

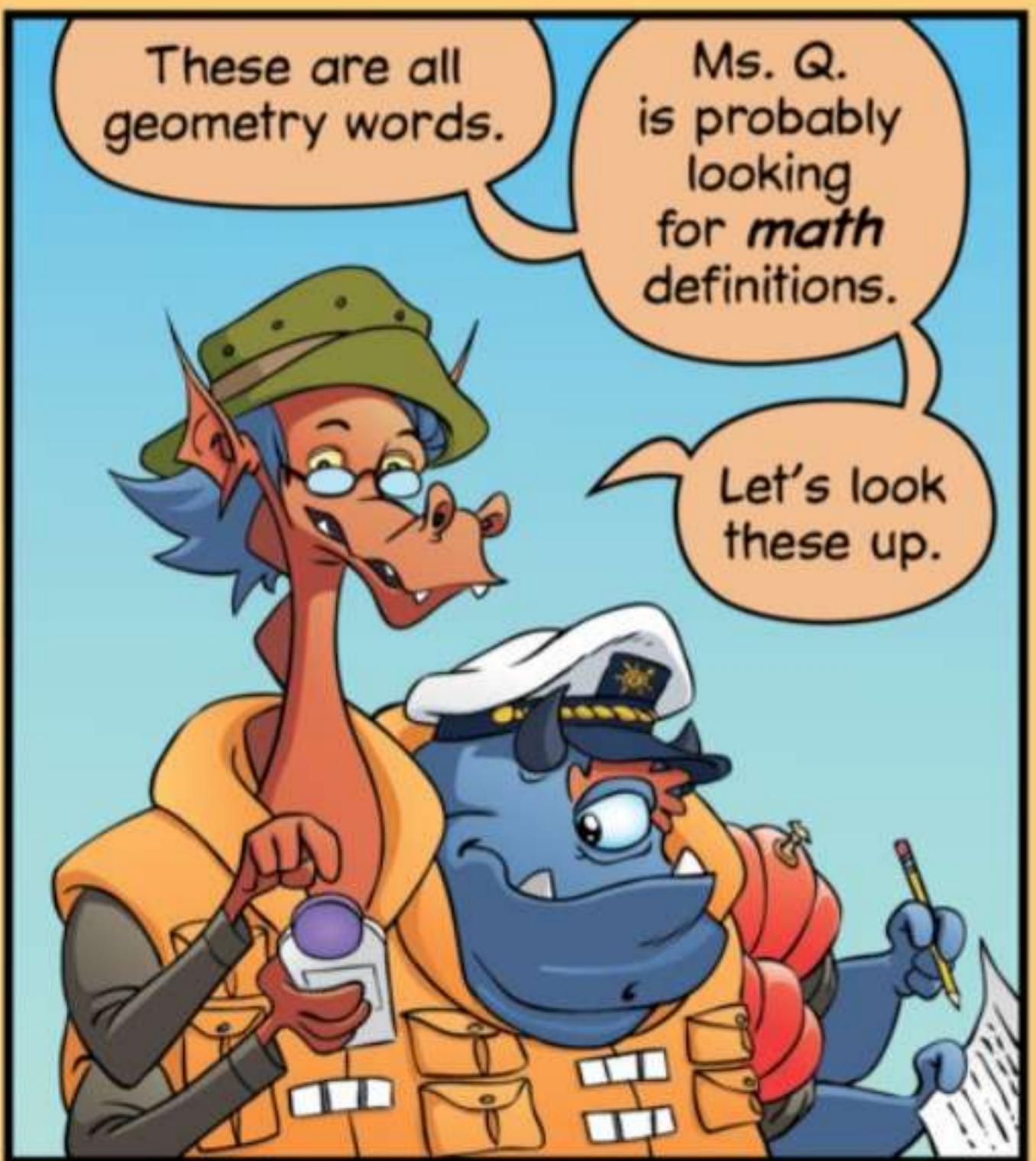
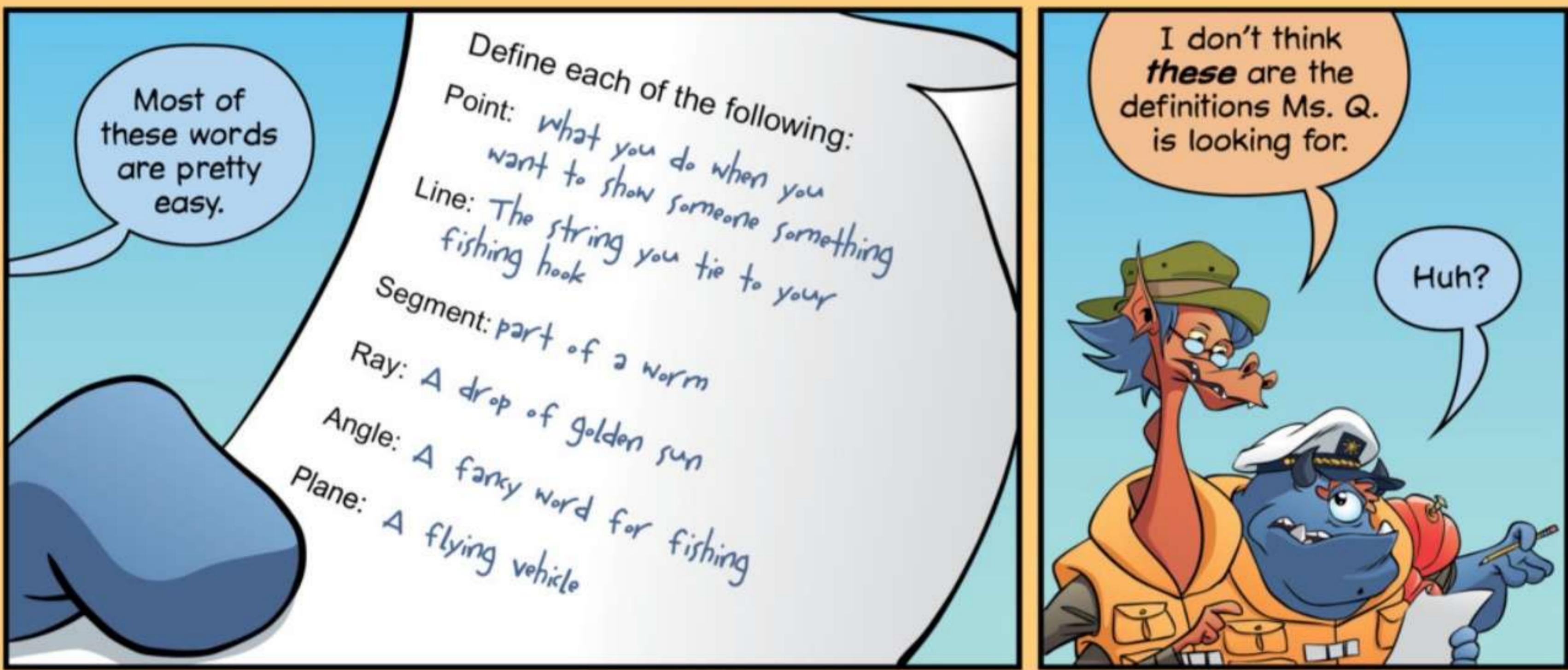
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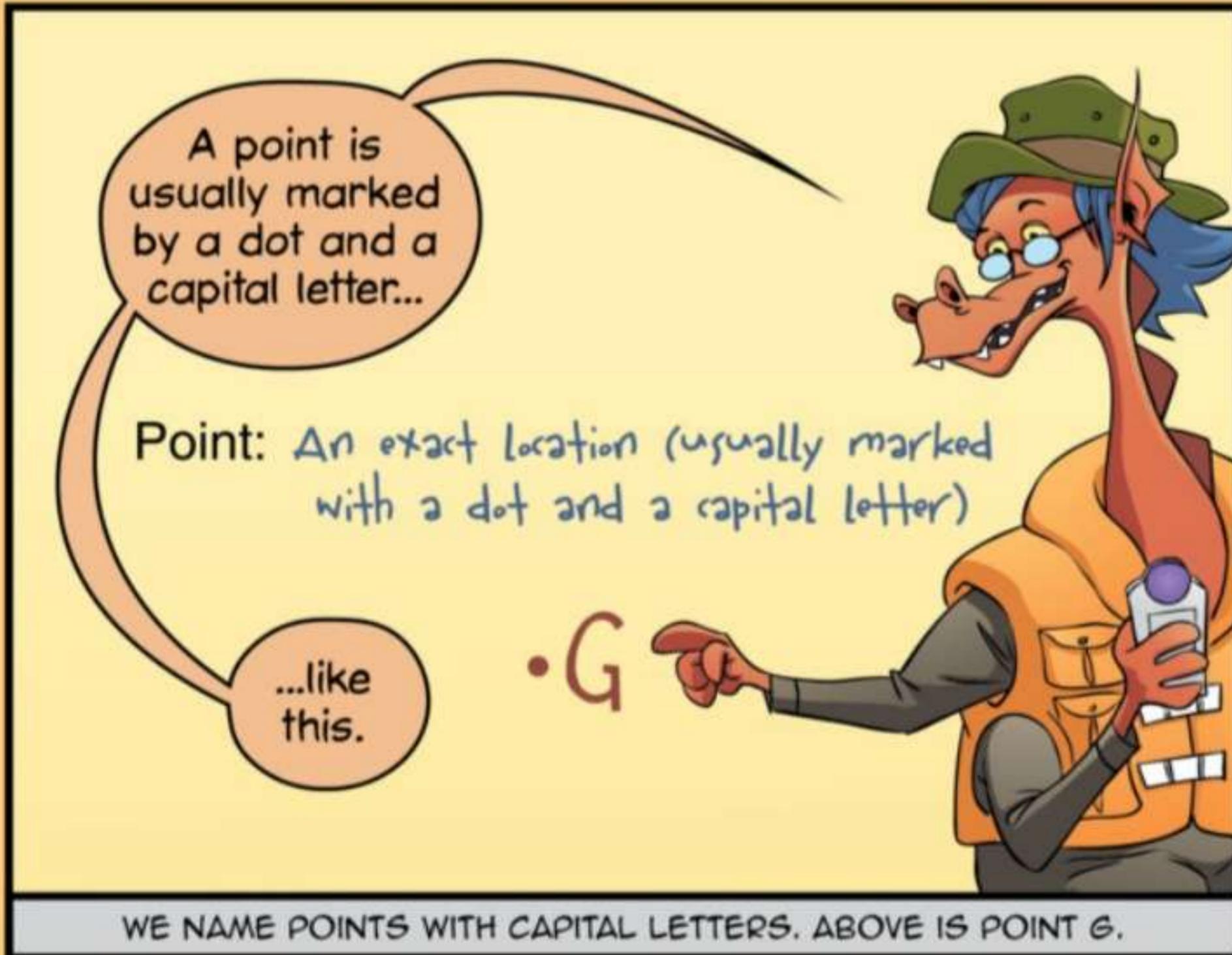
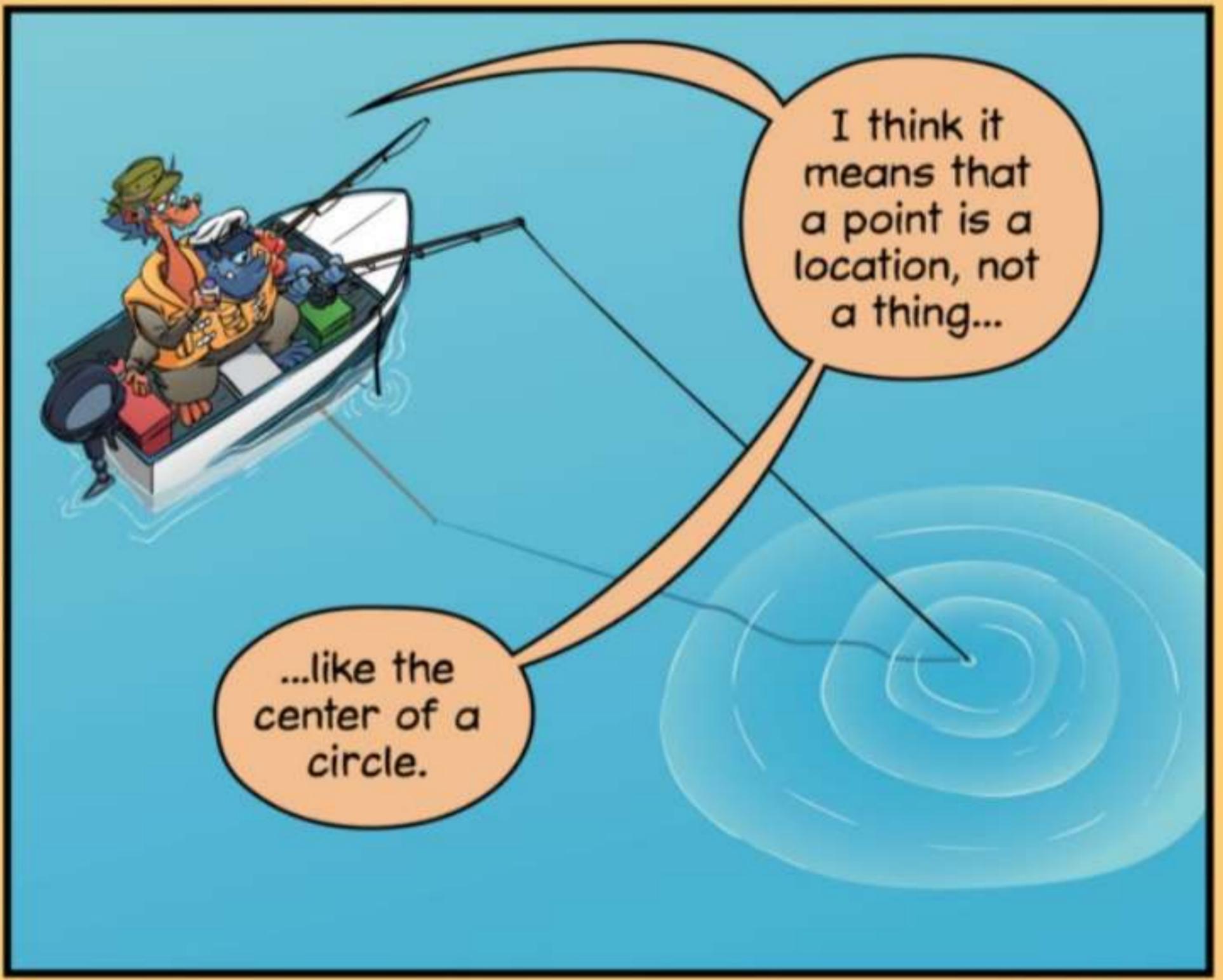
Click the Play List tab in the top-left to view a recommended reading/practice sequence.

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	How many different definitions do you know for the word "point"?	
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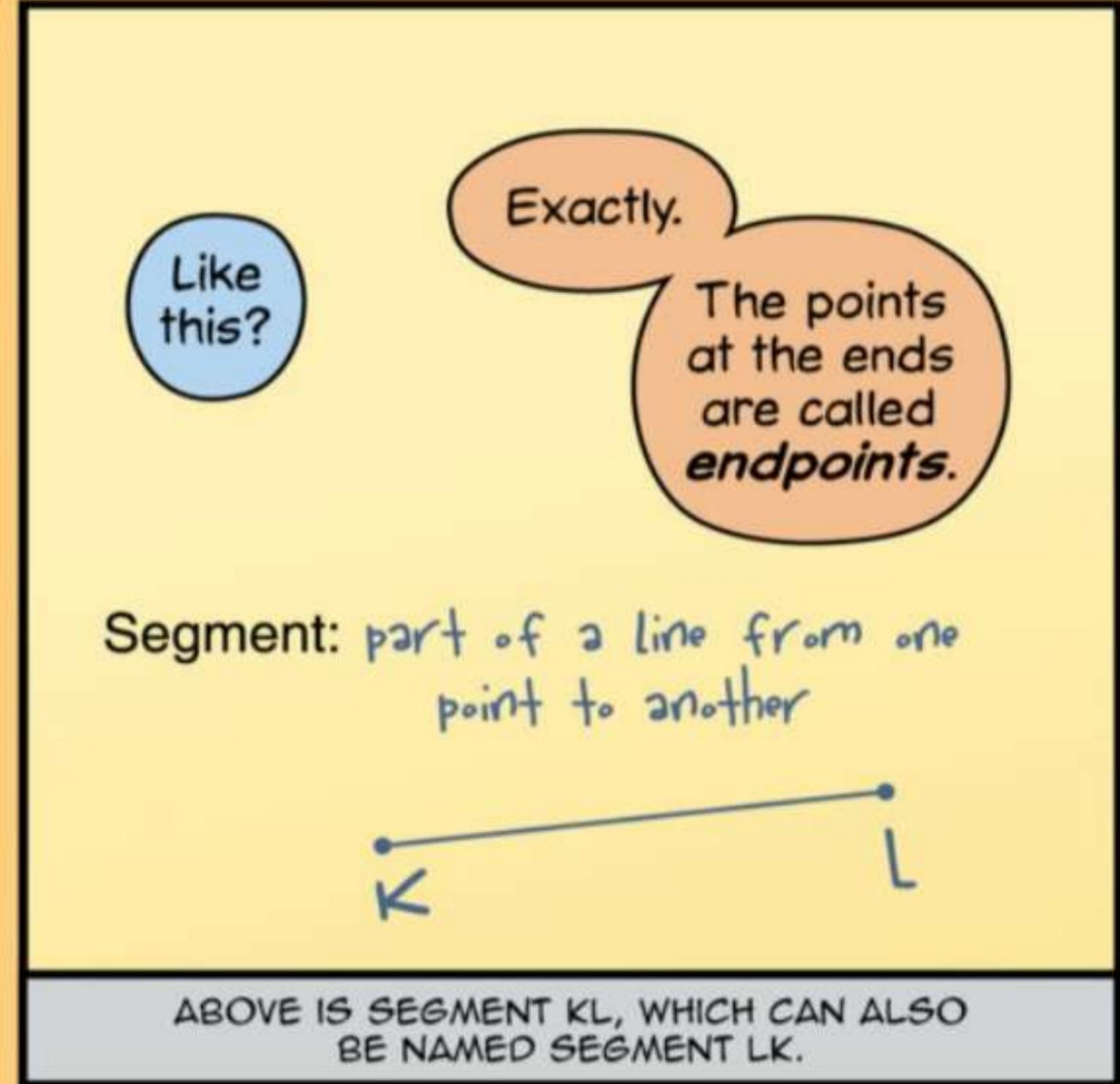
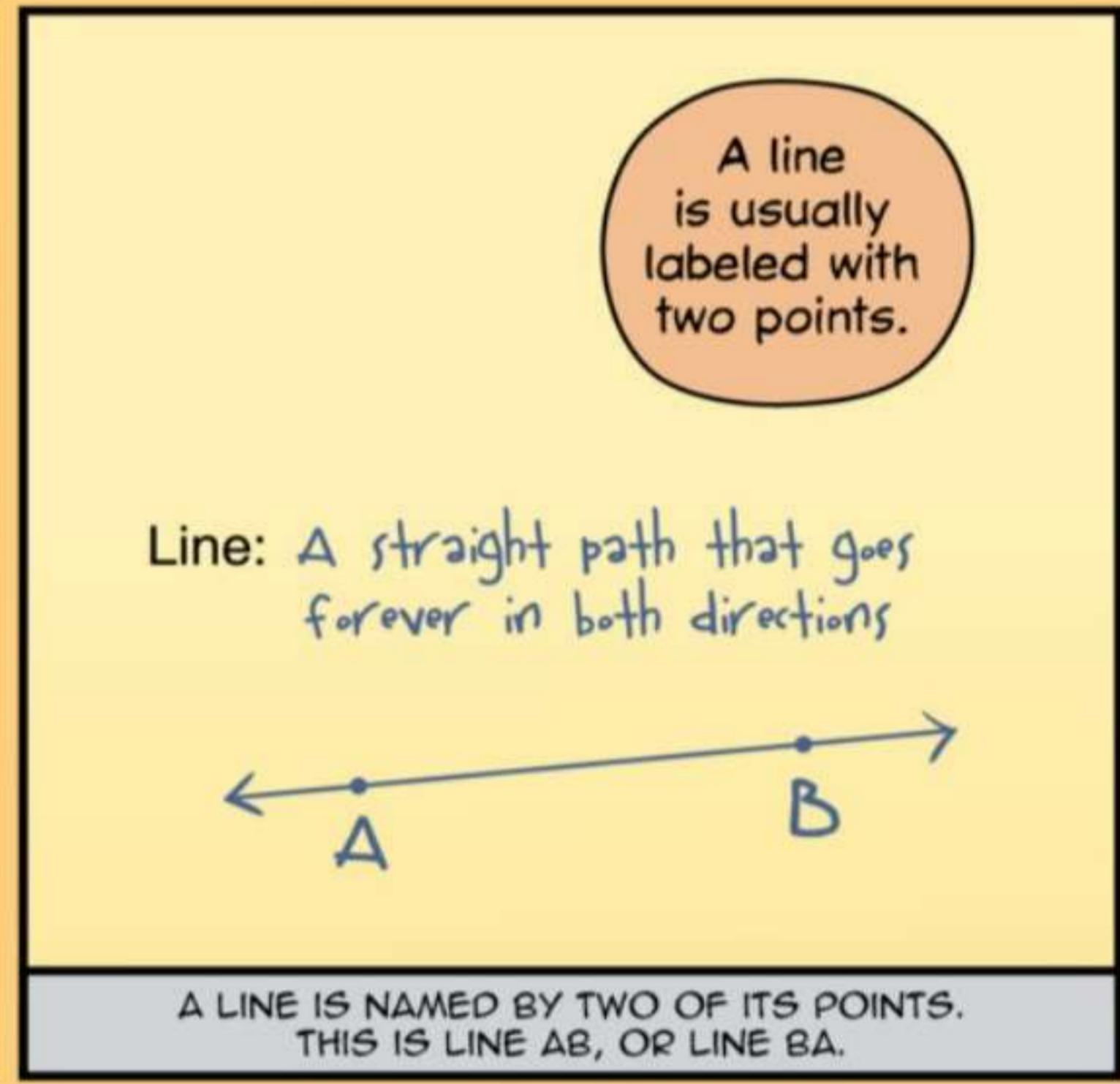
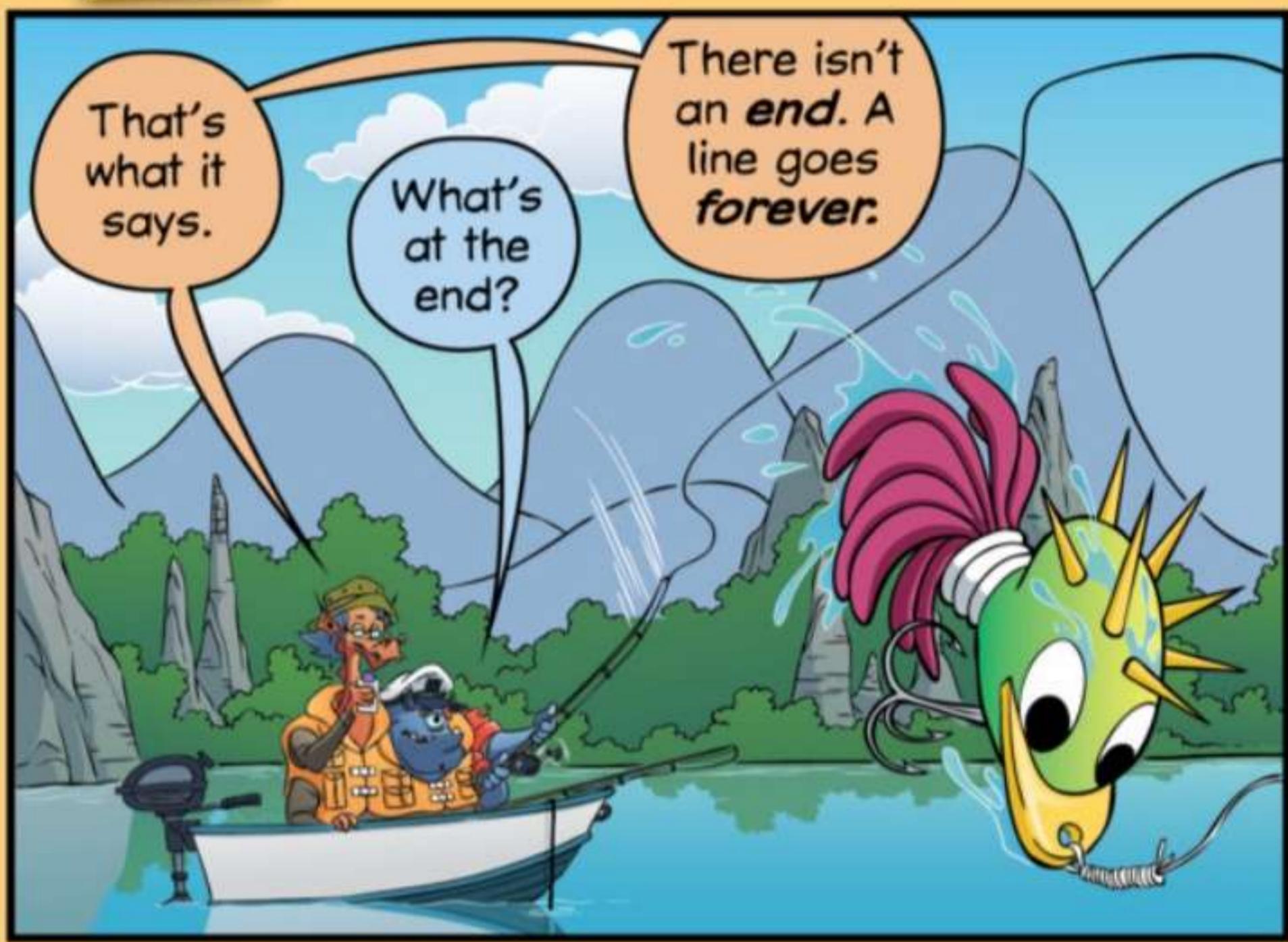
Chapter 1: Shapes



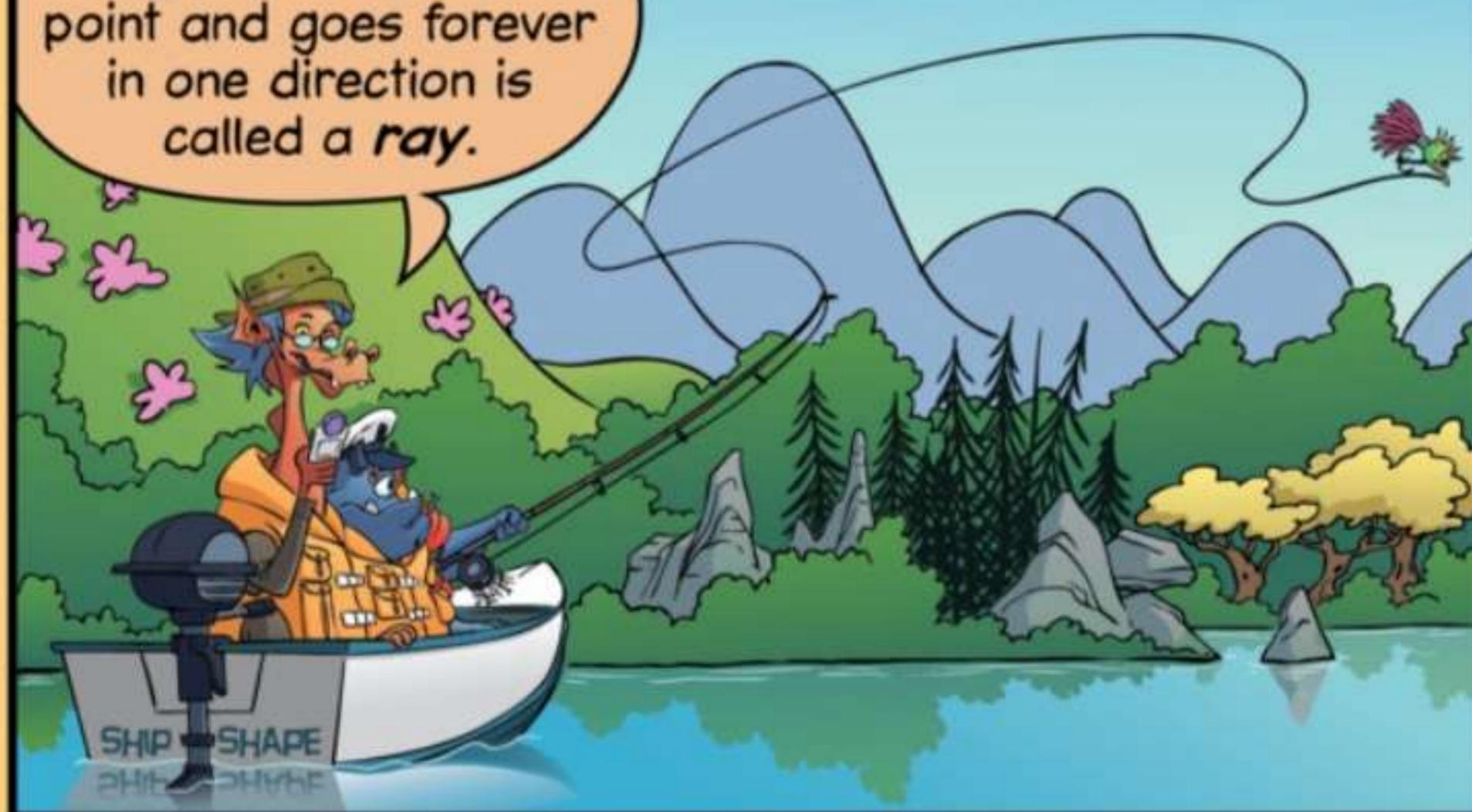




WE NAME POINTS WITH CAPITAL LETTERS. ABOVE IS POINT G.



The part of a line that starts at one point and goes forever in one direction is called a **ray**.



The point where the ray starts is called the **origin**.

Got it.

Ray: part of a line beginning at one point and extending forever in one direction



WHEN NAMING A RAY, ALWAYS BEGIN WITH ITS ORIGIN. THE RAY ABOVE IS RAY XY, NOT RAY YX.

What's the math definition of **angle**?



"Two rays that start at the same point make an angle."



I remember now! A **right** angle makes a perfect "L".

That's right.

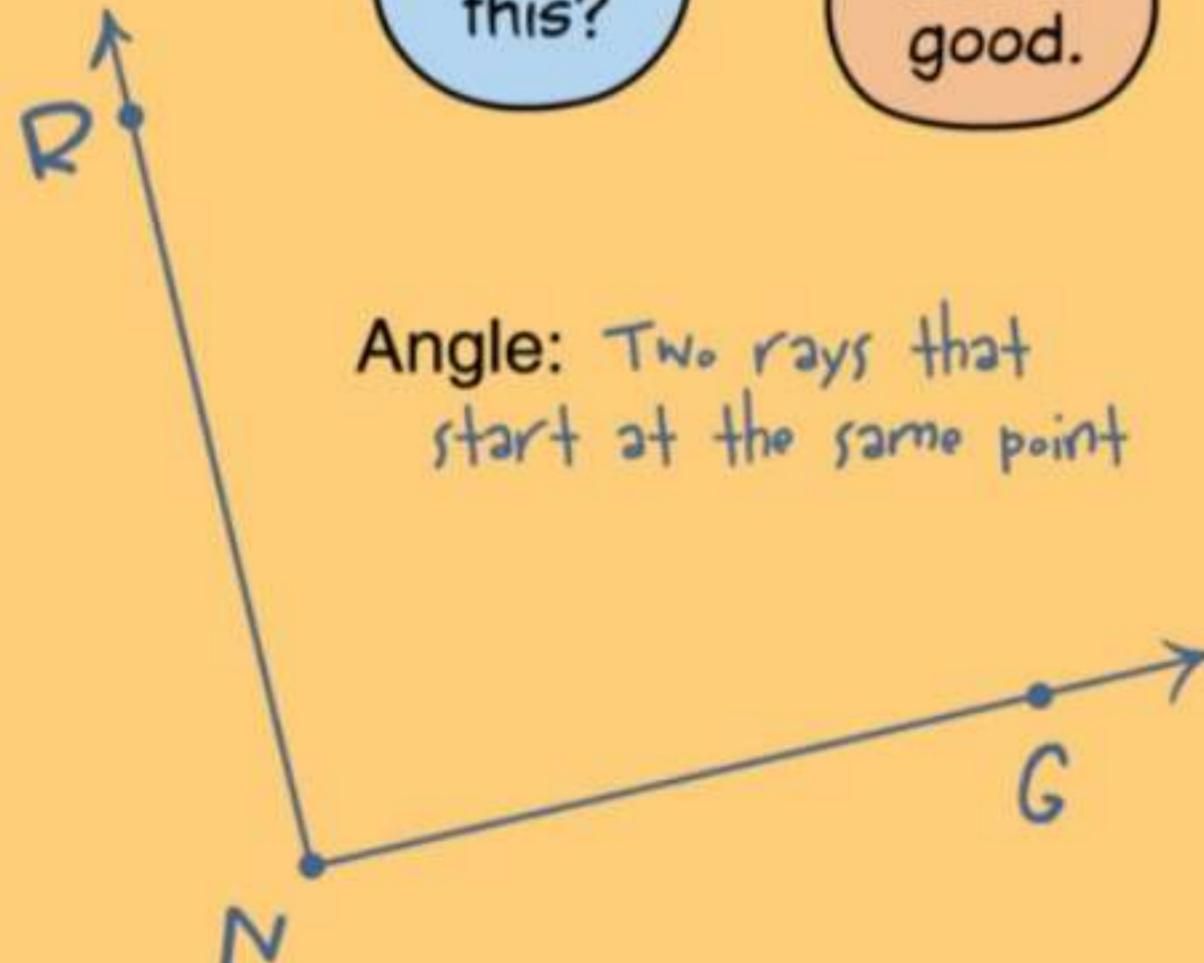
That's what I just said.

I mean, that's **correct!**

How's this?

Looks good.

Angle: Two rays that start at the same point

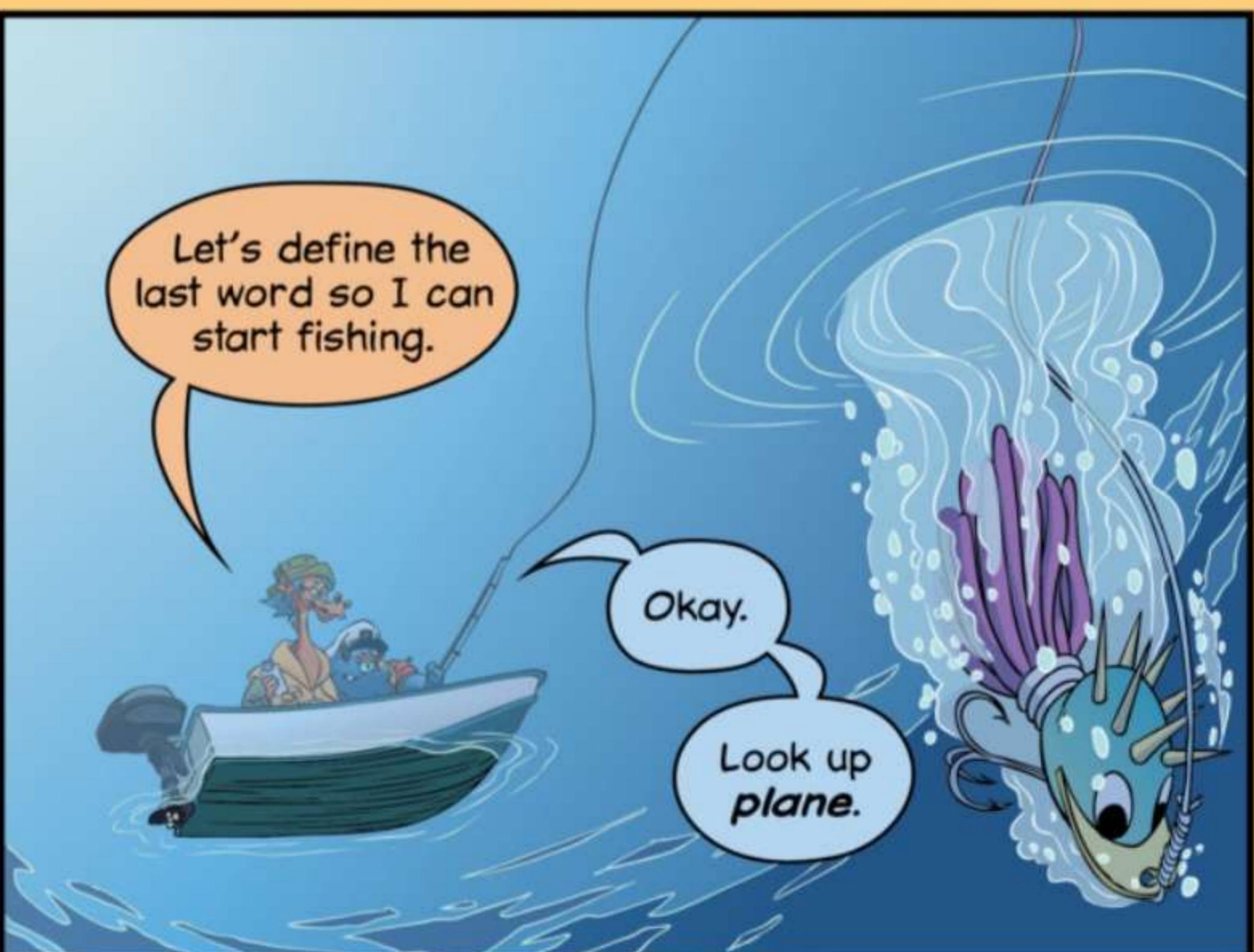


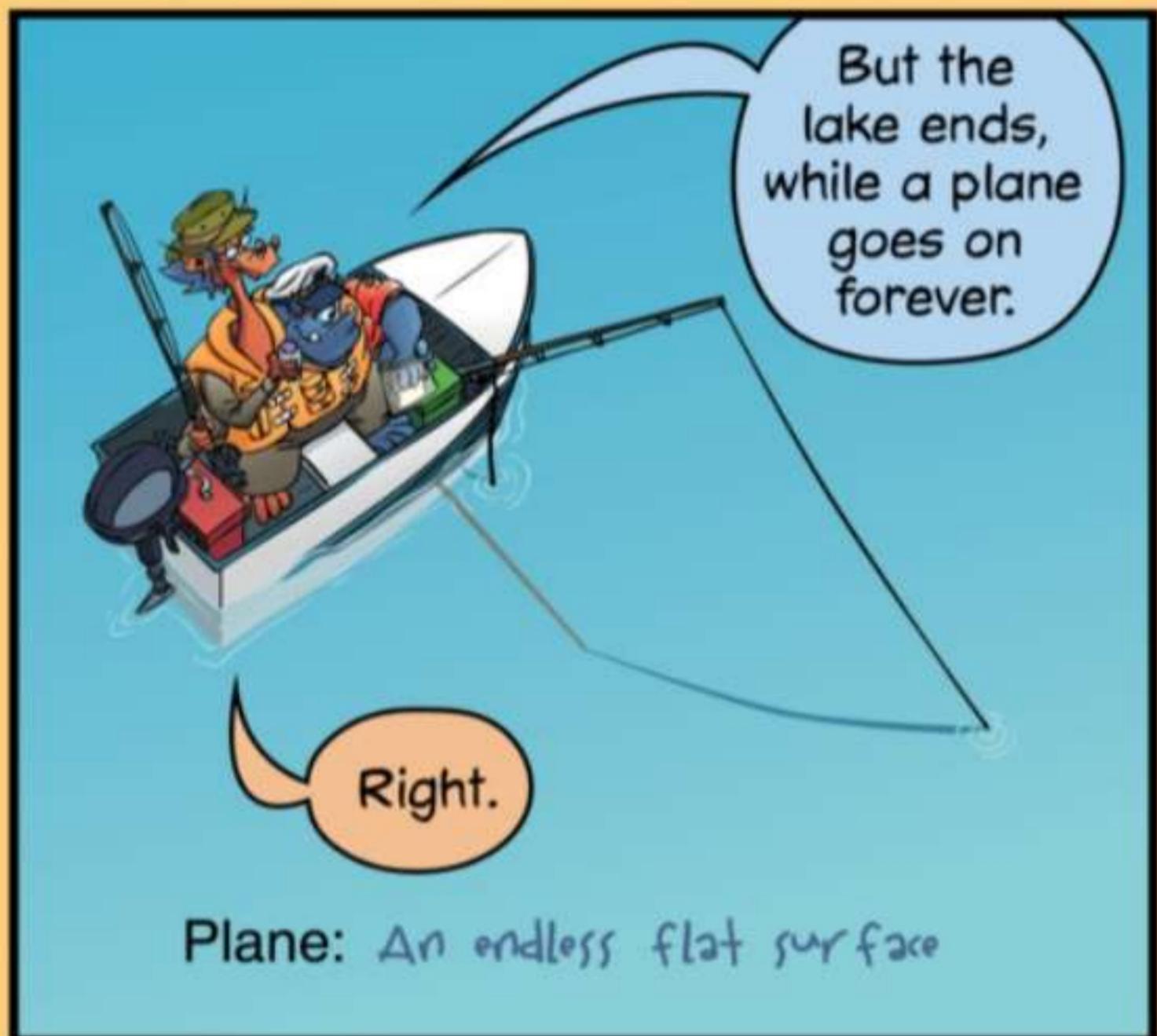
Let's define the last word so I can start fishing.

Okay.

Look up **plane**.

ABOVE IS ANGLE RNG.
THE SHARED ORIGIN ALWAYS GOES IN THE MIDDLE WHEN WE NAME AN ANGLE. SO, WE CAN ALSO NAME THE ANGLE ABOVE ANGLE GNR, BUT NOT ANGLE RGN OR ANGLE GRN.





Plane: An endless flat surface



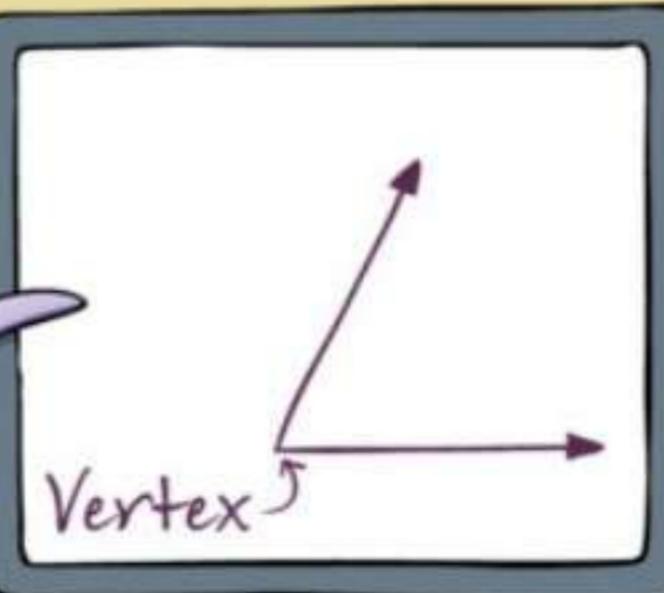
MATH TEAM

Measuring Angles



Two rays that start at the same point form an angle.

The point where both rays start is called the **vertex** of the angle.

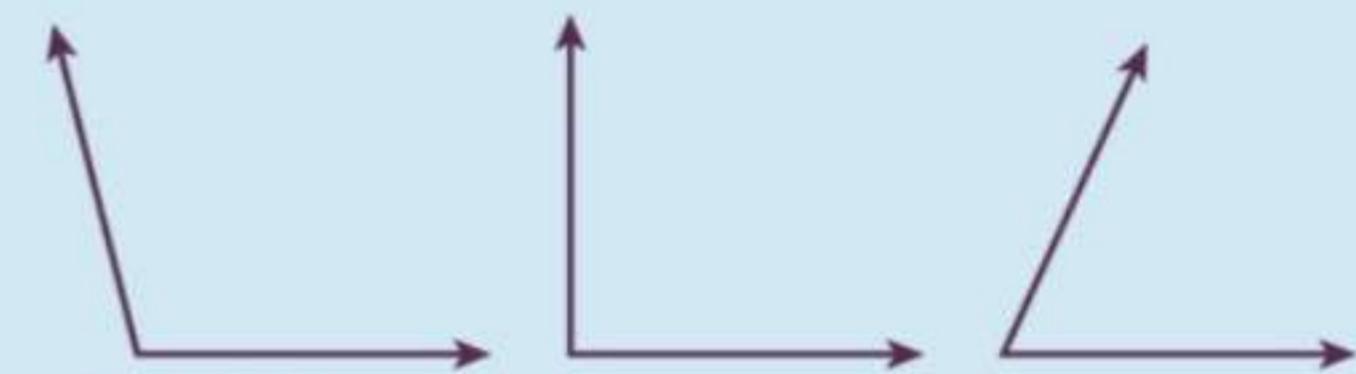


Today we're going to learn how to measure angles.

When comparing angles, we say that an angle is larger if it is more open...



...and smaller if it is more closed.



For example, how would you compare the sizes of these three angles?

The first angle is the most open, so it is the largest angle.

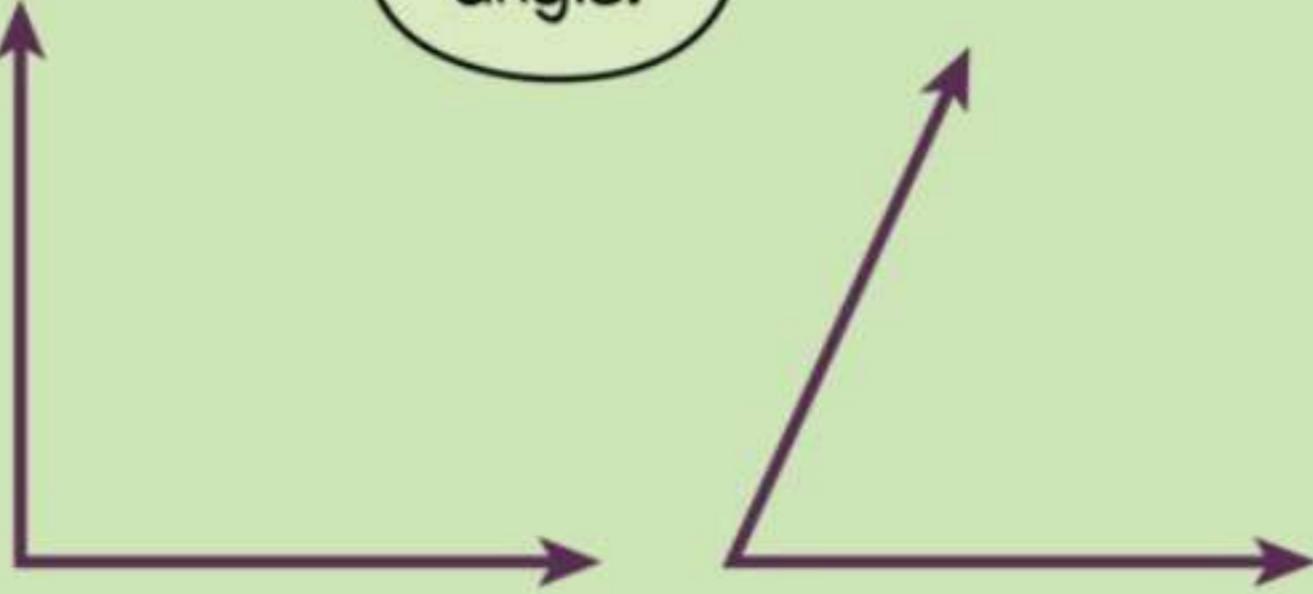
It's an **obtuse** angle.

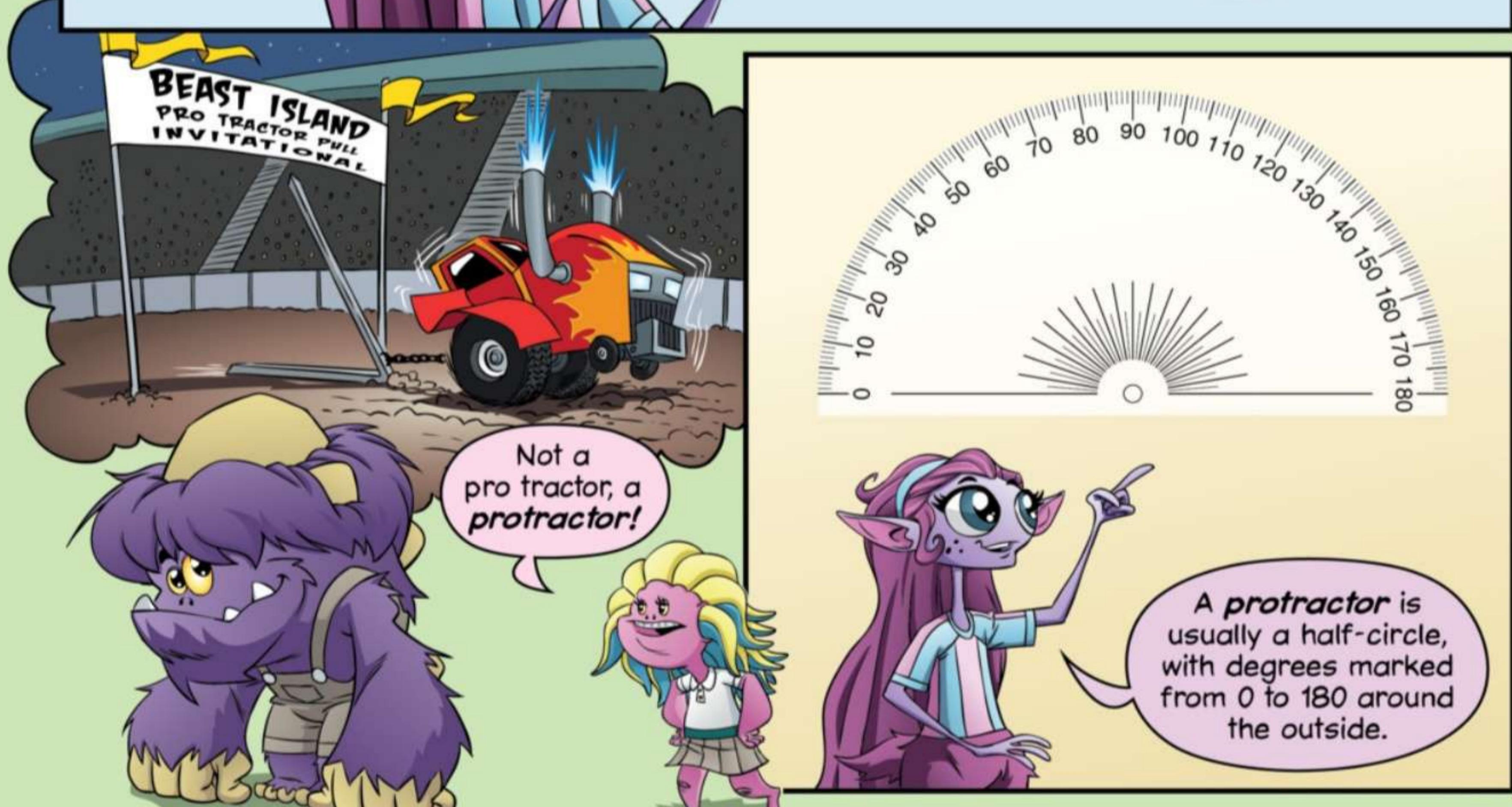
The second angle is more closed than the first, but more open than the third.

It's a **right** angle.

And the third angle is the most closed, so it is the smallest angle.

It's an **acute** angle.

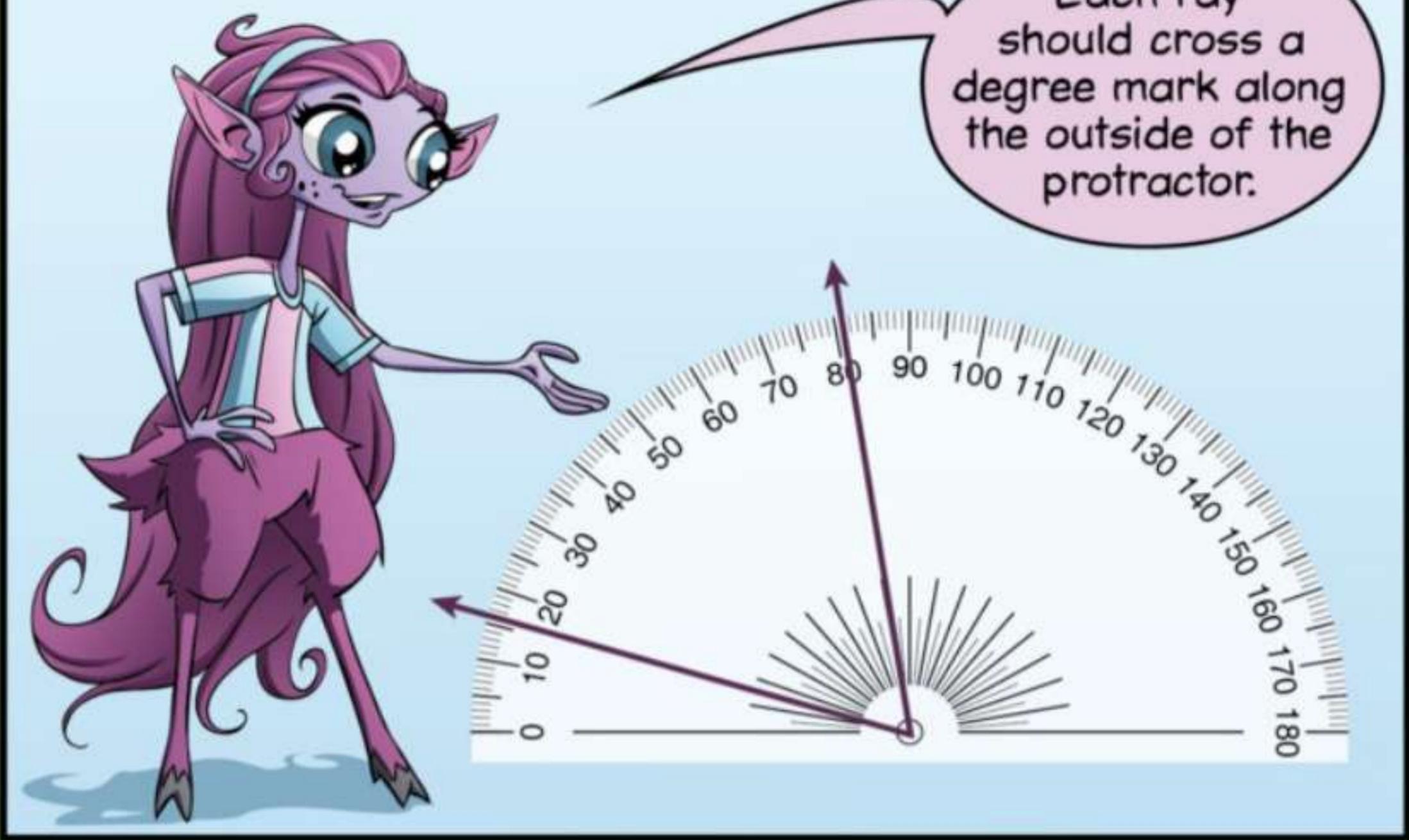




To measure an angle, place the center of the half-circle on the angle's vertex.



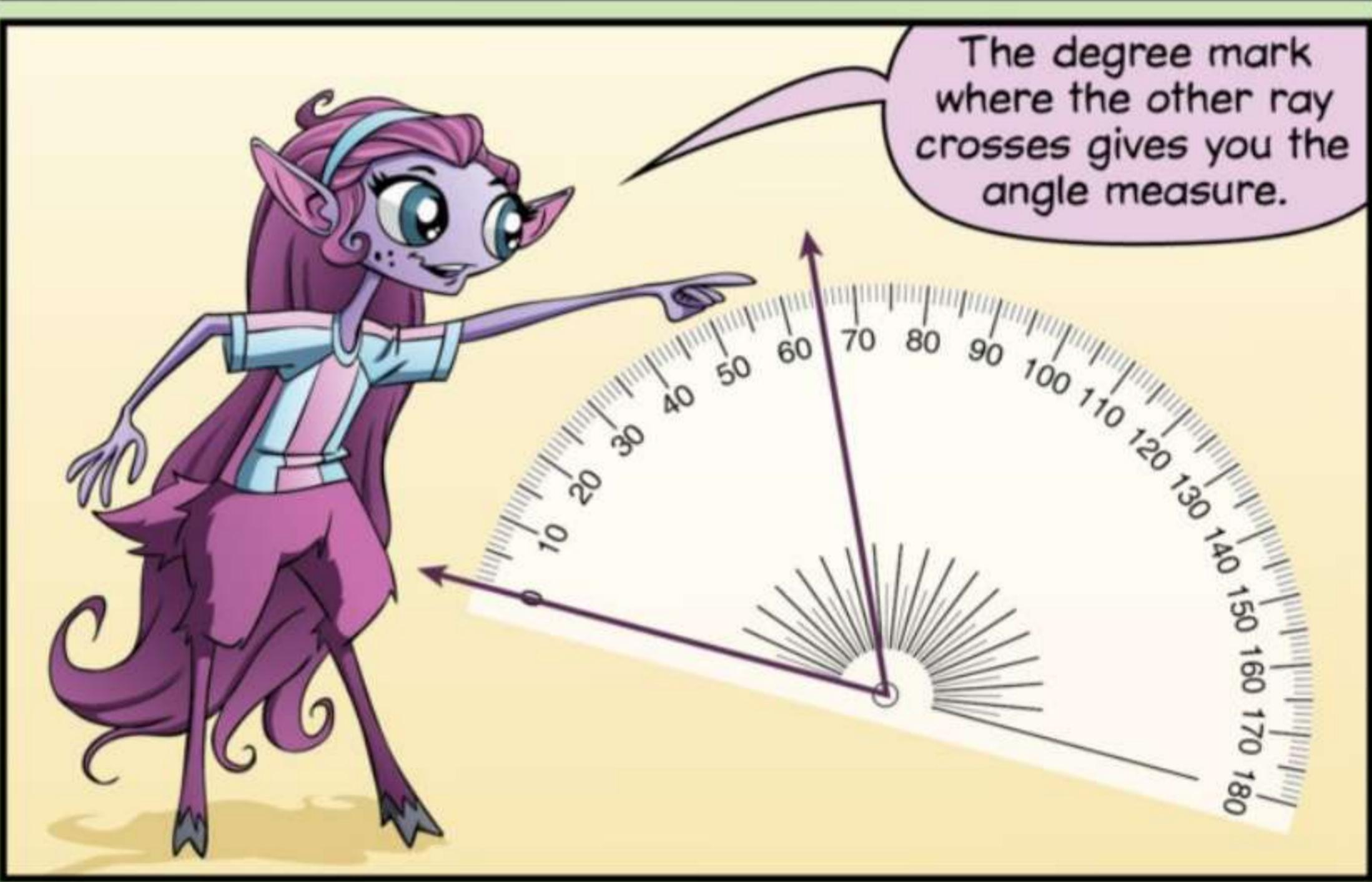
Each ray should cross a degree mark along the outside of the protractor.



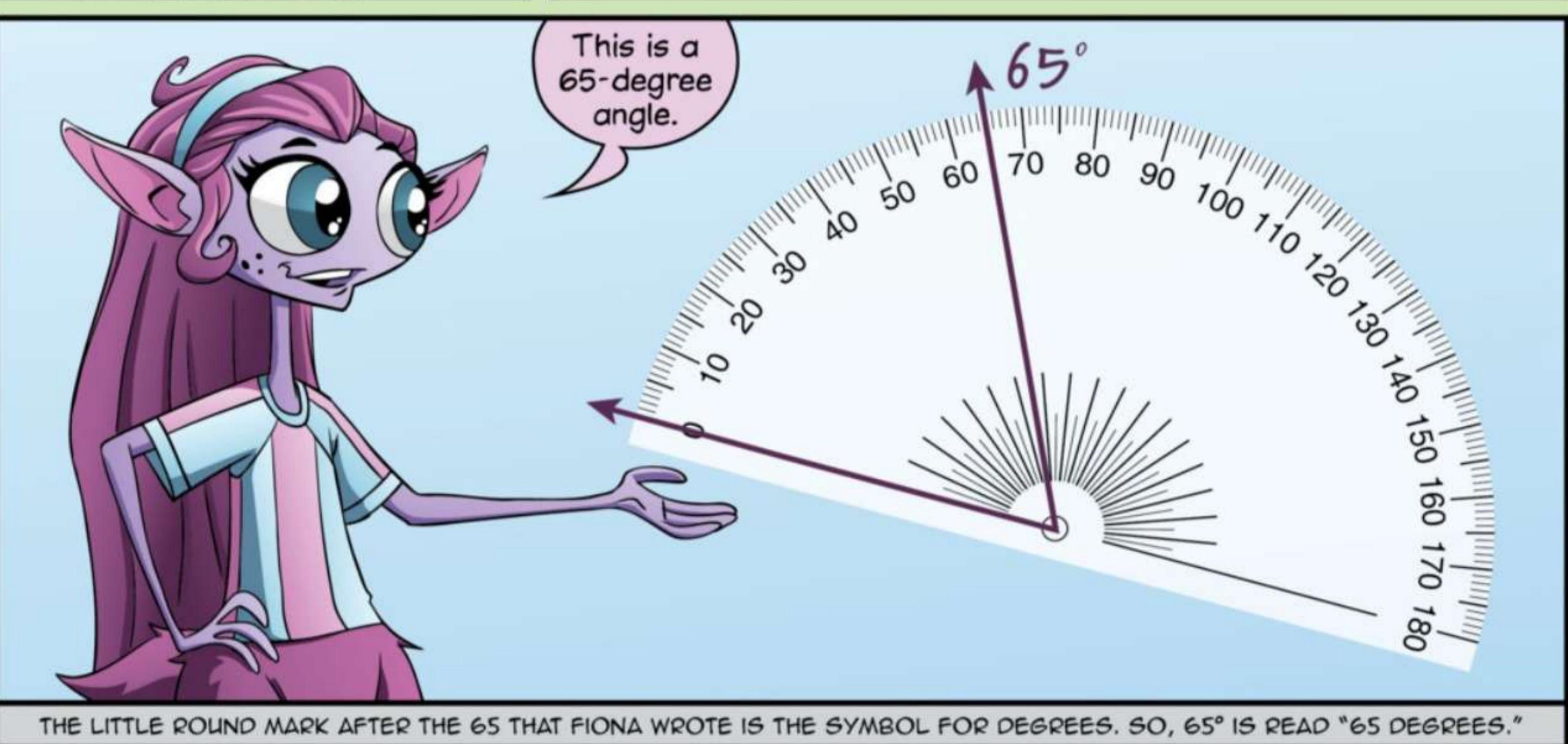
Turn your protractor so that one ray crosses the zero degree mark.



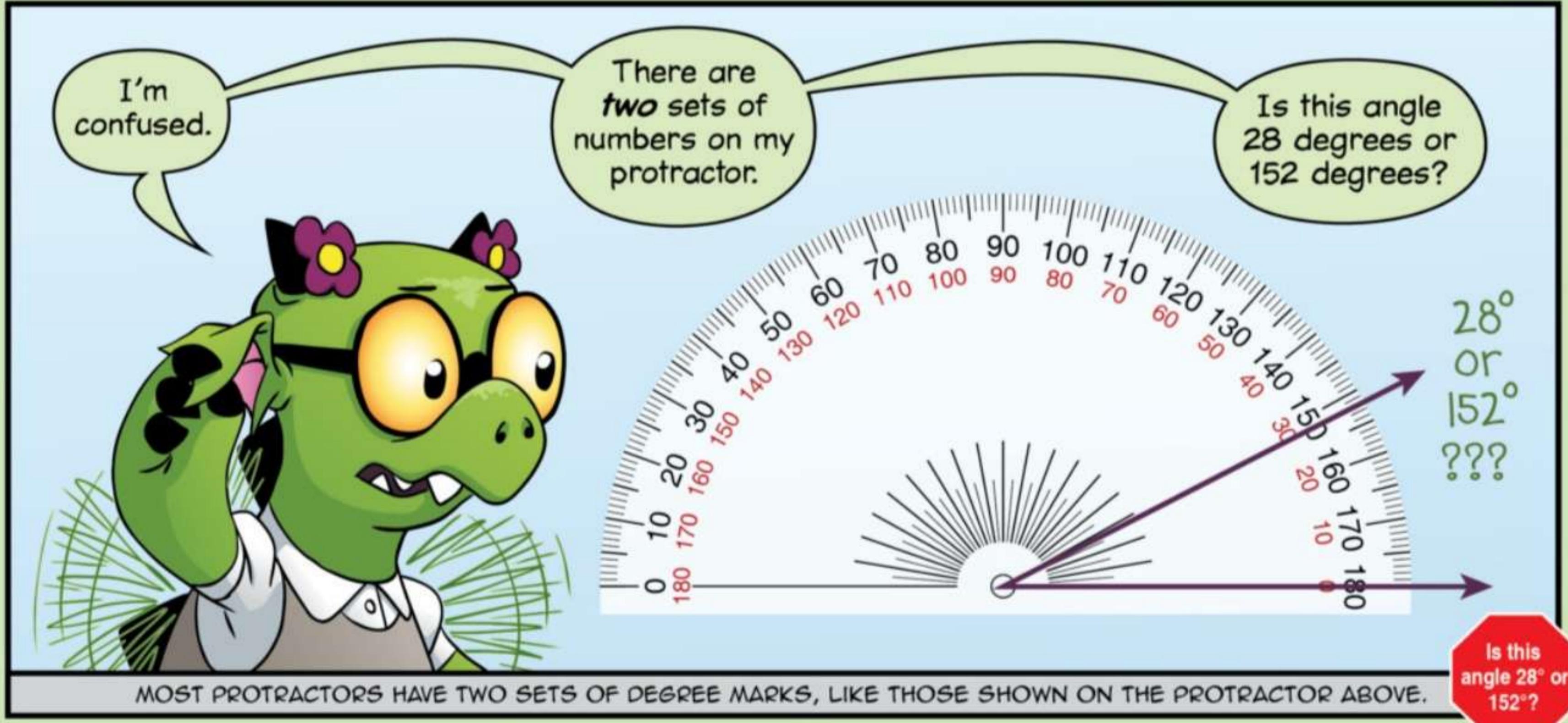
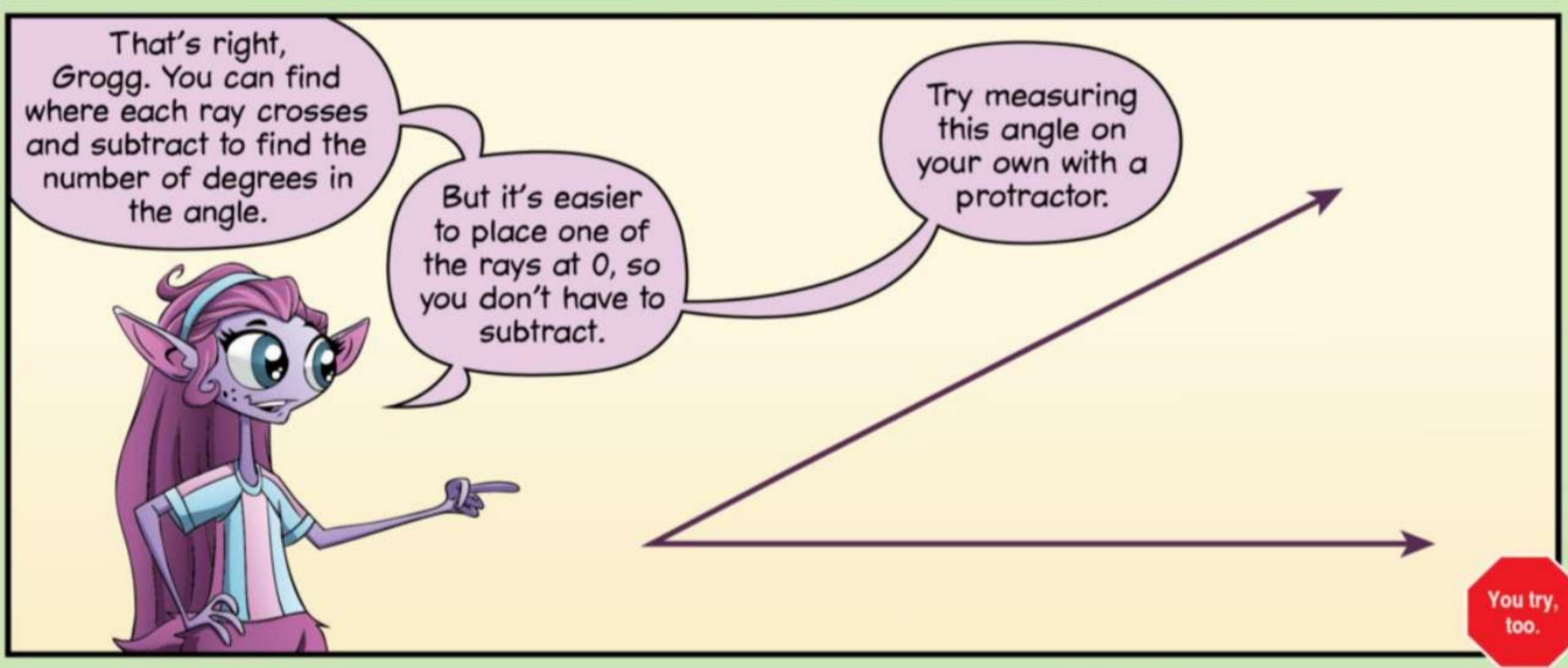
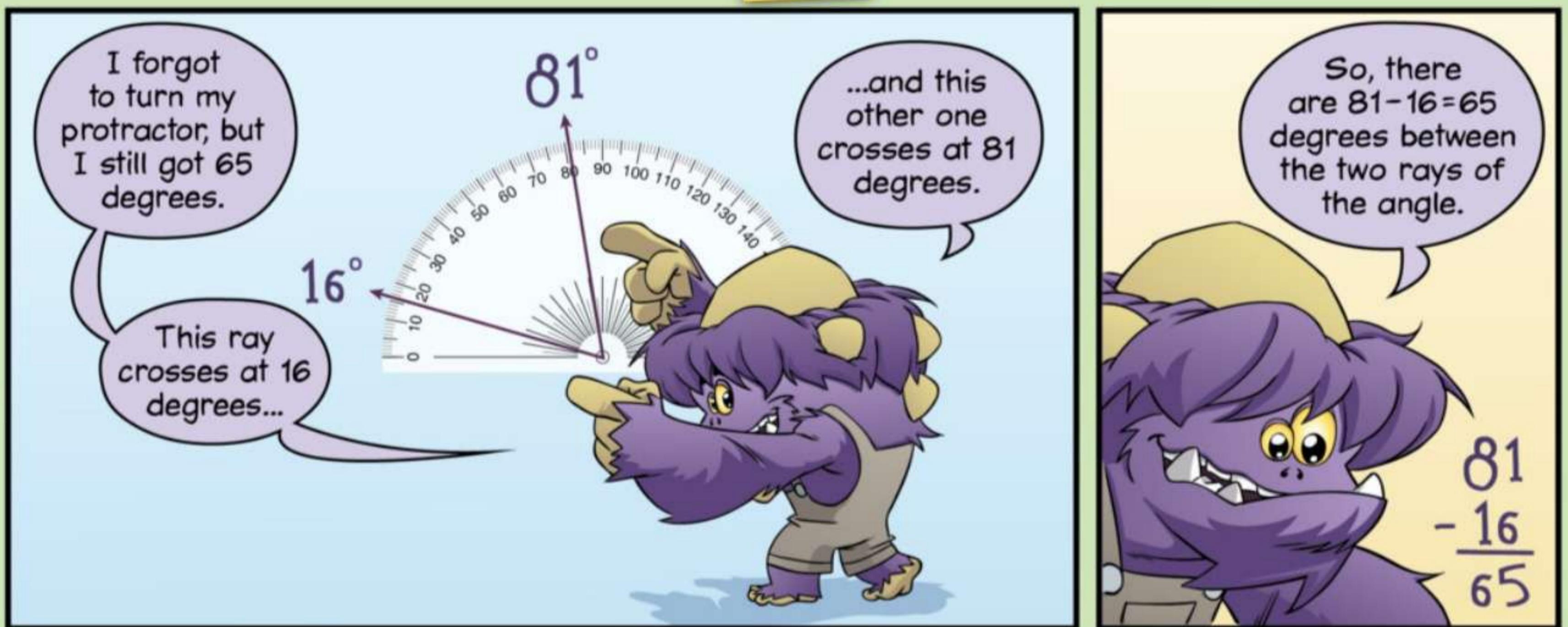
The degree mark where the other ray crosses gives you the angle measure.

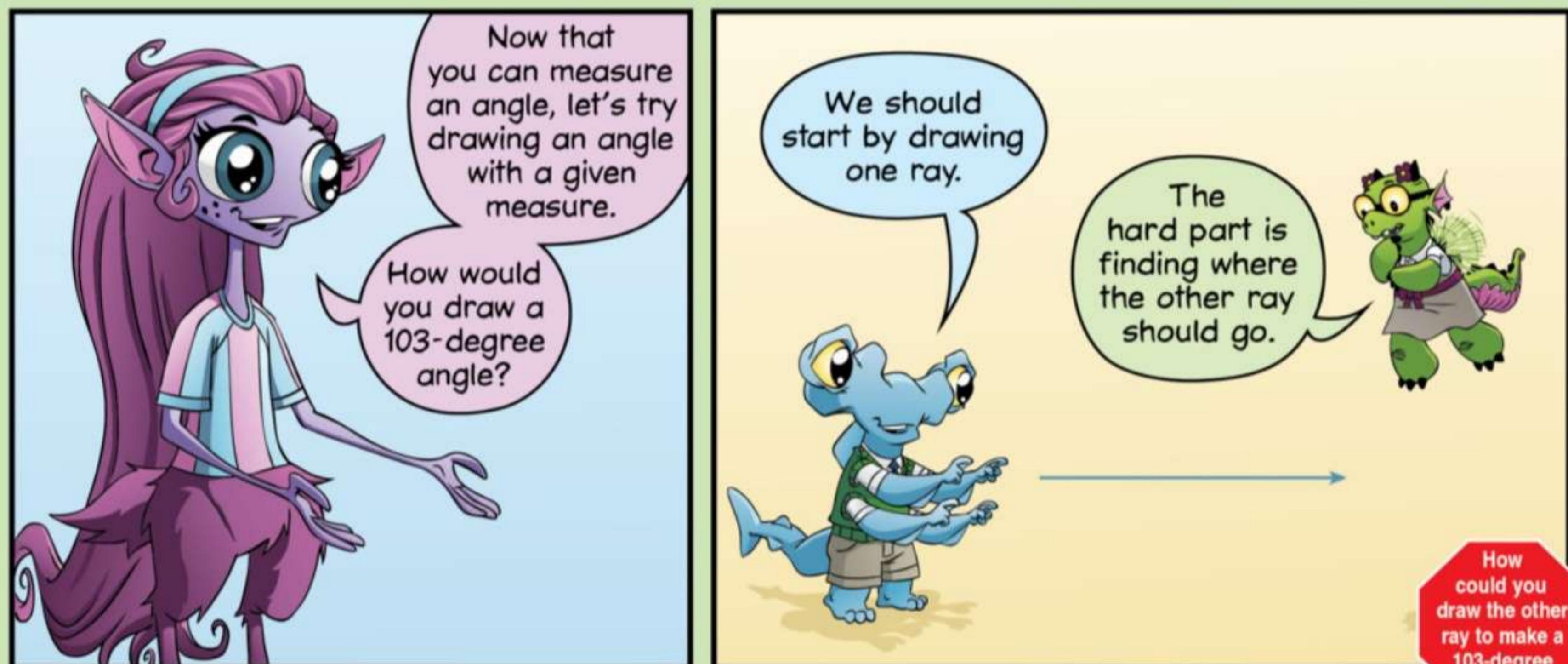
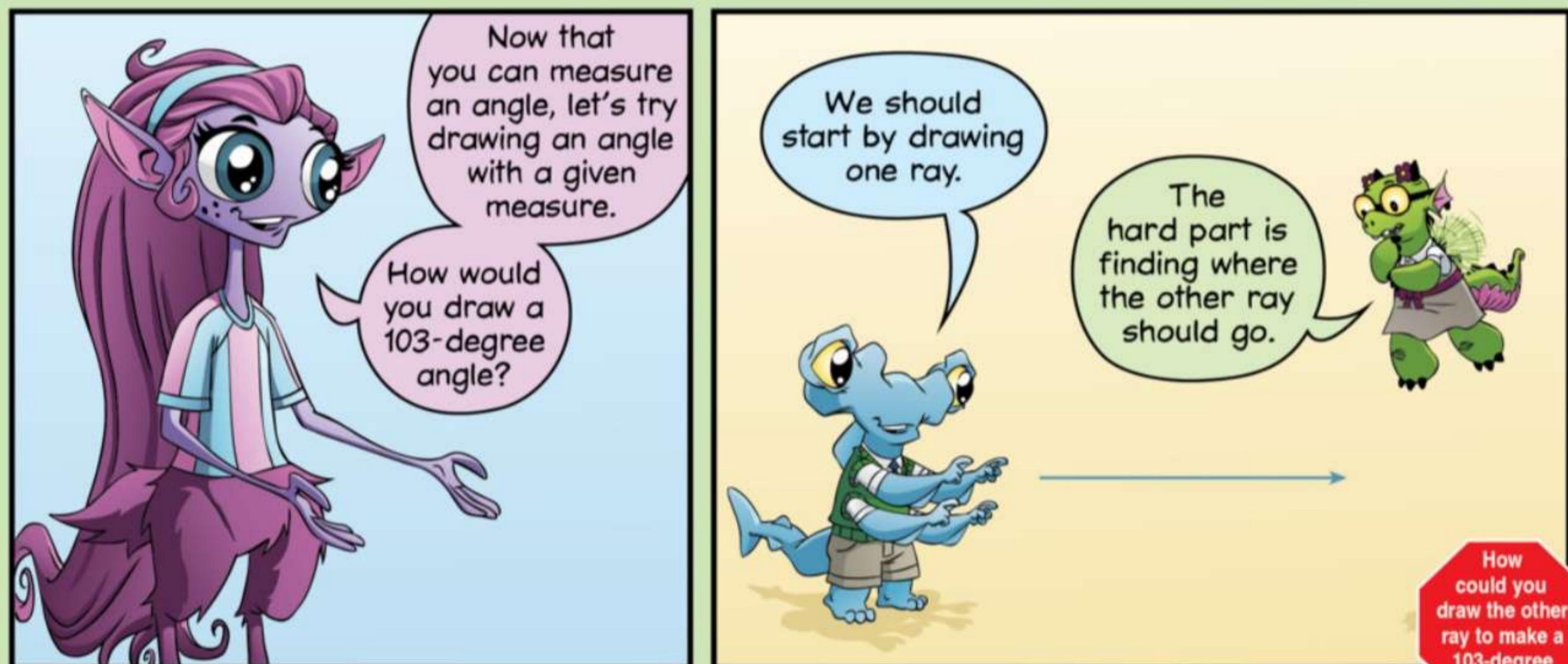
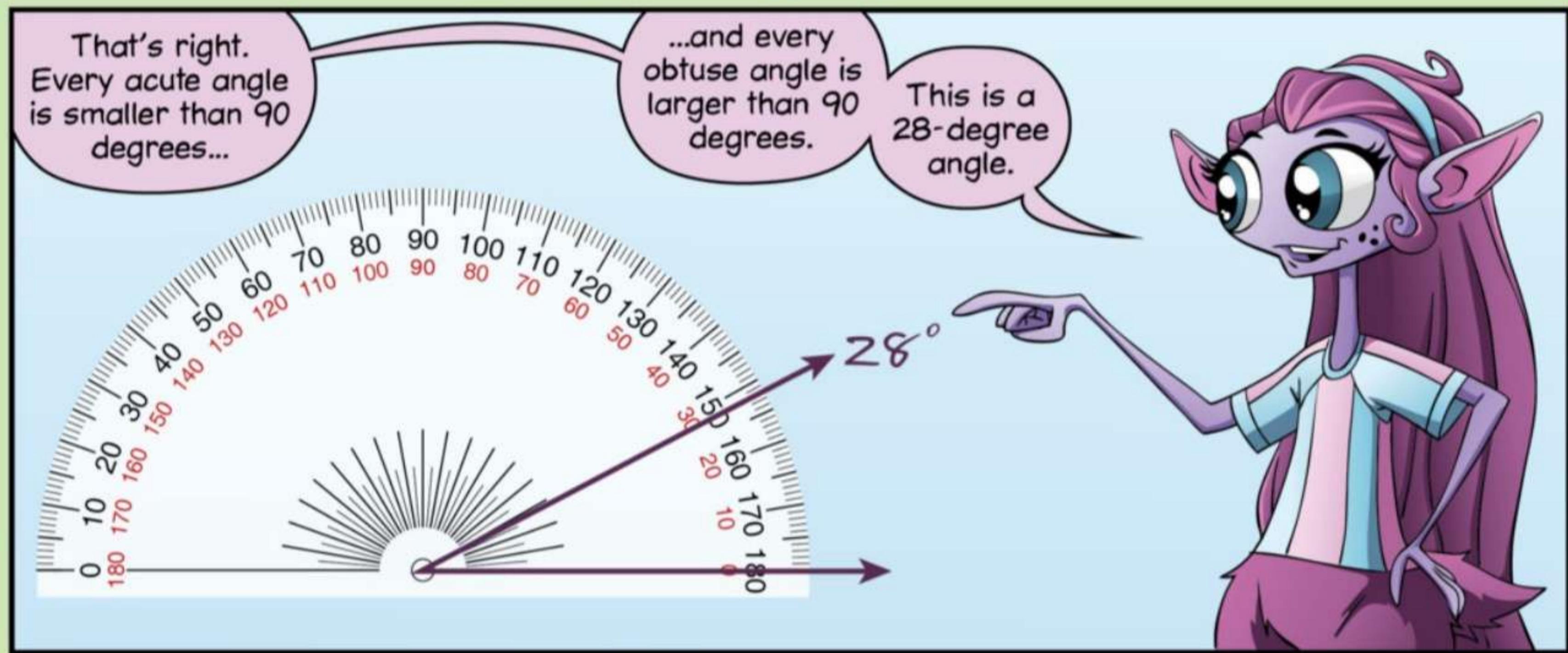
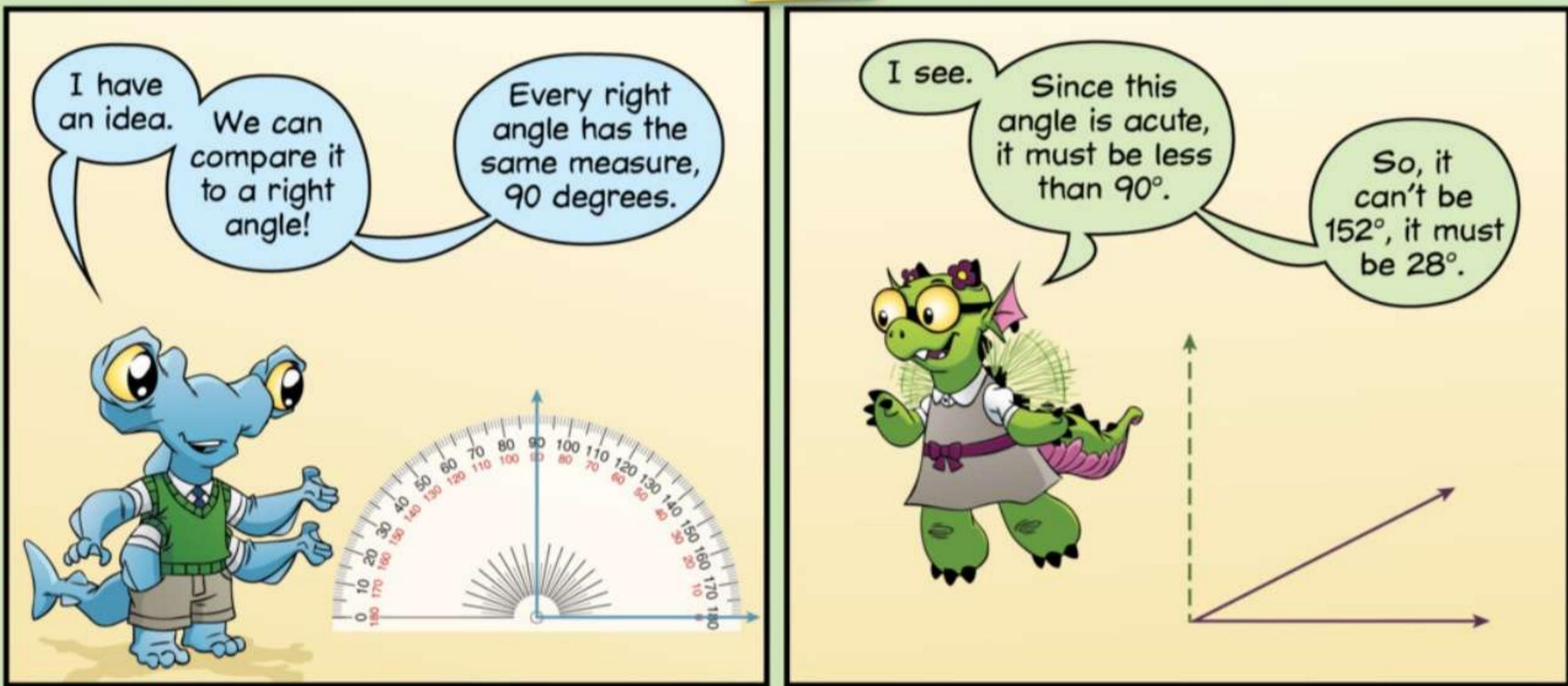


This is a 65-degree angle.



THE LITTLE ROUND MARK AFTER THE 65 THAT FIONA WROTE IS THE SYMBOL FOR DEGREES. SO, 65° IS READ "65 DEGREES."





How could you draw the other ray to make a 103-degree angle?

If we put the center of the half-circle on the vertex, and the first ray crosses through zero degrees...

...the second ray has to cross through 103 degrees.



We can draw a little dot at the 103.

Remember to use the 103 that makes the angle larger than 90 degrees.



Then, we draw a ray from the vertex through the dot!

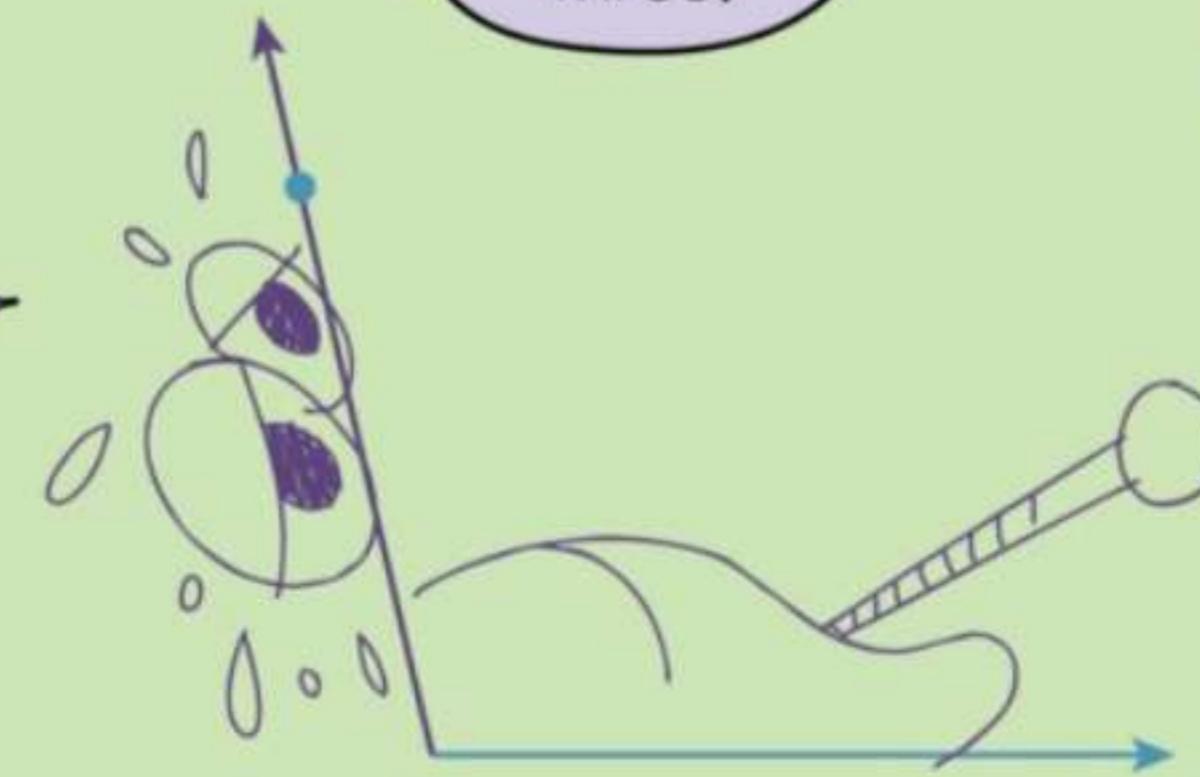
There it is, a 103-degree angle.

This angle needs to see a doctor!



It's got a fever of a hundred and three!

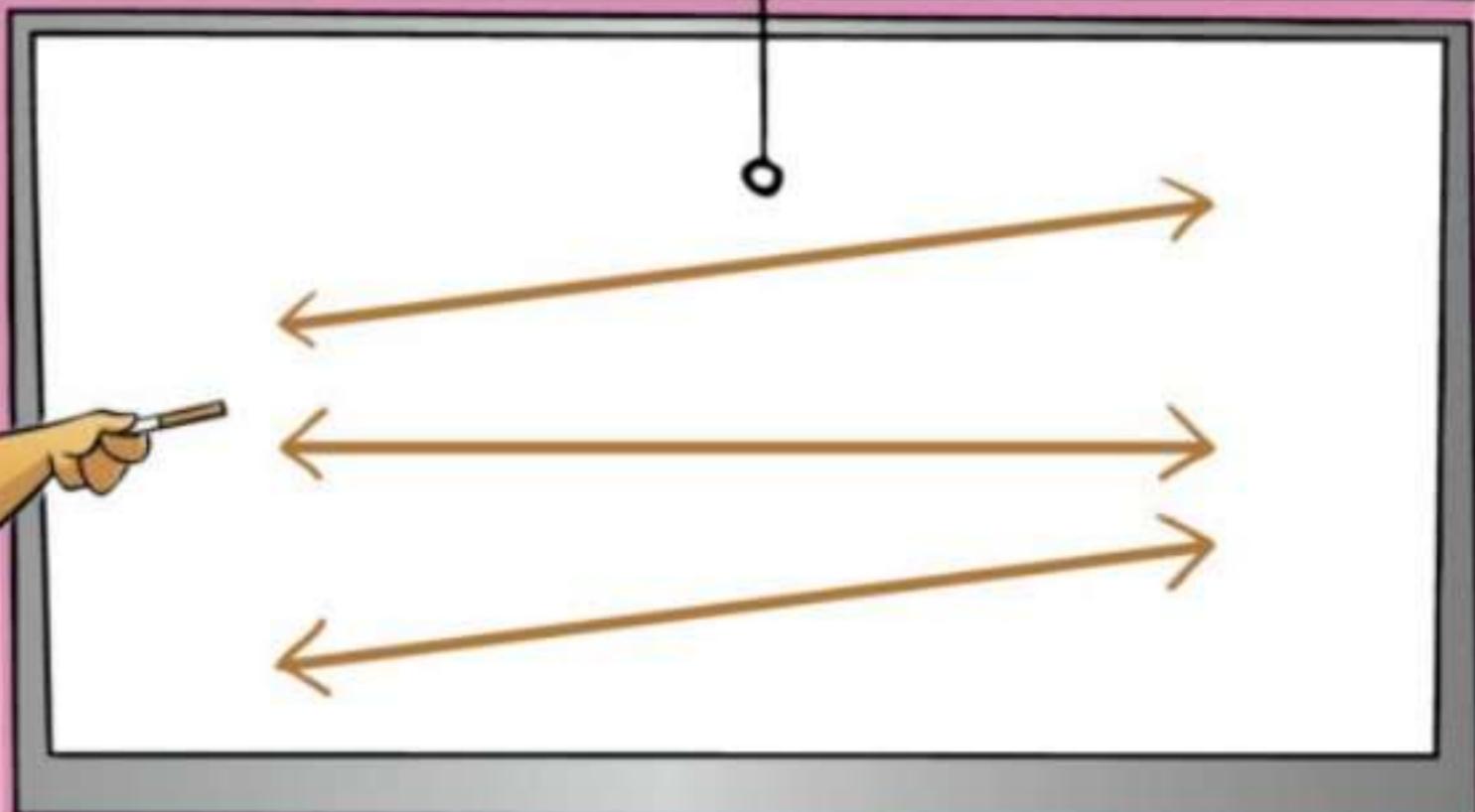
Ugh! You're giving me a headache.



Ms. Q.

Parallel & Perpendicular

I've drawn three lines on the board. Which of these lines intersect?



INTERSECT IS JUST A FANCY WORD FOR CROSS.

Lines go on forever in both directions, so the top line crosses the middle line here.

And the middle line crosses the bottom line here.



But the top line and the bottom line don't cross.

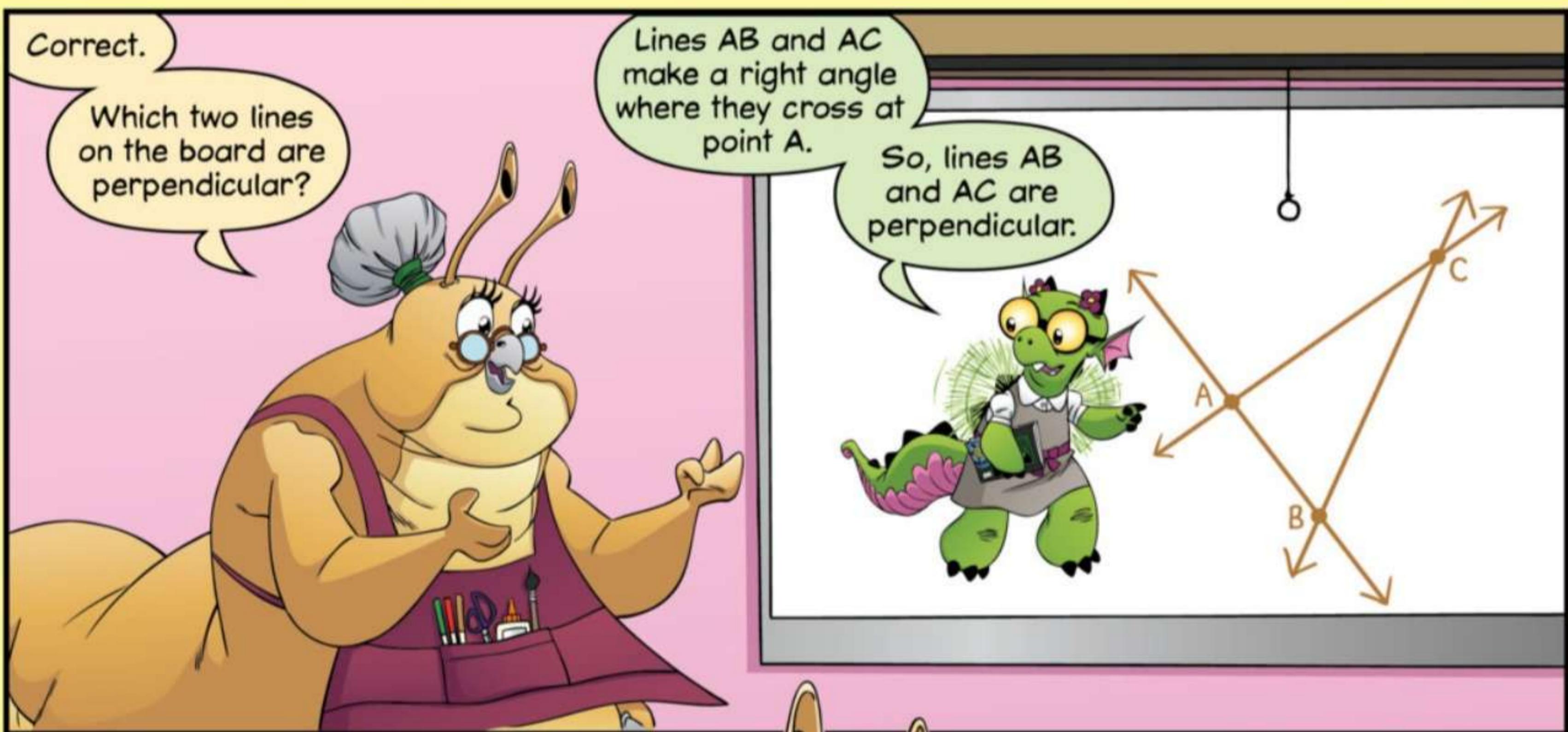
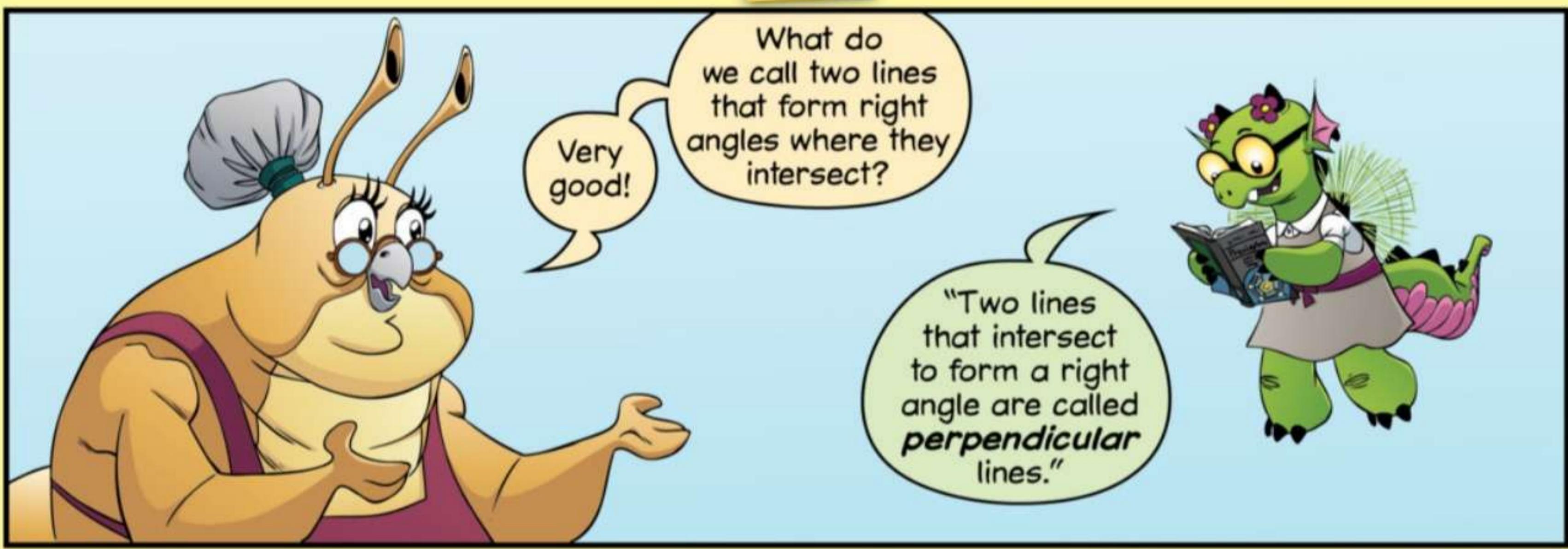


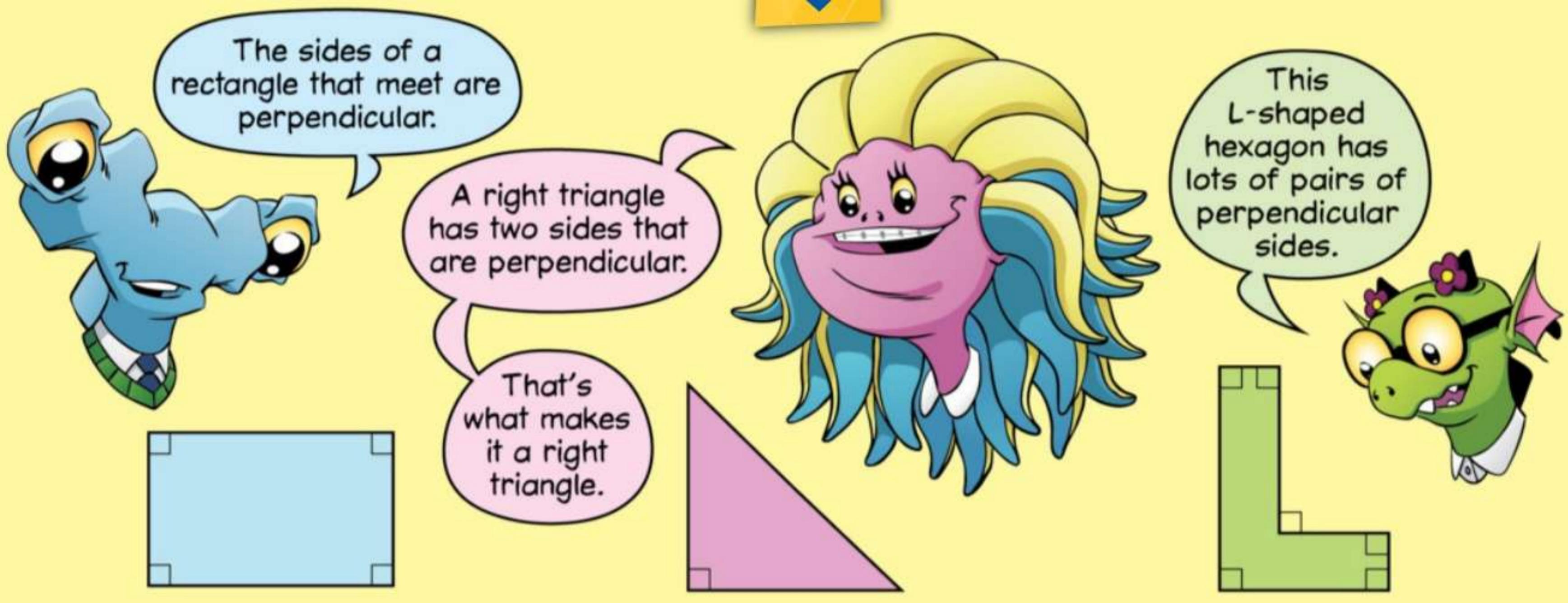
"Two lines in the same plane that don't intersect are called **parallel** lines."

What do we call two lines that don't intersect?



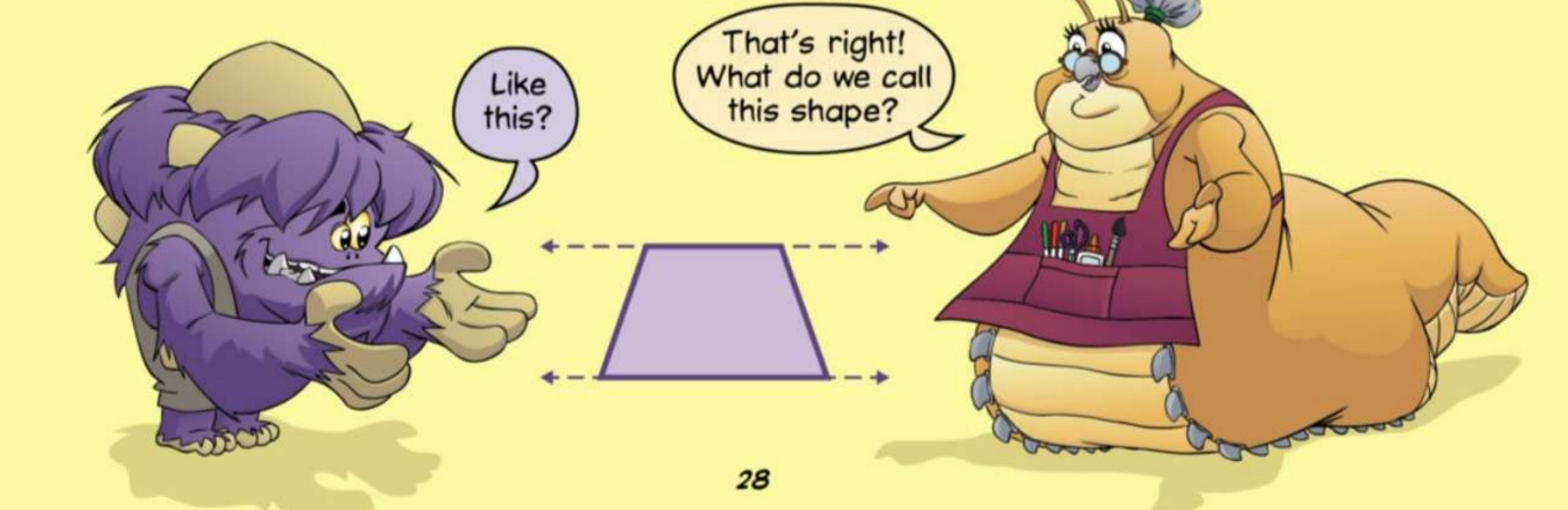
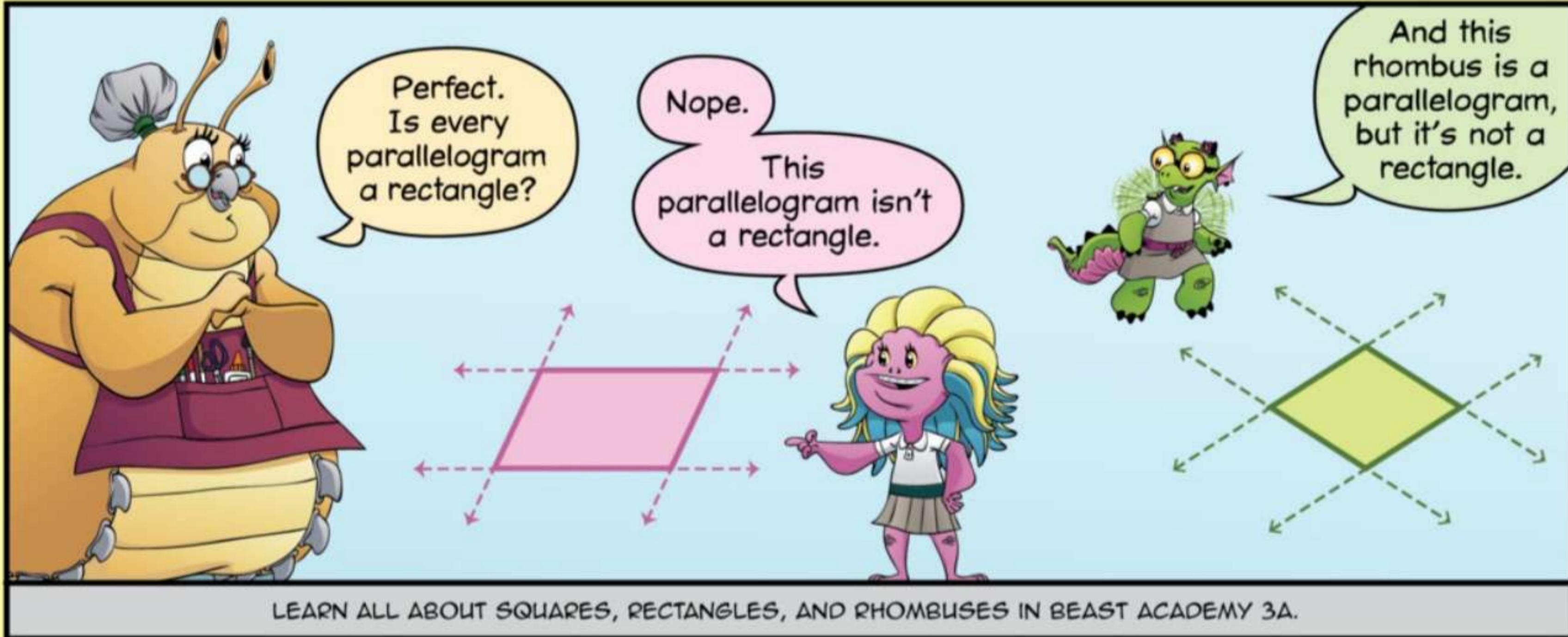
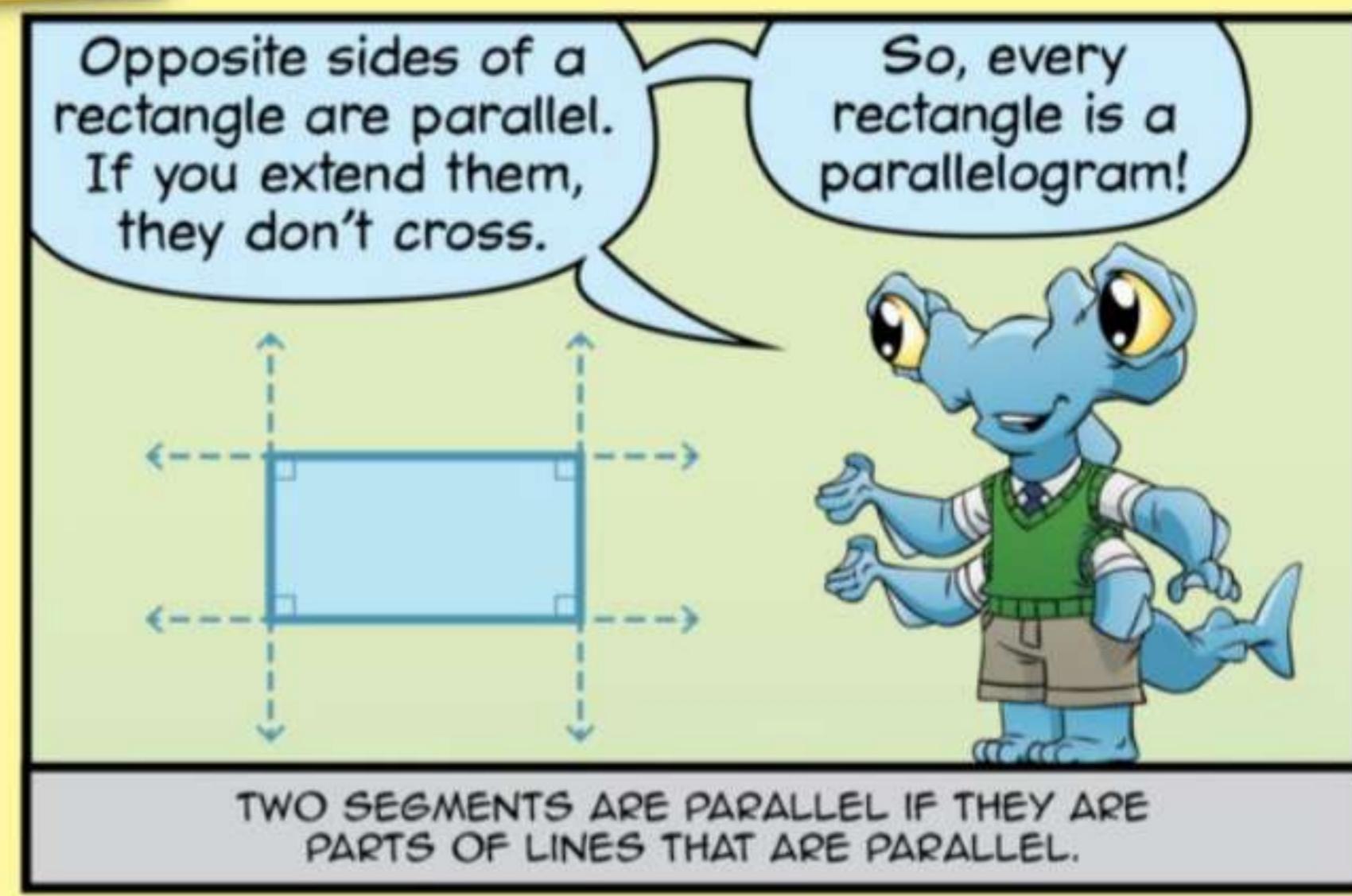
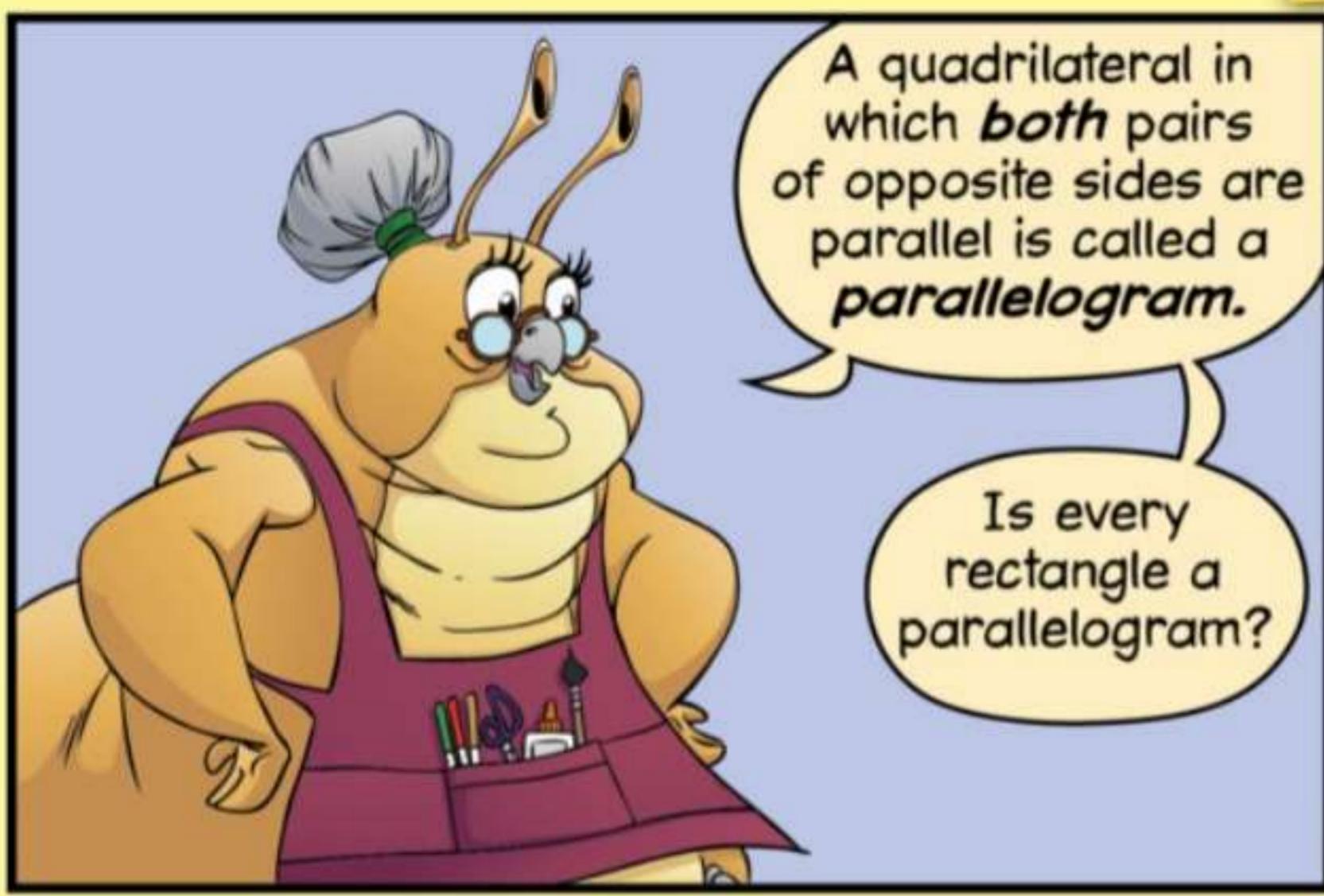
A PLANE IS AN ENDLESS FLAT SURFACE. FOR TWO LINES TO BE PARALLEL, THEY MUST BE IN THE SAME PLANE.





RIGHT ANGLES ARE OFTEN MARKED WITH SMALL SQUARES \square AS SHOWN IN THE DIAGRAMS ABOVE.





Found it!
"A **trapezoid**
is a quadrilateral
with at least one
pair of parallel
sides."



Good. Every trapezoid
has at least one pair of
parallel sides.

Who can draw
a trapezoid that also
has at least one pair of
perpendicular sides?



A TRAPEZOID HAS
AT LEAST ONE PAIR OF
PARALLEL SIDES. SO,
BY OUR DEFINITION,
ALL PARALLELOGRAMS
ARE TRAPEZOIDS. THIS
IS THE DEFINITION
PREFERRED BY MOST
MATH BEASTS.
OTHERS DEFINE A
TRAPEZOID AS HAVING
EXACTLY ONE PAIR
OF PARALLEL SIDES,
IN WHICH CASE A
PARALLELOGRAM IS
NOT A TRAPEZOID.

Can
you draw a
trapezoid that has
at least one pair
of perpendicular
sides?

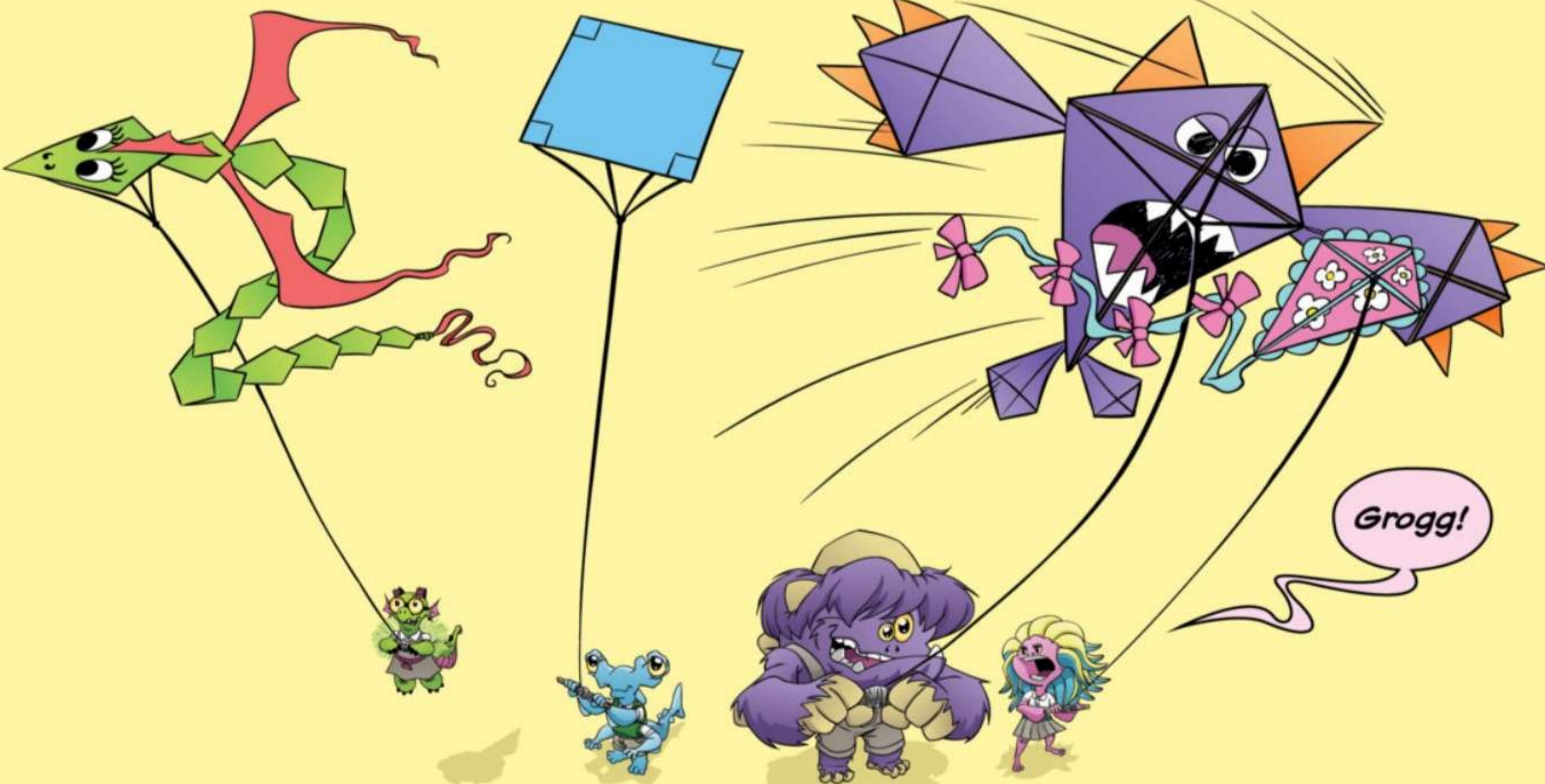


A square
has at least one
pair of parallel
sides, so it's a
trapezoid.





CONGRUENT SIDES ARE THE SAME LENGTH.





Here be the most beautiful vessel ever sailed...
...the Helen of Ahoy.

What makes this ship so beautiful?

She be the picture o' perfect symmetry.

Huh?



The left side be exactly the same as the right.

If you slice the ship down the middle...

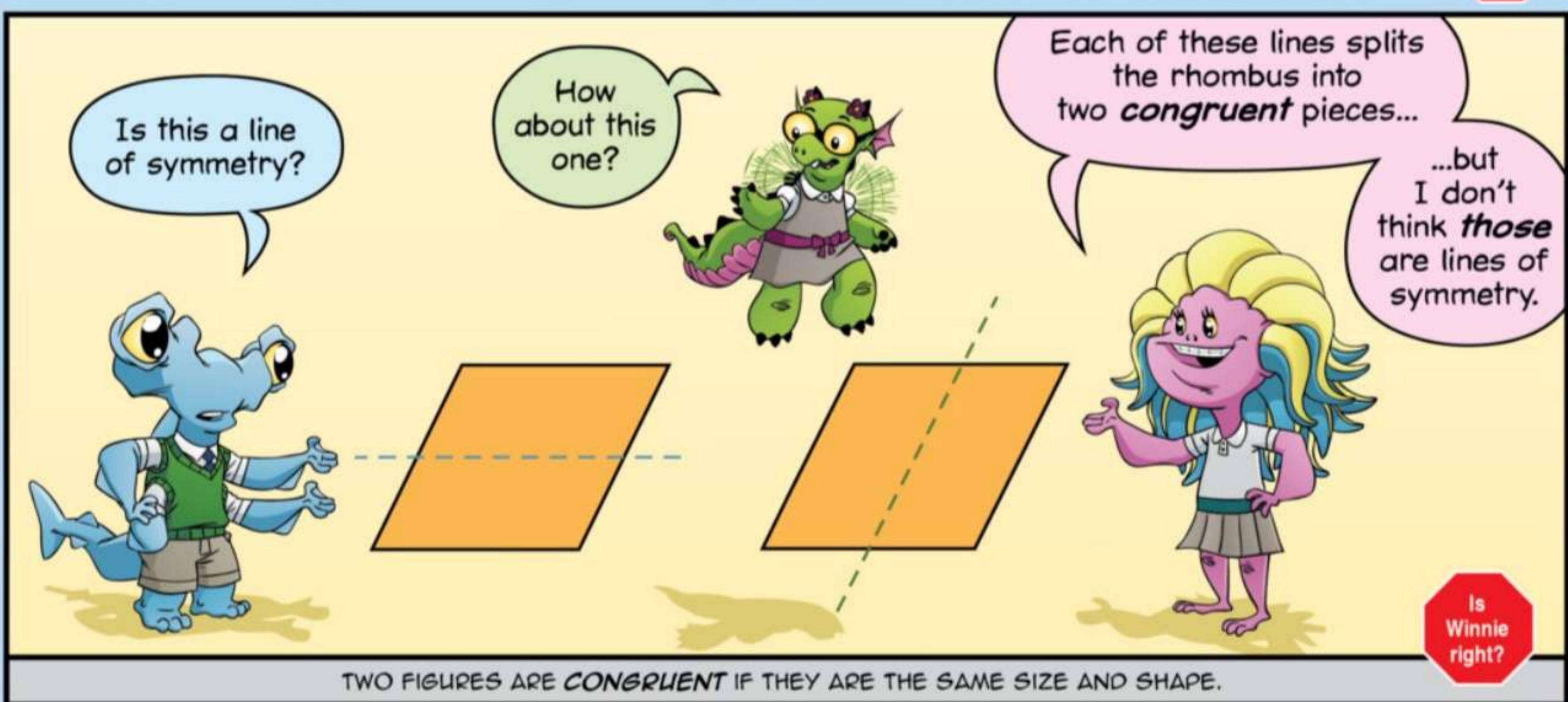
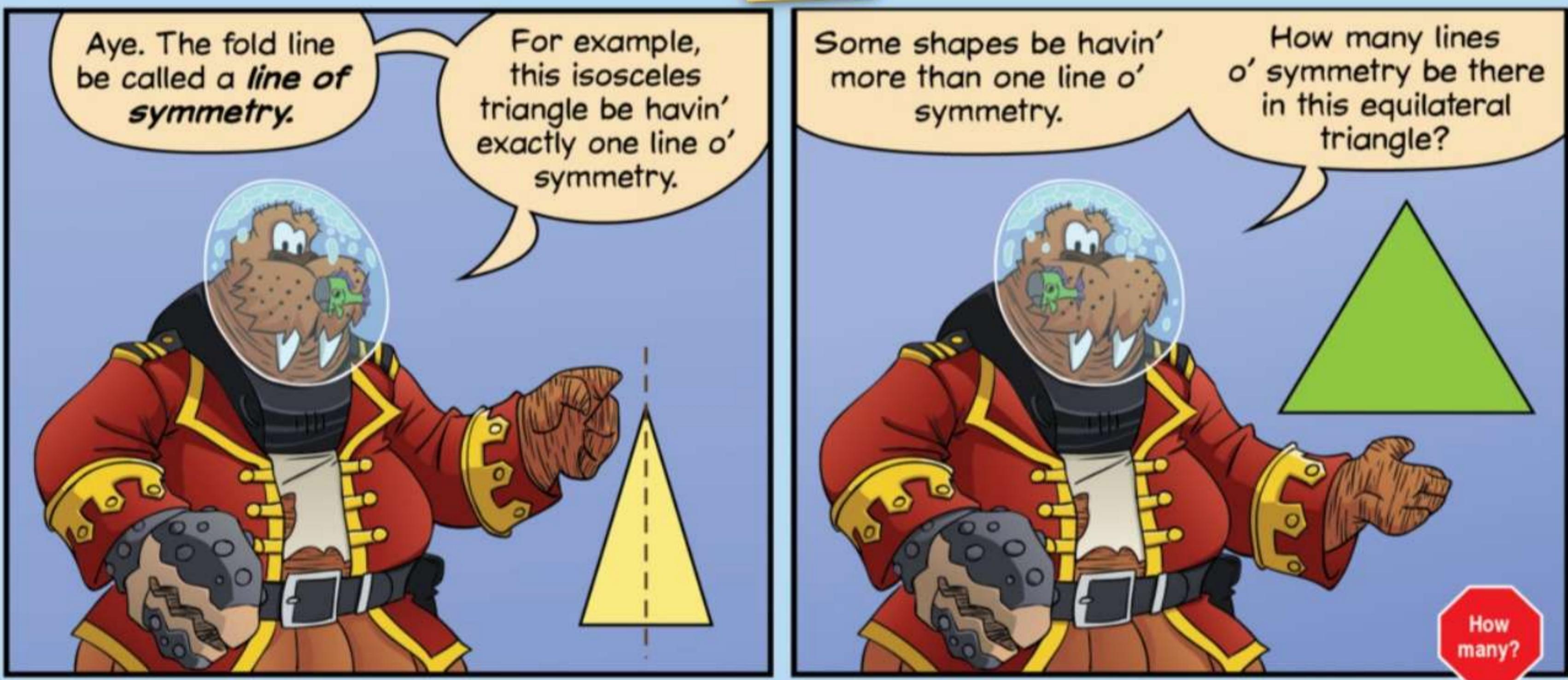
...one side o' the ship be a perfect reflection o' the other.
'Tis called **reflectional symmetry**.

A REFLECTION IS A MIRROR IMAGE.

If you can fold a shape so that one side matches the other side perfectly...

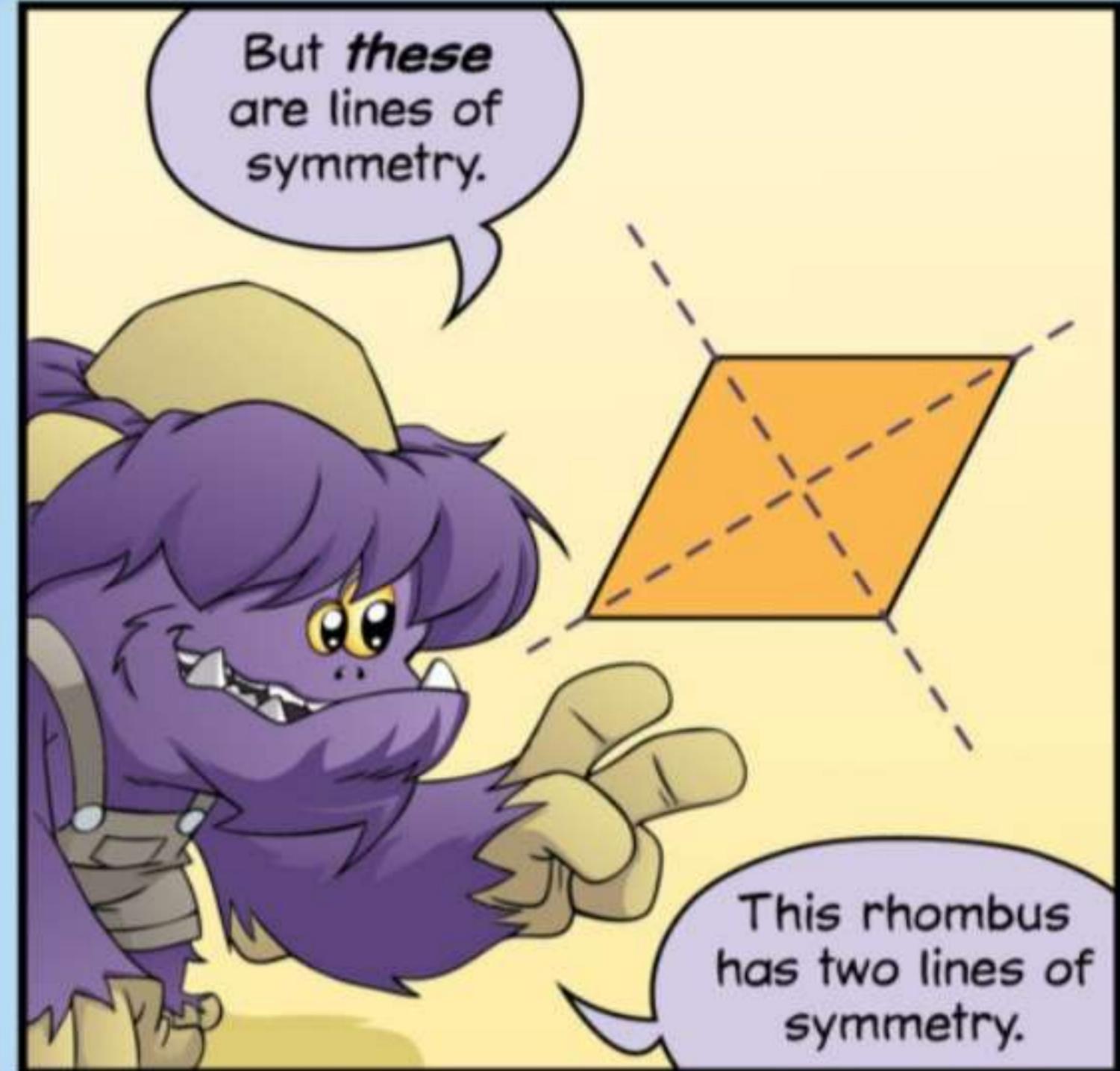
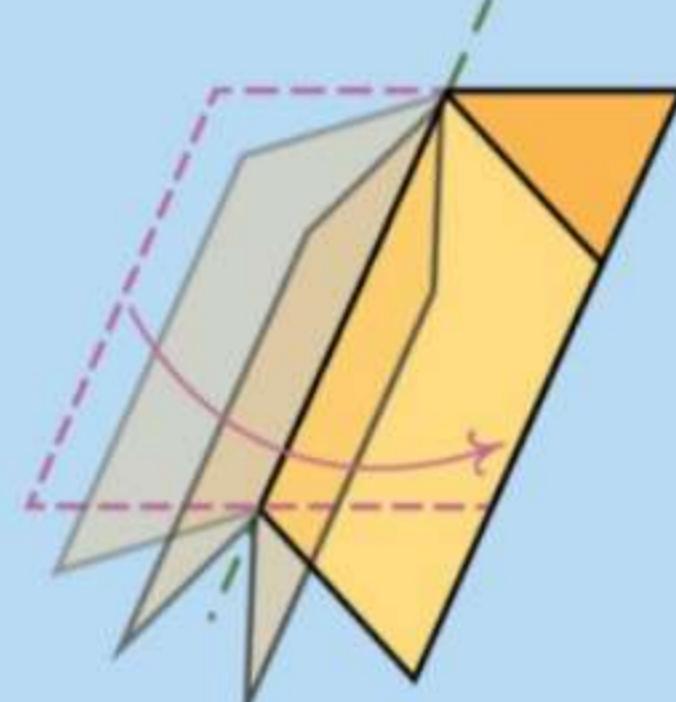
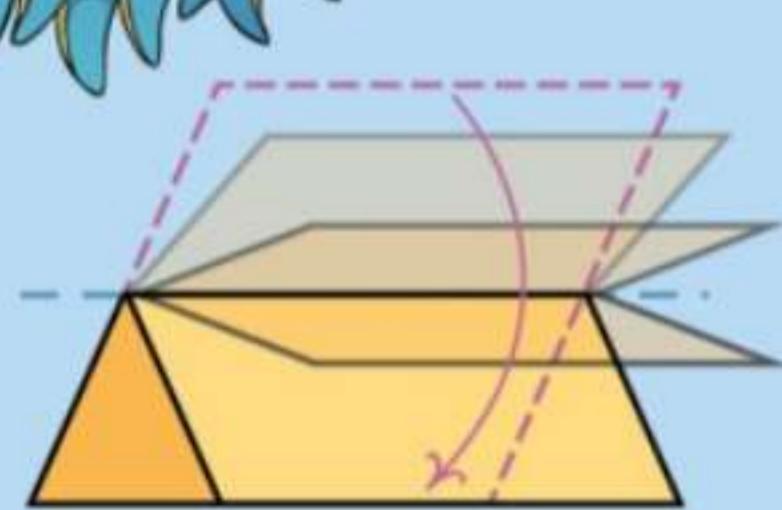


REFLECTIVE SYMMETRY IS SOMETIMES CALLED MIRROR SYMMETRY OR LINE SYMMETRY.





When you fold the rhombus on these lines, the two sides don't match up.

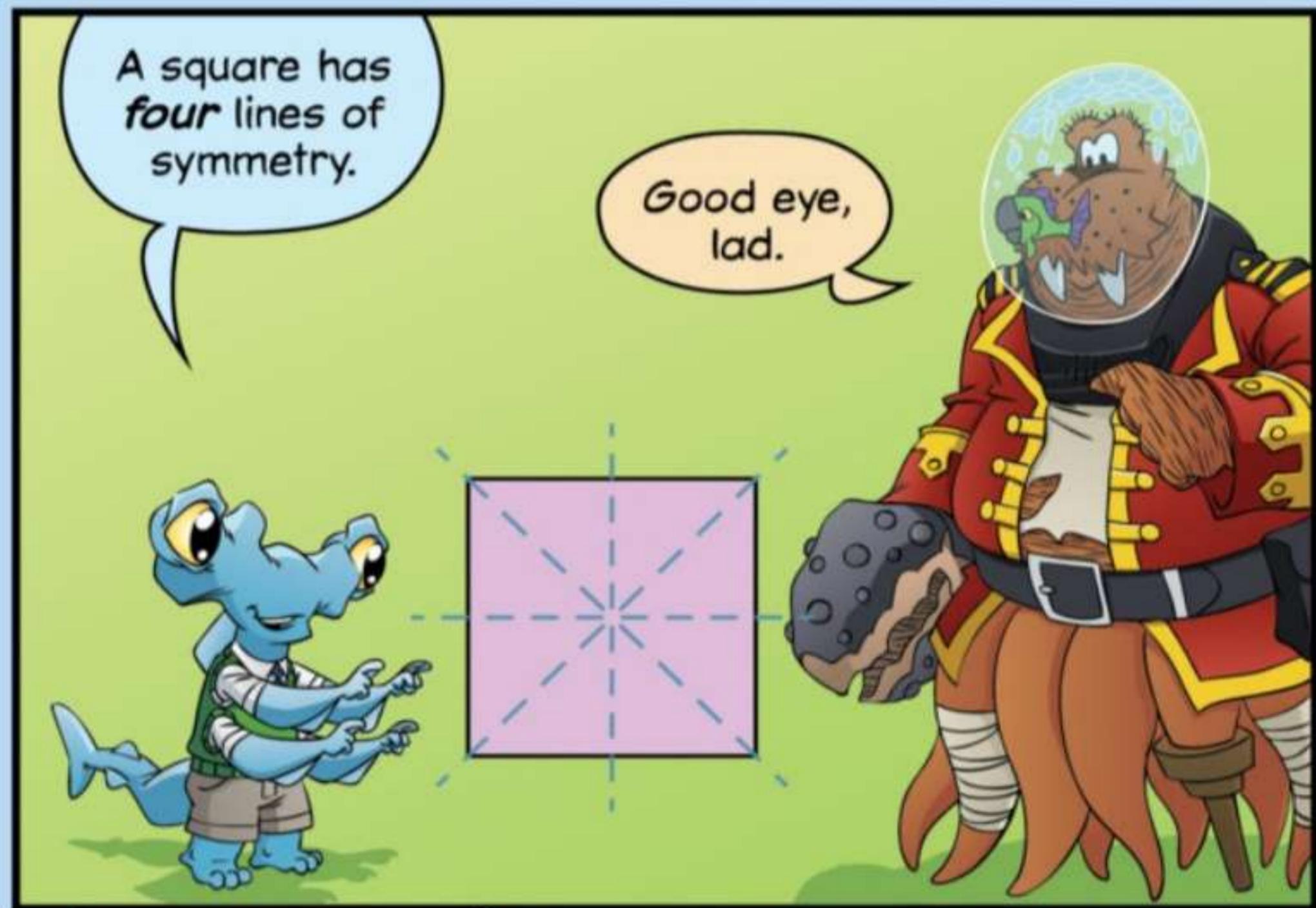


But *these* are lines of symmetry.

This rhombus has two lines of symmetry.

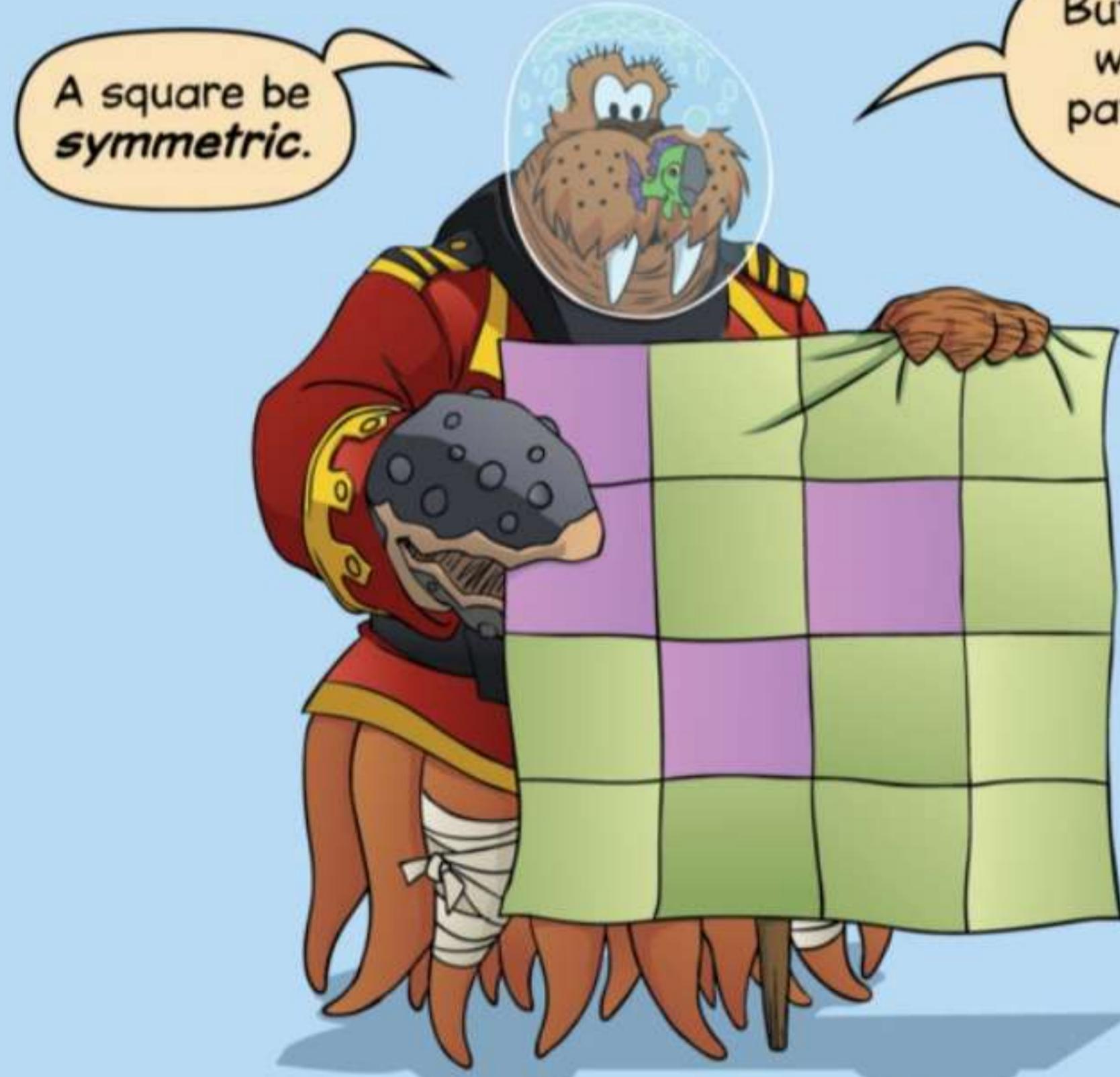


Aye.
How many lines o' symmetry be there in a square?



A square has **four** lines of symmetry.

Good eye, lad.



A square be **symmetric**.

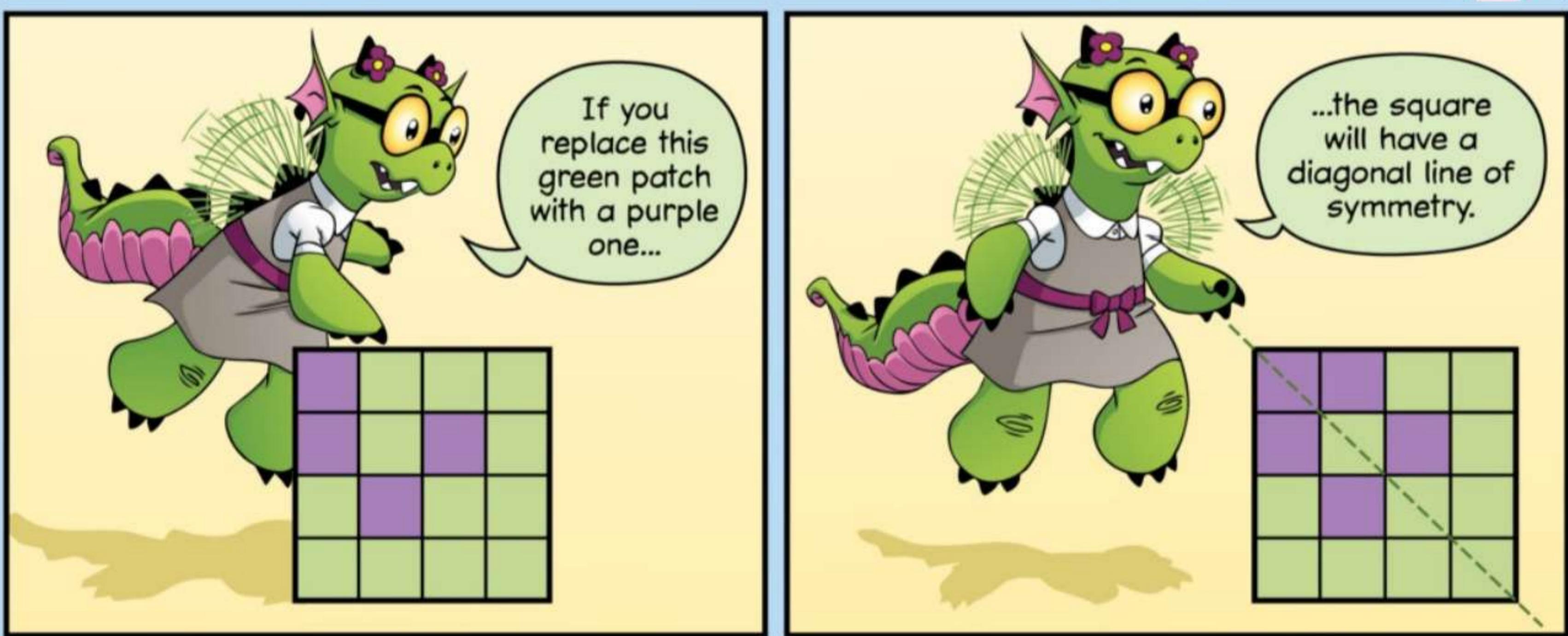
But what happens when we add a pattern inside the square?

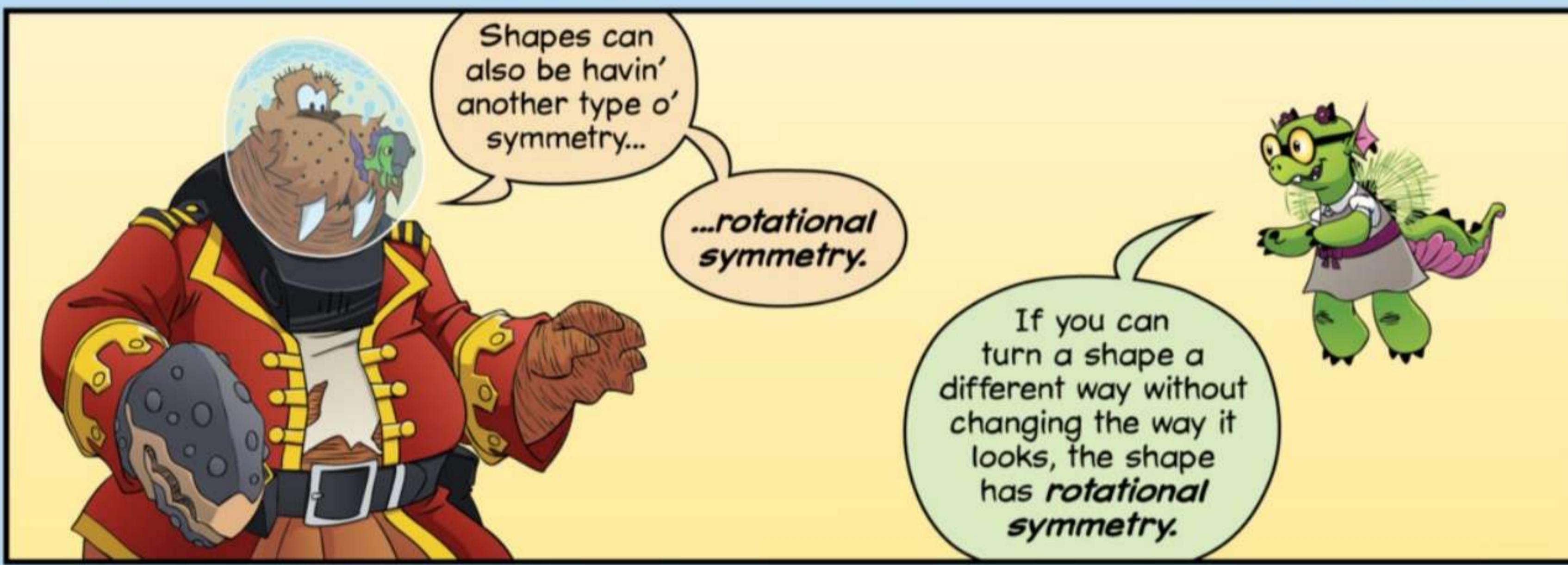
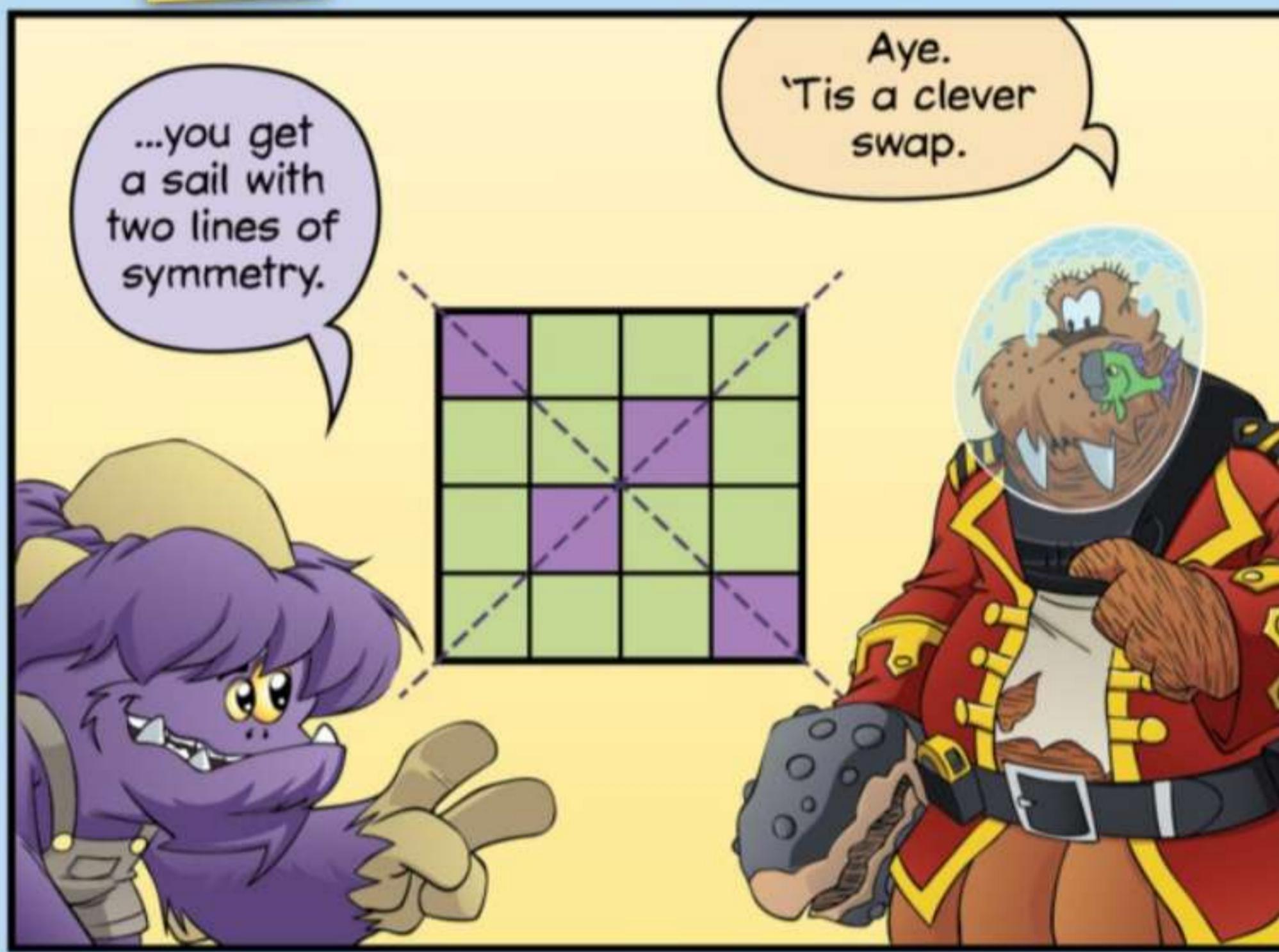
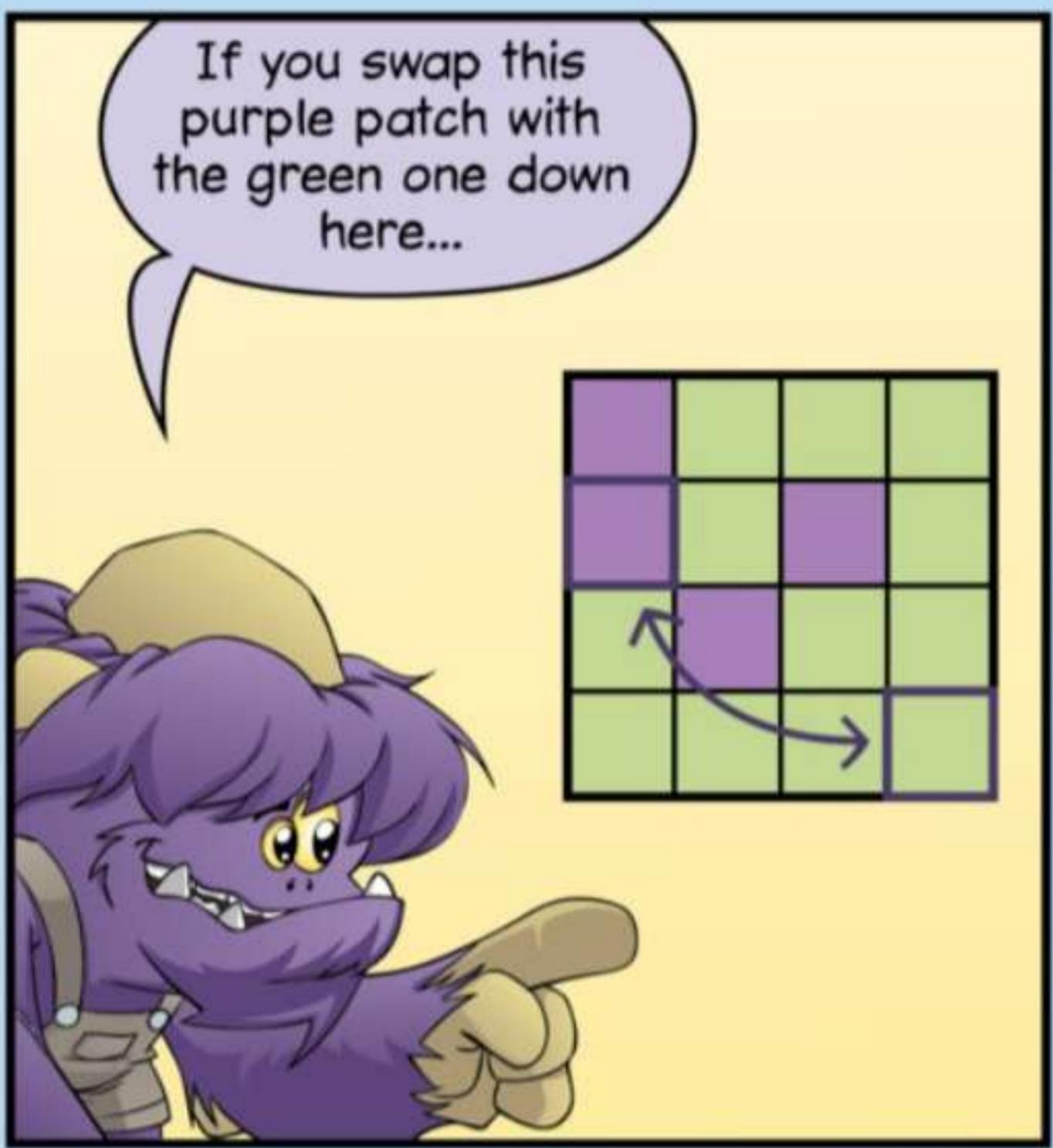
This sail from me first ship be made from 16 stitched squares...

...12 green, and 4 purple.

Be there any lines o' symmetry in the pattern on this sail?

Can you find a line of symmetry on Kraken's sail?







Aye. The number o' ways you can turn a shape to look the same be called its *order* of rotational symmetry.

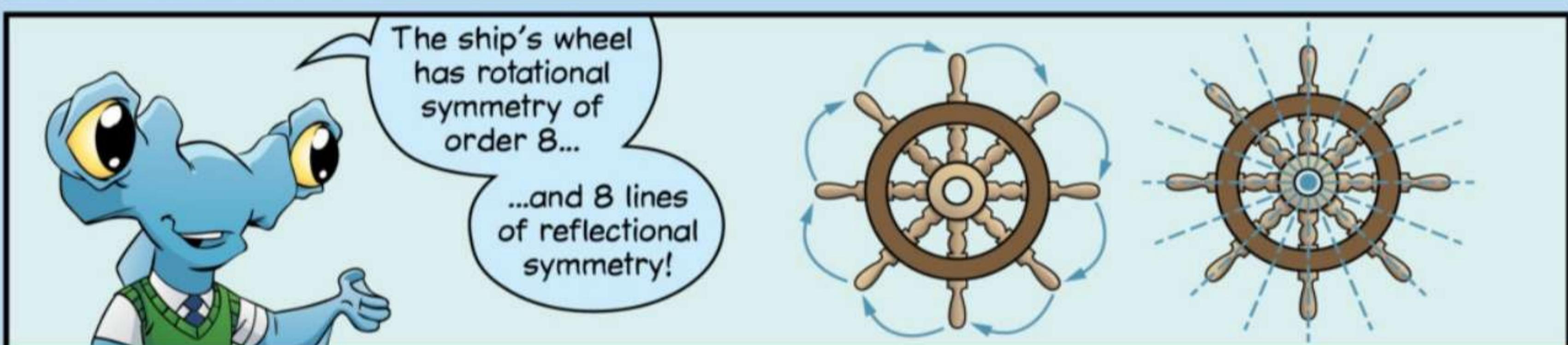
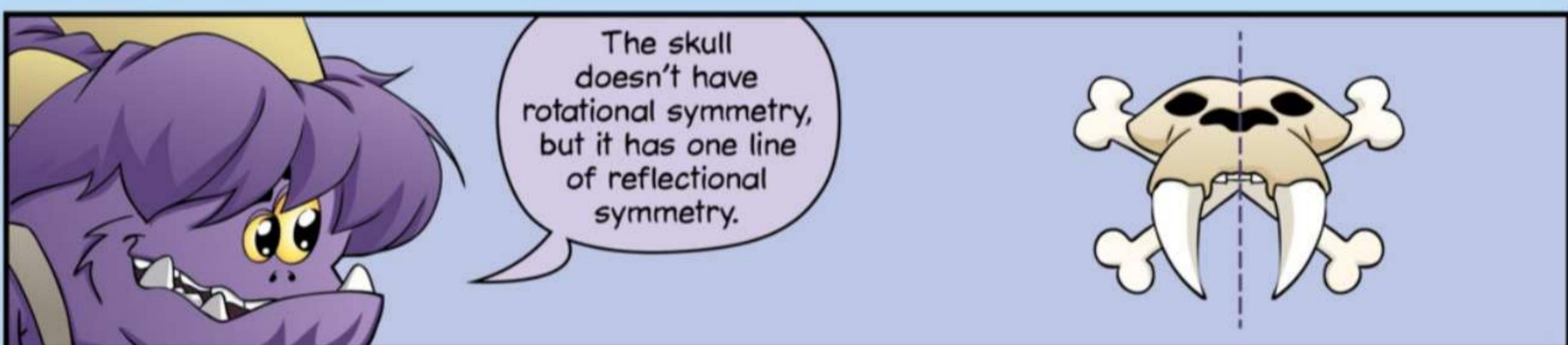
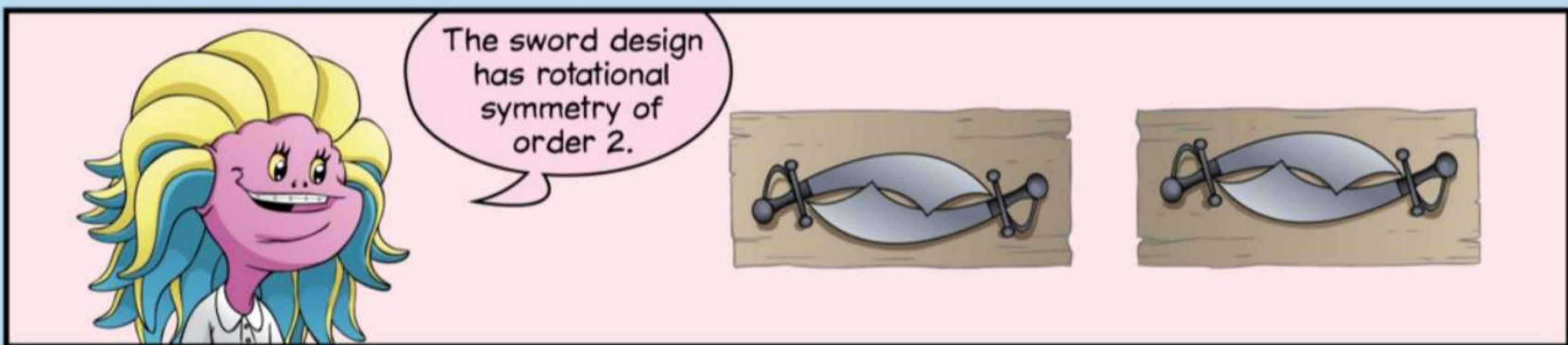
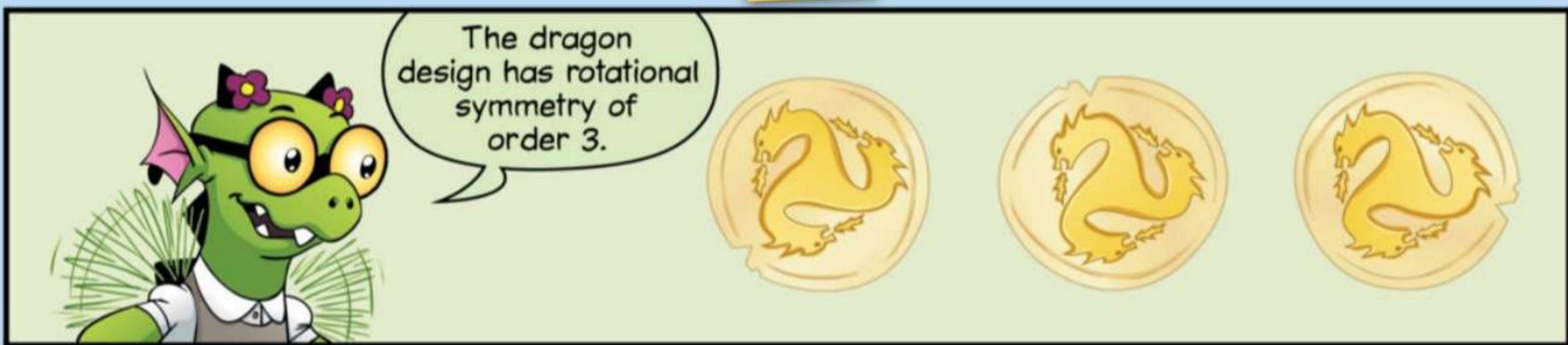


Right you arrrr!

*THIS INCLUDES NOT TURNING IT AT ALL (WHICH IS THE SAME AS TURNING IT ALL THE WAY AROUND), PLUS THE THREE TURNS SHOWN IN THE PANELS ABOVE.



Which shapes have reflectional and/or rotational symmetry?



RECESSIONS

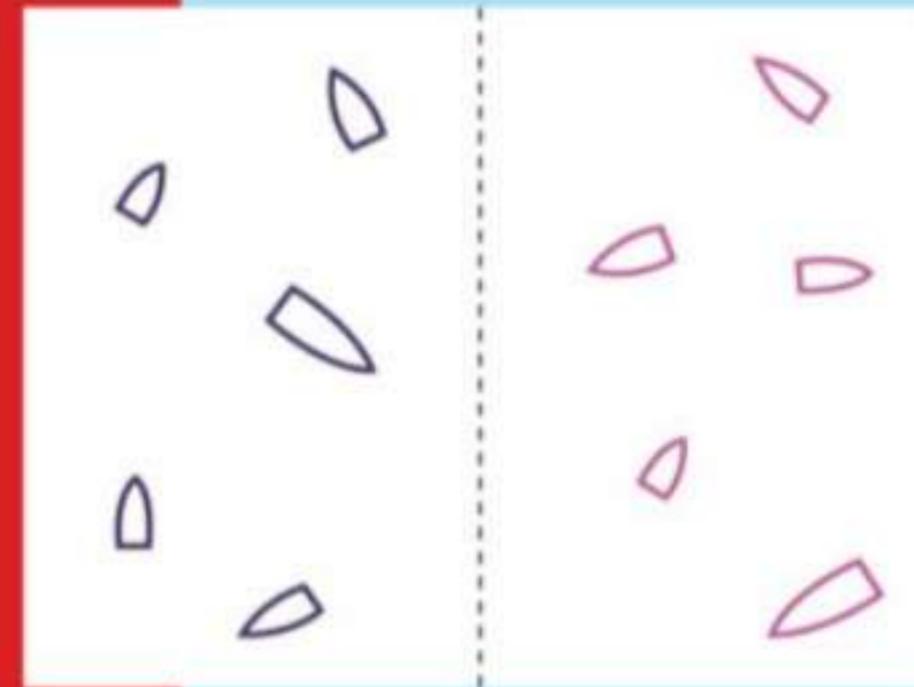
Carronade

Setup

The game is for two players.

Begin by folding a sheet of paper to divide it in half. Each player then traces five pirate ship outlines in ink on his or her side of the page.

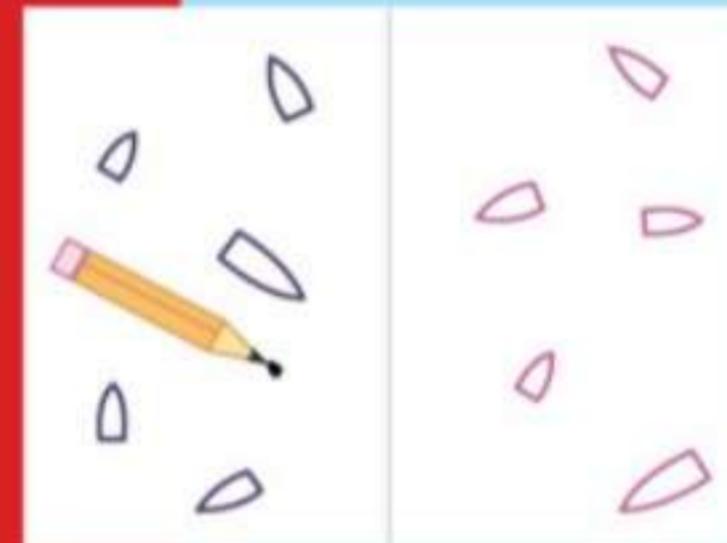
Players should use roughly the same five ship outlines. In our sample game, Grogg's ships are on the left and Winnie's are on the right.



Attack!

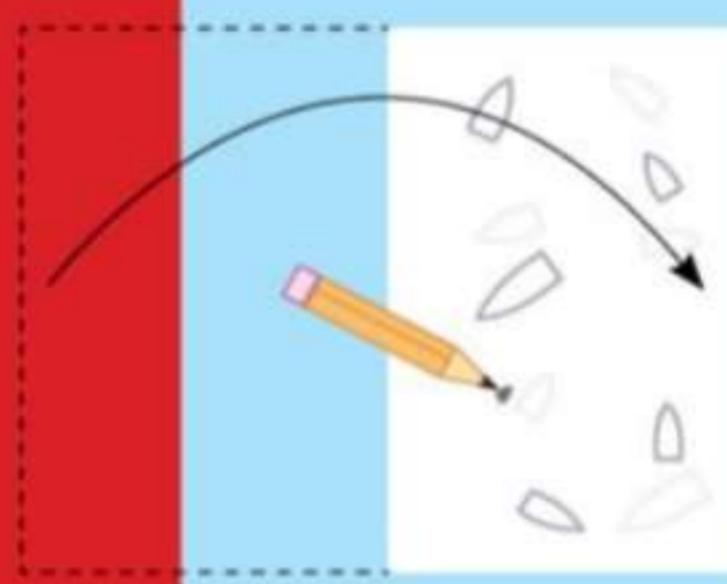
Step 1:

Players take turns firing cannonballs. In the example, Grogg goes first by making a small, dark pencil mark on his side of the paper as shown. Here, Grogg is firing a cannonball at Winnie's smallest ship.



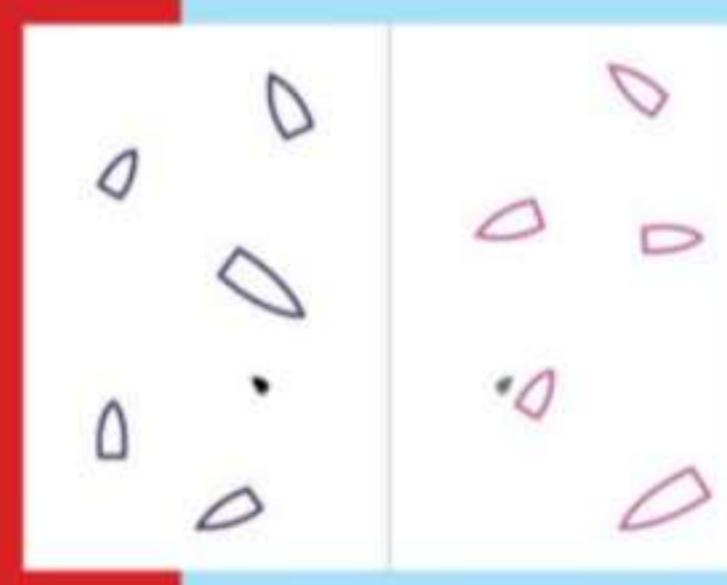
Step 2:

Grogg folds the paper in half. The dark pencil mark can be seen through the paper. Grogg scribbles over the mark, pressing on the back of the sheet to transfer his pencil mark to Winnie's side of the page.



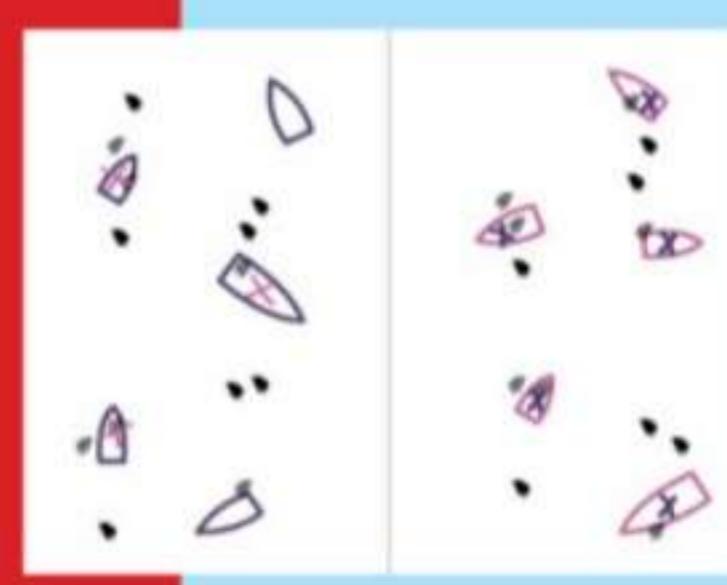
Step 3:

Grogg unfolds the paper to see where the cannonball landed. In the example shown, Grogg's shot was a miss. If the transferred mark touches your opponent's ship, the ship is sunk and marked with an X.



Victory!

The first player to sink all five opponent ships is the winner. Grogg is the winner of the game shown on the right.



Sample game boards, ship outlines, and game variations can be found at BeastAcademy.com.

