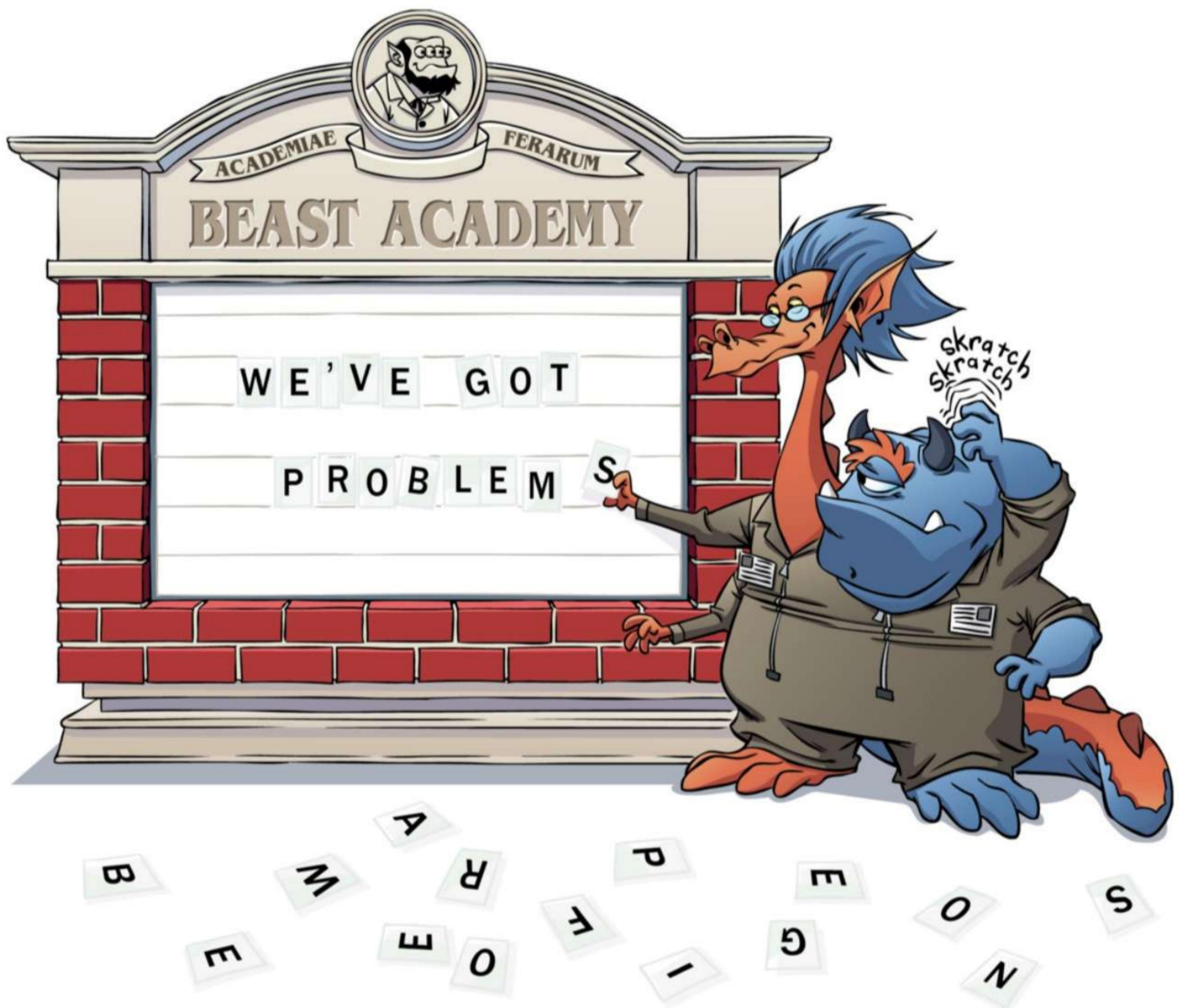


Contents: Chapter 1

Click the Play List tab in the top-left to view a recommended reading/practice sequence.

	Angles What are three different types of angles?	14-17
	Triangles Can you draw an obtuse equilateral triangle?	18-24
	R Don't Make a Triangle Can you avoid making a triangle?	25
	Quadrilaterals What is a rhombus?	26-31
	Grogg's Notes What do we call polygons that have more than four sides?	32-33
	Polyominoes Can three L-triominoes be arranged to form a 3 by 3 square?	34-41

Chapter 1: Shapes



Ms. Q Angles

Did everyone get their toothpicks?

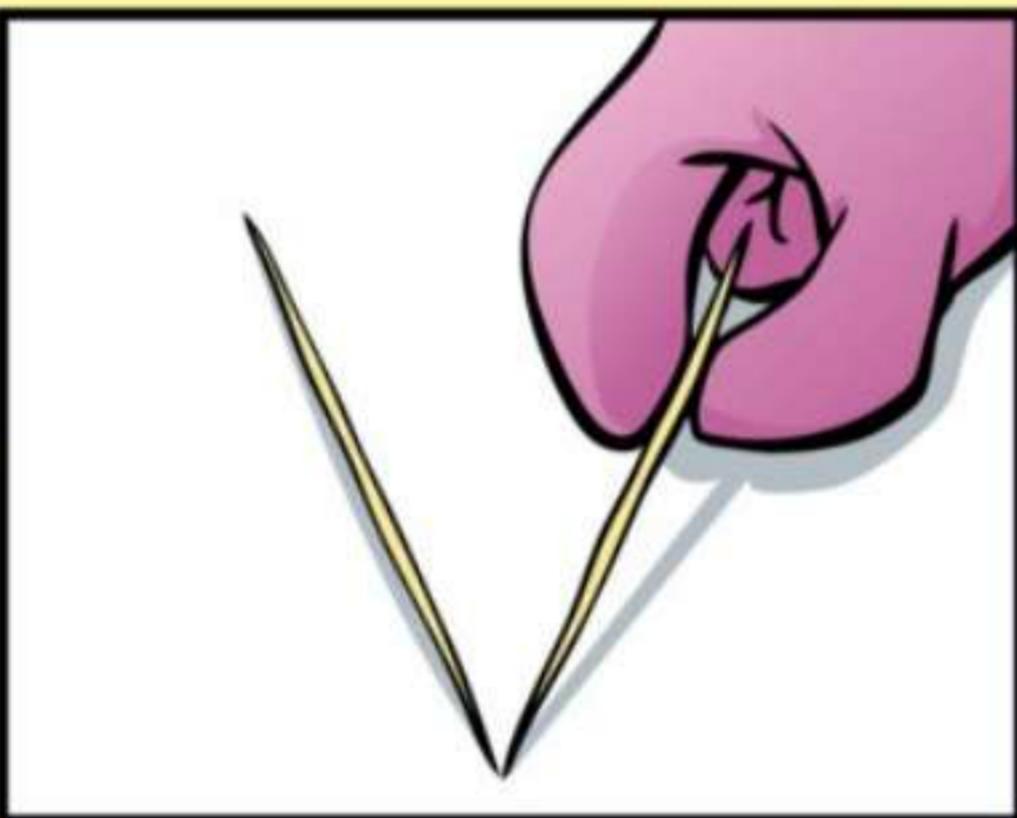
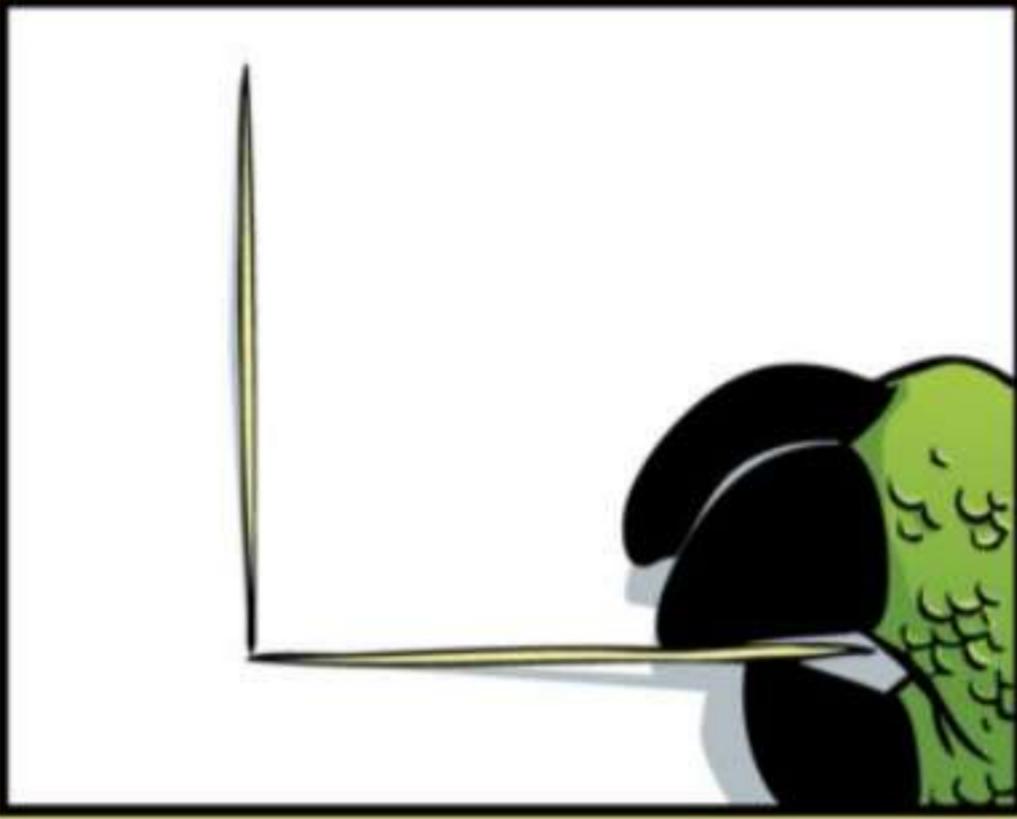
I did.

Yep.

Uh huh.

Ewww!

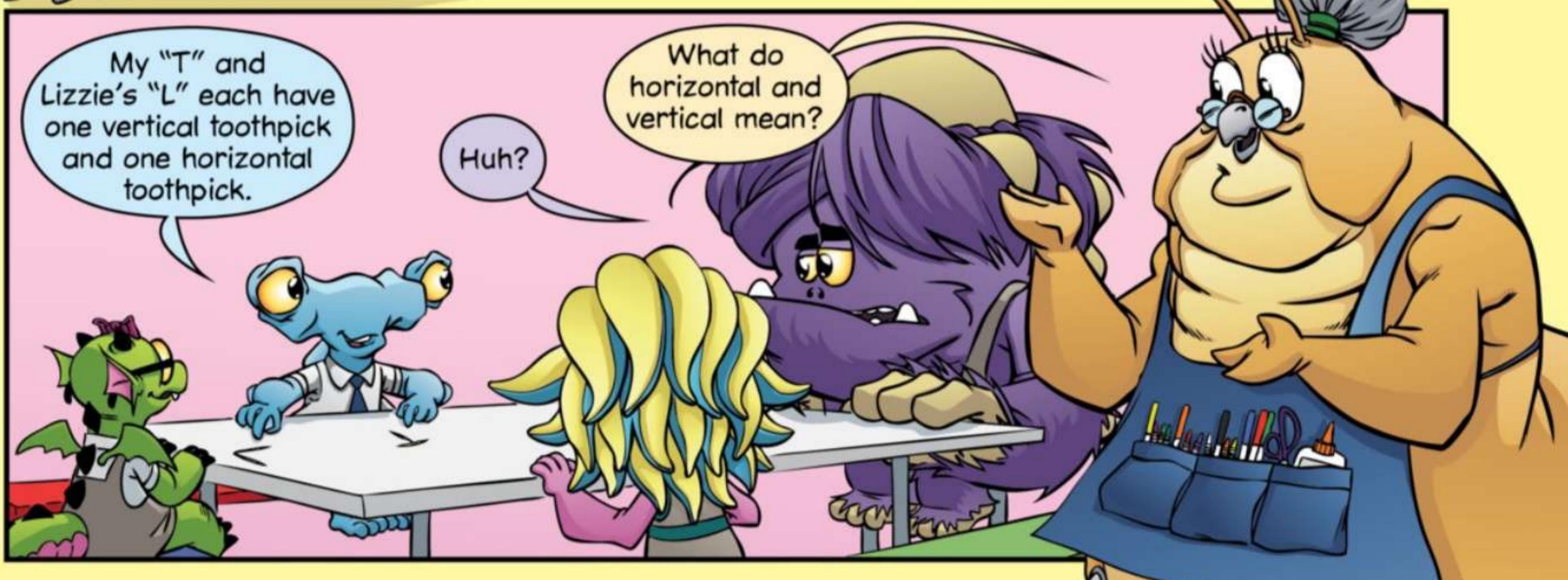
What letters can you create using just two toothpicks?



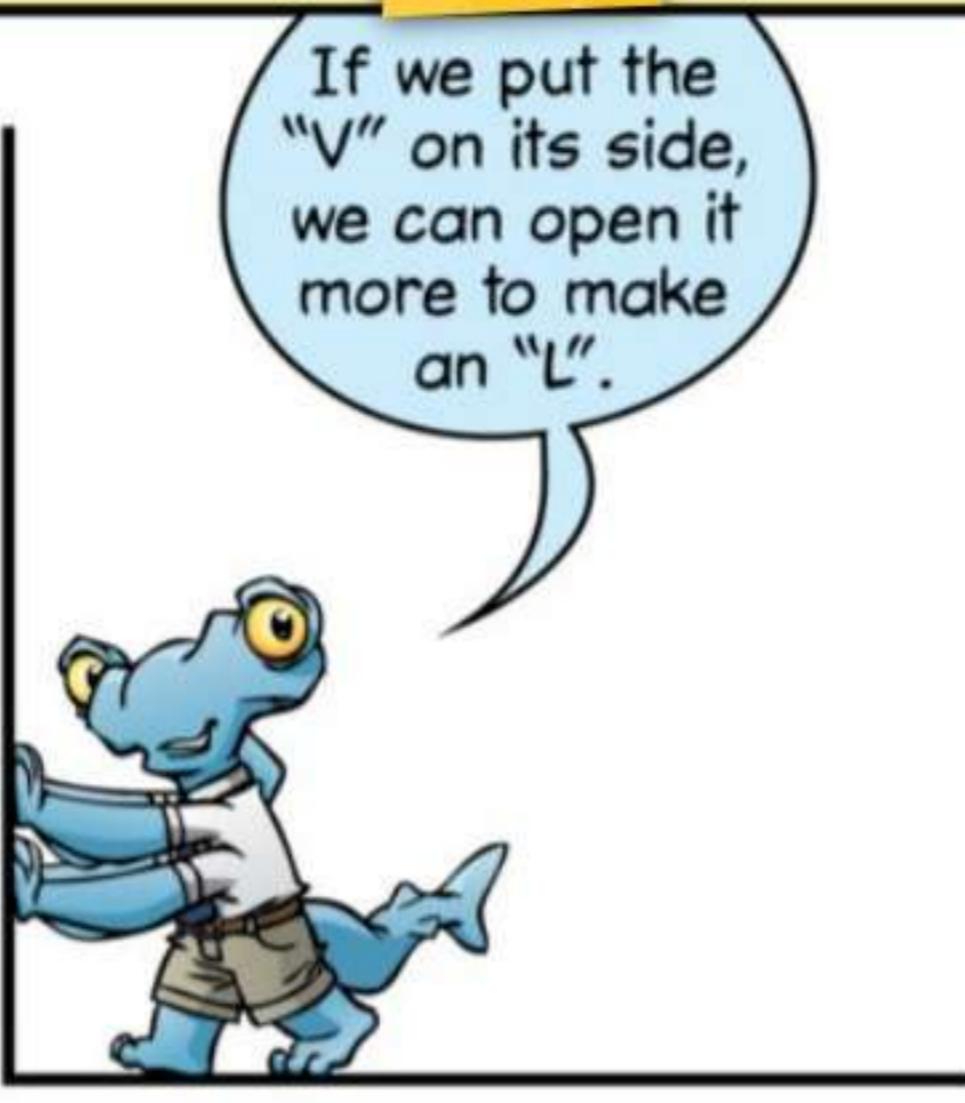
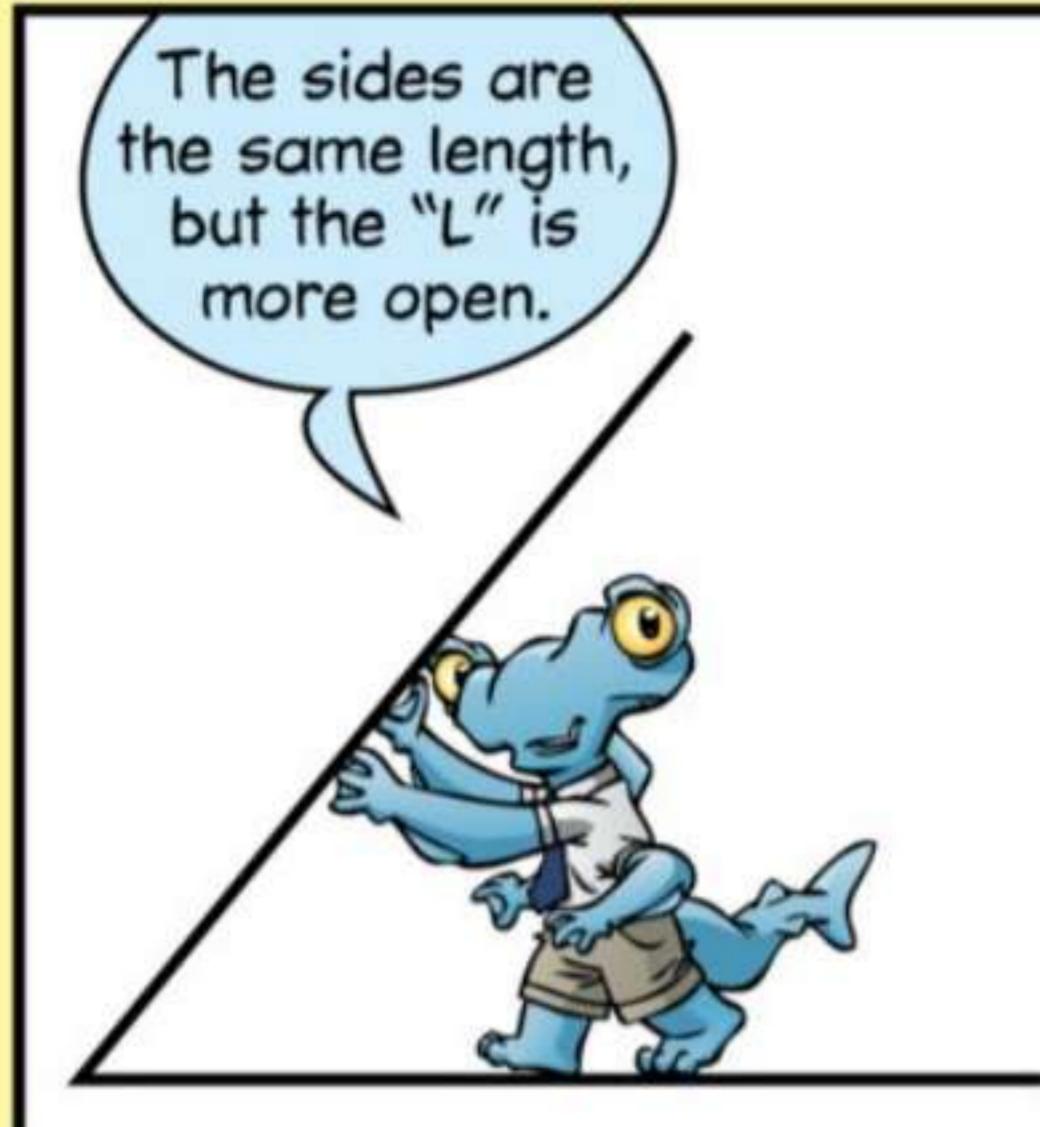
My "T" and Lizzie's "L" each have one vertical toothpick and one horizontal toothpick.

What do horizontal and vertical mean?

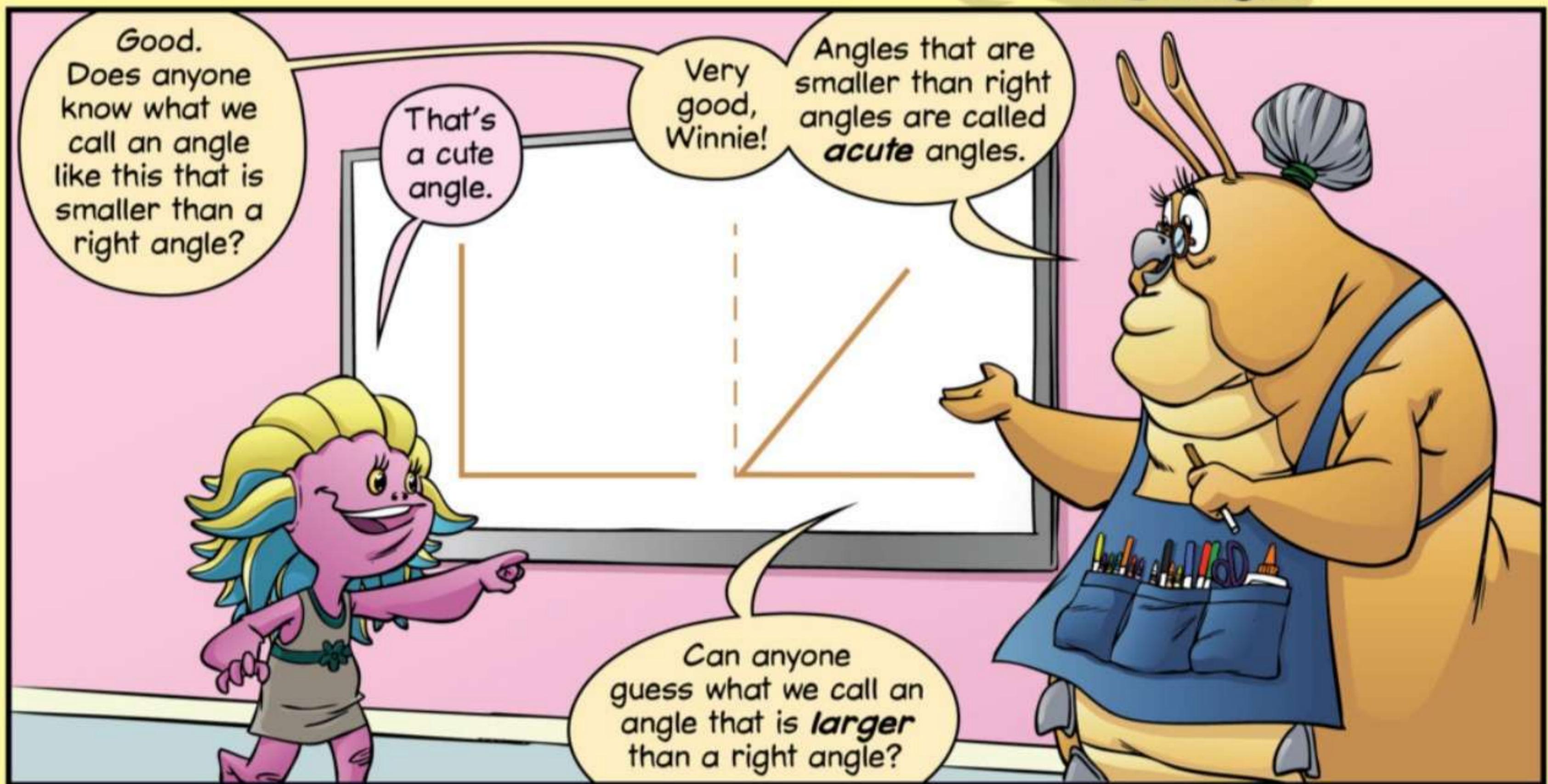
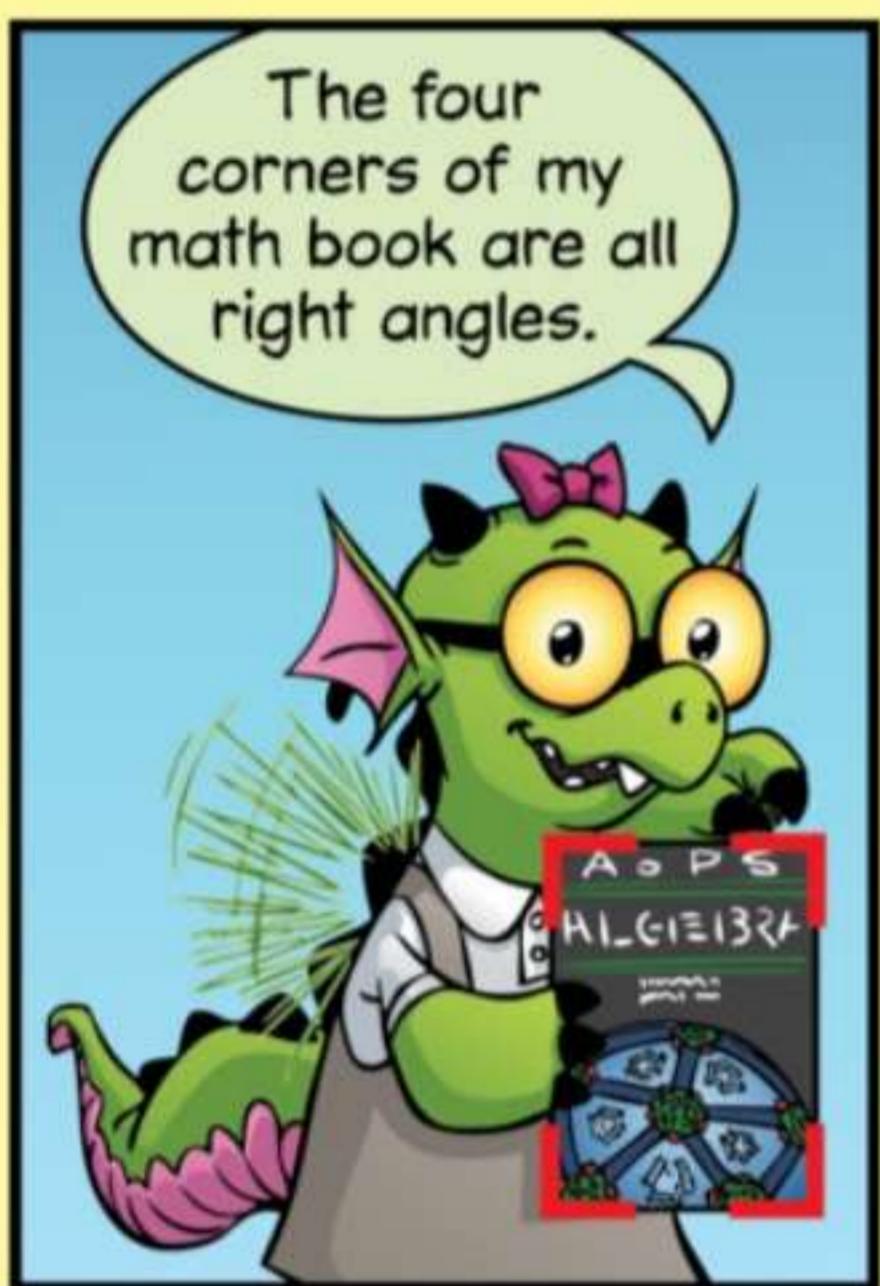
Huh?







WHEN MEASURING ANGLES, LARGER MEANS MORE "OPEN," AND SMALLER MEANS MORE "CLOSED." THE SIZE OF AN ANGLE DOES NOT DEPEND ON THE LENGTHS OF ITS SIDES.



Uncute angles?

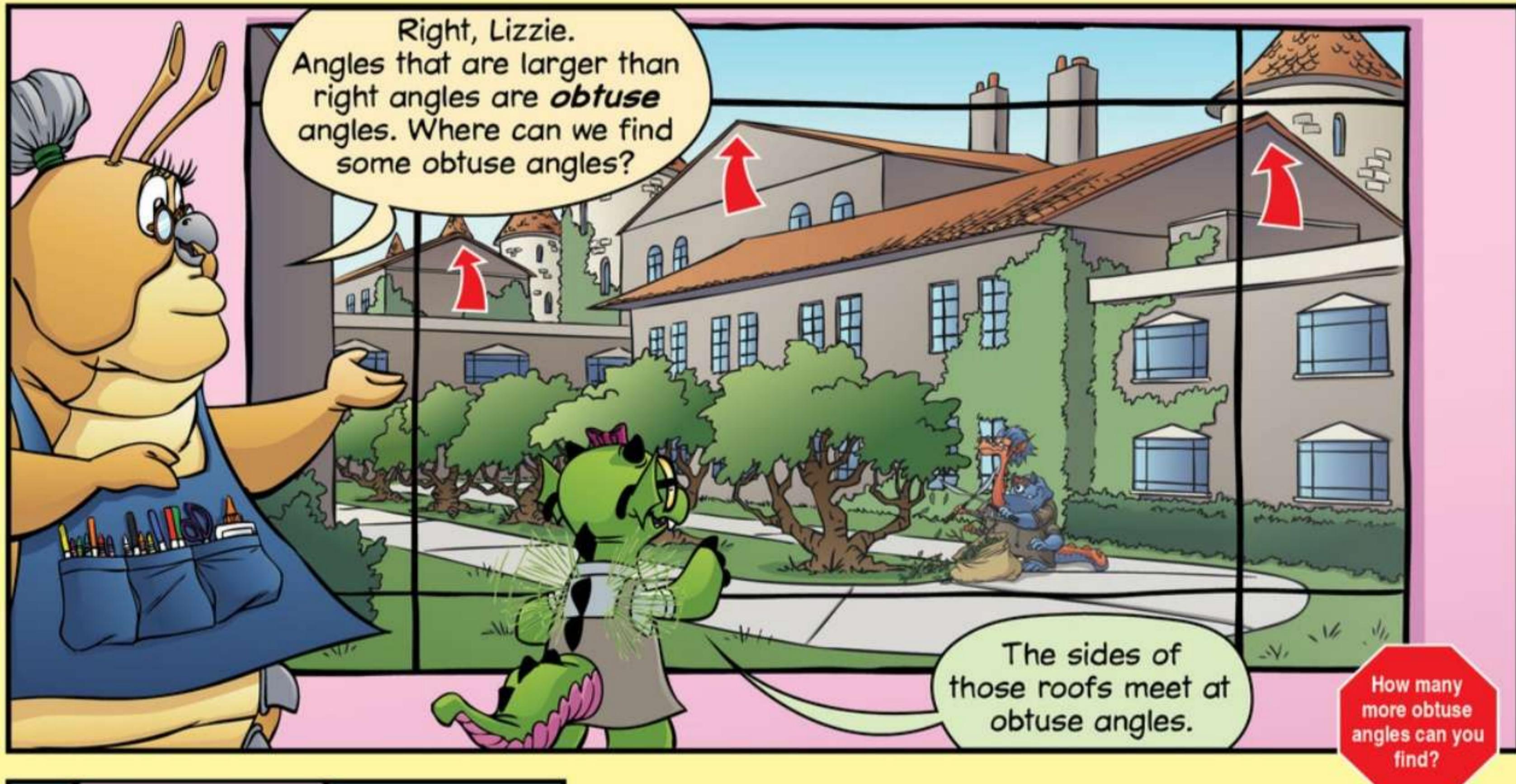
Wide angles?



I think they're called obtuse angles.



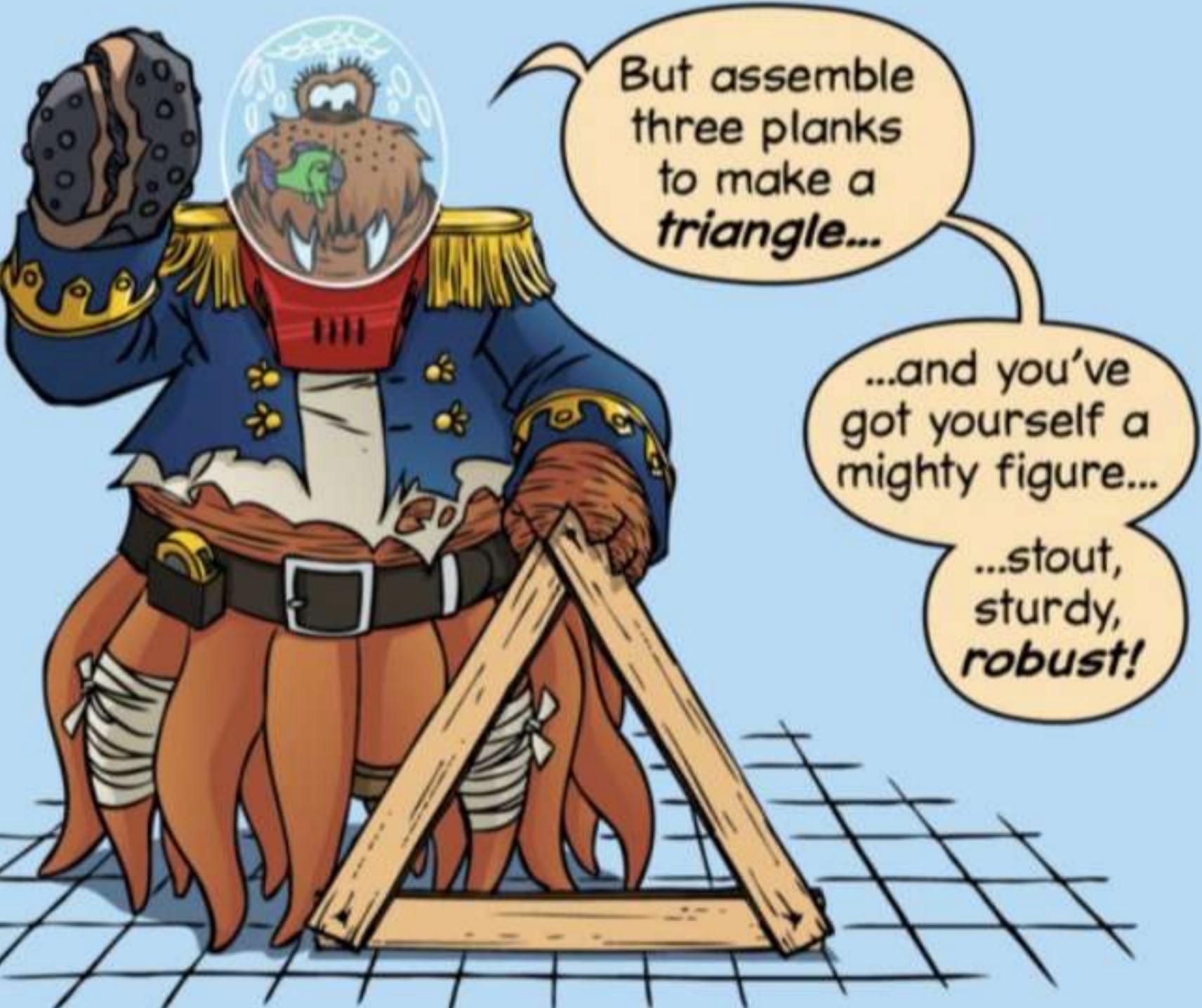
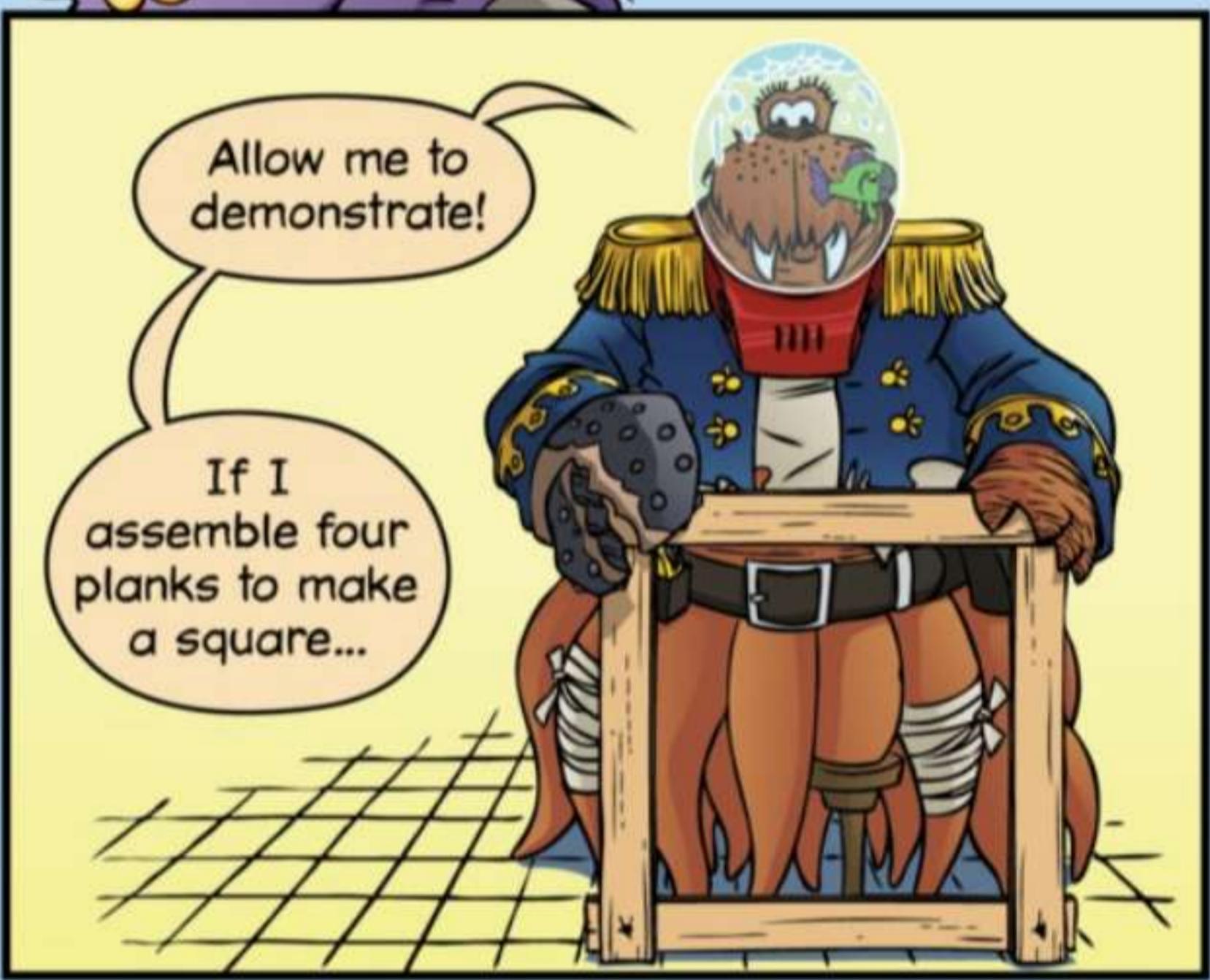
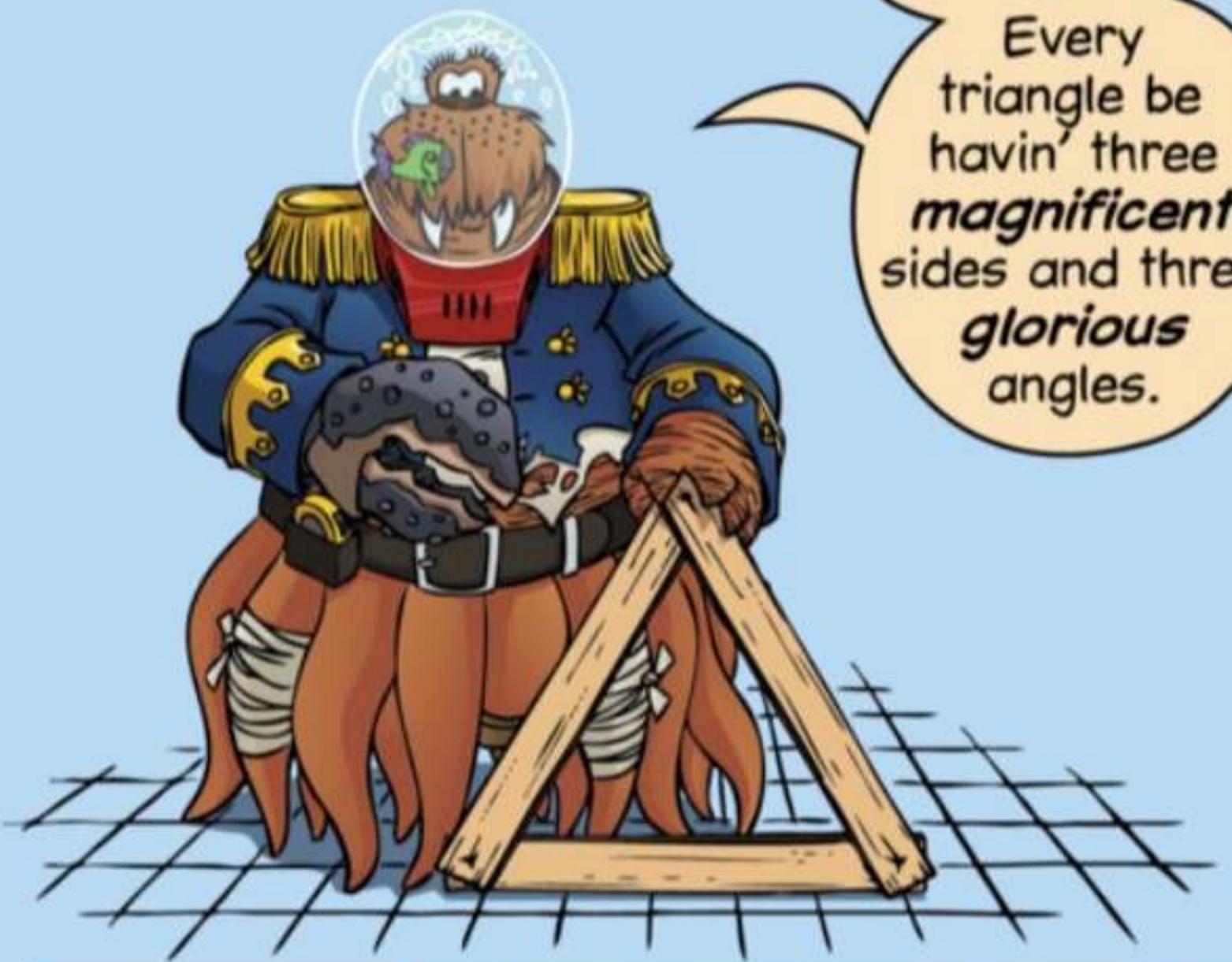
Right, Lizzie.
Angles that are larger than right angles are **obtuse** angles. Where can we find some obtuse angles?



All of the angles inside this stop sign are obtuse.



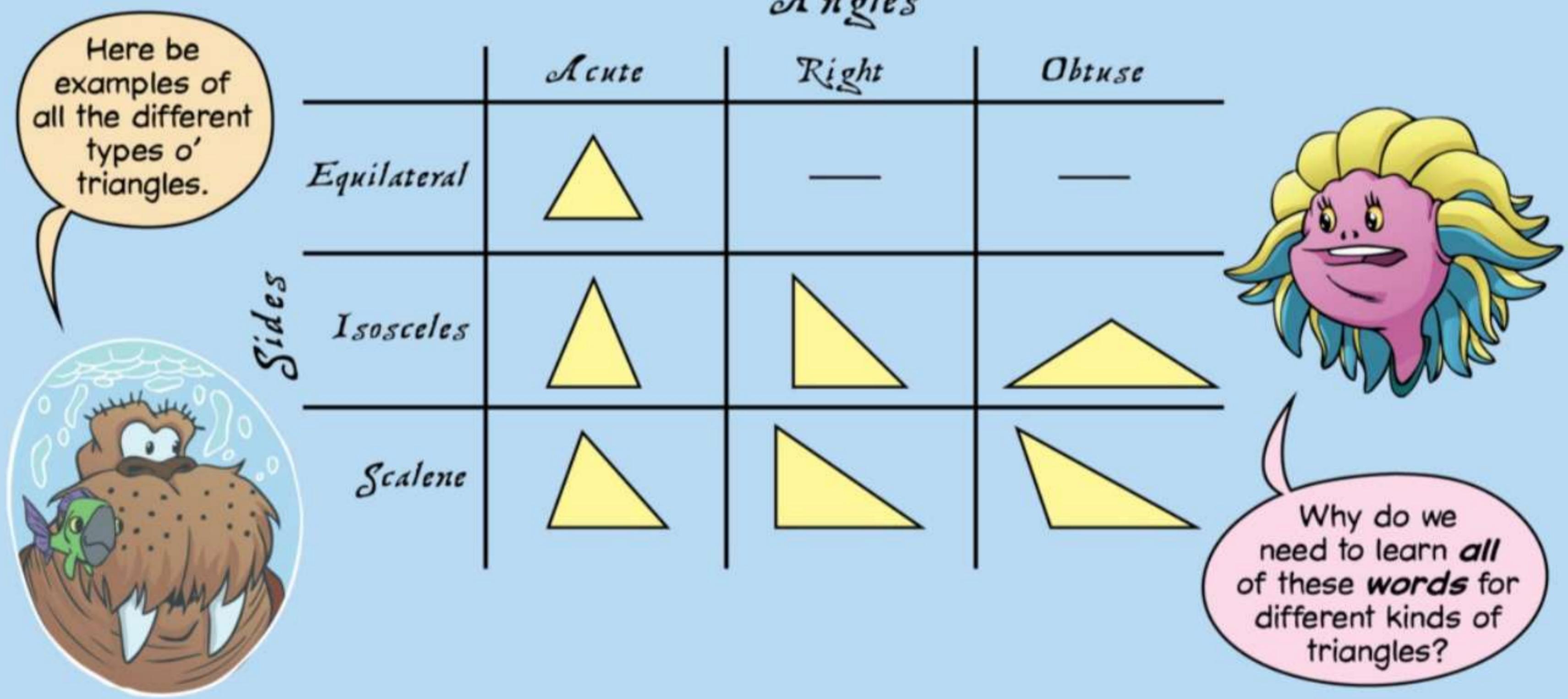
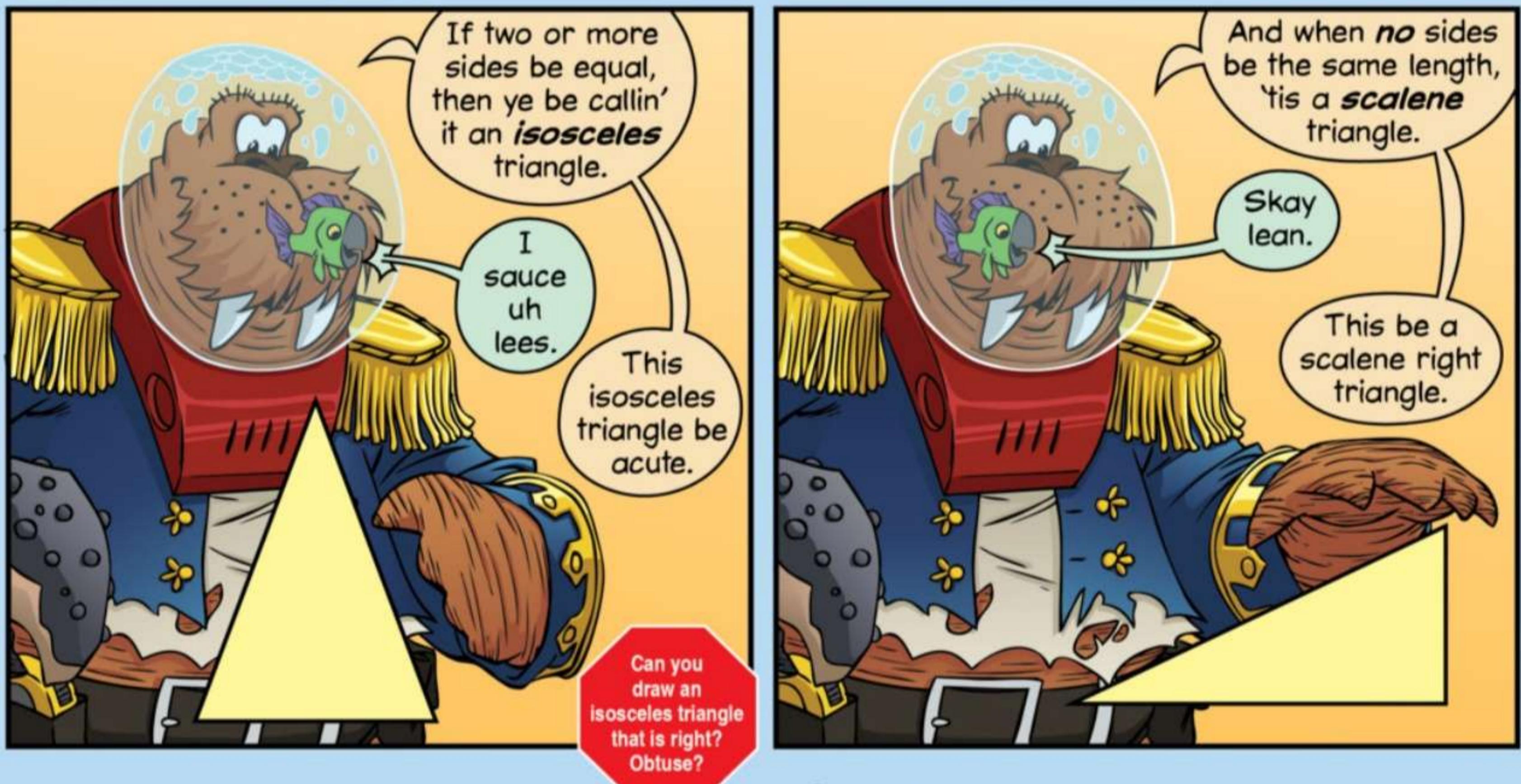
Workshop TRIANGLES

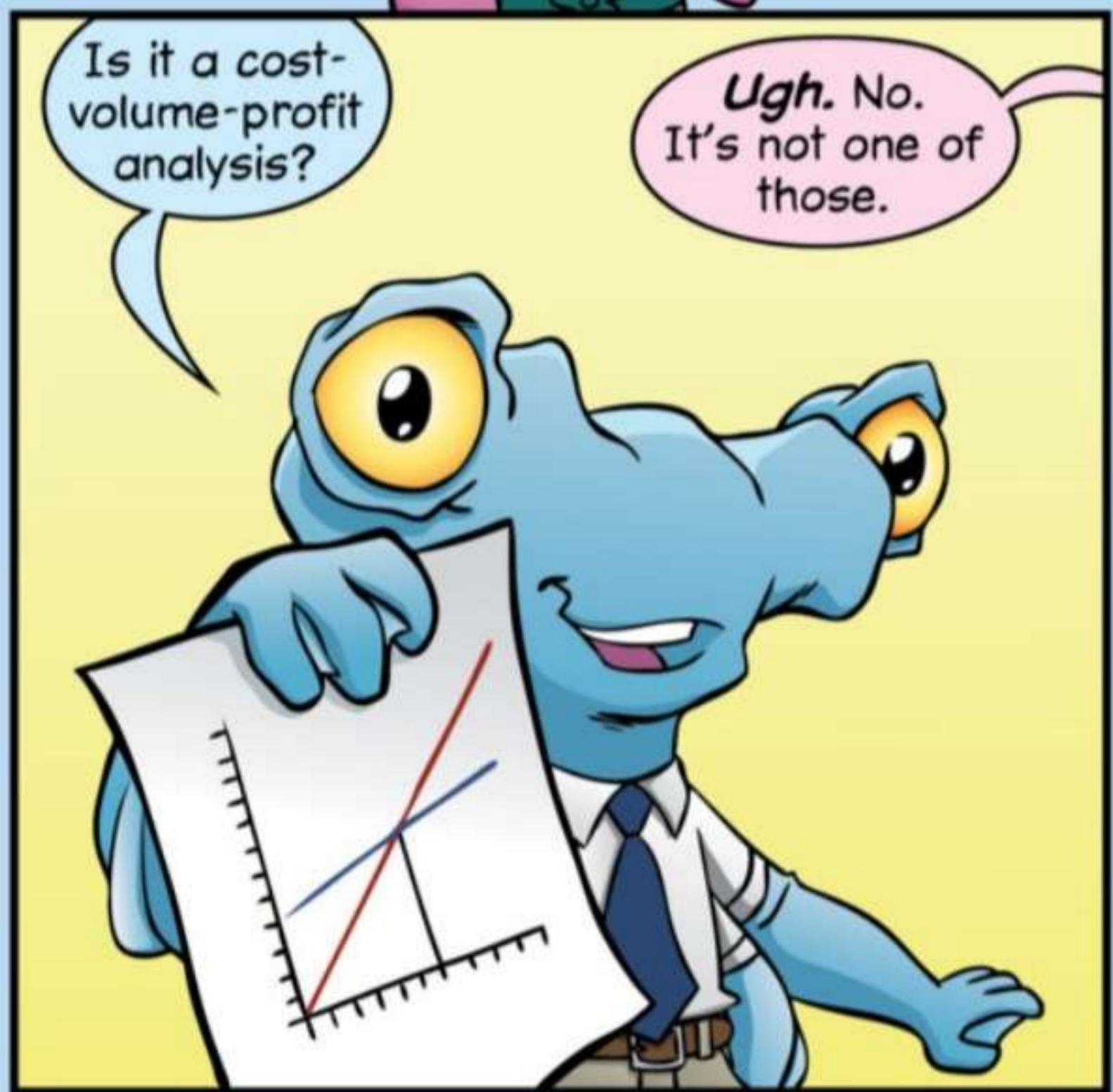
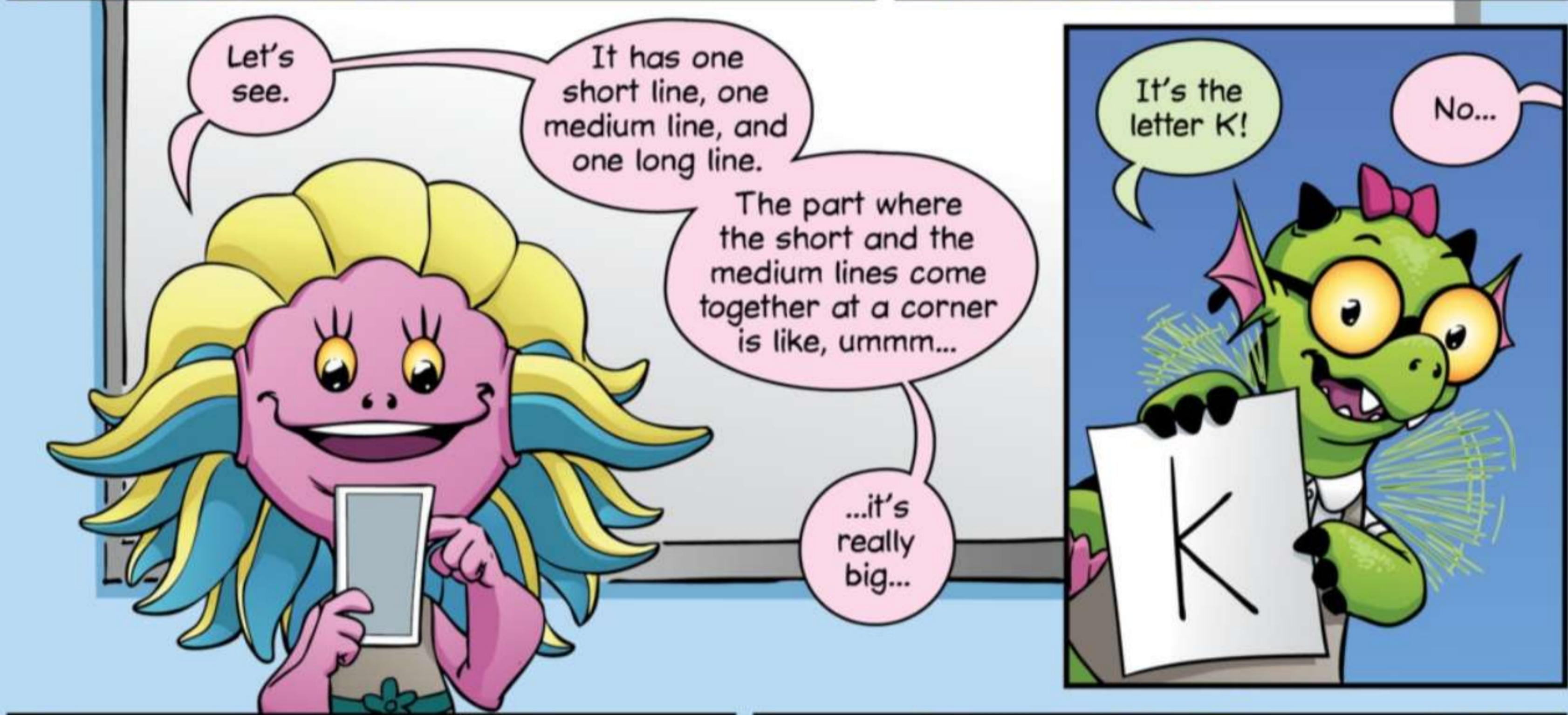


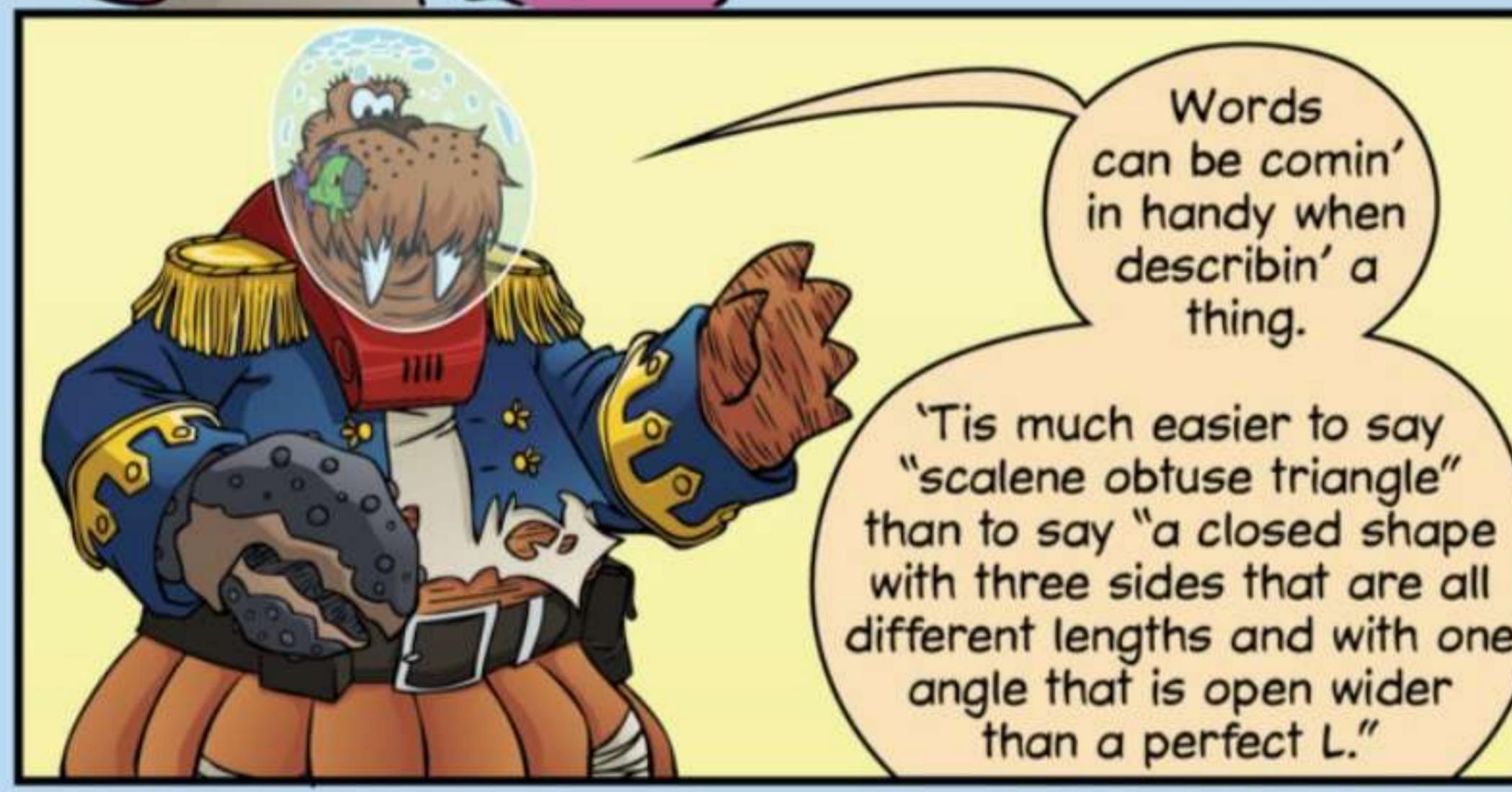








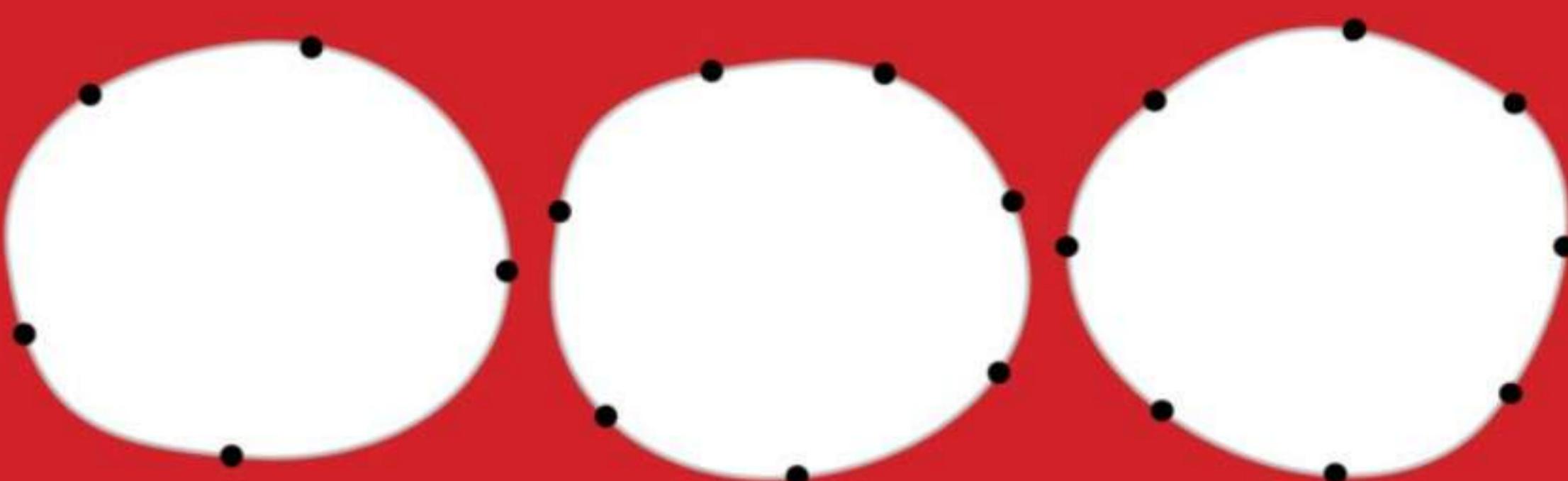




RECHISSION

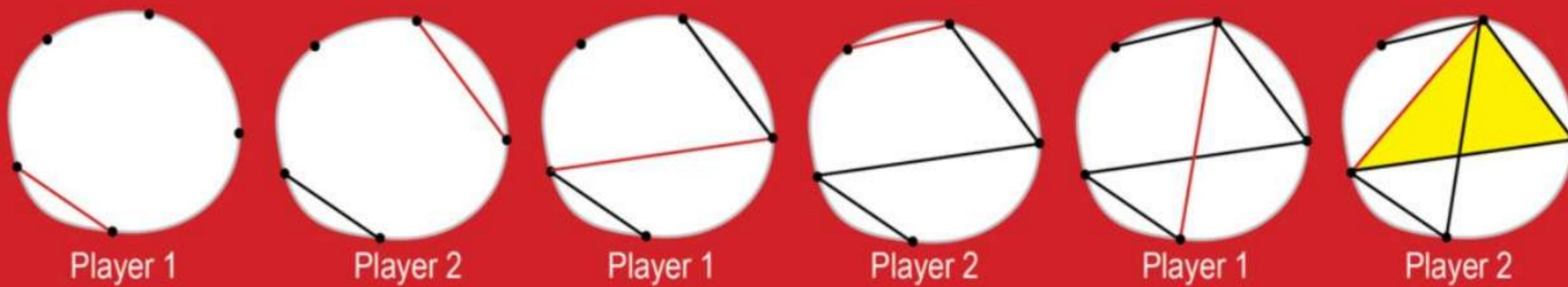
DON'T MAKE A TRIANGLE

Instructions: Draw from 5 to 8 dots connected on a loop as shown. Players take turns connecting two dots with a straight line. The goal is to avoid connecting a pair of dots that completes a triangle. The game ends when one player completes a triangle.

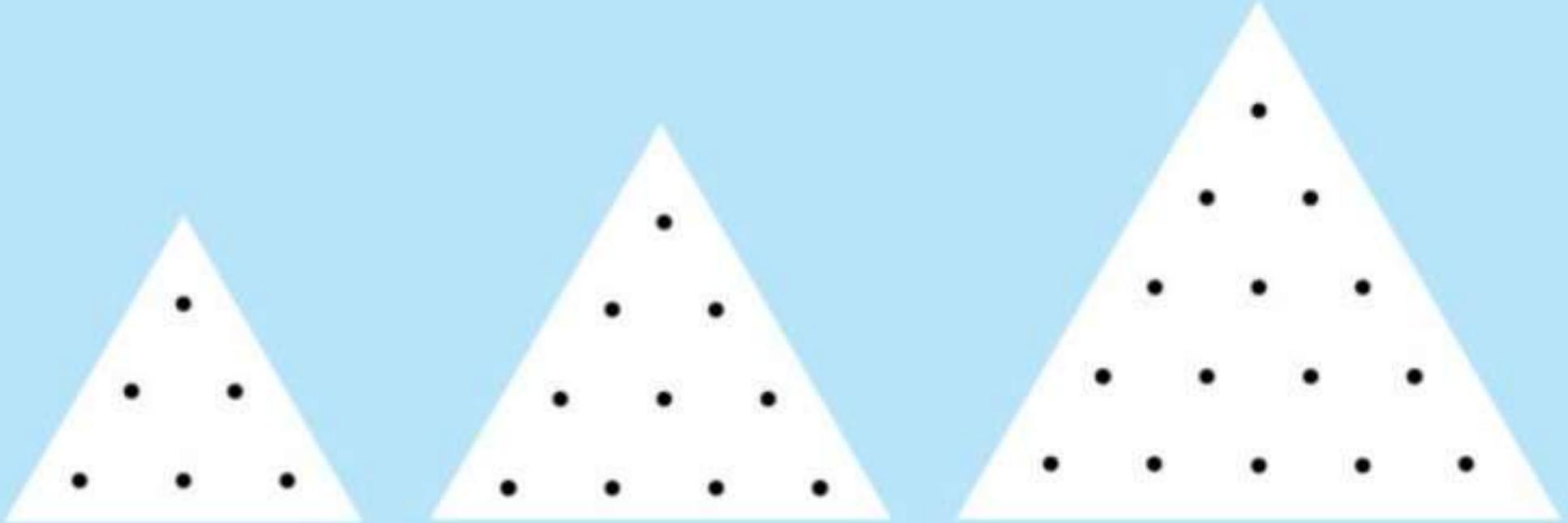


Important: Triangles only count if all three corners are on dots.

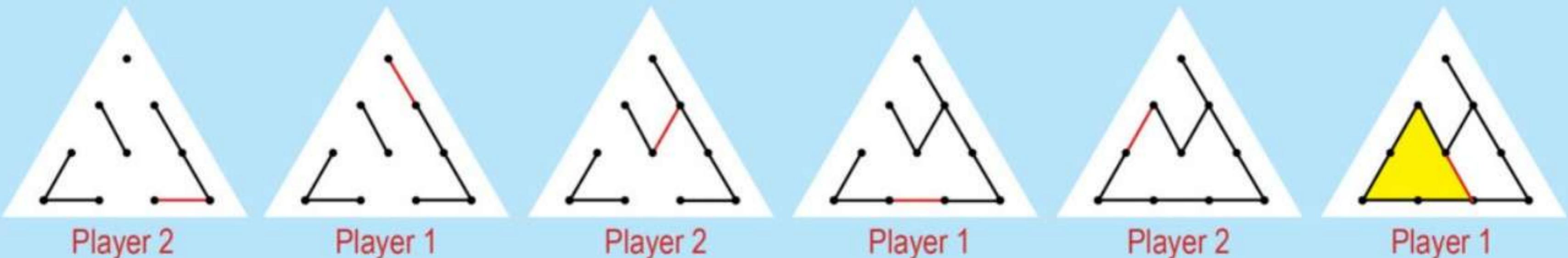
Example: In this game, player 1 wins because player 2 made a triangle.
Do you see a different last move player 2 could have made to win the game?



Variation: Begin with 6, 10, or 15 dots arranged as shown. Players take turns connecting a pair of neighboring dots. As before, the goal is to avoid connecting a pair of dots that completes a triangle of any size. You win the game when your opponent completes a triangle.



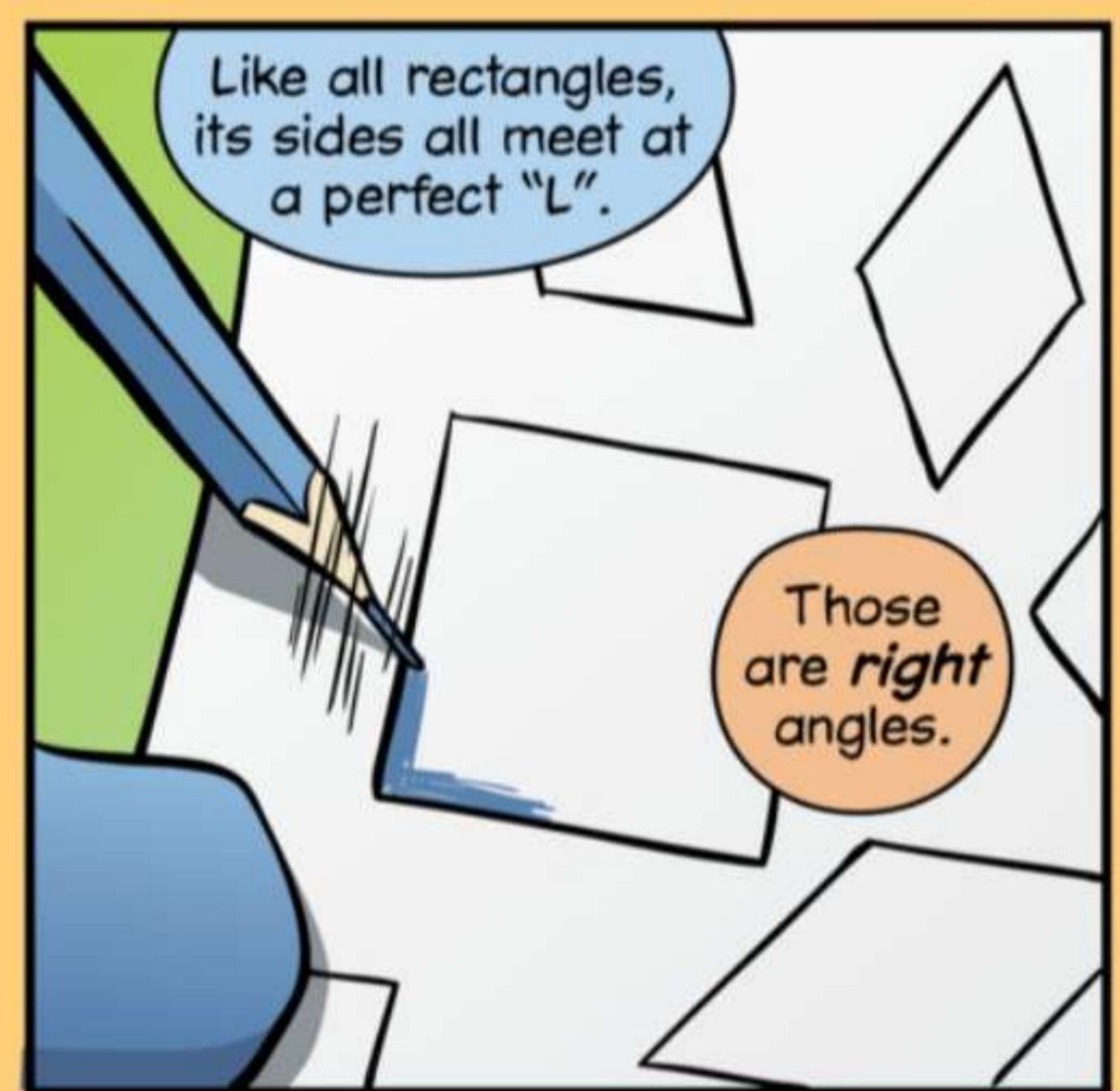
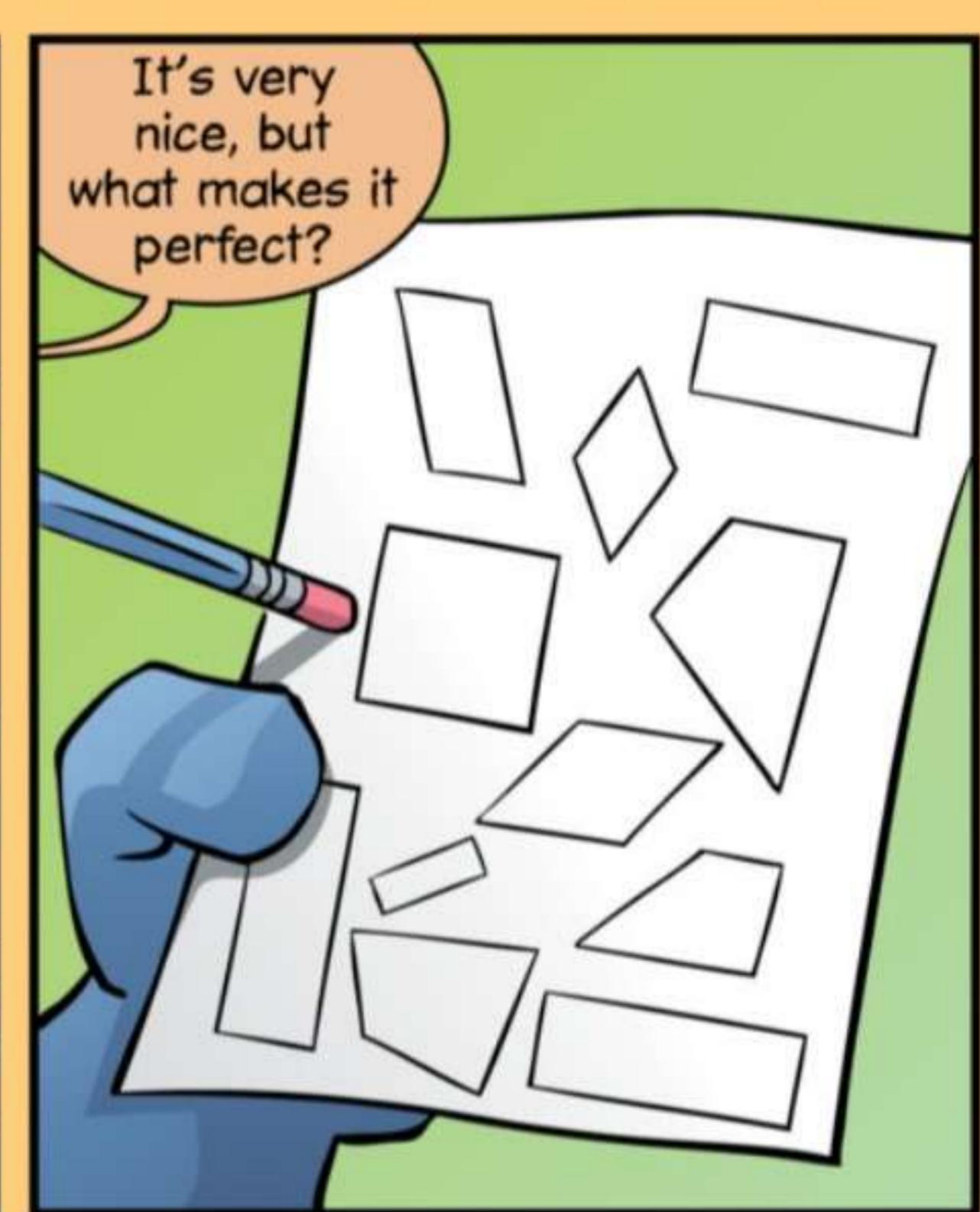
Example: Below are the last six moves of a game won by player 2.

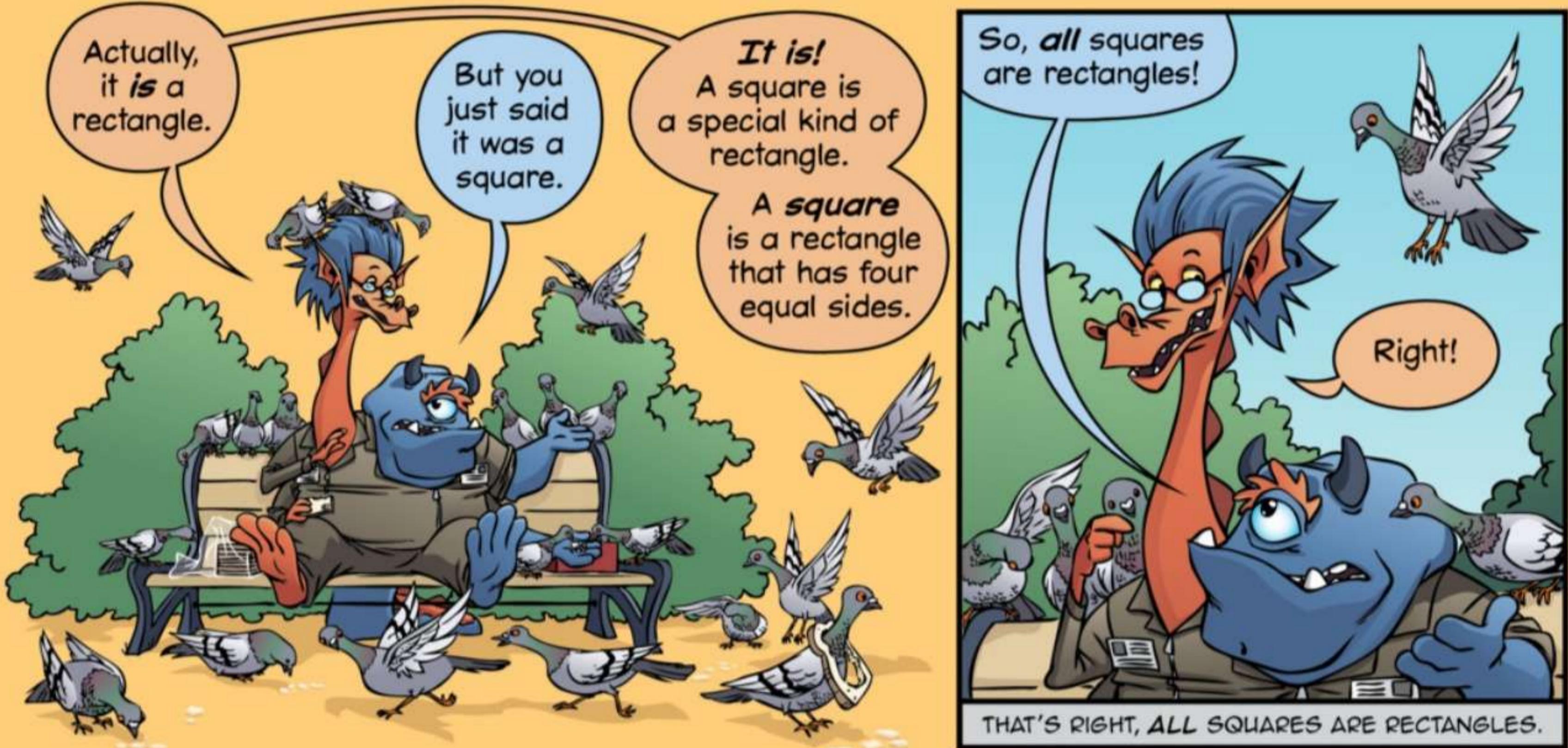


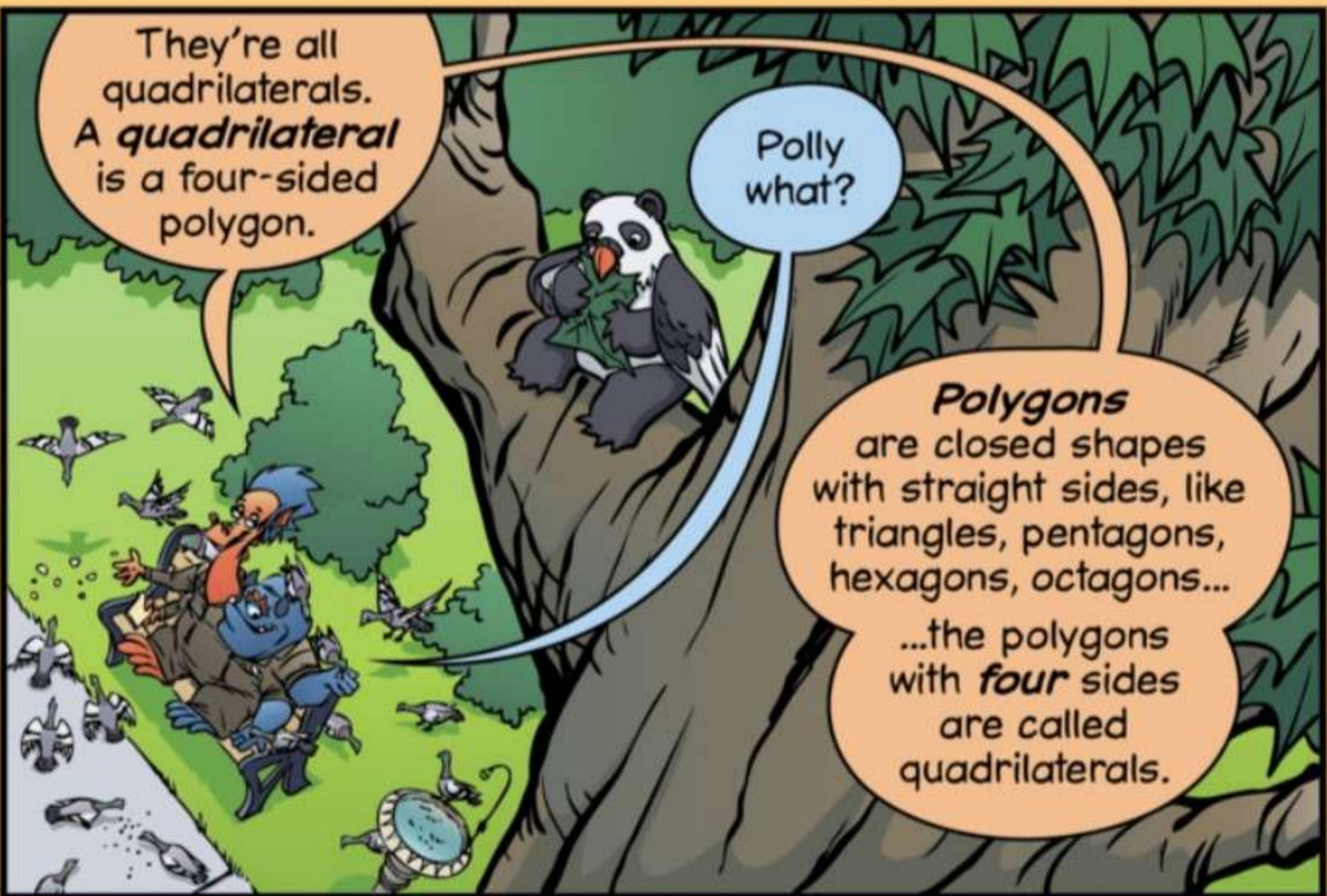
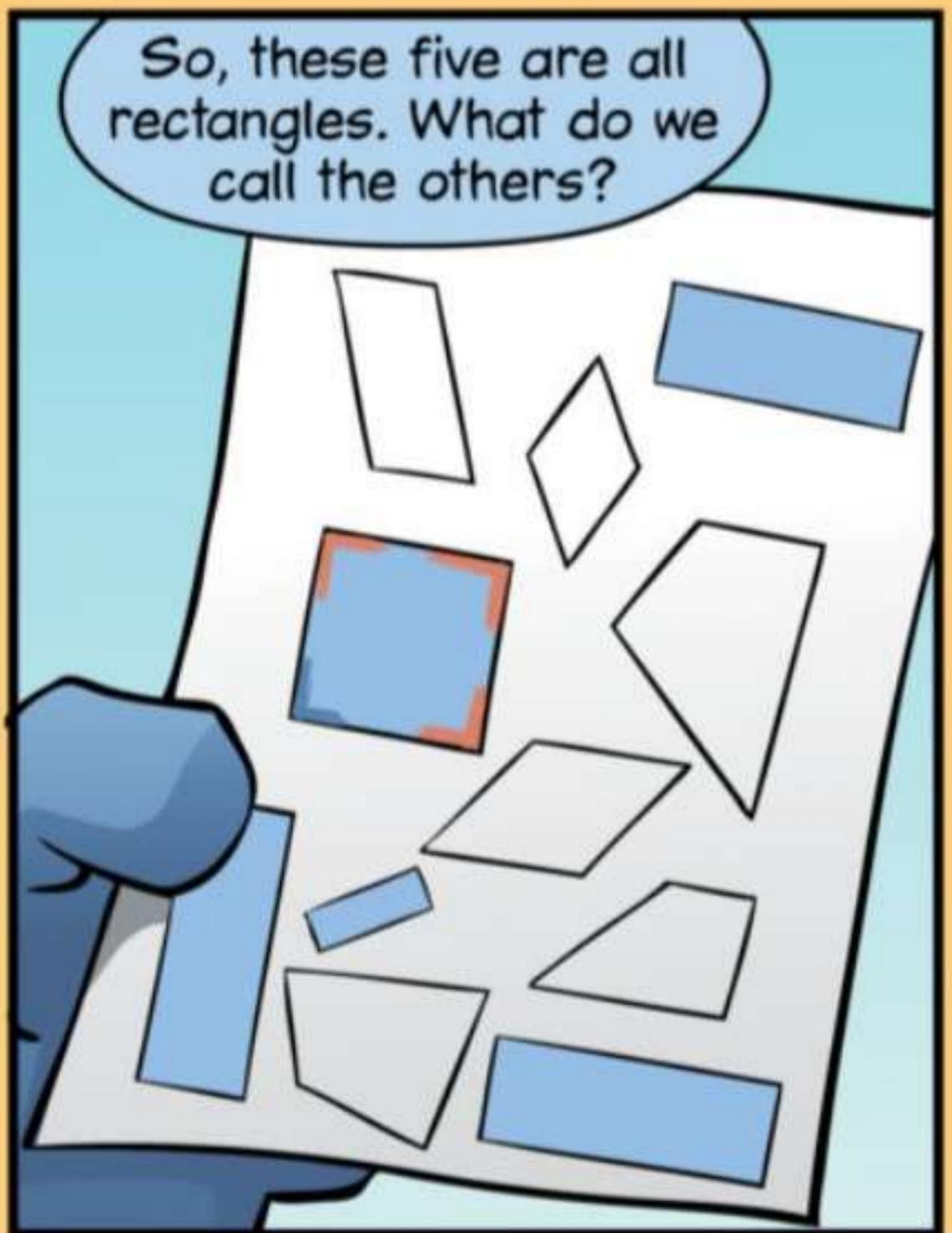
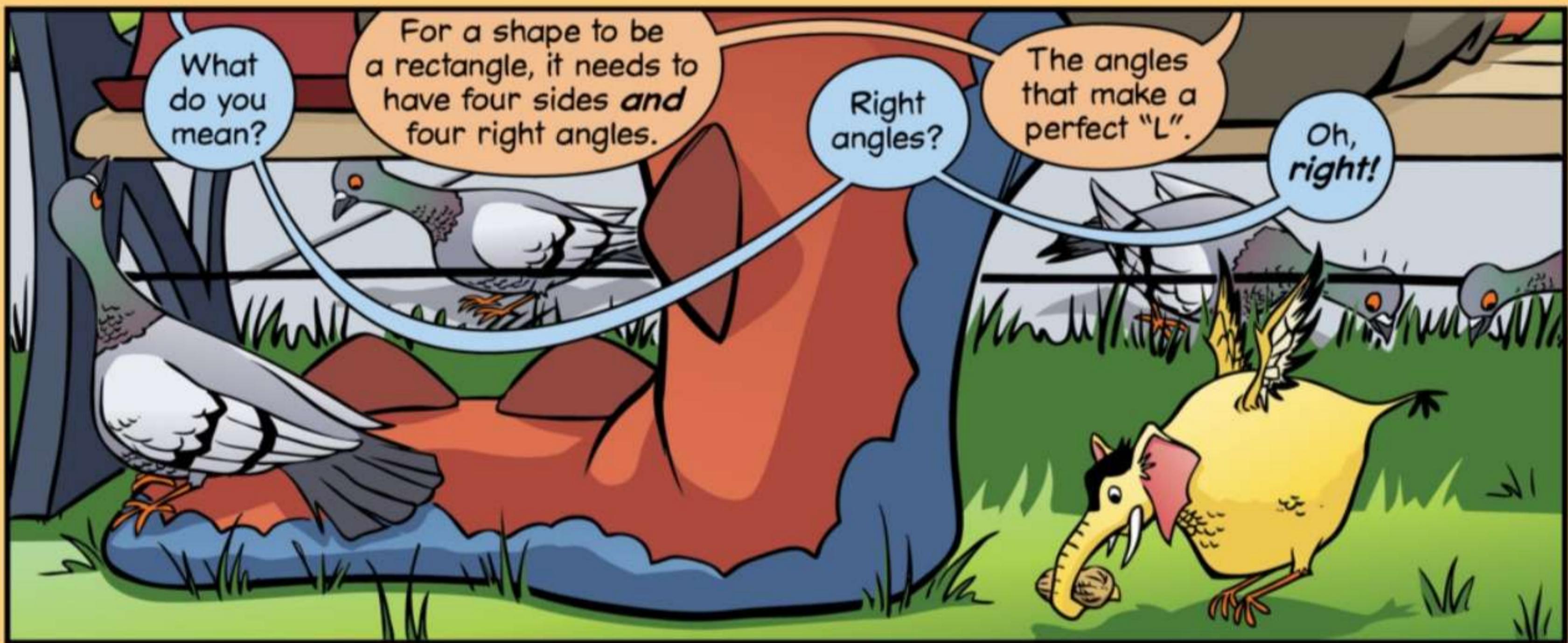
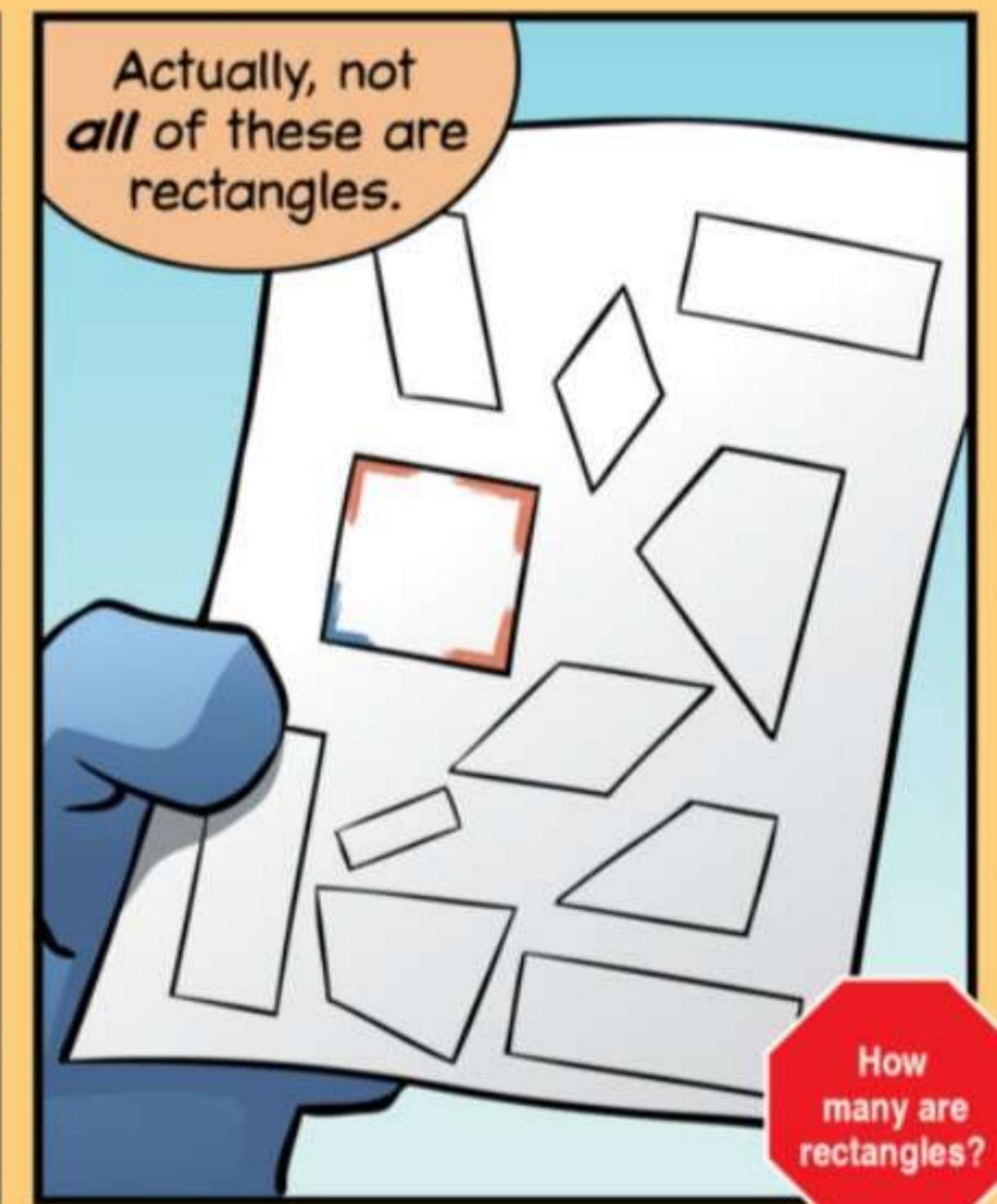
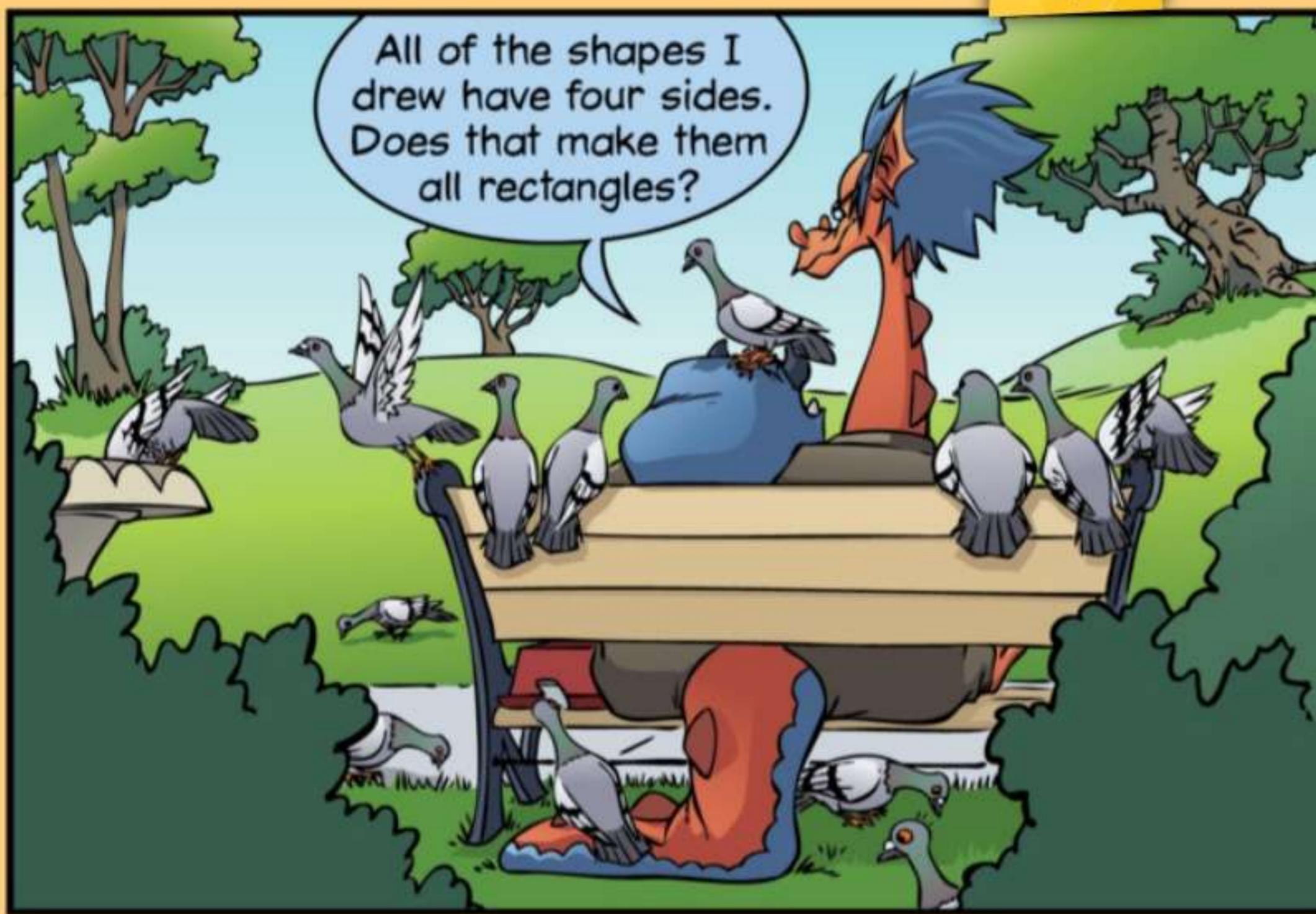


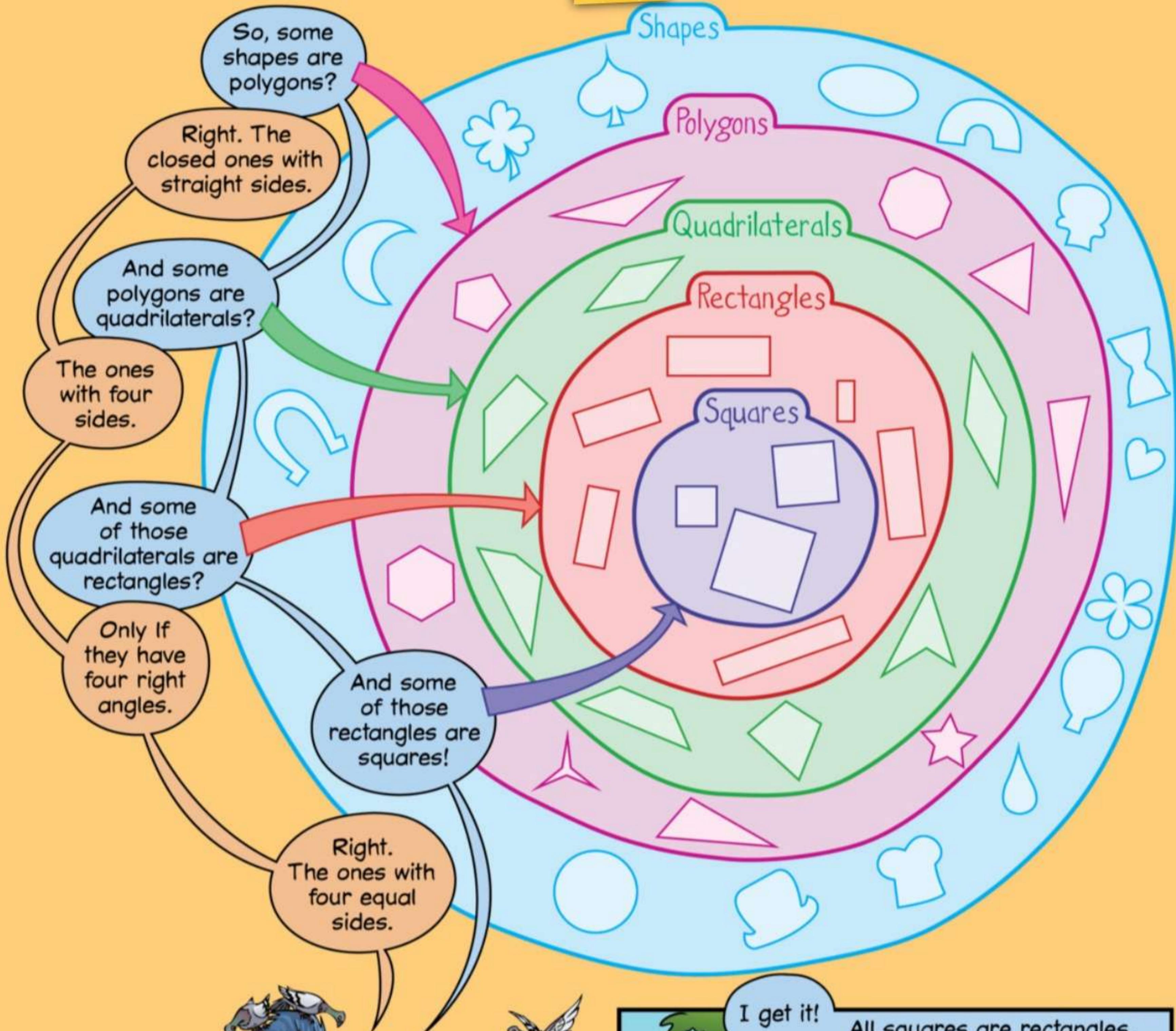
R & G

Quadrilaterals

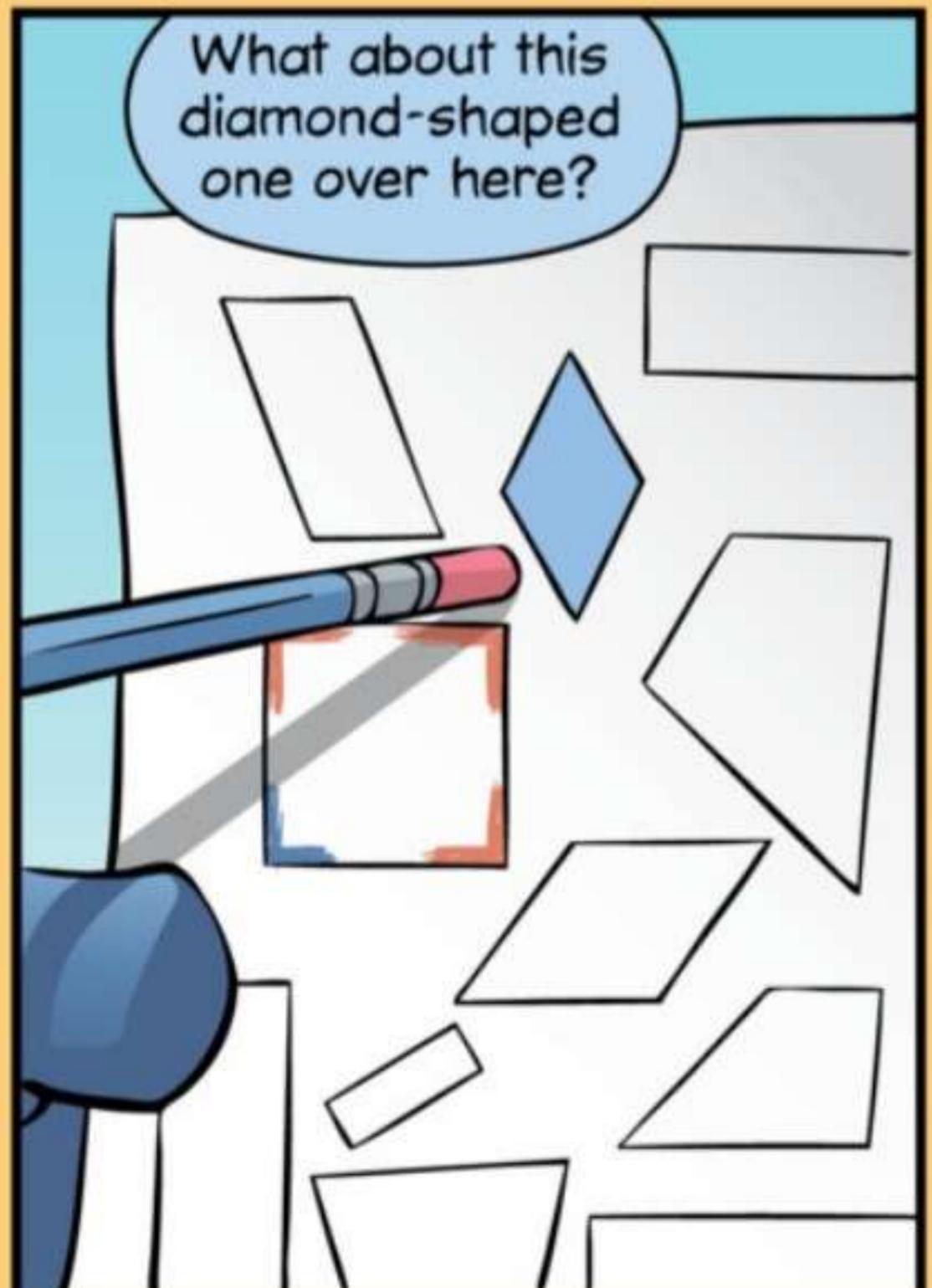
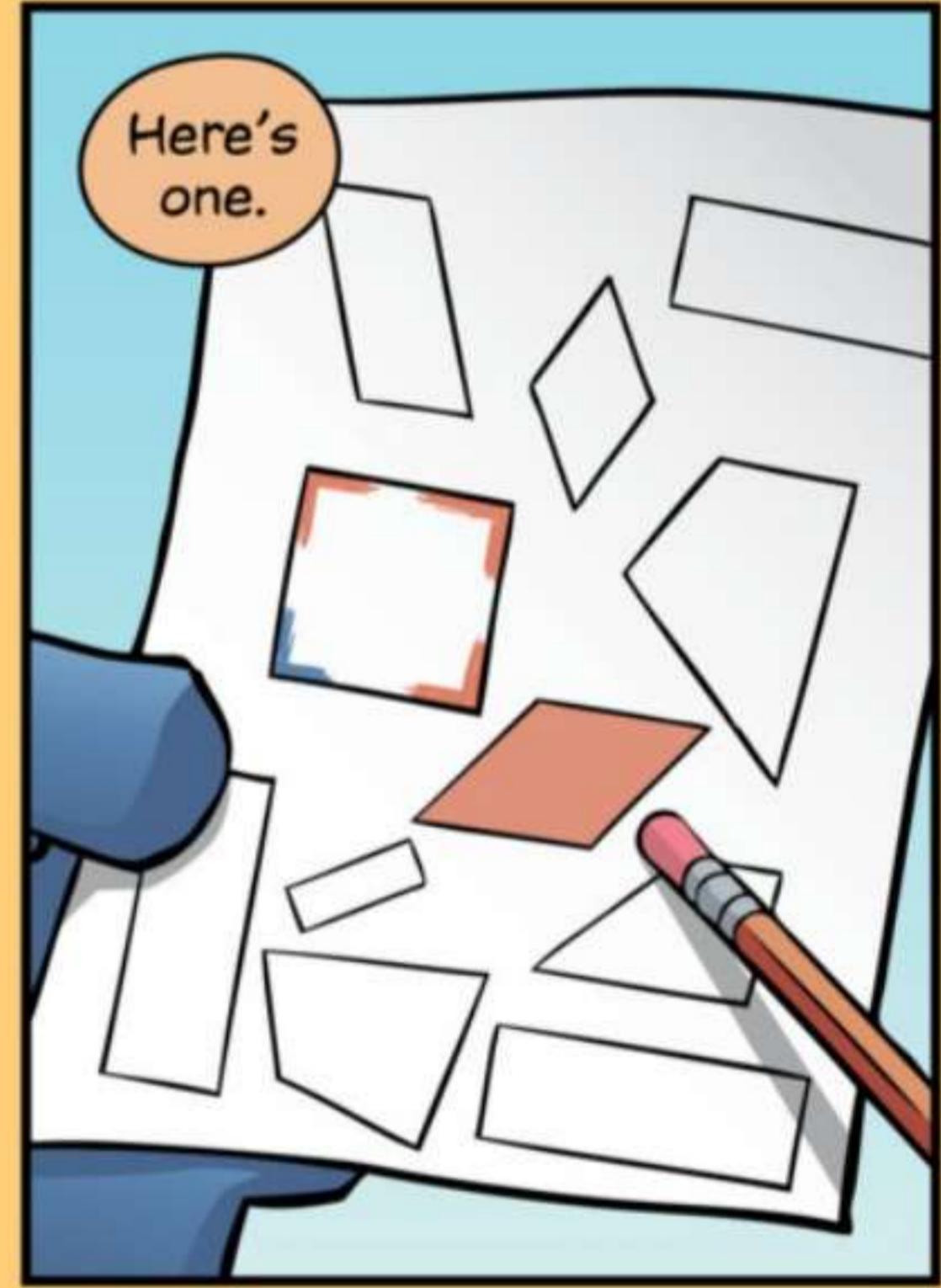
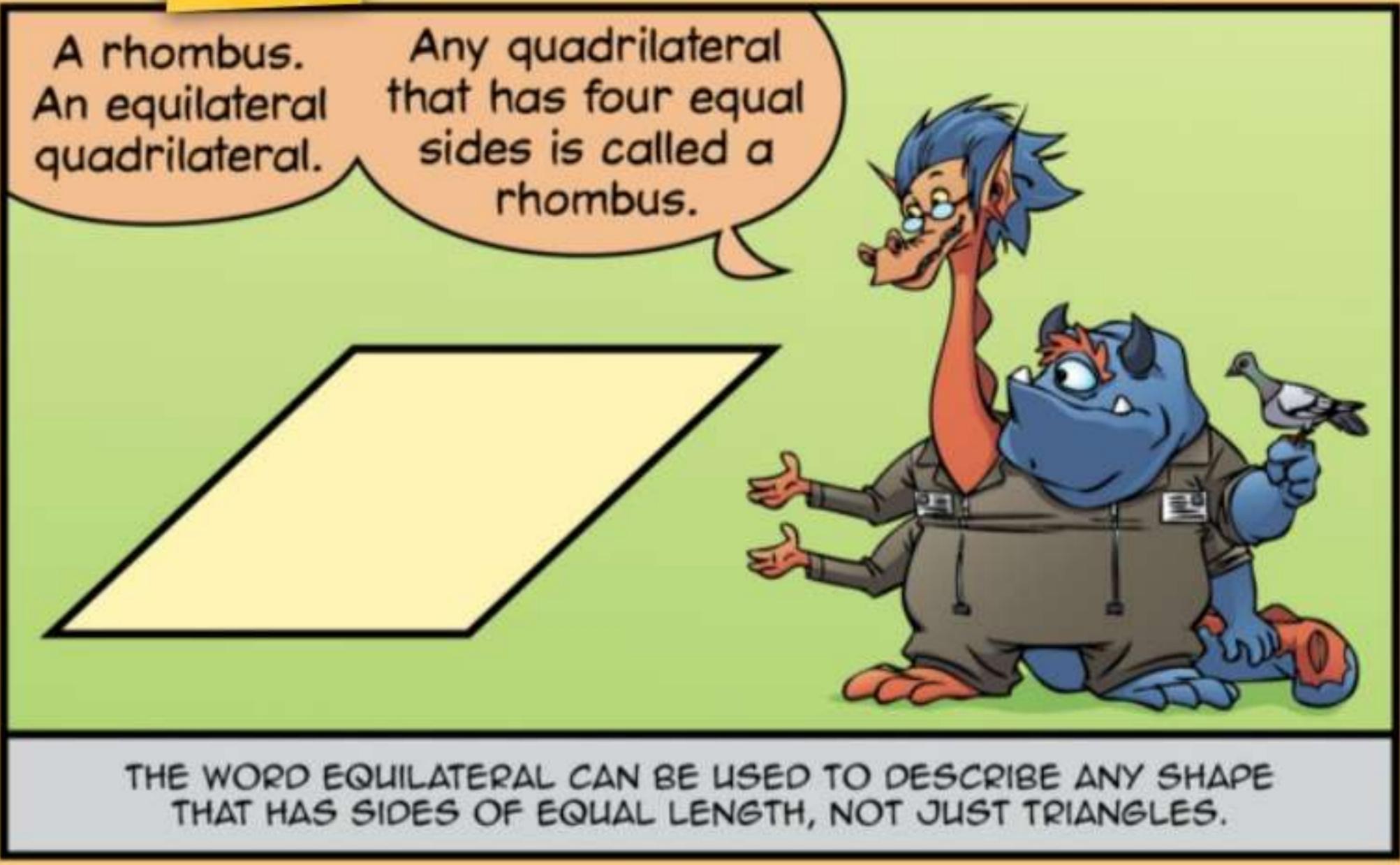


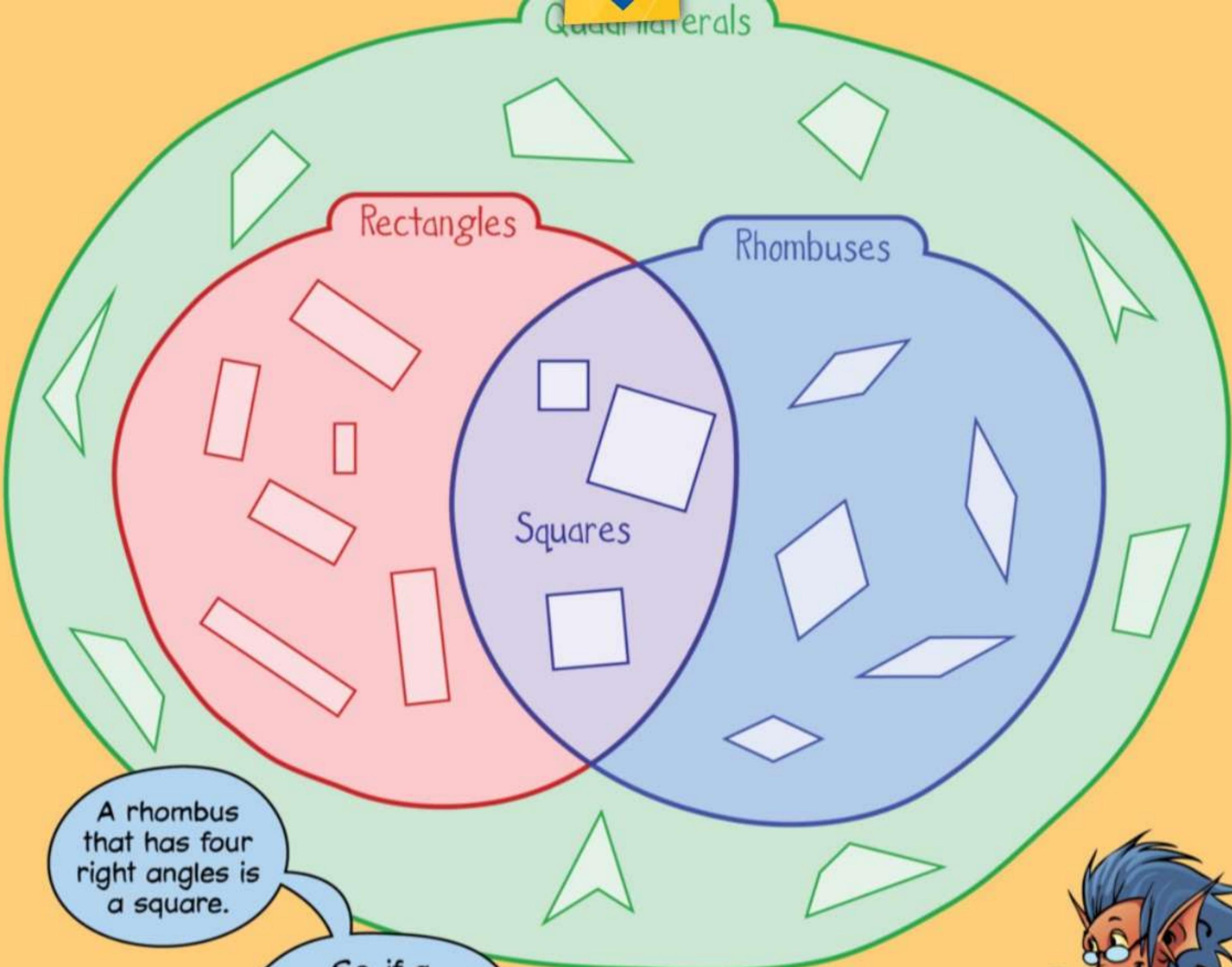






THE DIAGRAM ON THIS PAGE IS CALLED A **VENN DIAGRAM**. EACH LABELED RING REPRESENTS A CATEGORY. THE ITEMS INSIDE EACH RING BELONG IN THAT CATEGORY, AND THE ITEMS OUTSIDE EACH RING ARE NOT PART OF THAT CATEGORY.





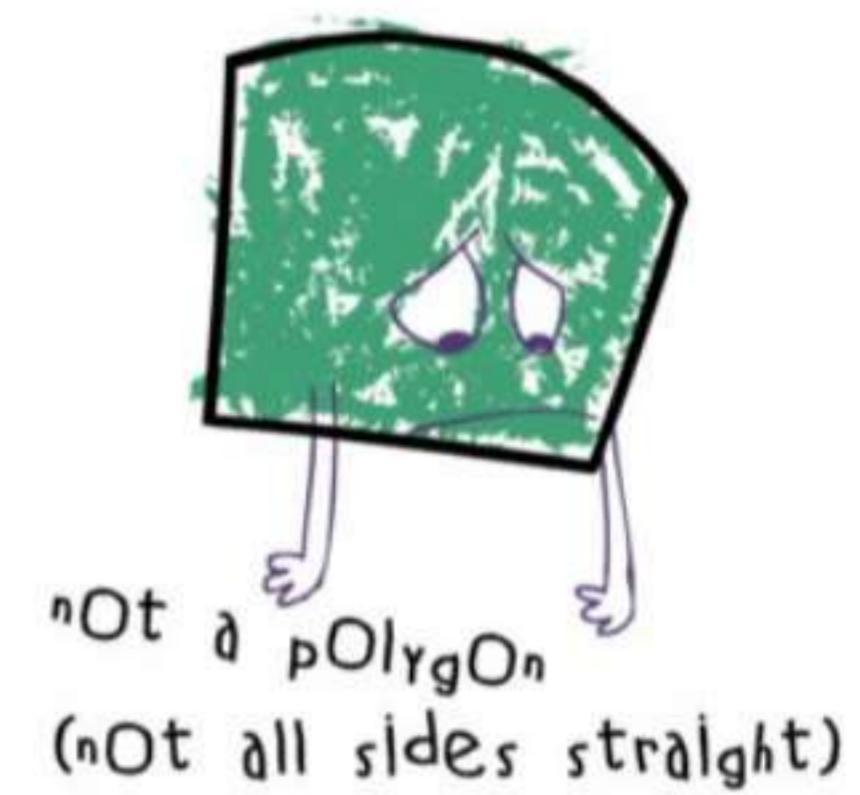
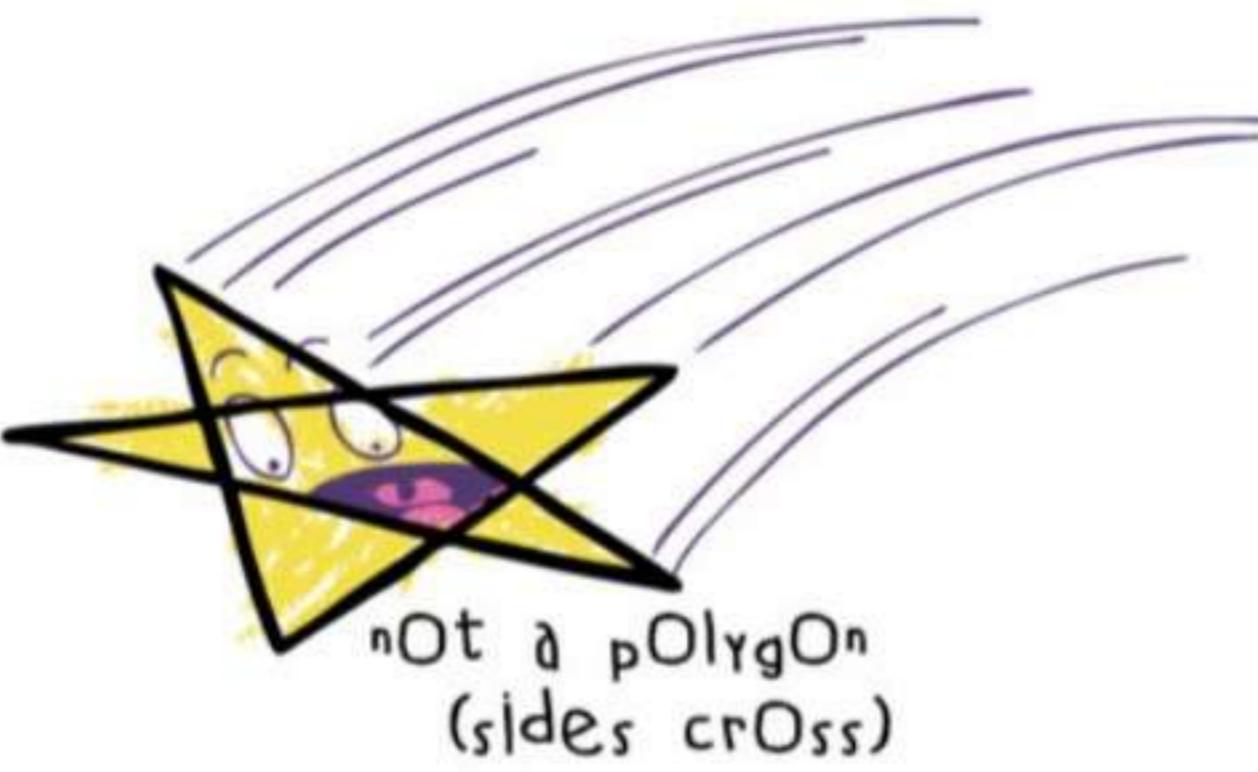
A rhombus
that has four
right angles is
a square.

So, if a
rhombus is also
a rectangle, then
it is a square.

Right! And a
rectangle that is
also a rhombus is
a square!



Polygons: closed shapes with straight sides

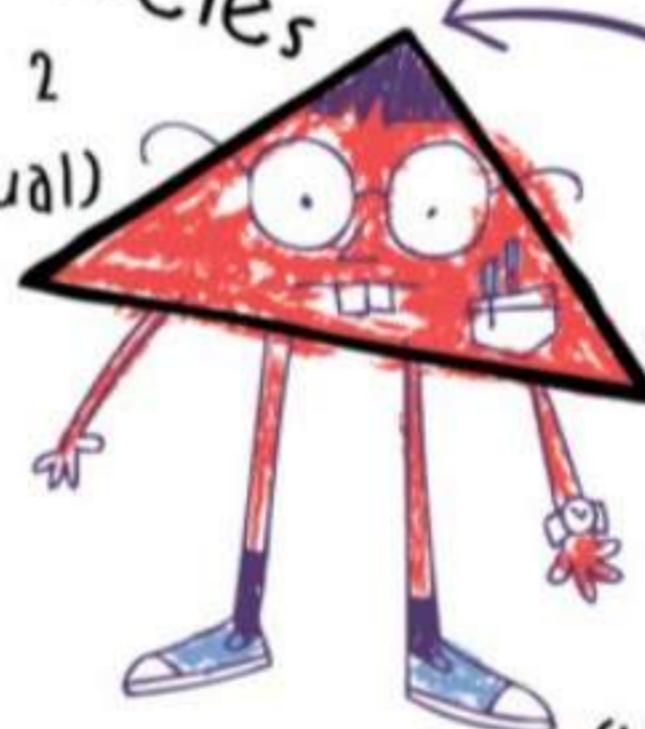


Equilateral
(3 sides equal)



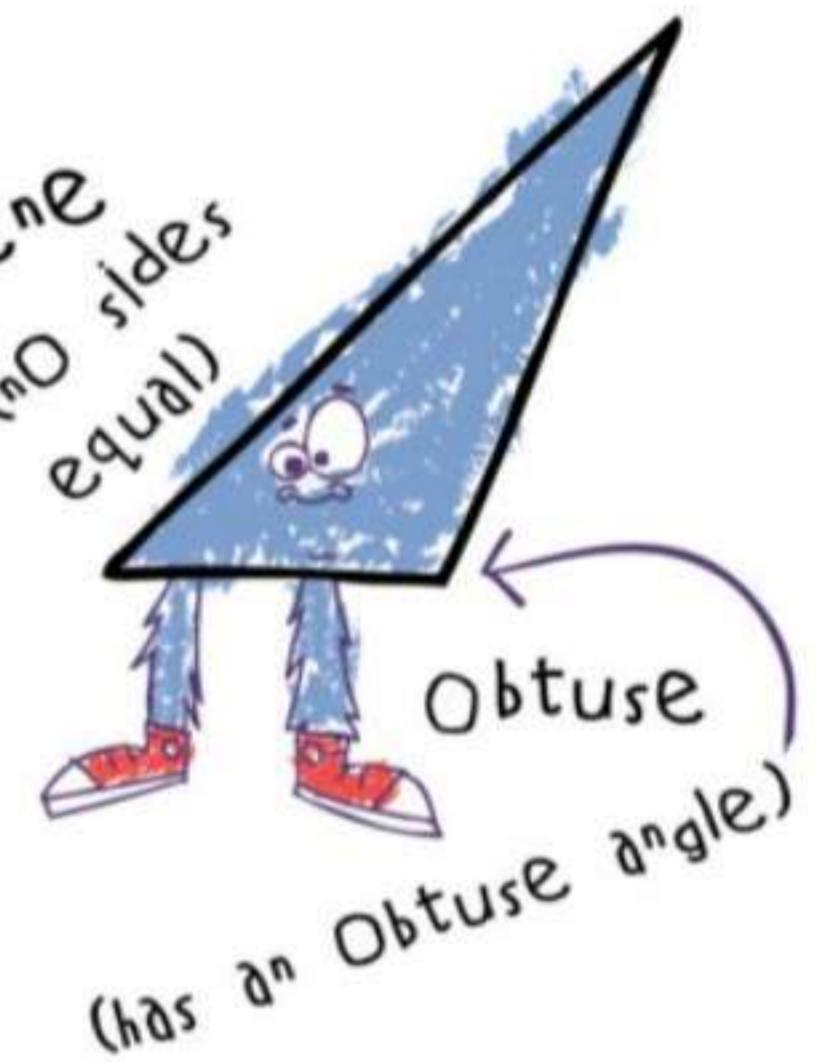
Acute
(all angles are acute)

Isosceles
(at least 2 sides equal)



Right
(has a right angle)

scalene
(no sides equal)



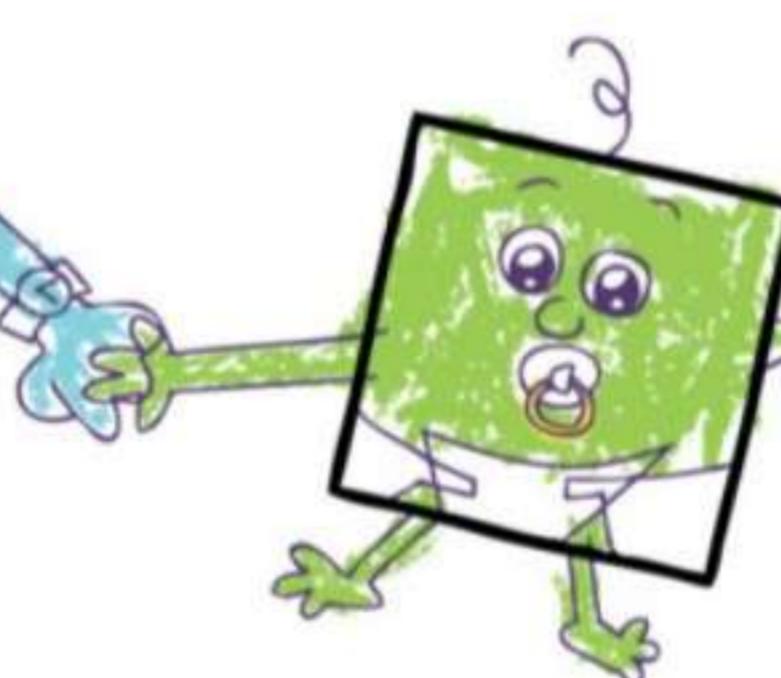
Obtuse
(has an obtuse angle)

Quadrilaterals: 4 sides



rectangle
has four
right angles

Family Of quadrilaterals



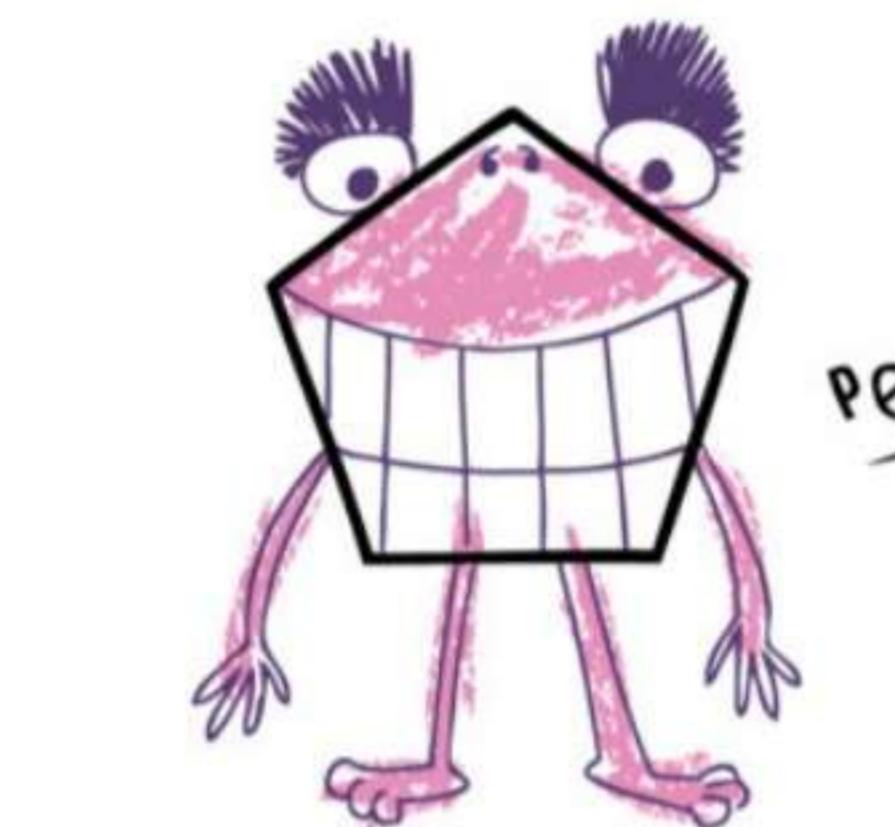
square
is a rhombus
and a rectangle



rhombus
has four equal sides

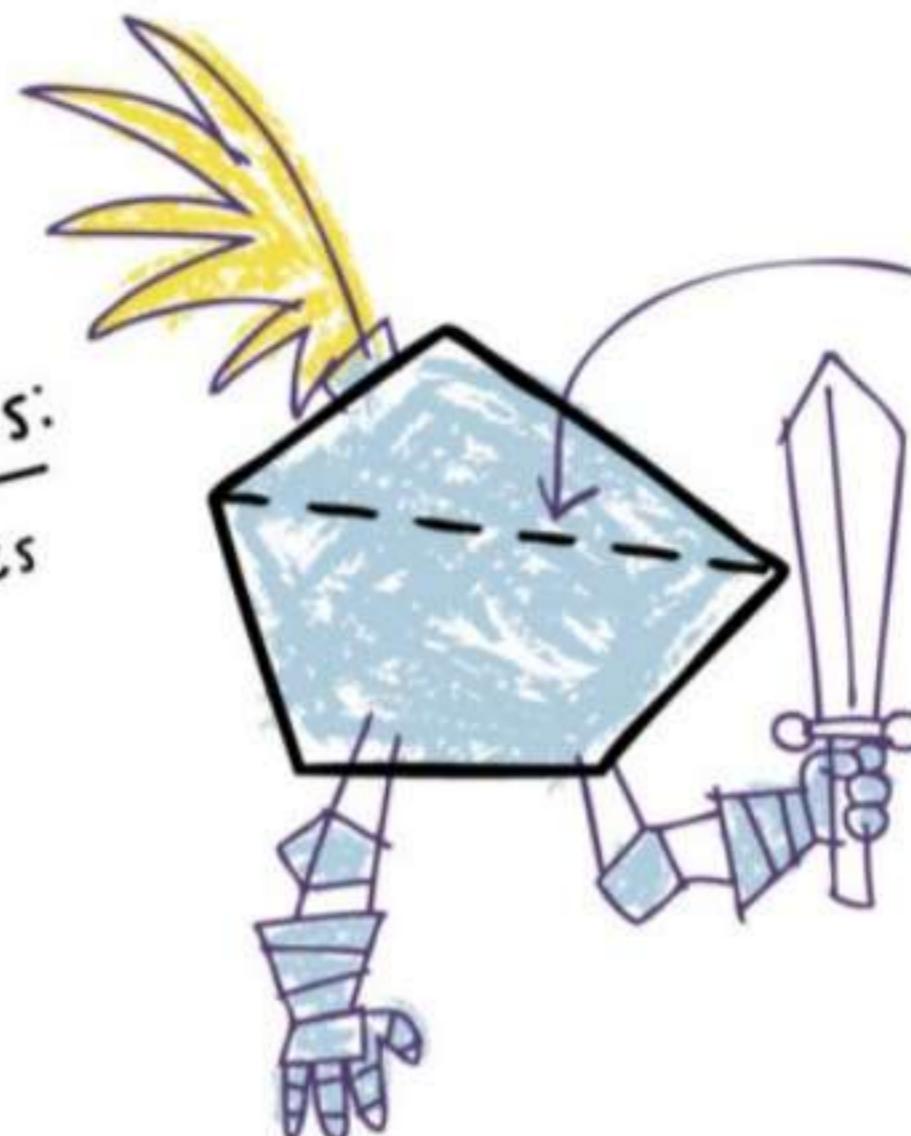
POLygoNs with more than 4 sides:

GroOgg



Pentagon:
5 sides

regular (all sides and angles are equal)

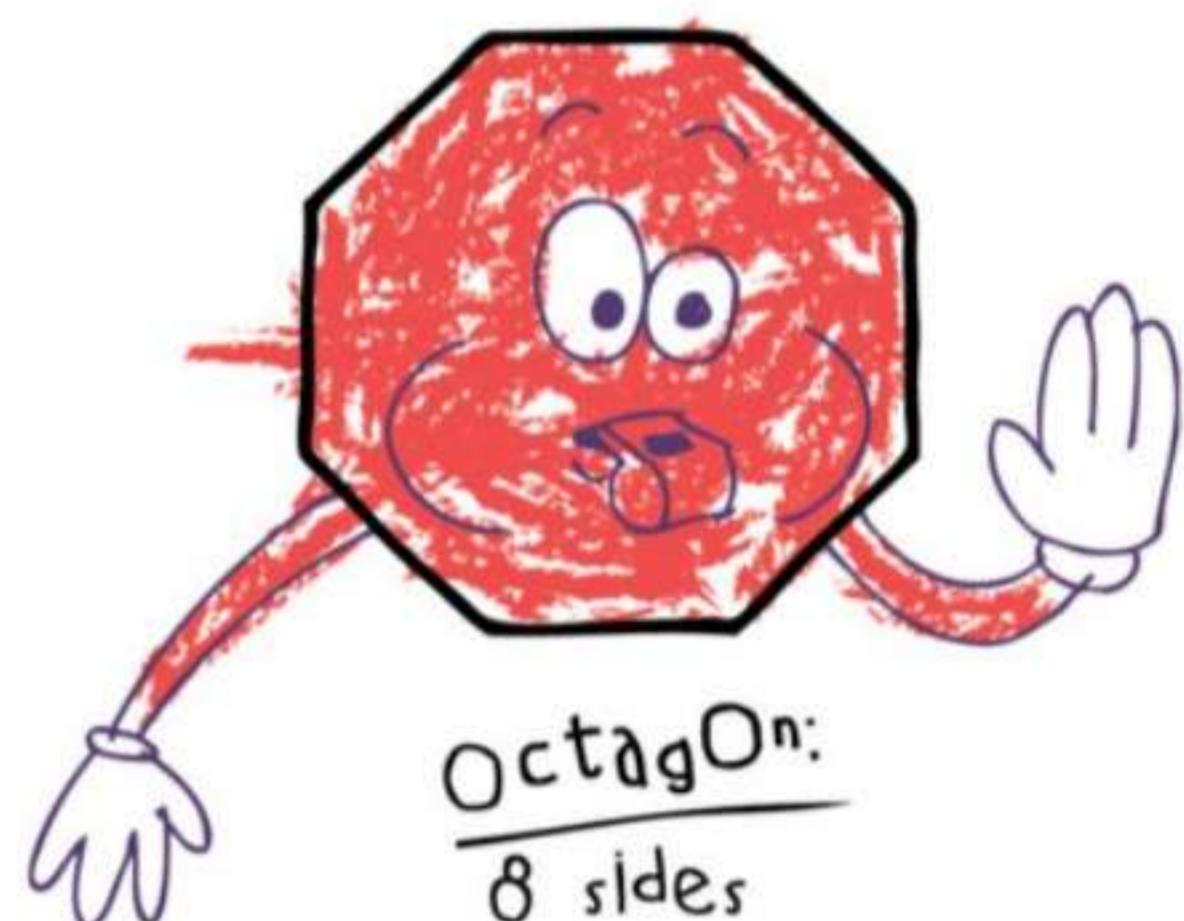
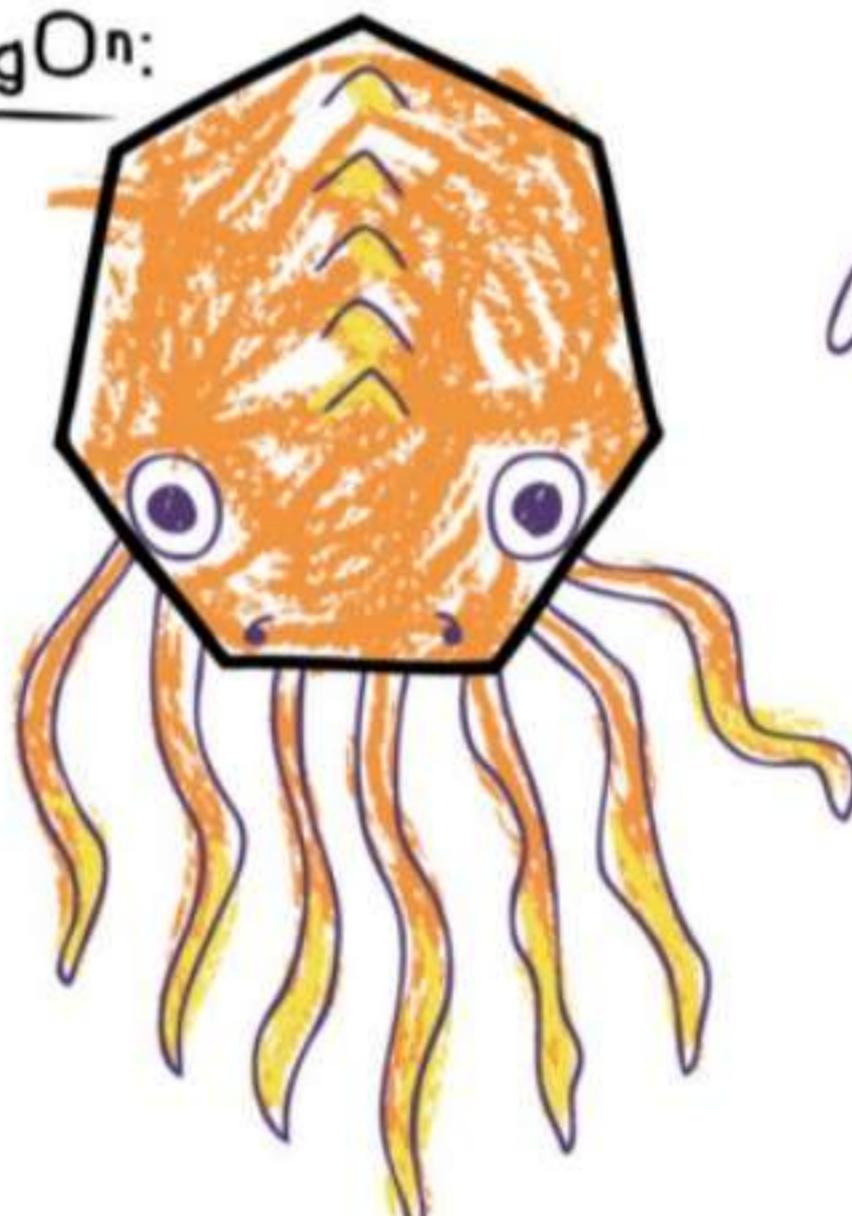


Diagonal: connects two corners that are not on the same side.

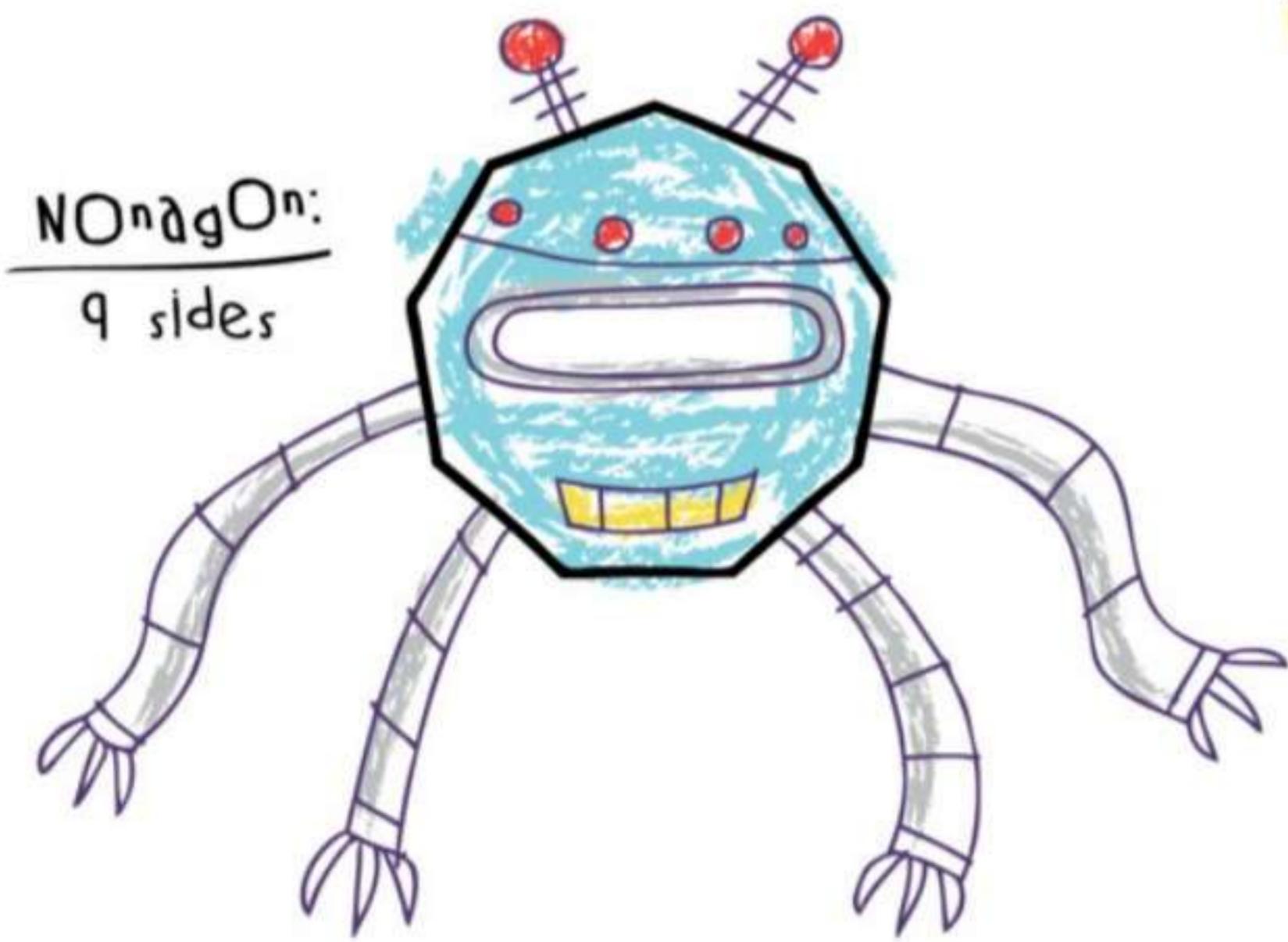


Hexagon:
6 sides

Heptagon:
7 sides

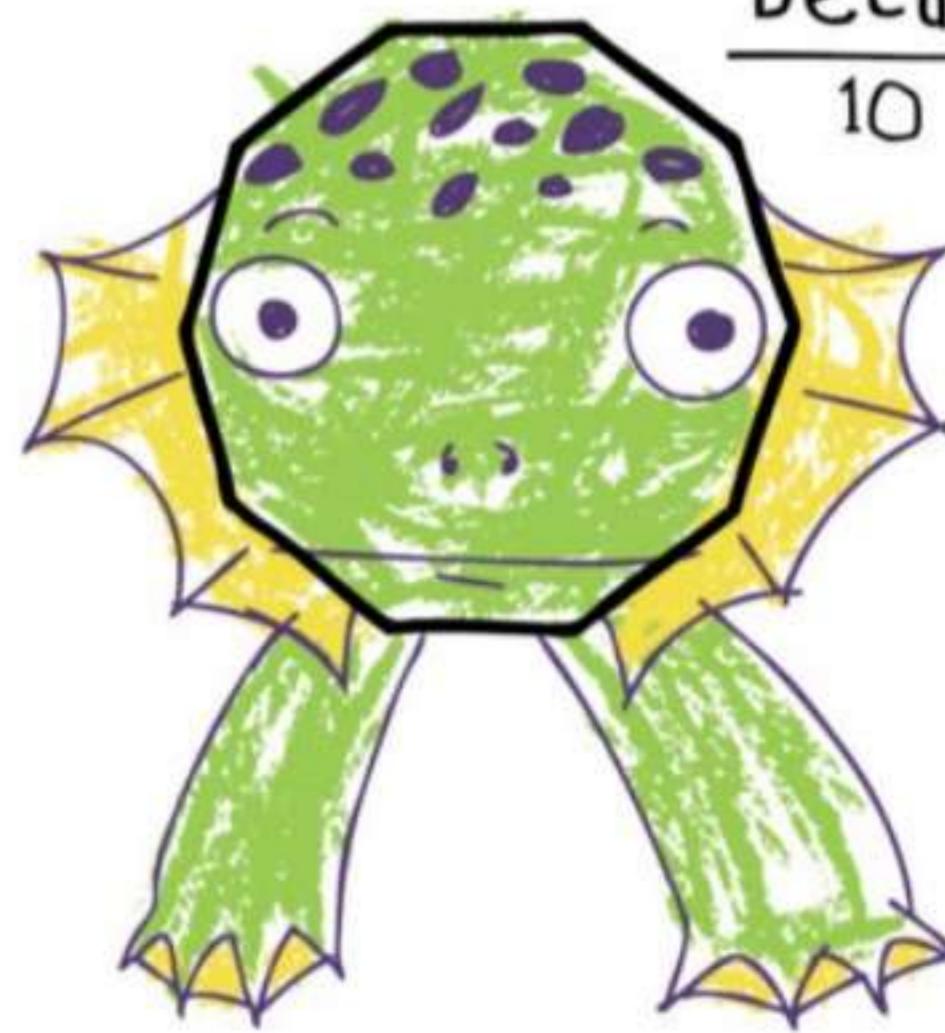


Octagon:
8 sides



Nonagon:
9 sides

Decagon:
10 sides



THE Lab

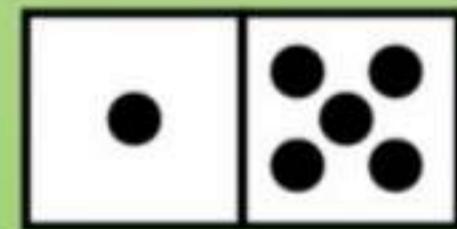
Polyominoes!



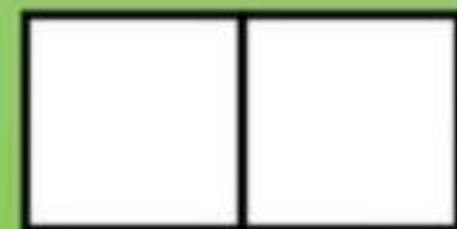
This is a single square.



If you put two squares together, you get a **domino**. You've probably seen dominoes with dots on them, like this.



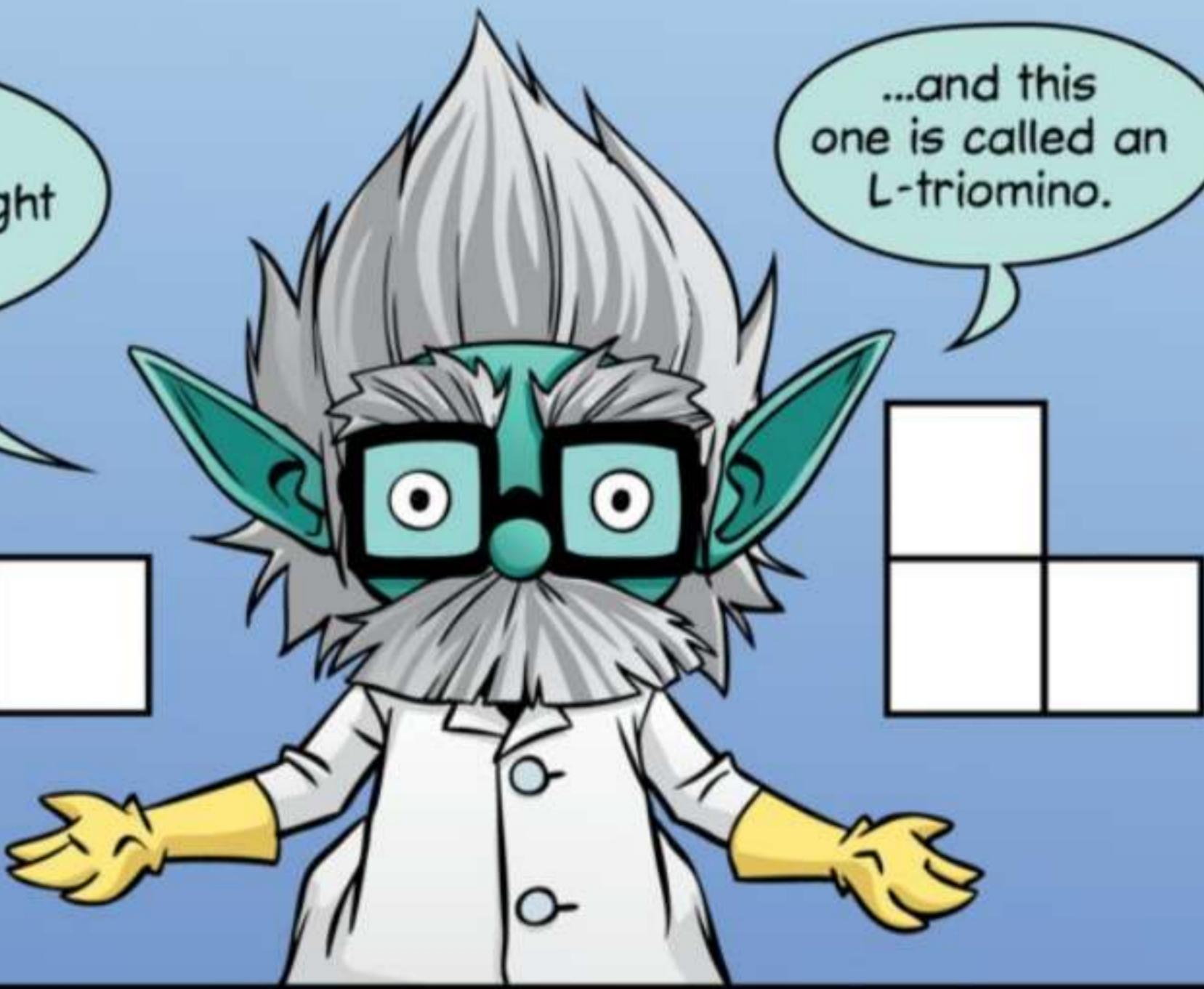
We don't need the dots for now, so we will remove them.



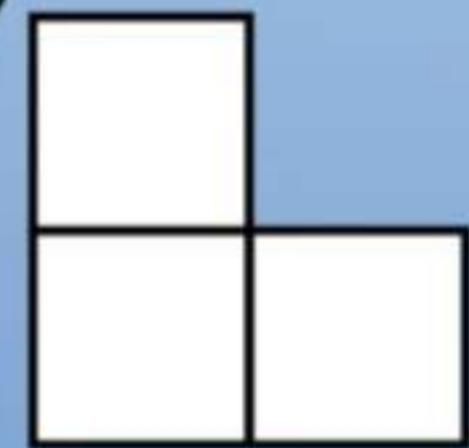
When we add a third square, we make a **triomino**. There is only one way to put two squares together to make a domino, but there are **two** triomino shapes.



This one is called a **straight triomino**...



...and this one is called an **L-triomino**.



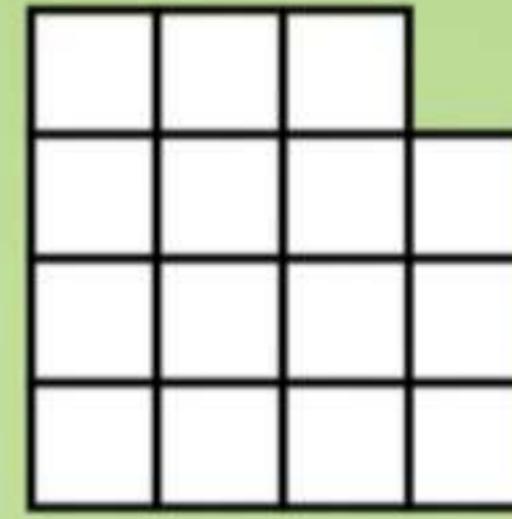
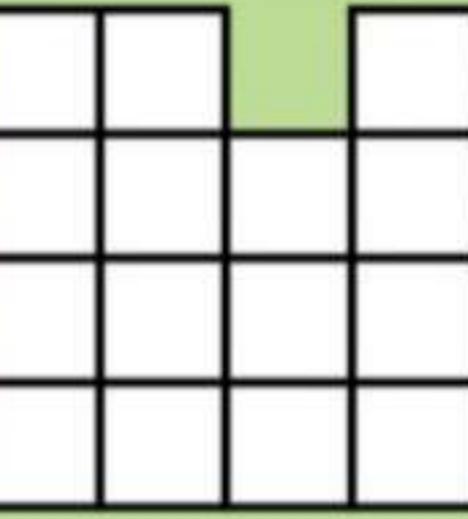
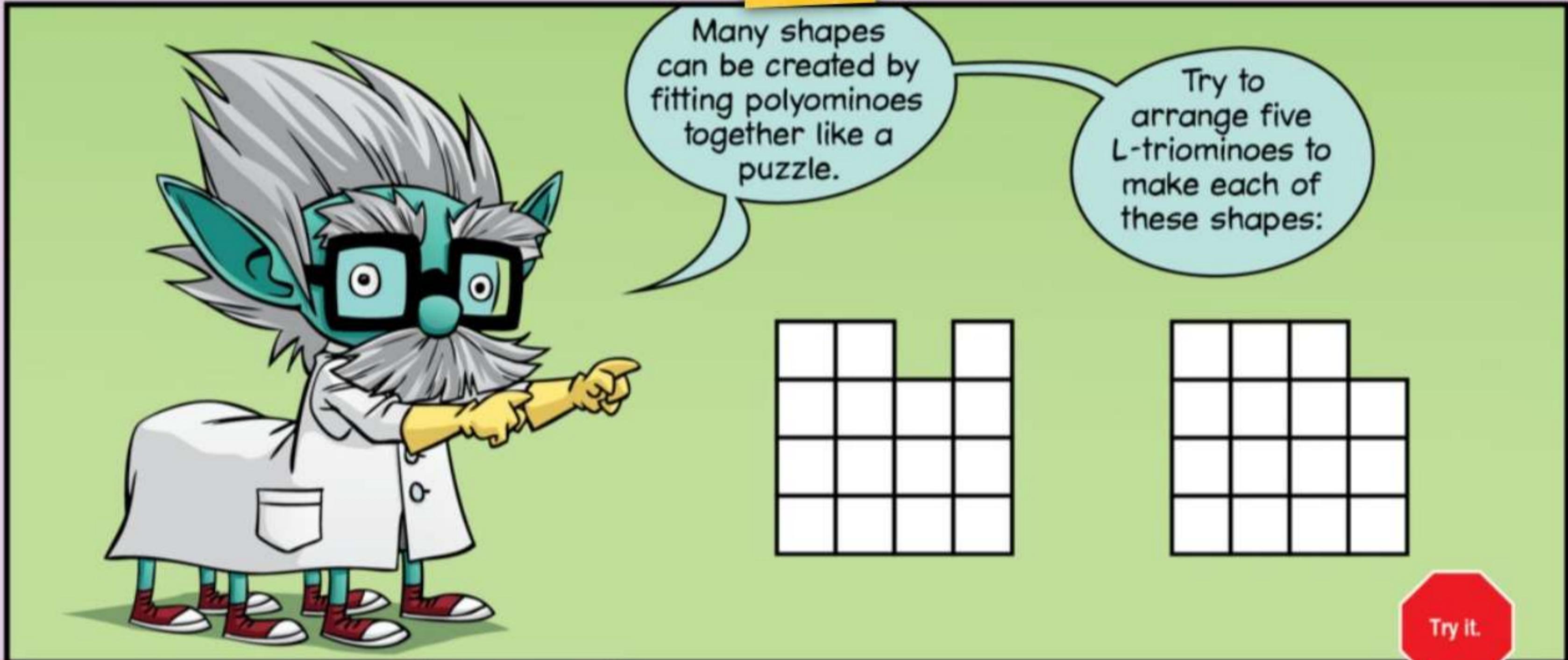
Dominoes and triominoes are both types of **polyominoes**.

If you can flip or turn one polyomino to look like another, they count as the same polyomino.

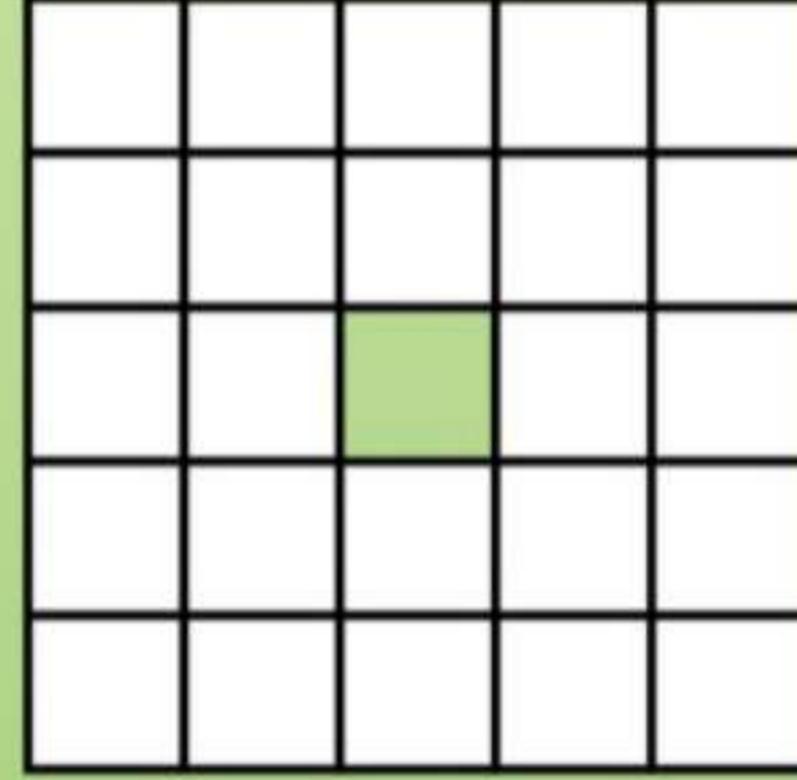
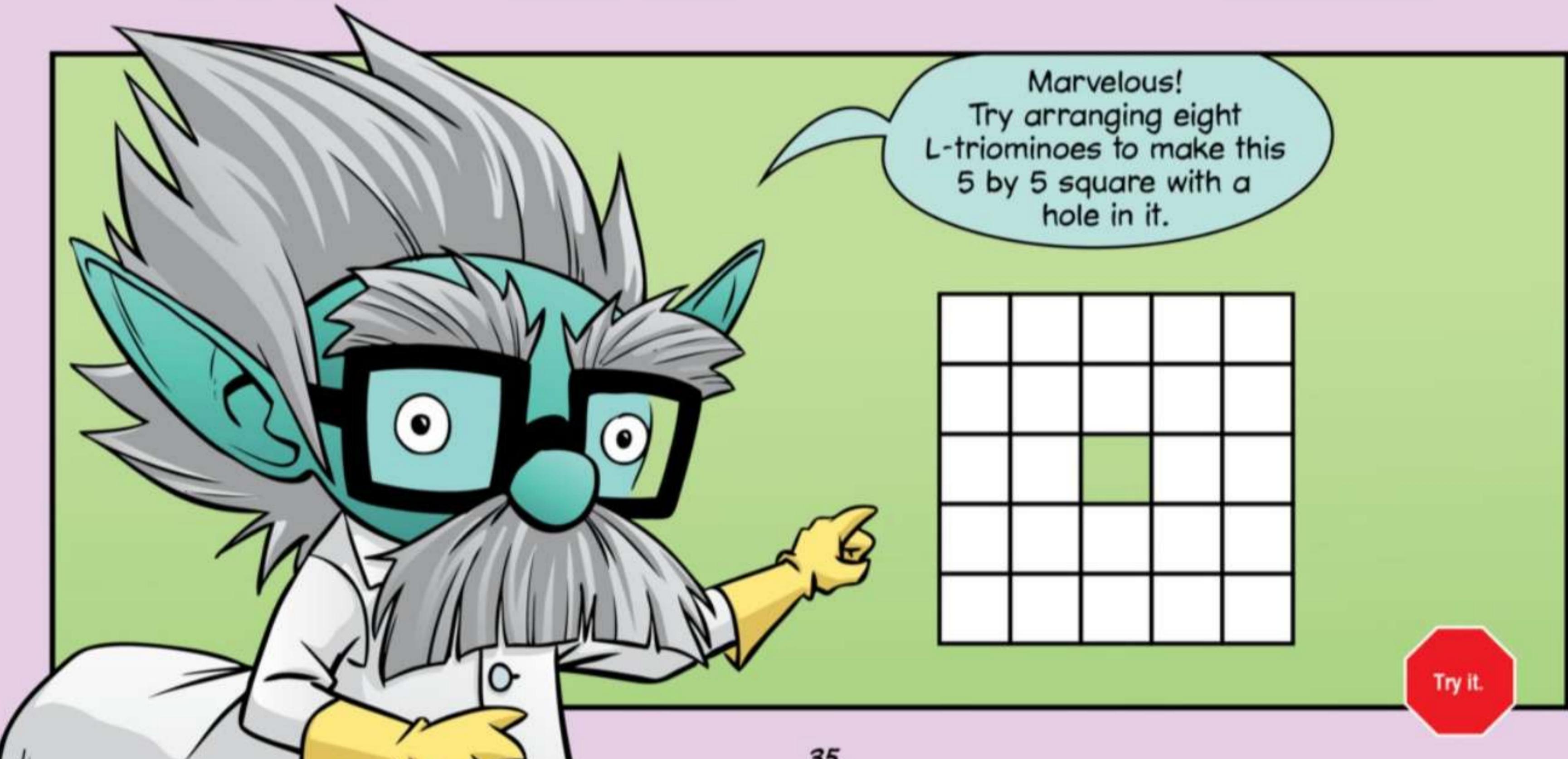
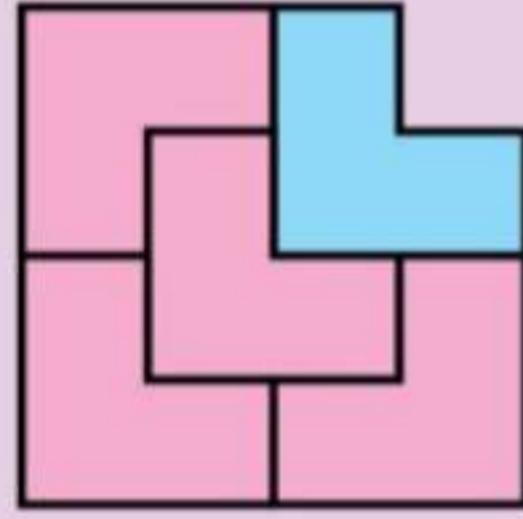
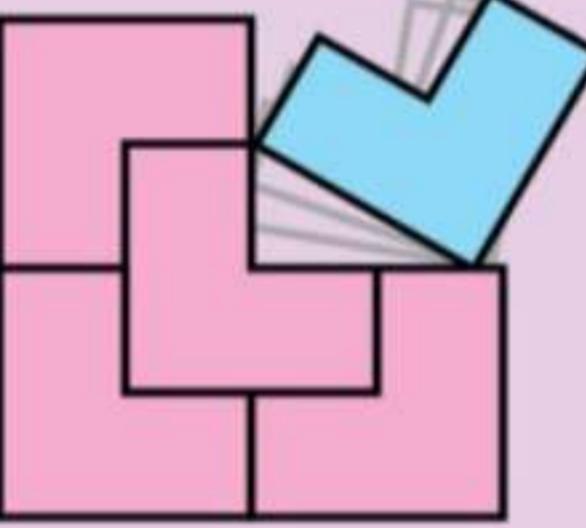
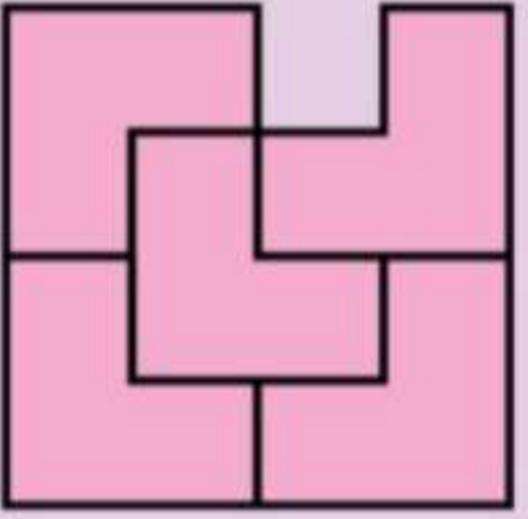
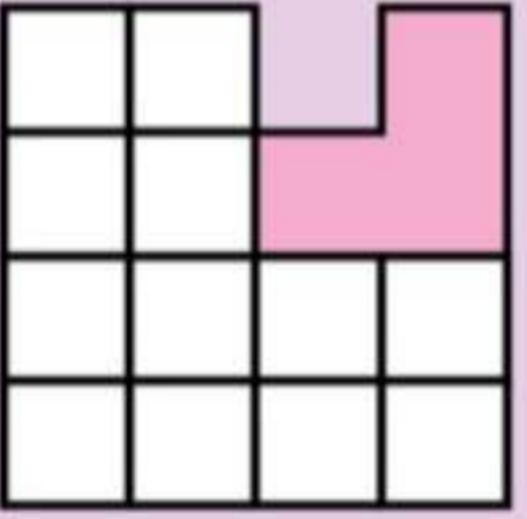
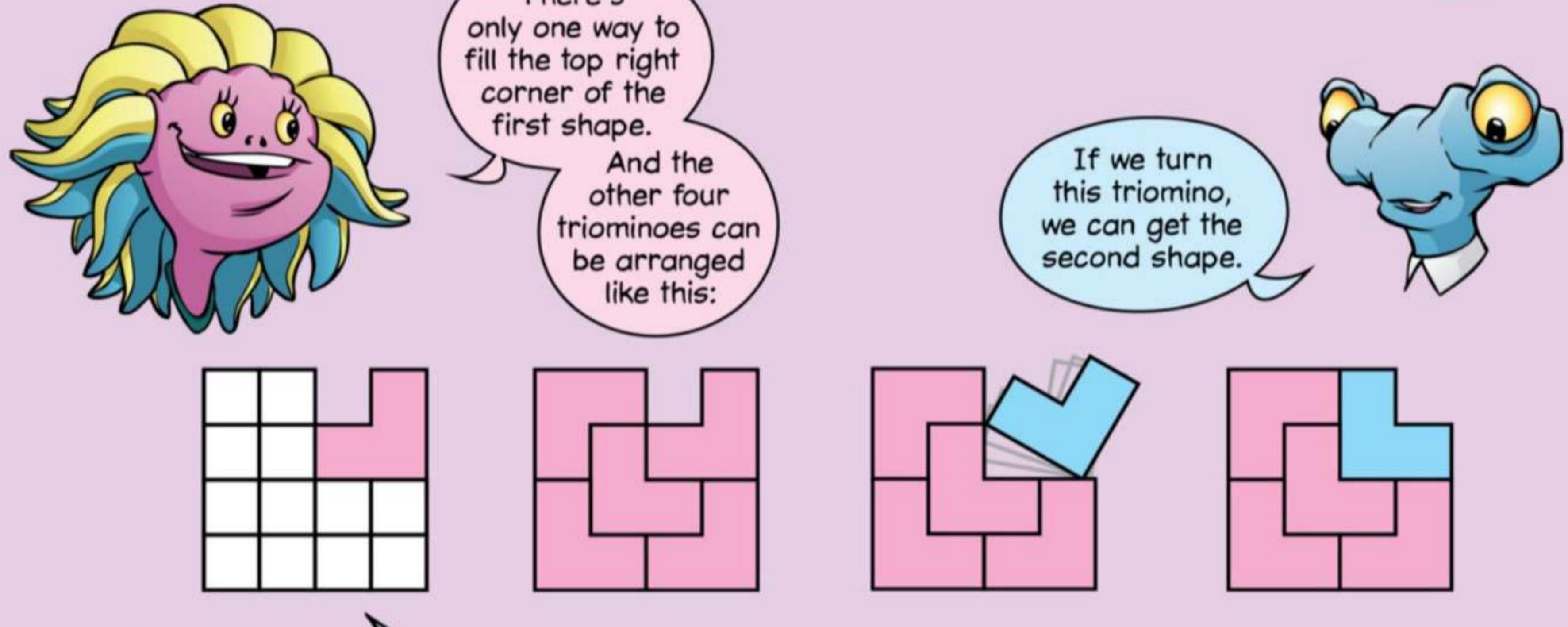
For example, the four triominoes below are all L-triominoes, just flipped over or turned around.



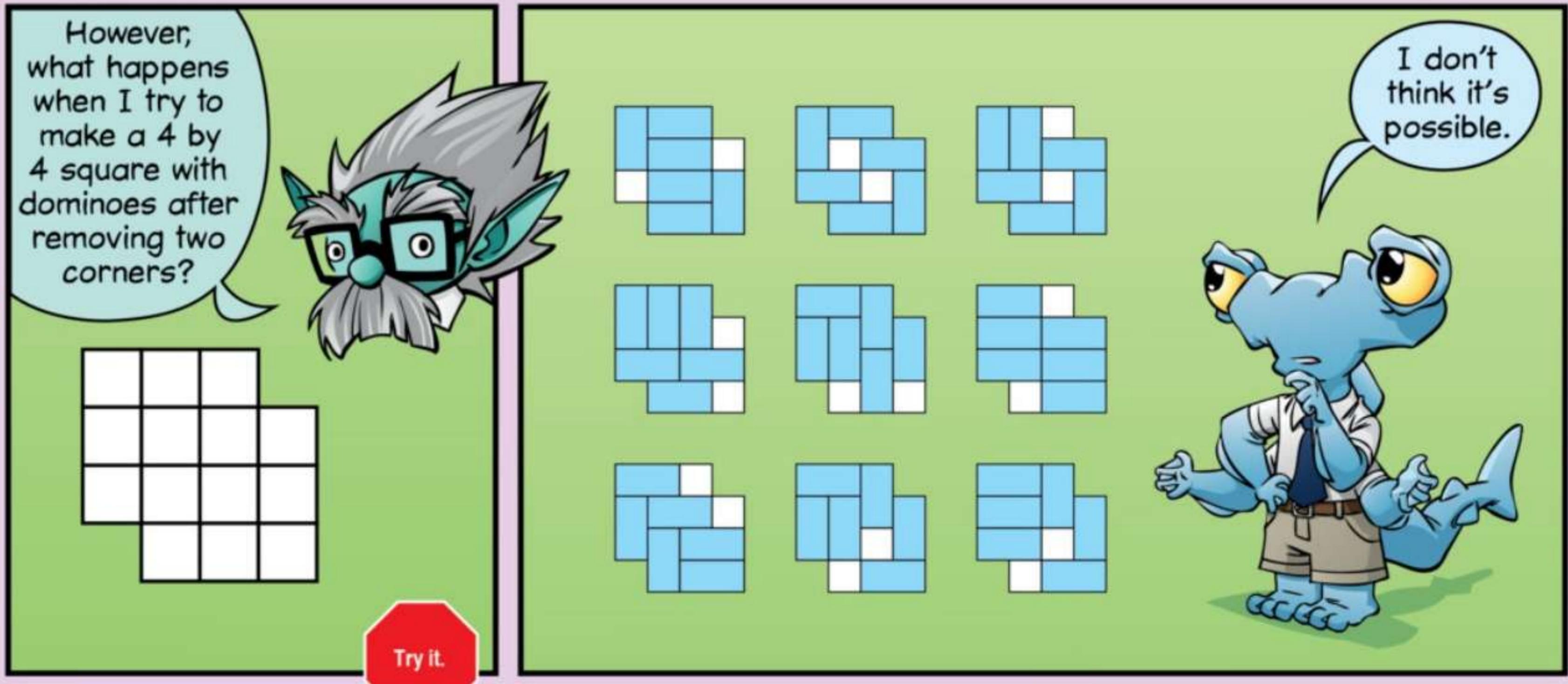
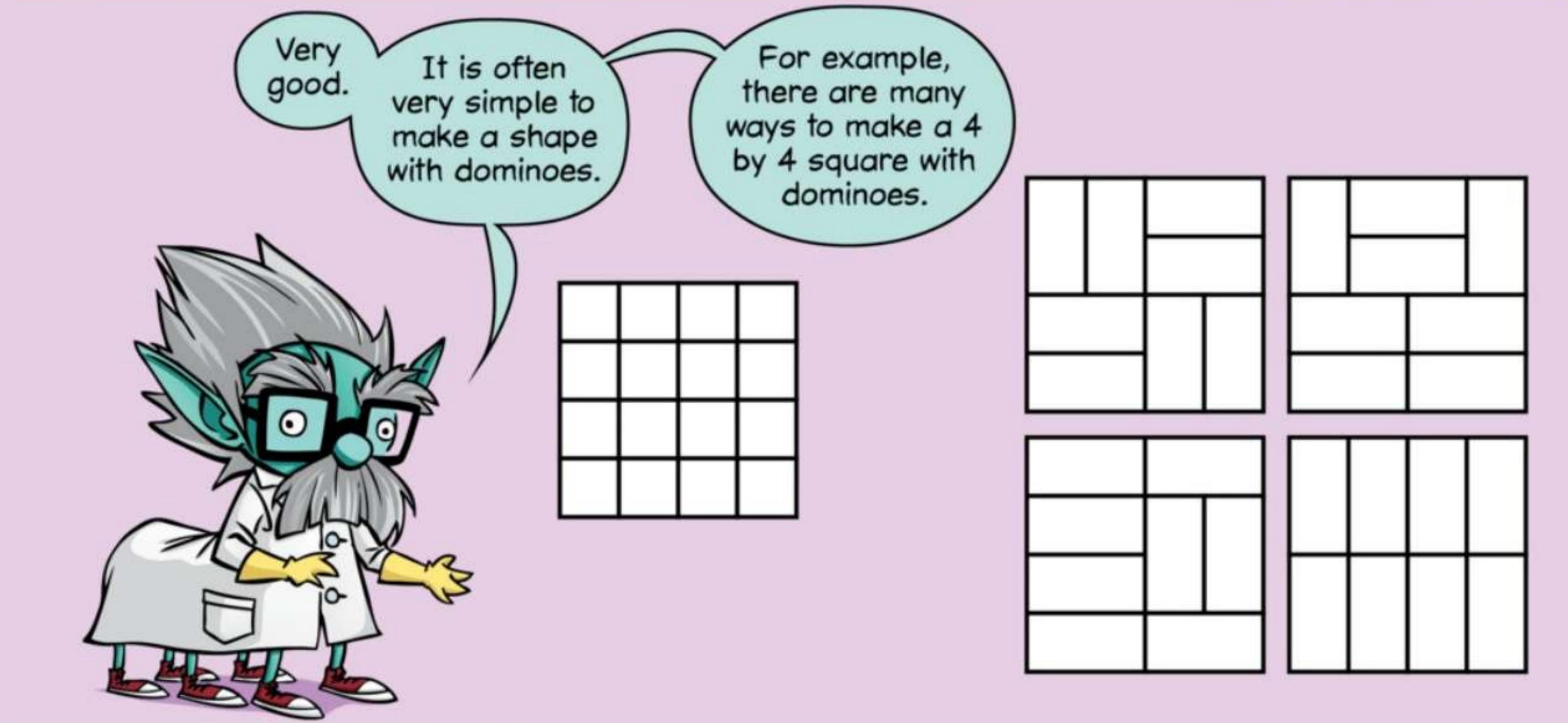
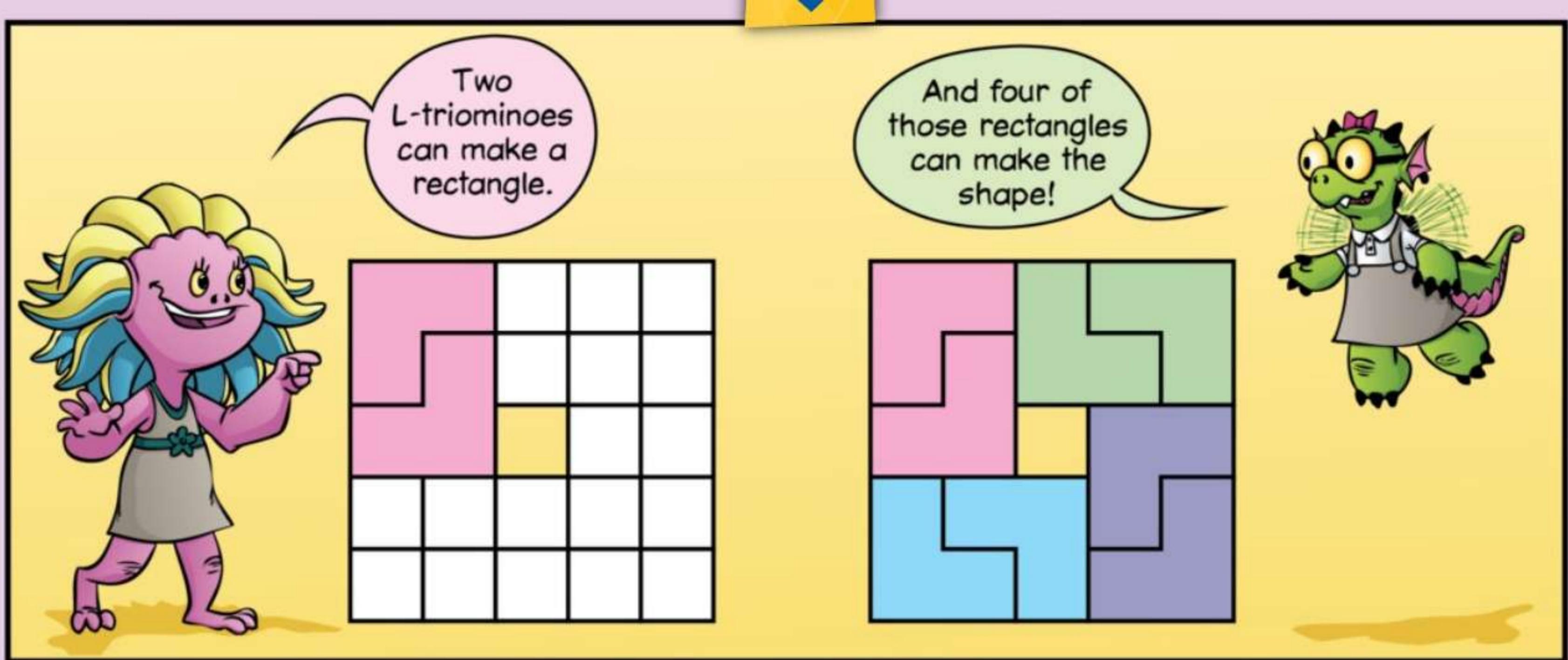
A POLYOMINO IS A SHAPE MADE BY JOINING THE SIDES OF SAME-SIZED SQUARES.

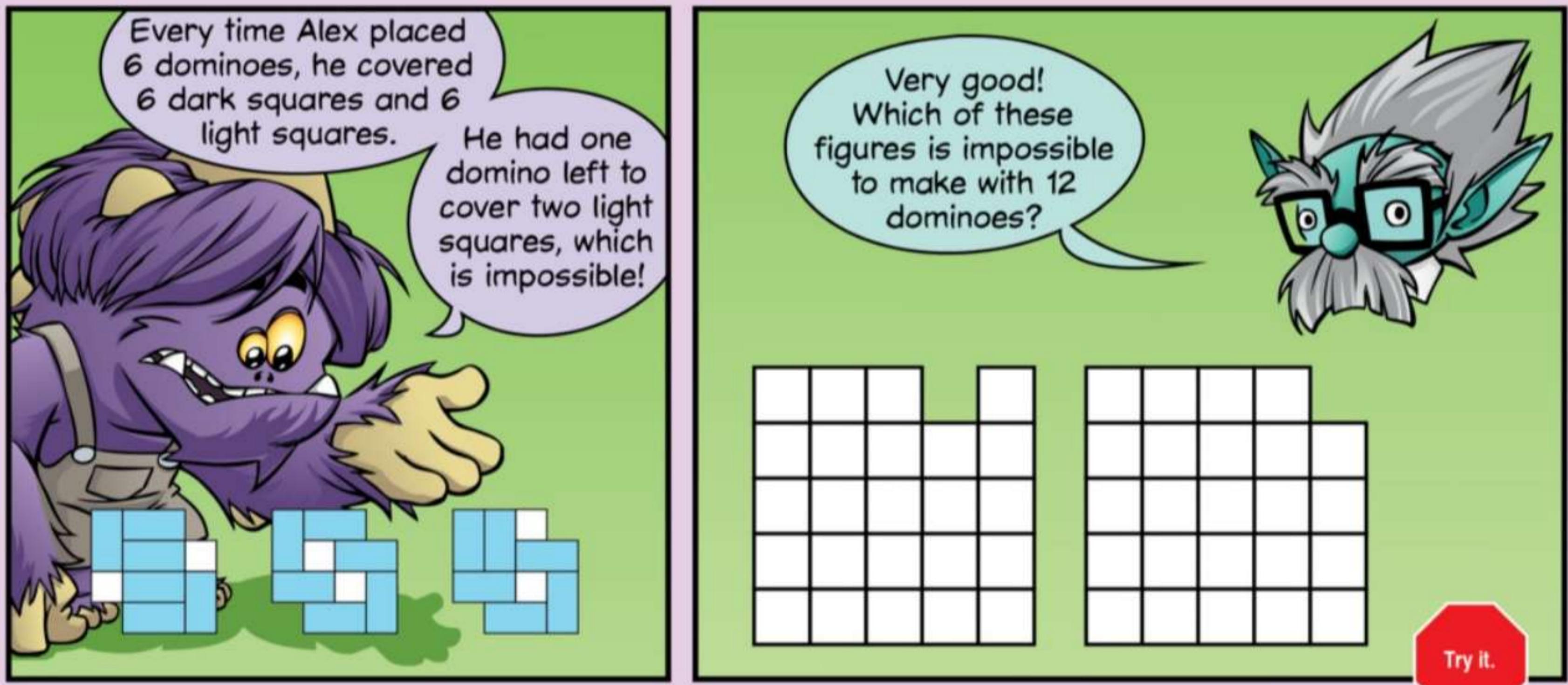
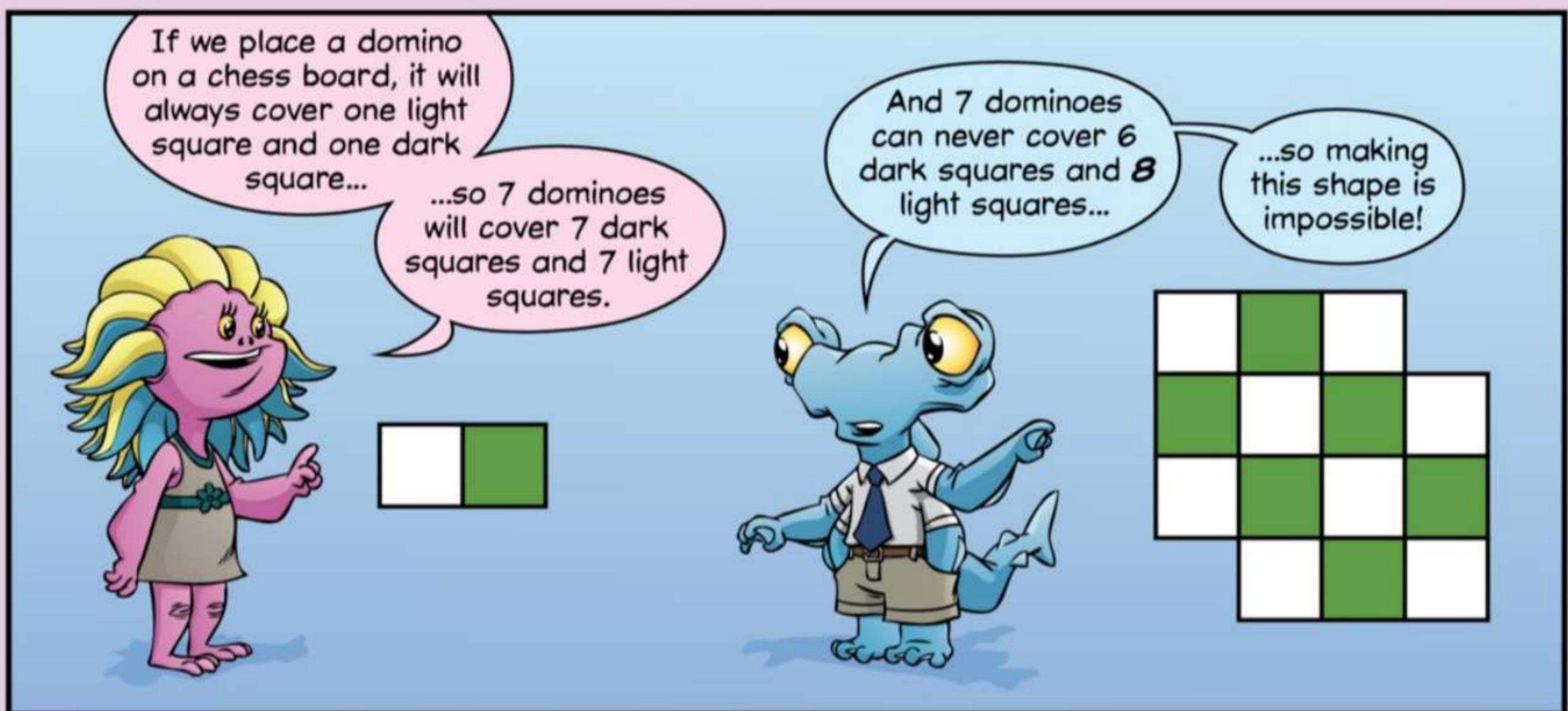
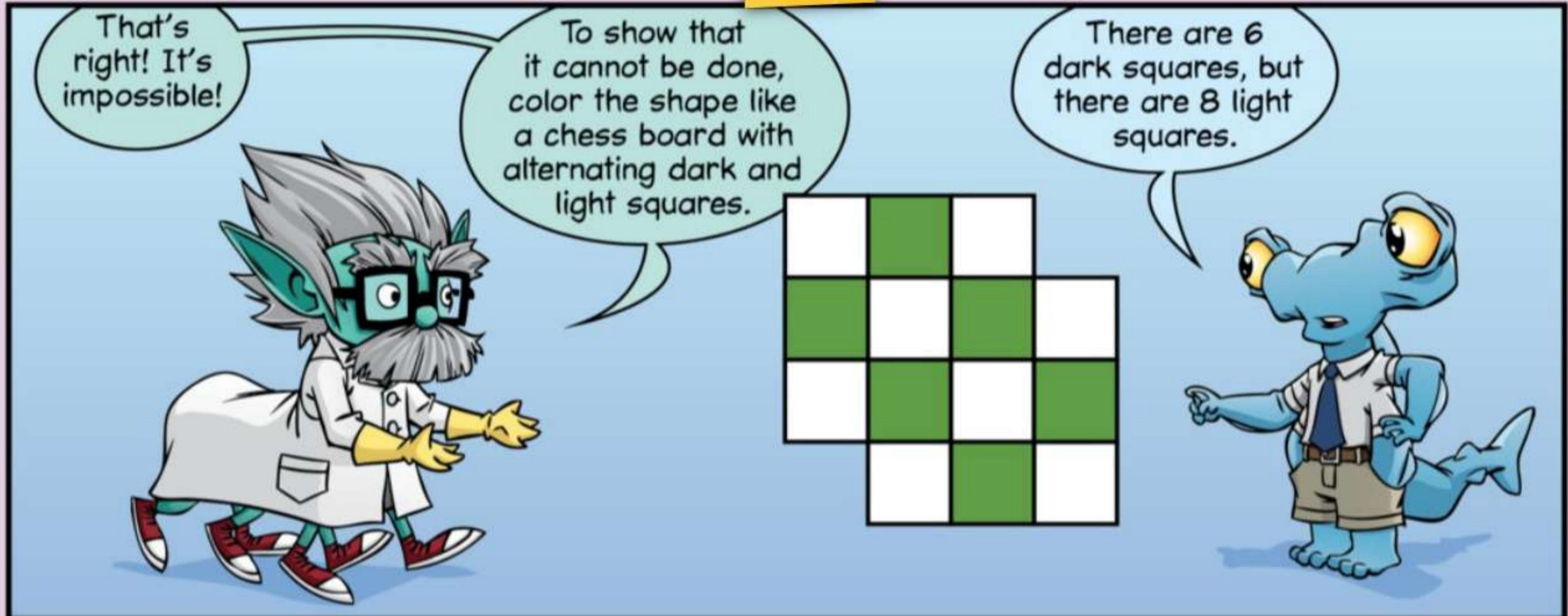


Try it.



Try it.



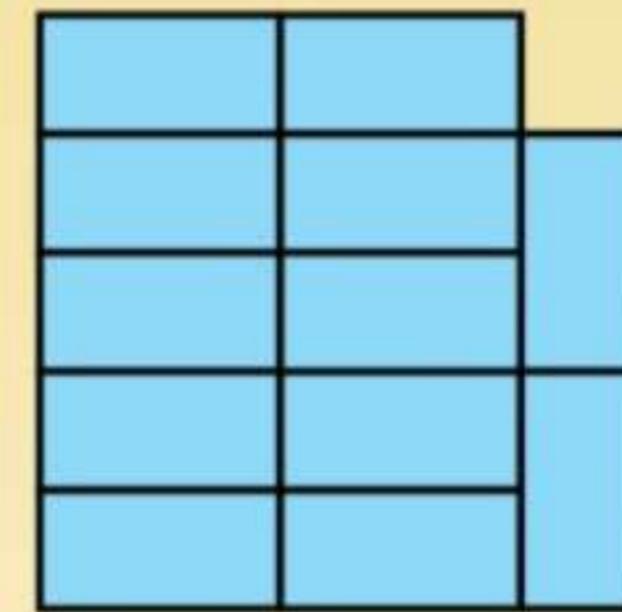
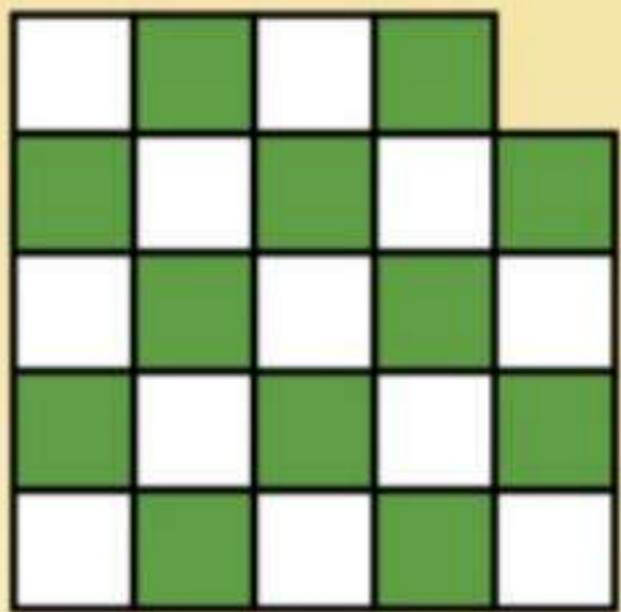
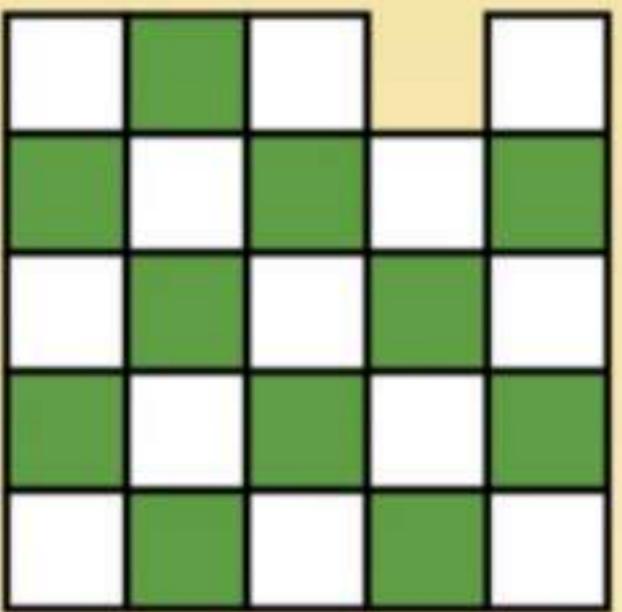


We can color them both like chess boards.

The one on the left has 11 dark and 13 light squares, so it is impossible to make with dominoes.

The one on the right has 12 dark and 12 light squares.

We can make it like this:



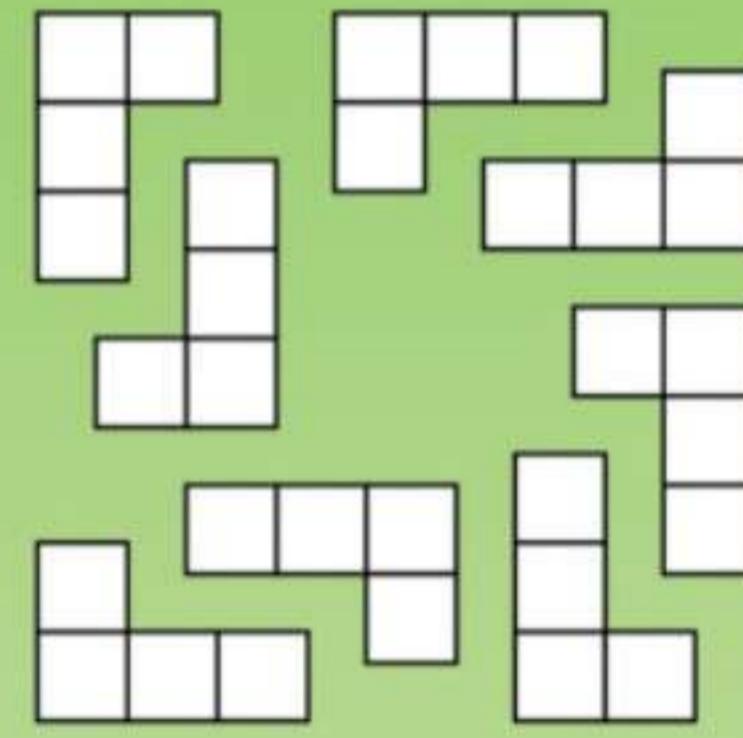
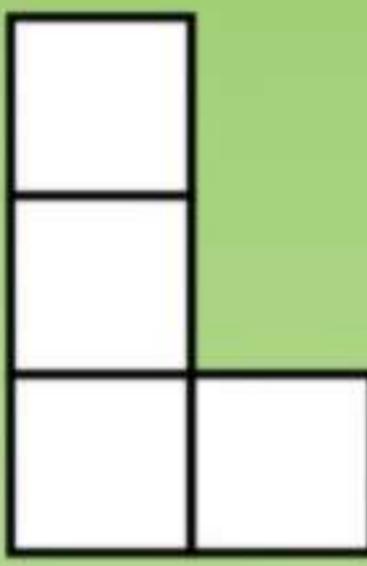
NOT EVERY SHAPE THAT HAS THE SAME NUMBER OF DARK AND LIGHT SQUARES CAN BE MADE WITH DOMINOES:

Good! Let's look at some more polyominoes.

The polyominoes with four squares are called **tetrominoes**.

There are **five** tetrominoes, including this one: the L-tetromino.

Remember that all of these are the same tetromino. They can be flipped over and turned around to look alike.



Try to find all five tetrominoes while I step out to get some more supplies.

Find all five tetrominoes on page 25 of the Practice book.



KLANG!

Boink!

BLERRF!

STOP THAT.

Bwah Ha Ha!
Professor Grok is gone.
I've abducted your educator.
It's time for something much
more diabolically difficult!

Tiling with Tetrominoes!

Any dizzy dolt can
dabble with dominoes. Now
it's time to test your talents
with tetrominoes!

Professor Grok is
locked in one of the five
rooms 'round the Rotunda.
Within each of the other
four rooms you will find a
ferocious fanged feline.

Placed on
each portal is a
particular pattern, an
arrangement of the
five tetrominoes.

Your beloved brainiac
is behind the perfectly
impossible tetromino tiling!
Open the correct door to save
Professor Grok. Open a
wrong door and...

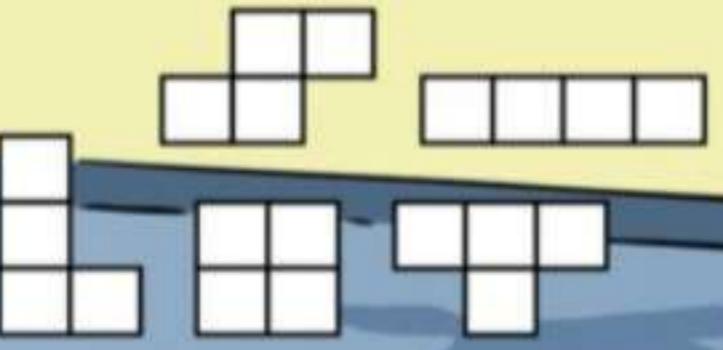
...You'll Surely be
Swallowed!!!



We need to
arrange the five
tetrominoes to make each
shape. Professor Grok is
behind the one that we
can't make!

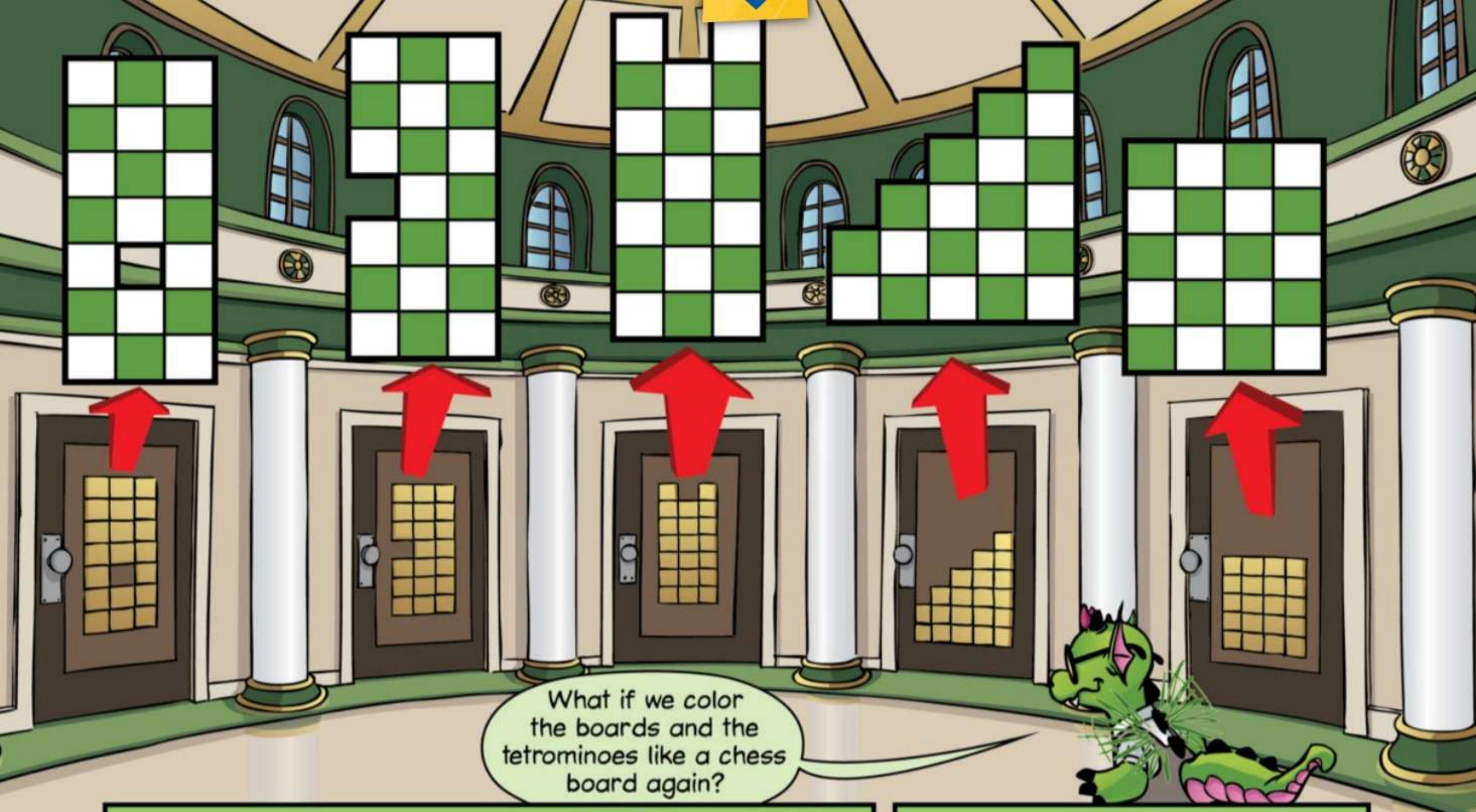
There must be
a reason why one
of the shapes is
impossible!

To the
Rotunda!

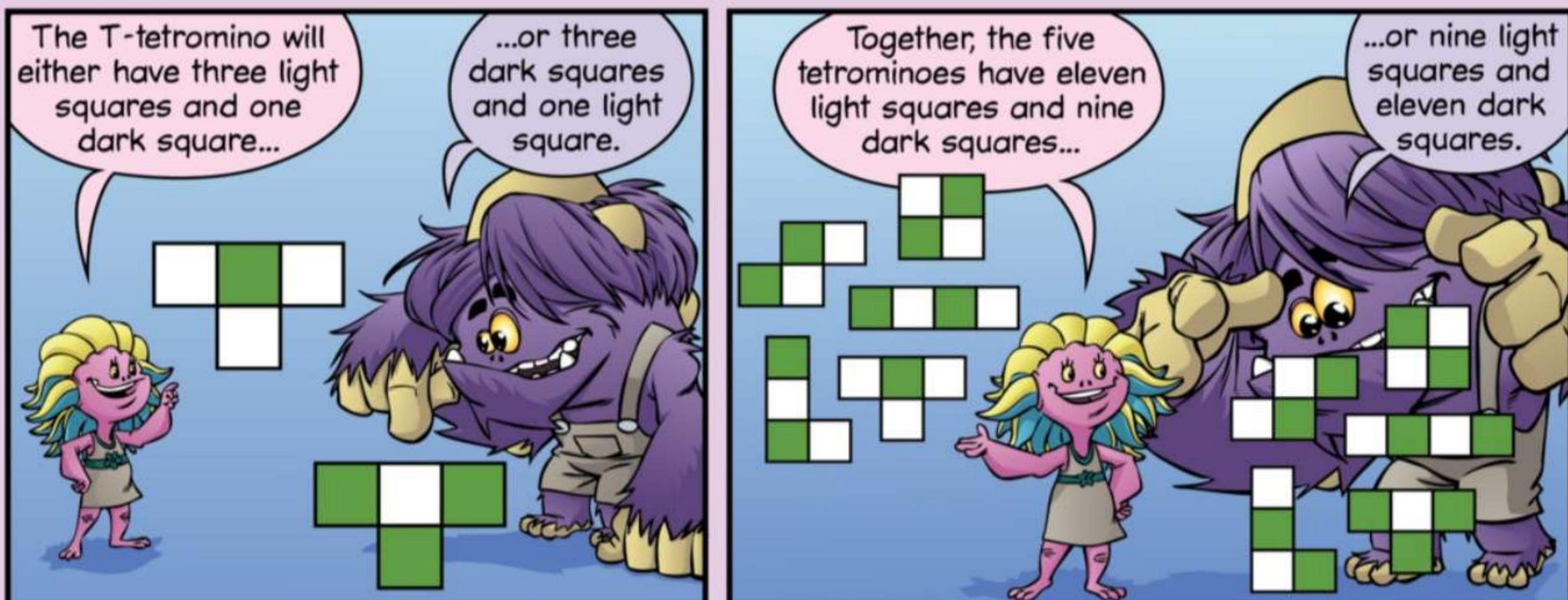
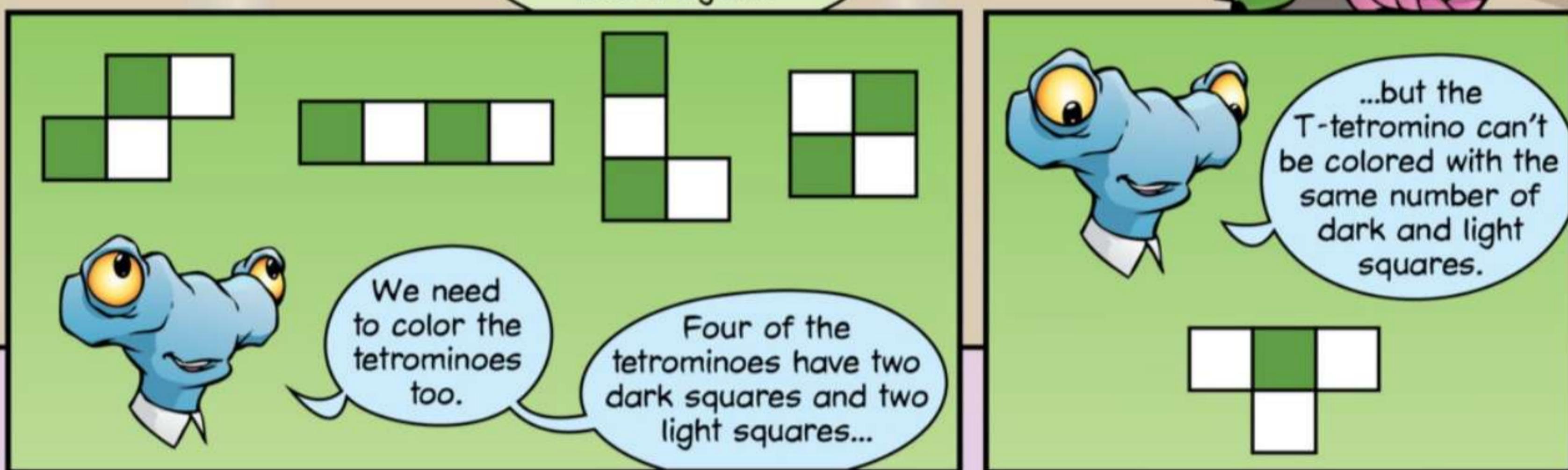


One of the
shapes on the
doors is impossible
to make. Can you
discover
which one?





What if we color the boards and the tетrominoes like a chess board again?





Find
a way to
make the others
on page 29 of
the Practice
book.

