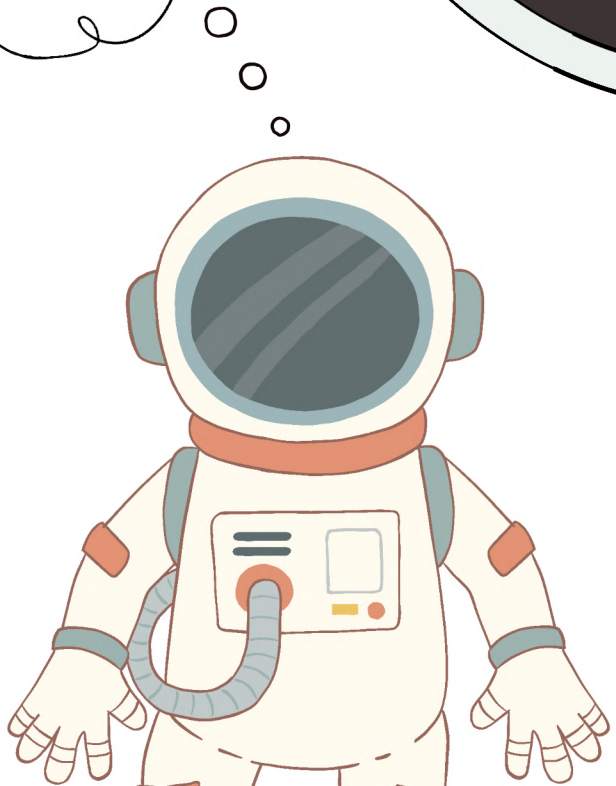
www.mathsthroughstories.org/ymsa2023

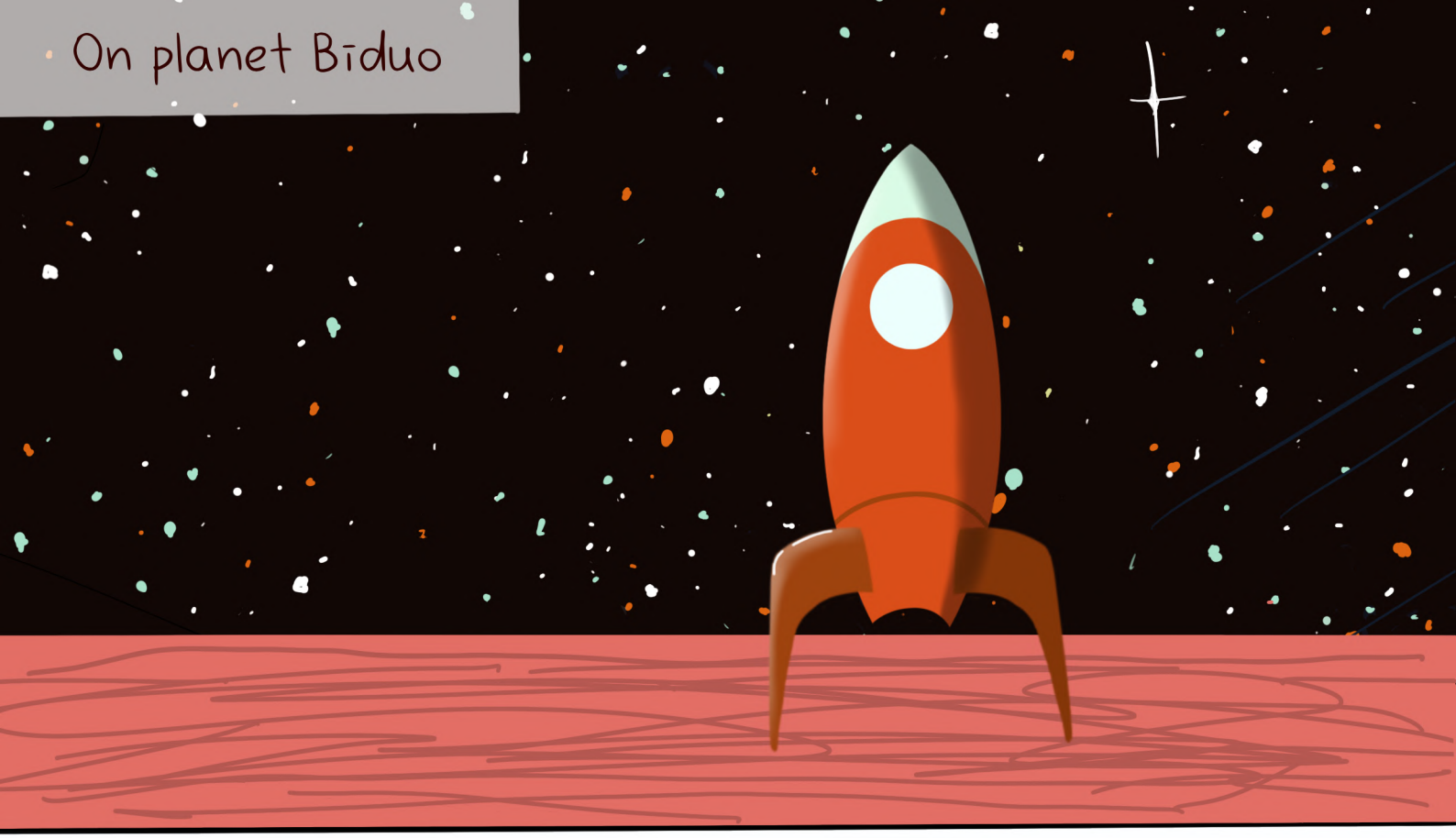
#YMSAMaths

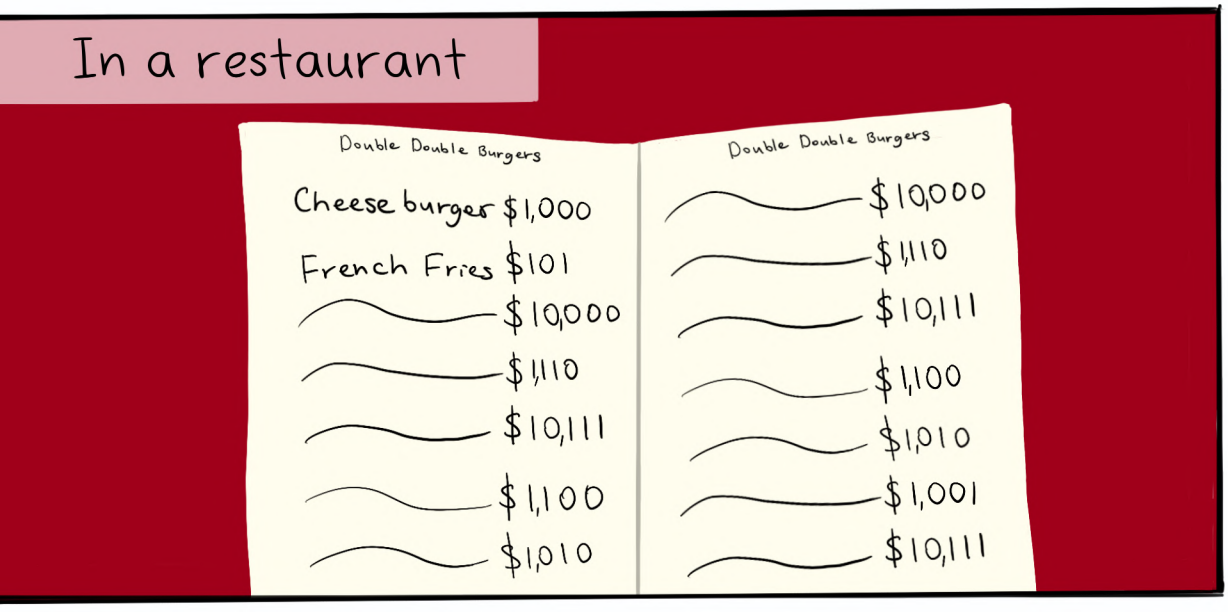
Sophie Han.
(Taipei European School)

In the space ship

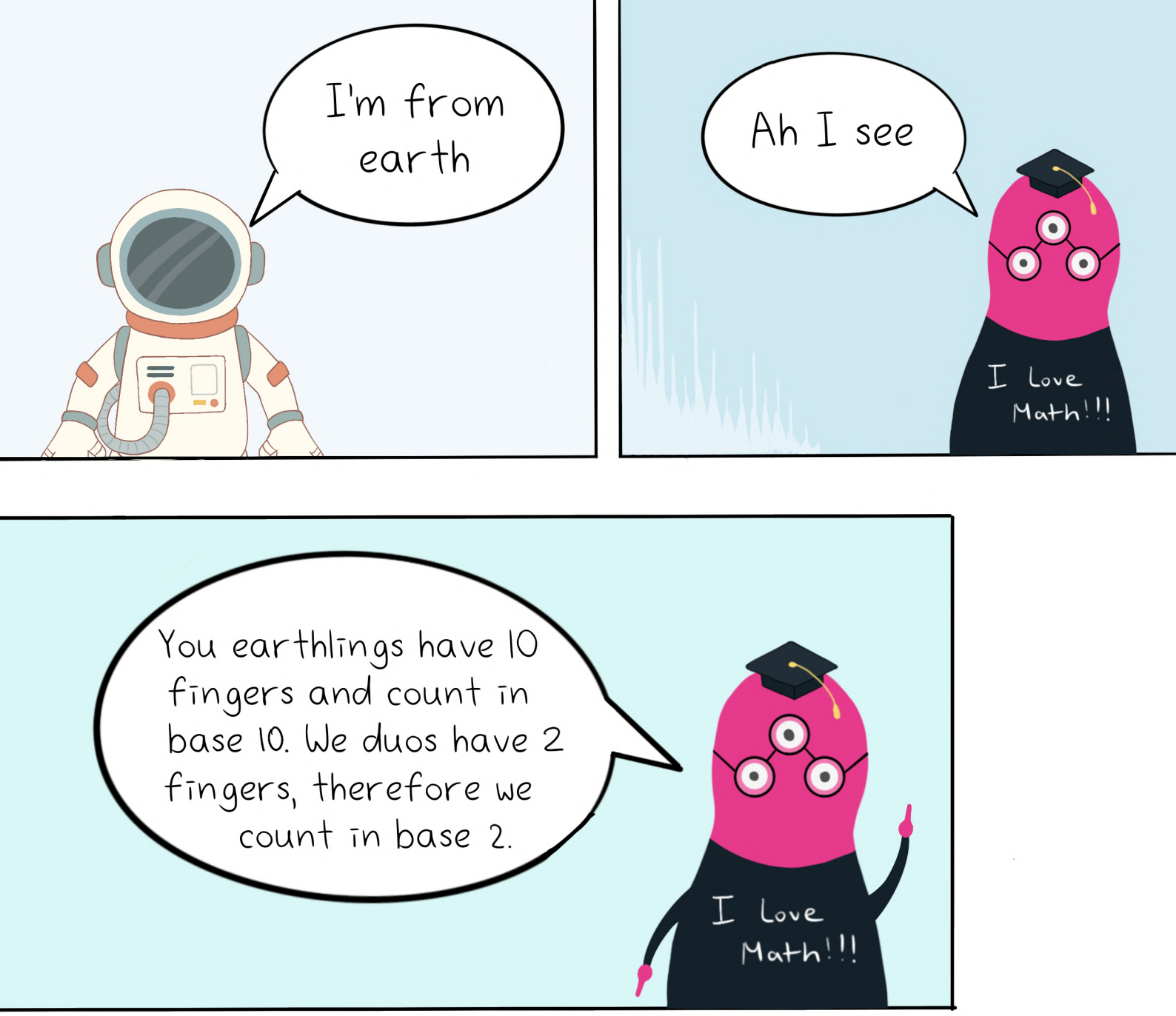




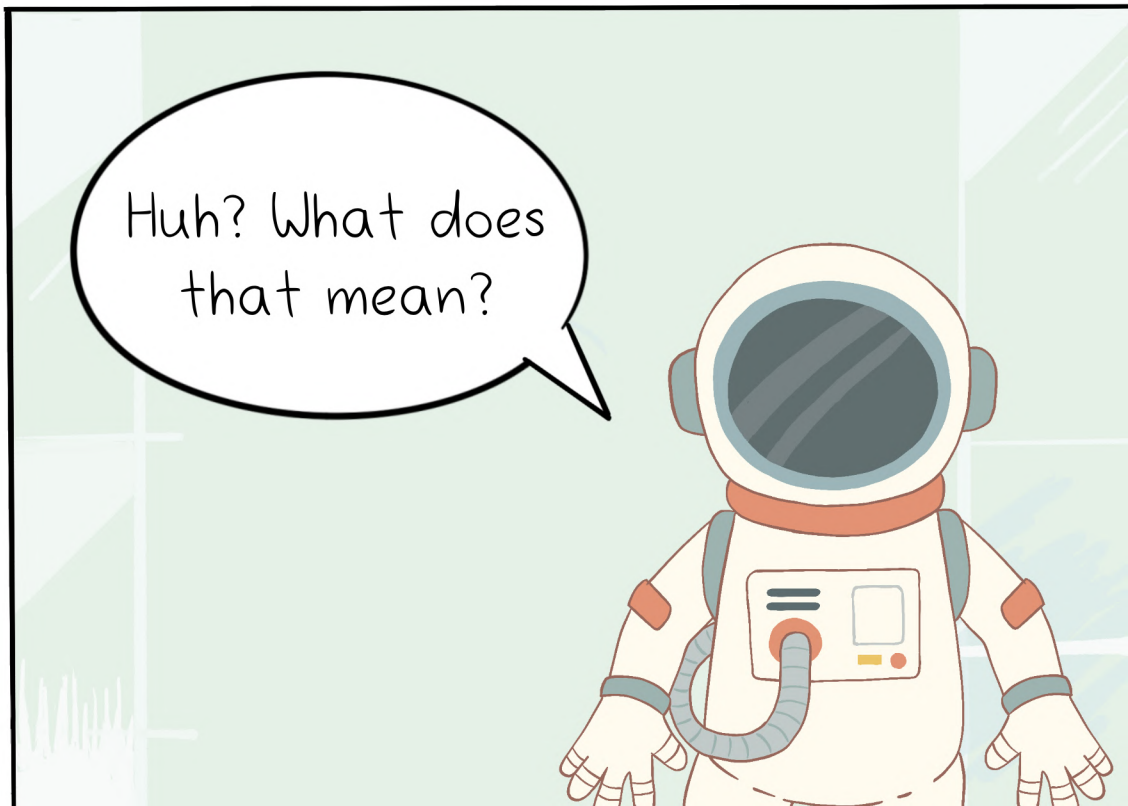

On planet Biduo


In a restaurant
Double Double Burgers
Cheese burger $1,000
French Fries $101
$10,000
$1,110
$10,111
$1,100
$1,010
Double Double Burgers
$10,000
$1,110
$10,111
$1,100
$1,010
$1,001
$10,111

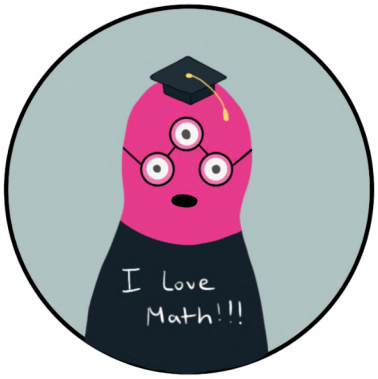

A $1000 burger?!!
Stop being so loud what's wrong with that? You must not be from here.
I Love Math!!!


I'm from earth
Ah I see
I Love Math!!!

You earthlings have 10 fingers and count in base 10. We duos have 2 fingers, therefore we count in base 2.
I Love Math!!!


Huh? What does that mean?

WHAT IS BASE 10 AND 2?



"Base 10 is a number system most commonly used on planet earth. It means using the 10 digits to write numbers. Base 10 uses the digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 & 9.

Base 2 is a number system most commonly used on planet Biduo. It means using 2 digits only to write numbers, and these digits are 0 and 1. This is why the prices of all our food items on the menu have numbers 0 and 1 only! Base 2 is also known as binary."

BASE 10

To convert base 2 to base 10 we first have to understand how base 10 works. Below is a quick example.

Step 1:

Draw a 3 row grid that has the same number of columns as the digits in your number.

Step 2 : Fill out the grid

This is a conversion grid table. Let's use my age as the number for our example. I am 1568 years old.

Row 1: Write the number you want to convert	1	5	6	8
Row 2 : Write the above number's base with powers in descending order.	10^3	10^2	10^1	10^0
Row 3: Write the values of the powers above.	1000 ($10\times10\times10$)	100 (10×10)	10 (the number raised to the power of 1 equals to the number itself)	1 (the number raised to the power of 0 equals to 1)

Step 3:

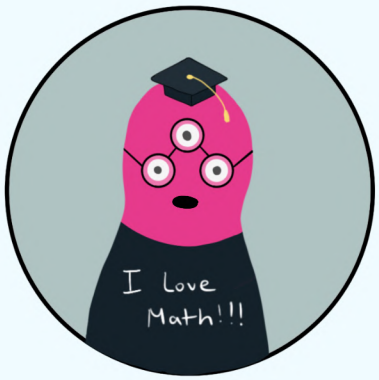
Multiply each number in row 1 with its corresponding number in row 2, and then add them up. Write it down like this...

$$\overset{1000}{(1\times10^3)} + \overset{500}{(5\times10^2)} + \overset{60}{(6\times10^1)} + \overset{8}{(8\times10^0)} = 1568$$

CONVERTING BASE 2 TO BASE 10

Now that we know how to use a conversion grid, do the same thing but with base 2, to find out how much that $1000 burger on our planet costs on planet Earth.

Row 1: Write the number you want to convert	1	0	0	0
Row 2: Write the above number's base with powers in descending order.	2^3	2^2	2^1	2^0
Row 3: Write the values of the powers above.	8 ($2\times2\times2$)	4 (2×2)	2 (the number raised to the power of 1 equals to the number itself)	1 (the number raised to the power of 0 equals to 1)



Let's find out how much that burger costs in base 10.

Now do the same as the base 10 example

$$(1\times2^3)+(0\times2^2)+(0\times2^1)+(0\times2^0)=8$$

The burger is actually only $8 on Earth!!!

CONVERTING BASE 2 to BASE 10

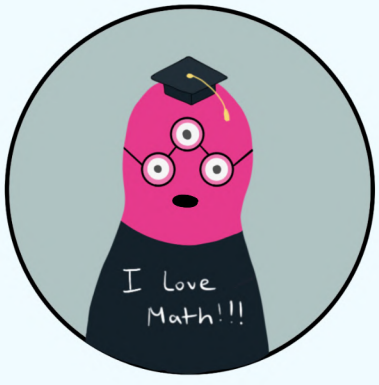
Now that we know how to use a conversion grid, lets do the same but instead use a number with three base 2 digits. Now your conversion grid will have just 3 columns for each of the three digits.

Row 1: Write the number you want to convert

Row 2: Write the above number's base with powers in descending order.

Row 3: Write the values of the powers above.

1	0	1
2^2	2^1	2^0
4 (2×2)	2 (the number raised to the power of 1 equals to the number itself)	1 (the number raised to the power of 0 equals to 1)



Let's find out how much those $101 french fries on our planet cost on planet Earth.

$$\underset{4}{(1 \times 2^2)} + \underset{0}{(0 \times 2^1)} + \underset{1}{(1 \times 2^0)} = 5$$

The french fries are actually only $5 on Earth!!!


Oh now I understand. I'll get a $1000 burger and $101 french fries.

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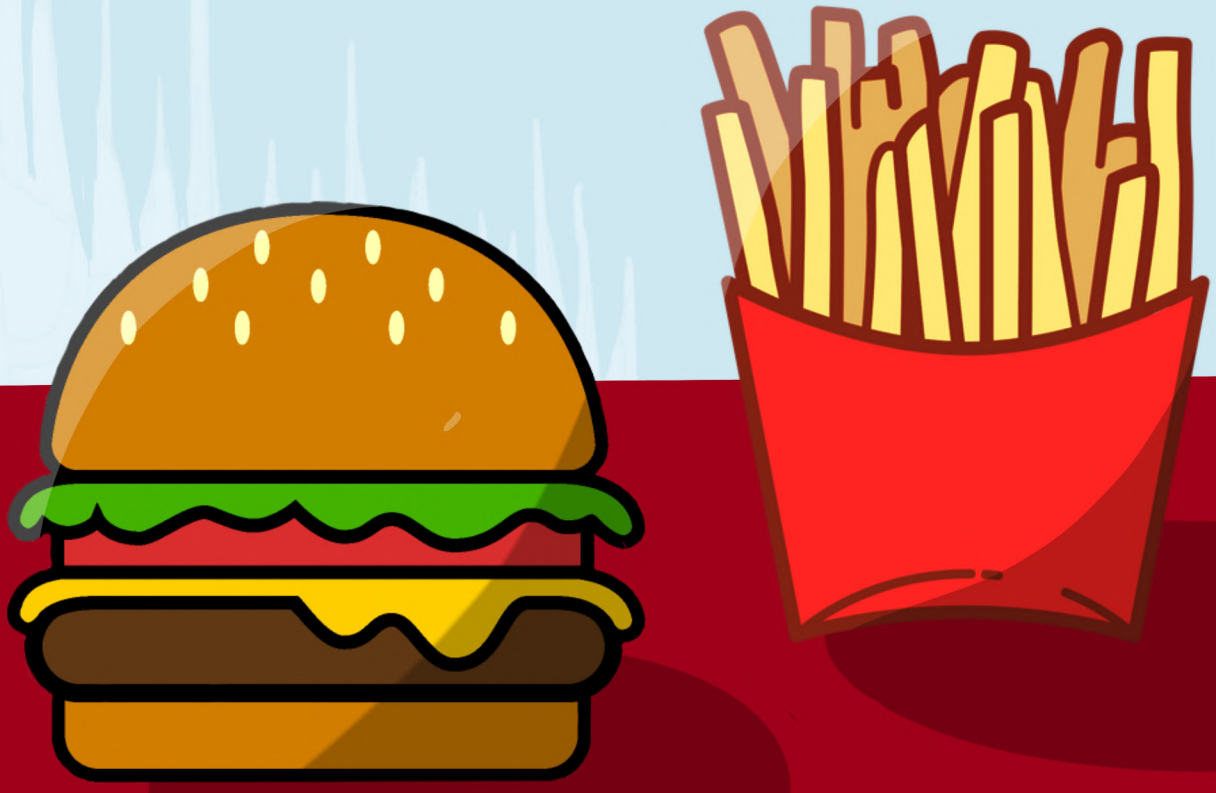
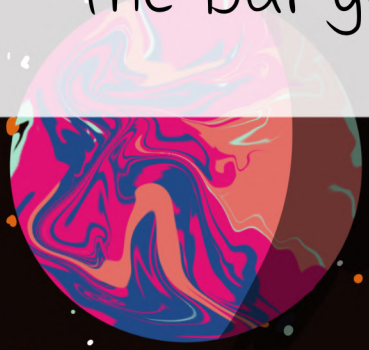


ABOUT THE AUTHOR

My name is Sophie Han and I go to Taipei European School in Taiwan. My inspiration for this mathematical story was when my class and I didn't do well in a math test about converting bases, I decided to write this story so that everyone could learn how to convert bases not only well, but in a fun way. I have always enjoyed drawing, however I had never created a mathematical story picture book before. Writing this story has not only made me try new things but in the process, I have also learnt how to convert bases which I didn't before. Further, I have learnt how to explain mathematical ideas much clearer and in different ways. I enjoyed the process of creating this mathematical story picture book, and would encourage other students around the world to take part in the Young Mathematical Story Author (YMSA) competition!

"A $1000 BURGER?!!"

A hungry astronaut travels to a faraway planet for food. But discovers that the food there is awfully expensive. He learns that not everyone counts the same. Will he get the burger he so desperately needs?



THE $1000 BURGER

Sophie Han.
(Taipei European School)