



THE 2022 YOUNG MATHEMATICAL STORY AUTHOR (YMSA) COMPETITION

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

LONGLISTED

'Tree Trouble' by Yang Kalli (12 years old)
at Dulwich College Beijing (China)

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

www.mathsthroughstories.org/ymsa2022

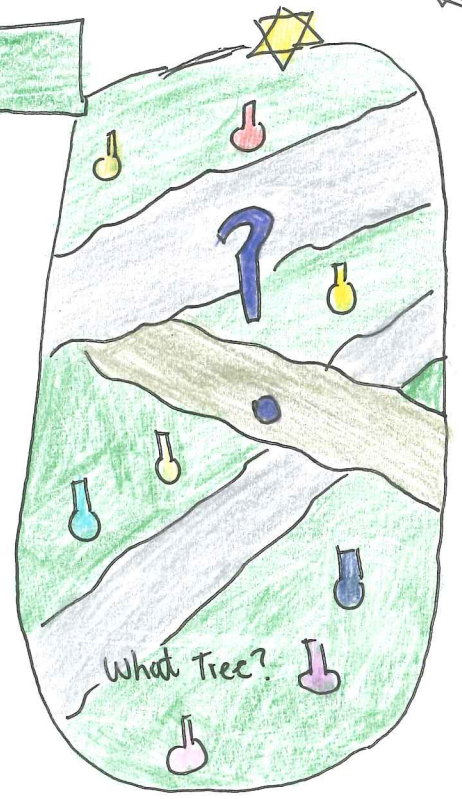
#YMSAMaths

TREEE

ROOBBLE



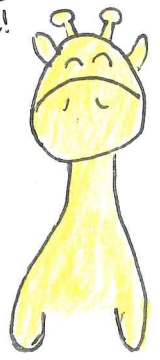
It's Christmas, in the little village of Animals!



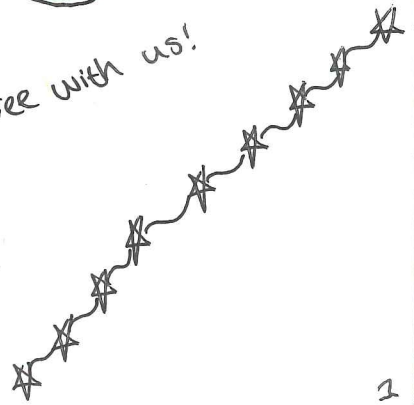
Sphere shaped trees are the best!



Rectangular Trees are the best!



Come! Paint a tree with us!

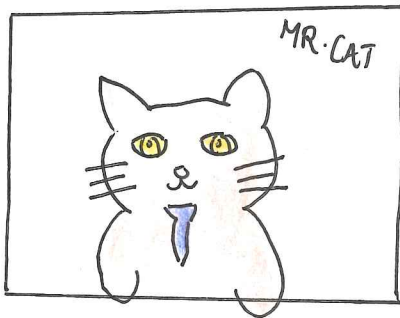


It is Christmas Eve in the little village of Animalia. The lights are twinkling with beautiful Christmas colors, with villagers walking around in a festive mood. Everything looks perfect for the night to come, yet there is just one problem... The Christmas Tree used for the annual "Paint a Christmas Tree on Christmas Eve" has not been ordered yet!

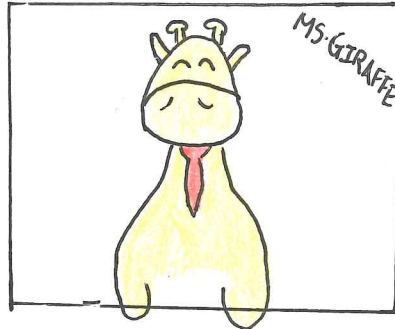
Why not?

Apparently the directors have been arguing about which type of Christmas Tree they should buy...

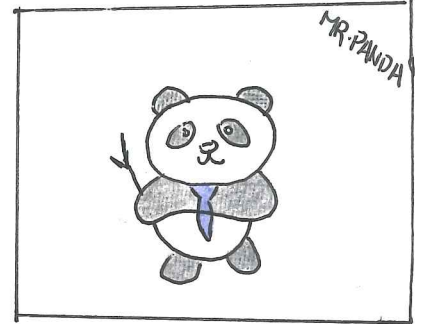
Meet the Directors!



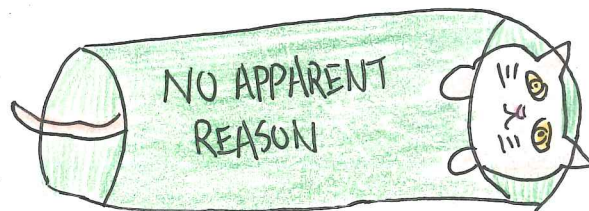
MR. CAT wants the cylinder tree, for no apparent reason...



MS. GIRAFFE wants the rectangular tree, but sadly, she seems to be the only one that can reach the top...



Last but not least, MR. PANDA wants the sphere-shaped tree, due to his... ohh... rather round body...



They've been arguing for weeks, yet they still haven't decided on a tree to buy.

Until...

They received a notice from the board of directors, telling them that this year's paint is limited! And that they should buy the tree which uses the less paint.

How do we know which tree uses the less paint though...

MS. GIRAFFE humbled.

MR. PANDA nodded agreement.



MR. CAT thought for a second, then blurted out -

We'll use Math! Finding the surface area! Which is the total area of a 3D shape, such as in our case, trees! It can be extremely useful when knowing how much paint you need for a wall, how much paper to wrap a gift...



How do we do that? I've never been good at Maths! I couldn't even fit in the classroom!

Grumbled MS-GIRAFFE

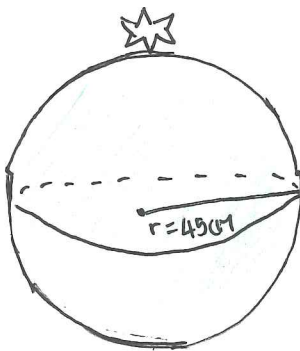
"Well...", MR-CAT responded silkily, "let me teach you all!"

Finding The Measurements

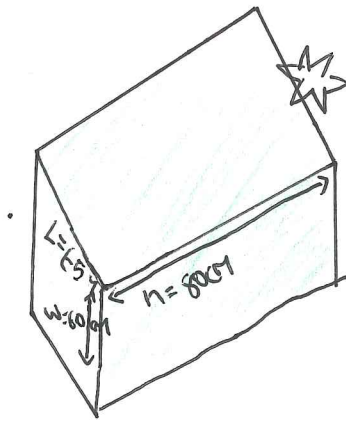
First of all, we need to know the measurements of the different trees.



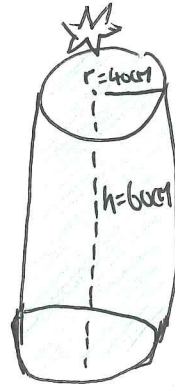
THE MEASUREMENTS



- There is a 45cm Radius for the sphere Christmas tree -



- The width is 60cm, length is 65cm and the height is 80cm for the rectangular tree -



Not drawn to scale

- There is a 40cm radius and a 60cm height for the cylinder tree -

"We shall start with the sphere", announced MR-CAT, "there is always a formula to solve the surface area!"

Formula for Sphere

$$4\pi r^2$$



- little notice! We will use 3.14 for π -



Okay... I now know the formula! So I'll just put the measurements in!

$$4 \times 3.14 (\pi) \times 45^2 = \text{Surface area of Christmas sphere}$$

↑
radius

$$= 25434 \text{ cm}^2$$

Exactly! The surface area is 25434 cm² -
Always remember the unit of surface area is Squared!



DID YOU KNOW?

The Greek mathematician Archimedes discovered that the surface area of a sphere is the same as the lateral surface area of a cylinder, having the same radius and a height the length of the diameter of the sphere!



Lateral surface area



radius

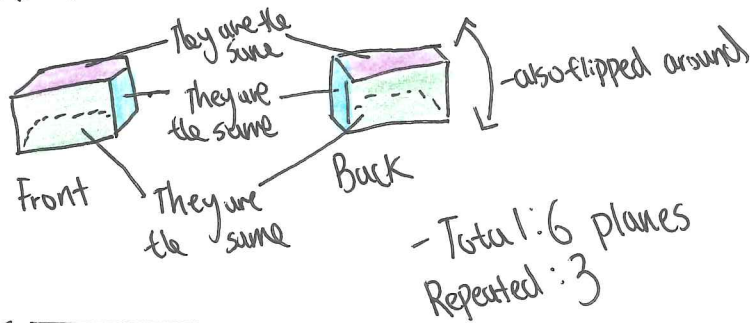


diameter



Let's move on! I'm so excited to try out my measurements! How do I find the surface area of a rectangular prism though?

"We can start by understanding how a rectangular prism works", claims MR-CAT, "We know that the area of a flat surface is calculated by multiplying length and width. A rectangular prism (3D) is quite similar. Since it has 6 flat surfaces, 3 repeated. We only need to find the area of the various 3 surfaces, add them together, then times by two, since there are 6 surfaces."



From this, we can see that the formula is ...



Formula for Rectangular Prism $2(wl + hl + hw)$

w = width
l = length
h = height

"Now we can put the measurements in"



Me! Me! Me! I know how to do this!

$$\begin{aligned} & 2(60 \times 65 + 80 \times 65 + 80 \times 60) \\ &= 2(3900 + 5200 + 4800) \\ &= 2 \times 13900 \\ &= 27800 \text{ cm}^2 \end{aligned}$$

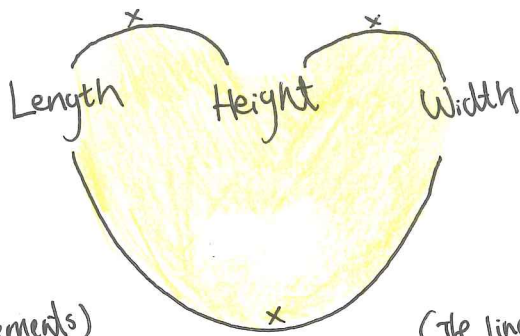
The surface area of the rectangular prism is 27800 cm²

"You're not bad at Math at all!", says MR-PANDA, smiling.

"Turns out I'm not!", laughs MS-GIRAFFE.

THE SMILEY FACE METHOD

You can remember the formula for the surface area of a rectangular prism, like this:



(These are the measurements)

(The lines stand for multiplication)

The surface area of the rectangular tree is bigger than the surface area of the sphere-shaped tree. Sorry MS-GIRAFFE, but the rectangular tree is...



- ELIMINATED - you can still help us solve the cylinder tree's surface area though!



OOO! I know how to find the surface area of a cylinder!

A cylinder is a lateral surface with two circular bases at the top and bottom. The lateral surface can be flattened/unrolled into a flat surface.



→ Stick the two ends together →



From this we can see that the lateral surface of the cylinder is the circumference of the circular plane, multiplying the height.



Then if we are to include the circular bases, which we are, we'll find the area of it using πr^2 , and since there are two, we'll times it by two.

Formula for Cylinder	$2\pi rh + 2\pi r^2 \rightarrow$ simplified into $\rightarrow 2\pi r(r+h)$	
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△ π is 3.14

"Now let's put the measurements in!", MS-GIRAFFE claims confidently.

$$2 \times 3.14 \times 40(40+60) = 25120\text{CM}^2$$

The surface area of the cylinder tree is 25120CM^2

Correct! You have all mastered the skill of finding surface area.

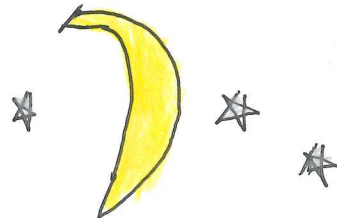
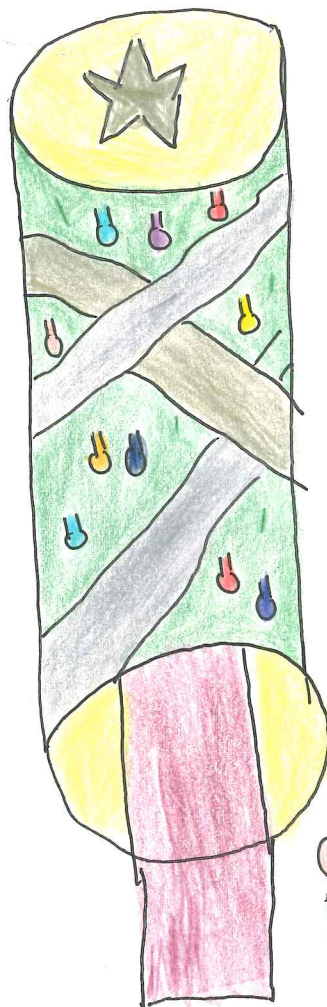
$$\text{Sphere} = 25434\text{CM}^2 \quad \text{Rectangular Prism} = 27800\text{CM}^2 \quad \text{Cylinder} = 25120\text{CM}^2$$

In conclusion, we can see that the cylinder tree has the least surface area, therefore it uses less paint!



"We DID IT!" MS-GIRAFFE and MR-PANDA shouted in unison,
"MR-CAT thanks for teaching us! You deserve to have the cylinder tree for the activity!"

~And That Night



Giraffe noises

they had the most beautiful Christmas ever ~

Panda noises



-The End-