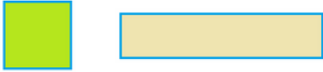## Squares as Rectangles?

G'Day! This is your math friend James. Today I am answering a question from Carla.
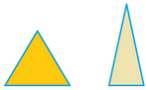
Is a square also a rectangle?

This is a question a lot of people ask!

Math books go to a lot of fuss to give different names to different kinds of shapes. But sometimes the description of the shape being named is confusing, especially if the description could also apply to a second shape.

Before I give my answer to Carla's lovely question, let me ask you these questions. What answer would you give to each of them? (Do you know the definition of each shape name mentioned?)

1. Is an equilateral triangle also an isosceles triangle?

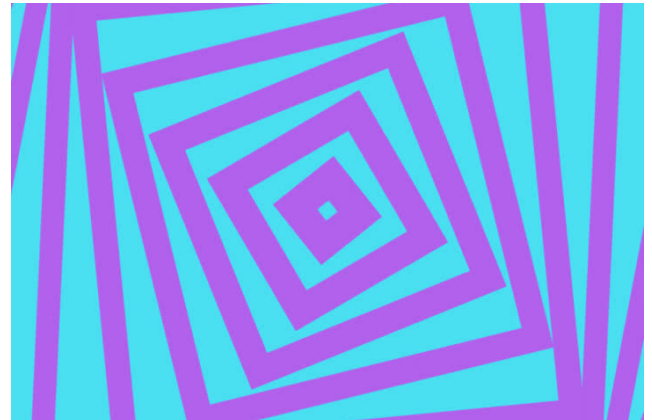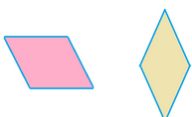2. Is a parallelogram also a trapezoid?

3. Is a square also a rhombus?

4. Is a diamond also a square?

5. Is a rhombus also a diamond?

The answer to Carla's question, and all the questions I ask, depend on the wording people use to explain what they mean by "square," "rectangle, "rhombus," and such. You have to read the words people write not so much as a mathematician, but as a lawyer!

For example, people say that a square is a "four-sided shape with four 90-degree angles and four sides the same length" and that a rectangle is a "four-sided shape with four 90-degree angles." If you read those words carefully, then a square fits the definition of being a rectangle too! The answer to Carla's question is: YES! A square is a rectangle.

A triangle is equilateral if it has "three sides all the same length" and isosceles if it "two of its sides are the same length." Well, if a triangle has three sides all the same length, then it certainly has two sides the same length. Equilateral triangles are isosceles triangles too!

A parallelogram is a "four-sided shape with two pairs of opposite sides parallel." But the definition of a trapezoid is tricky. Some people write: A trapezoid is a "four-sided shape with a pair of opposite sides parallel." Others write: A trapezoid is a "four-sided shape with exactly one pair of opposite sides parallel." The answer to question 2 is: It depends on who wrote your textbook!

What is your textbook's definition of a trapezoid? According to the author of your book, does a parallelogram fit the definition of being a trapezoid?

A rhombus is "a four-sided shape with all four sides the same length." Every square is an example of a rhombus.

Finally, the word diamond. This is not a word used by mathematicians and so I don't know if there is an official definition of one! Some people say that a diamond is a square with its edges at 45 degrees to the horizontal and vertical. But I am not sure if this is a complete definition. For example, the diamonds you see in a deck of cards look more like a rhombuses to me. (But maybe their sides are curved?)

A square is most everything in our list. It is a rectangle, a rhombus, and a parallelogram, and depending on your textbook, it might be a trapezoid too! (Alas ... A square is not a triangle, isosceles or otherwise!)

Check out **MATHICAL** for award-winning math books for middle-schoolers and teens, the YouTube channel **NUMBERPHILE** for math videos galore, and **MORE MATH!** for even more resources. Wowza!
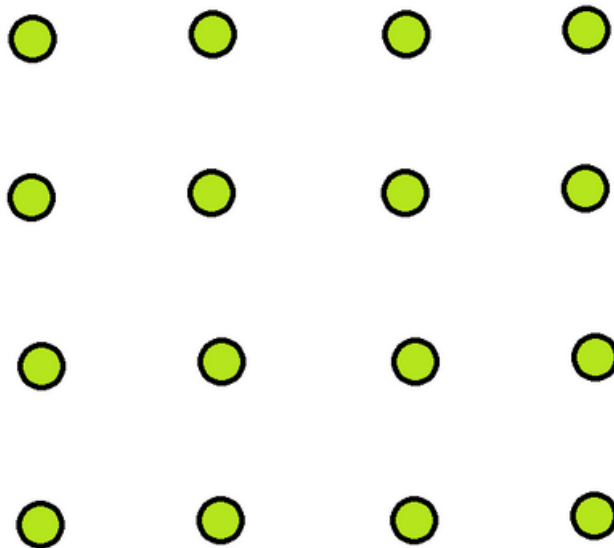
Chistopher Danielson's book **WHICH ONE DOESN'T BELONG?** is a perfect fit for today's theme!

Do you have a math question for me to answer, or try to answer?

Write to me **at the website**. Each week I'll pick a new question and give my thoughts on it!

puzzle #1
One can draw 20 squares on the array of dots shown below with each corner of the square you draw on a dot. Can you find all 20?

puzzle #2
How many rectangles can you draw on the grid shown with each corner of the rectangle you draw on a dot?

About the Author: Dr. James Tanton

The NMF Weekly is written by mathematician Dr. James Tanton as a resource for friends and fans of the 2021 National Math Festival.

Learn more at globalmathproject.org/nmf-weekly & nationalmathfestival.org