In our mathematicians toolbox, we need ways of thinking that can help us solve problems. These include:

Positive attitudes: **being curious**, **being willing to take risks** (not worrying about getting it wrong!), **persevering** (keeping going)

Useful strategies like our Mathematical Thinking Powers

Useful questions to ask ourselves:

I wonder what would happen if...?

How can I show this?

Is this the best way to start? What else could I try?

Have I seen something like this before?

Mathematical Thinking Powers

Imagining	Expressing (Showing & talking)
Imagining is the ability to think about "What will happen if…?". You can imagine objects, patterns, numbers and resources to help you solve problems. Imagination allows you to contemplate what is not actually present. E.g. I think it will be an odd number.	Expressing is any means of communicating mathematically. It is telling or showing each other how you work something out – it can be talking, sketches, diagrams, using equipment, recording equations etc. E.g. "Area = length x height ….so the area of this rectangle is 9cm x 5cm = 45cm²."
Conjecturing (Clever guessing)	**Convincing**
Conjecturing is making educated guesses based on what you have noticed. If you see a pattern, you can make clever guesses about what you think will happen because of the pattern you saw. E.g. "4, 8, 12 and 16 are all even. I think all the multiples of 4 must be even."	Convincing is the process of showing that your ideas are correct (or incorrect). E.g. "All multiples of 4 must be even because all multiples of 4 are double the corresponding multiple of 2, which means they must me multiples of 2, which are all even."
Specialising (Trying it out)	**Generalising (Making rules)**
Specialising is trying out a few specific examples to test an idea or find out more information. E.g. "Does odd plus odd make an even?" "Okay, let's try it. 3+1=4. Erm…5+7=12. And 1+5=6. Looks like it, yes."	Generalising is making rules (generalisations) that work in different situations. E.g. "Right, so odd + odd always makes an even."
Organising	**Classifying (Sorting out)**
Organising is using a system or working systematically (having a clear starting and finishing point). It allows you to see what you have done and notice patterns. E.g. "If we always start with the biggest number first, followed by the next biggest, then the next biggest, until we get to the smallest number last."	Classifying is identifying common **properties** or differences by which we can sort ideas or information. E.g. "3, 18, 27 and 42 are all multiples of three, but only 18 and 27 are also multiples of 9."

Three Way Mix-up investigation

Jack has three blue tiles, three yellow tiles and three red tiles.
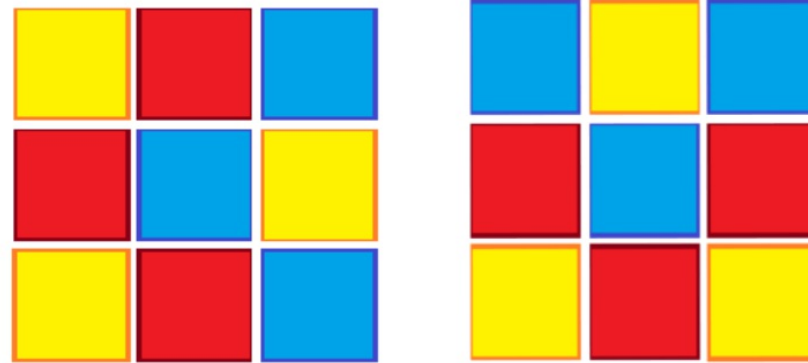He put them together like this to make a square.
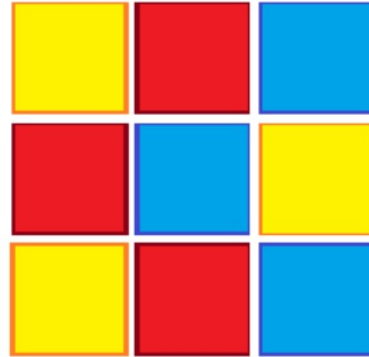
He made the rule that you could not put two tiles of the same colour beside each other.

Can you find another way to do it?

What can you use to help you?
How can you keep track of your ideas?
Which ways will work best for you?

Three Way Mix-up investigation

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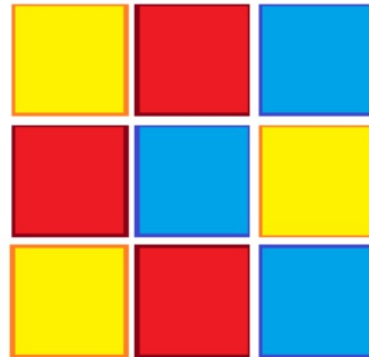He put them together like this to make a square.

What's the same?
What's different?

He made the rule that you could not put two tiles of the same colour beside each other.

Three Way Mix-up investigation

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How can you keep going?
What else could you try?
What is in you toolbox? *See next slide*

He made the rule that you could not put two tiles of the same colour beside each other.

Can you find another way to do it?
Can you find ALL the ways to do it?

How can you keep track of your ideas?
How can you convince me that you found all the ways?
Can you think of a system to use?

Success criteria - what did you try?

As a learner:

- be curious
- take risks
- persevere

Ask yourself:

- What would happen if...?
- Is this the best way to start? What else could I try?
- How can I show this?
- Have I seen something like this before?

If you get stuck, try:

- imagining
- specialising (try it out, have a go)
- conjecturing   (say what you think)
- convincing (yourself, each other, anyone!)
- organising (have a system)
- classifying (describe your arrangements, what is the same or different about them?)

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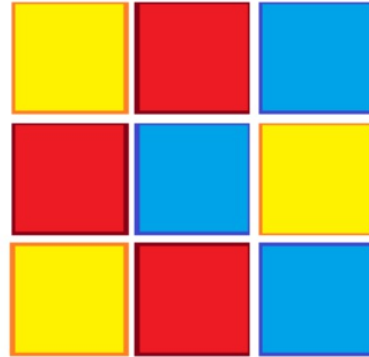
How many ways have you found so far?
Can you describe your strategy?
Did you keep trying?

He made the rule that you could not put two tiles of the same colour beside each other.

Can you find another way to do it?
Can you find ALL the ways to do it?

How can you convince me that you found all the ways?