[ MATHS PROBLEM ]

# WHAT'S IN A NAME?

Understanding how inclusive definitions apply to shapes is difficult, says **Colin Foster** – here's how to use these technical names with confidence…

The idea that all squares are parallelograms, but that not all of the latter are the former, is something students often find difficult. They'll likely see parallelograms as wonky shapes with unequal adjacent sides and no right angles; applying the same term to a square therefore feels wrong.

## THE DIFFICULTY

This task helps to make the students' difficulties with inclusive definitions visible:

*True or false?*
*A. Every square is a parallelogram*
*B. Every parallelogram is a square*

Many students will be unsure about this. They might reject both statements, believing that squares and parallelograms are mutually exclusive. Or they might get muddled and think B is true, instead of A (The correct answer is that A is true and B is false).

If students answer correctly, you could ask, '*Make up five more examples of true/false statements like this, using different shape names that you know.*'

## THE SOLUTION

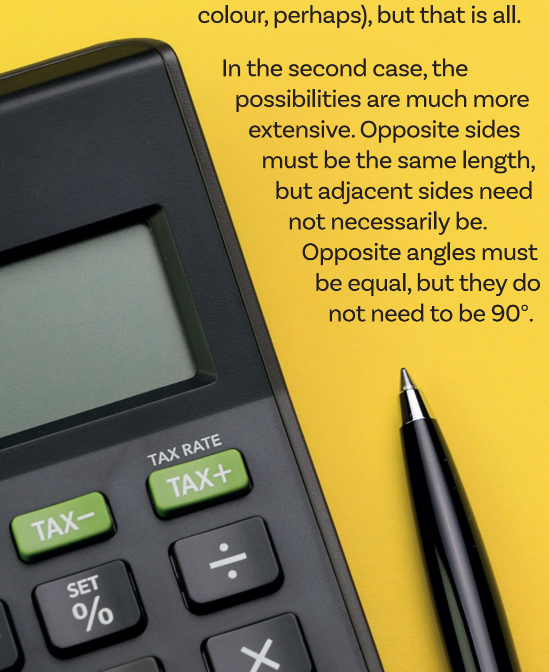
Here are some tasks that will help students make sense of inclusive definitions:

### 1. Draw some examples

- *Draw 5 different examples of a square. Make them as different as you can.*
- *Now, draw 5 different examples of a parallelogram. Make them as different as you can.*

In the first case, with a square there is not much that can be varied. Students can change the length of the sides and the orientation (and things like the colour, perhaps), but that is all.

In the second case, the possibilities are much more extensive. Opposite sides must be the same length, but adjacent sides need not necessarily be. Opposite angles must be equal, but they do not need to be 90°.



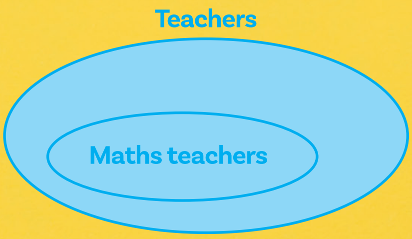

Now, you might ask:
- *Could one of your parallelograms actually be a square? Why / why not?*
- *Could one of your squares actually be a parallelogram? Why / why not?*

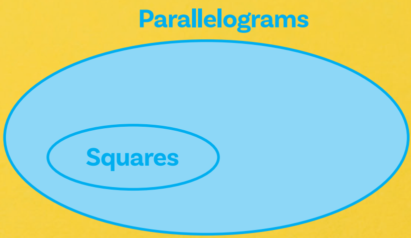
### 2. Use analogies to familiar things

Inclusive definitions aren't just a strange 'maths thing' – they're all around us, so switching to a more familiar context can be helpful. Consider the following statements:

*True or false?*
*A. Every maths teacher is a teacher*
*B. Every teacher is a maths teacher*

Here, it's pretty obvious that A is true and B is false. 'Maths teacher' is a specific example, a particular type of 'teacher'. Venn diagrams might help:




### Check for understanding

These tasks will help to assess how students' understanding has developed:

- *Think of 3 more examples of true/false statements like this that are **not** to do with maths*
- *Think of 3 more examples of true/false statements like this that **are** to do with maths*
- *Draw Venn diagrams to illustrate your examples*

Students might come up with statements such as:
- *Every dog is a mammal, but not every mammal is a dog*
- *Every multiple of 6 is an even number, but not every even number is a multiple of 6*

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