THE 2021 YOUNG MATHEMATICAL STORY AUTHOR (YMSA) COMPETITION

THE CINDY NEUSCHWANDER AWARD
(THE 12-15 YEARS OLD CATEGORY)

SHORTLISTED

'Buffy's Mathematical Adventure of Pythagorean' by Niyati Patel (13 years old) at Pinewood Public School (Canada)

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

www.mathsthroughstories.org/ymsa2021

#YMSAMaths

Buffy's Mathematical Adventure of Pythagorean Theorem!


By : Nivati Patel

This was Buffy the squirrel's 6th round of dropping nuts to her nest. The sun was shining in Bouverville and it was a very hot and sunny day. Buffy was **very** tired. Buffy loved peanuts--they were her most favourite snack, and just yesterday she had found a **great**, **big** stash of nuts in someone's garage. So, Buffy was busy scampering up and down the streets of Abott to gather all the nuts. She was very happy because of her new discovery!

ONE WAY →

Abott St

Buffy was finally tired. She thought there has to be an easier way. Every time I find nuts, I have to descend to my nest underground then have to go another few meters to put my nuts in my nest. After all of that hard work I have to go back up, it is very time and energy consuming for me. After all I am getting a little bit old, she thought as she muffled a laugh. But then she got an idea. **A great idea!**

Can You Guess It?

Drawings are not to scale

land

← Underground

? Wood

5m

4m
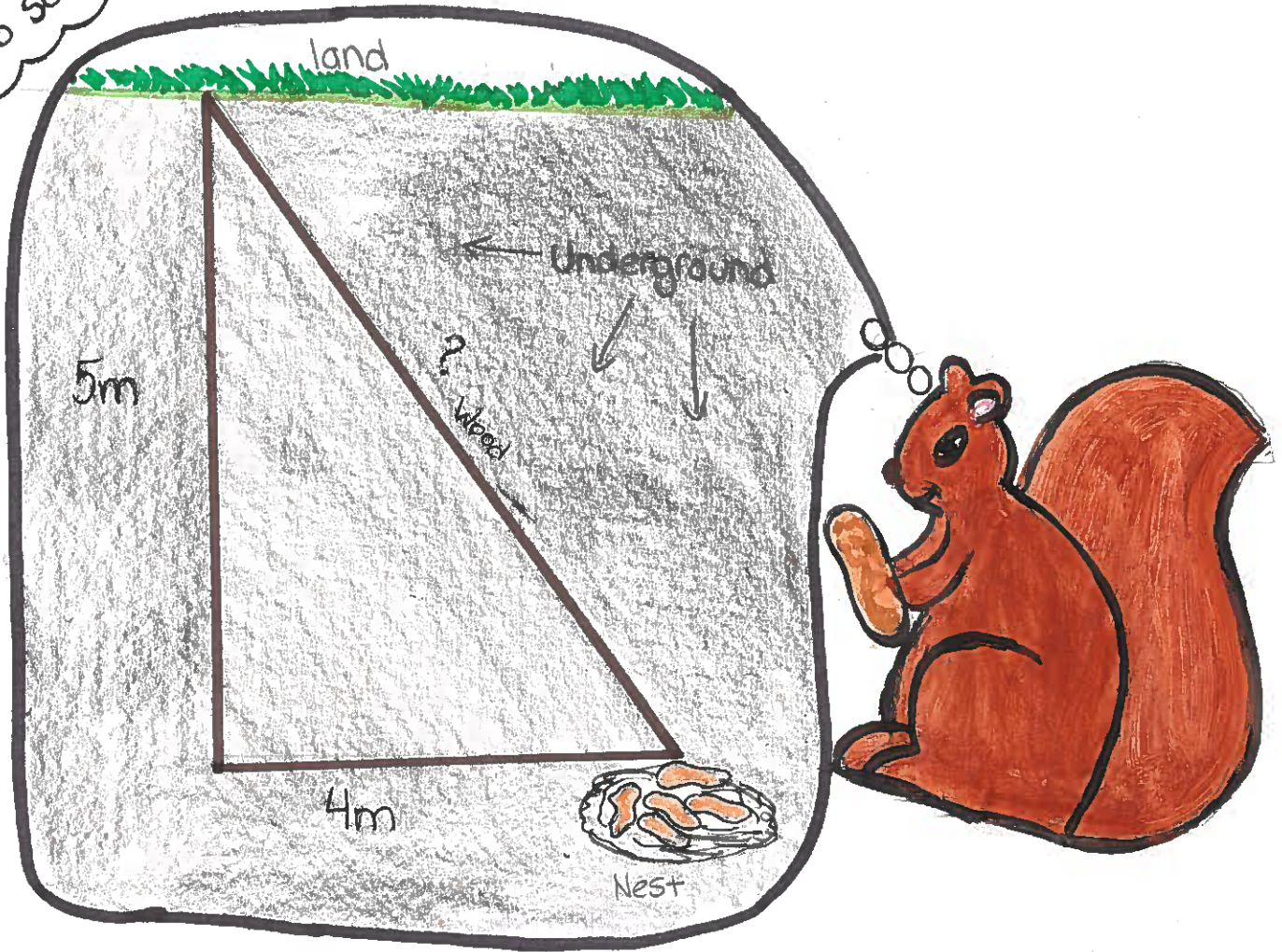
Nest

Buffy was thinking if I got a piece of wood and put it down across the diagonal gap then gravity will push my nuts right into my nest. If that works then that would take me less time and it would be less exhausting for my teeny tiny body. But I need a piece of wood.

Buffy got to work the next morning. She creeped into farms and garages, but she found no such luck. The sun was hot that day, so she decided to take an afternoon nap. When she got home, she found that her friend Clumpy was waiting for her. Clumpy asked her where she had been the entire morning as it was hot and humid outside. Buffy told her about her scavenge for wood. Clumpy got very excited as she knew exactly how to help her friend.

9m

8m

6.40m

7m

8.20m
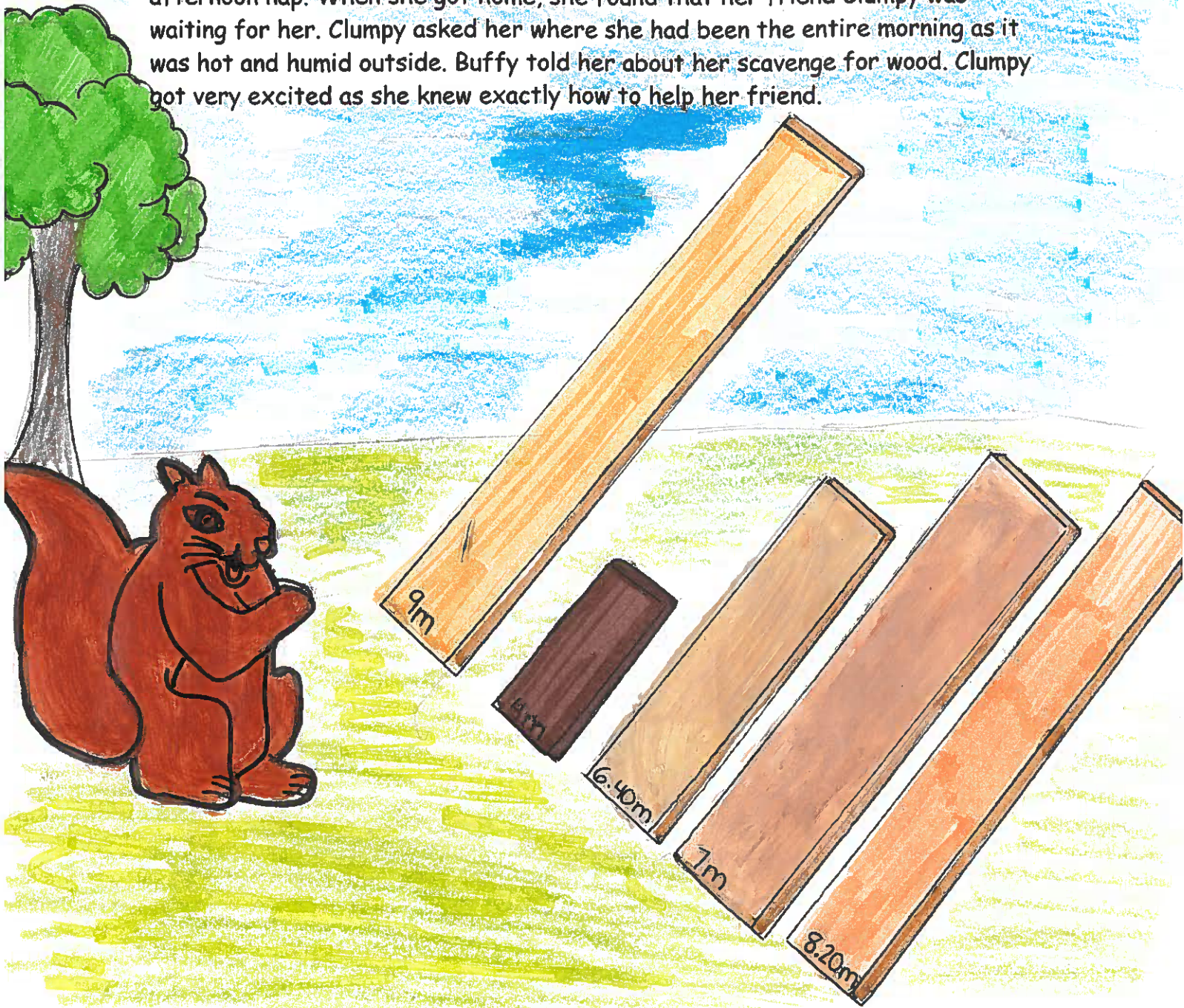
So, the next morning the two of them left and headed to down the street. People passed by on both sides of the sidewalk, but they scampered through the busy traffic. After a long walk they reached their destination, an old construction site. Buffy and Clumpy got to work as they poked around things to find the wood. Then Buffy cried," I FOUND THE WOOD!" Clumpy came over and she saw perfectly lined pieces of wood all of different sizes.

Clumpy glanced at Buffy and realized that she looked confused. She asked Buffy what the problem was. Buffy told her that she did not know which size of wood to take for her nest. But luckily for Buffy, Clumpy knew exactly how to find out. She told Buffy that they would come for the wood again but first they would have tea at Clumpy's home.

Clumpy and Buffy sipped on their tea while Clumpy sifted through an old, dusty, brown book. Out of curiosity Buffy asked Clumpy what it was about. Clumpy announced that it was her magical book of math.

Clumpy examined one of the pages very carefully, then turning to Buffy she said, "This is the Pythagorean Theorem, it will help you solve your problem." Buffy scanned the page. But she was still very confused.
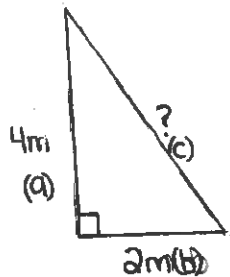
The Pythagorean Theorem
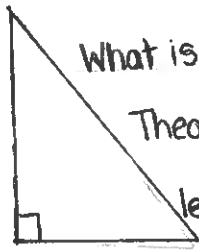
What is the Pythagorean Theorem? The Pythagorean Theorem is a formula used to find unknown side lengths of right-angled triangles.

How To Use It:

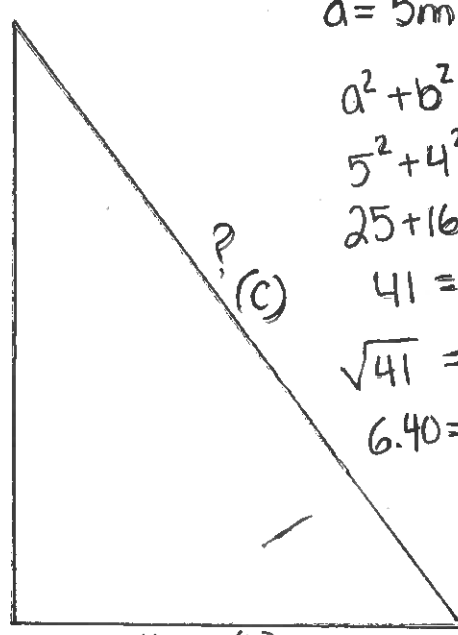The formula to use the Pythagorean Theorem is $a^2 + b^2 = c^2$.

For example we can apply this formula to a problem like below:

4m (a)
? (c)
2m (b)

In this problem side a is 4m and side b is 2m. But side c is unknown. To figure this out we replace a with 4 and b with 2 in our formula. So, our formula changes to be $4^2 + 2^2 = c^2$. Our next step would be to square 4 and 2. The square of 4 is 16 (4x4) and the square of 2 is 4 (2x2). So, our equation turns into something like this $16 + 4 = c^2$. Our next step is to add 16 and 4. Which will give you 20. So, $20 = c^2$ but we need to find c, so, the opposite of squaring a number is finding the square root. The square root of 20 ($\sqrt{20}$) would be 4.47m. This means side c is equal to 4.47m.

Buffy asked Clumpy how this would help her. Clumpy took out a piece of paper and drew Buffy's problem on there. Then she wrote down a formula.

Clumpy told Buffy," When you have two measurements in a right-angled triangle, but you don't know the third side length then you can use something called the Pythagorean Theorem to help you. The Pythagorean Theorem is a formula you have to remember. In your problem the line we named "a" is 5m long and "b" is 4m. According to the Pythagorean Theorem formula, we substitute "a" for 5 and "b" for 4." She wrote all of this on a piece of paper for Buffy to follow along.
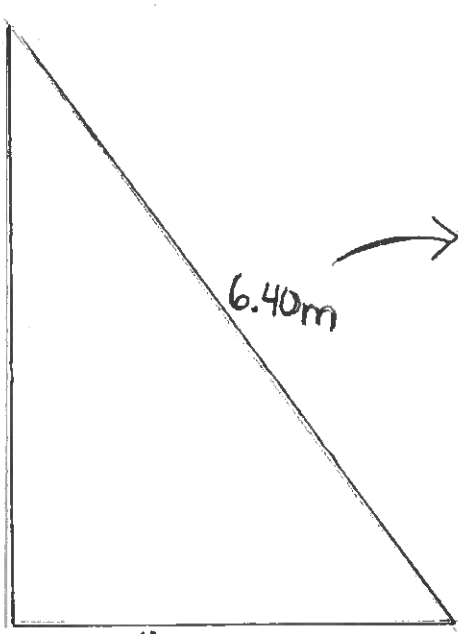
Formula $a^2 + b^2 = c^2$

$a = 5m \quad b = 4m \quad c = ?$

$a^2 + b^2 = c^2$

$5^2 + 4^2 = c^2$

$25 + 16 = c^2$

$41 = c^2$

$\sqrt{41} = c$

$6.40 = c$

5m (a)

? (c)

4m (b)

Some Rules:

① C always has to be the hypotenuse side or the longest side.

② This formula only works for right-angled triangles

③ e.g a^2 does not mean a x 2 it means a x a.

6.40m

5m

4m

Side length for c is 6.40m.

We know that 4x4 is the same as 4^2 because the exponent is 2. That just means to multiply the base number by itself. So, 4x4 is 16 and 5x5 is 25. She continued to write all of this down.

Then it is time for our next step, Clumpy told Buffy. Buffy asked Clumpy: "Does this mean that next I have to add 16 and 25?" Clumpy was very excited that Buffy was understanding the formula, "Yes!" she squealed. So, Buffy added the two.

$$25 + 16$$
$$= 41$$

She got 41m. Now what do I do she asked Clumpy? Clumpy told her that now she would need to find the square root of 41. Buffy asked Clumpy why. Clumpy told Buffy that this was because the opposite of squaring a number is finding the square root of a number. Buffy found the square root of 41 is 6.40m. Now Clumpy told Buffy," We can go get a piece of wood that is 6.40m long. This would be because we already know a and b's side lengths so, we found that c=6.40m.

Now they knew which size of wood Buffy wood need they went back through the busy traffic and reached the construction site. There they found the perfect size labelled neatly in black-6.40m. She and Clumpy carried it all the way back to the nest and then they fitted it into the gap. And it fitted in just right. Buffy would save a lot of time from having to descend all the way down to her nest to drop her nuts. All she had to do was put them on the hypotenuse and they would automatically roll down with the help of gravitational force.

6.40m
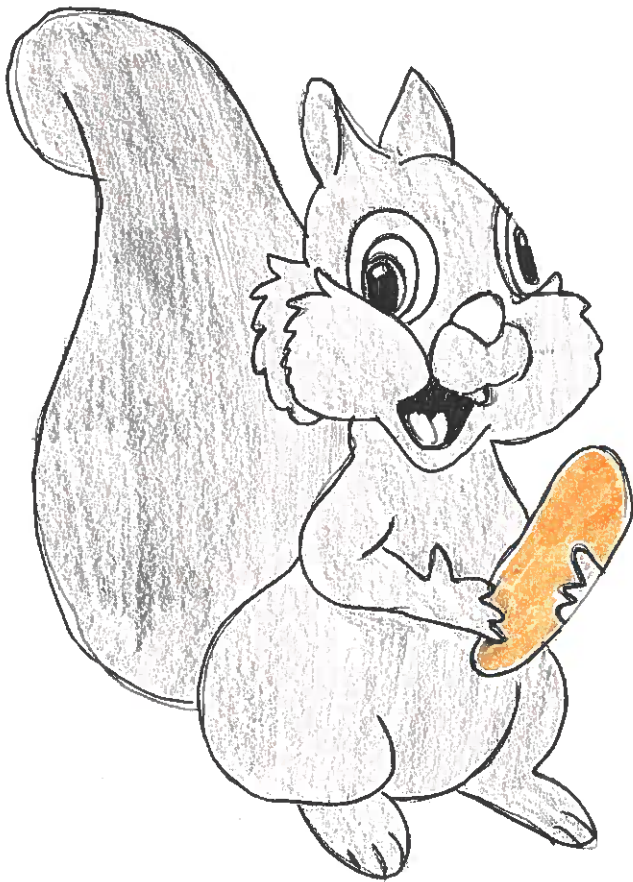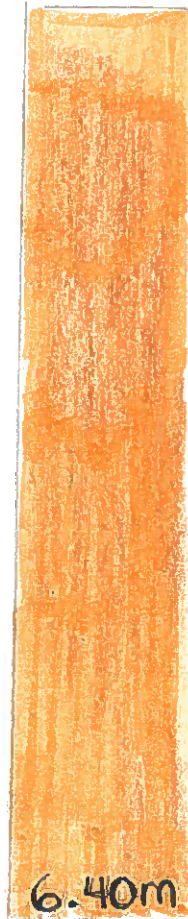
Buffy

Buffy happily announced to Clumpy," Now I can help others build their homes like this just how you helped me! We all just need to remember a^2+b^2=c^2!!!"

Buffy the squirrel is collecting nuts for the winter. She finds a stash of nuts in someone's garage but every time she goes to drop her nuts in her nest, she has to descend vertically then she has to go another few meters before she reaches her home. But Buffy gets an idea. But for this idea she needs your help and her friend Clumpy's. Will you help her on this journey? Will she be able to find a less exhausting way to collect her nuts? Or will she have to continue the hard way?

ABOUT THE AUTHOR

My name is Niyati Patel, and I am 13 years old. Currently in grade 8 I attend Pinewood Public School in Ontario, Canada. My inspiration for this story comes from my love for math. I really think that math is not hard for anyone when you get hold of the concept and I think once you get a really good example you get the grip in math. As I understood in my class a lot of people did not understand how to use the theory, so I decided to tie it in with nature and I ended up preferring to use Buffy the squirrel. I do want to encourage everyone to take a shot at this contest because not only is it fun and engaging, you can learn something new.