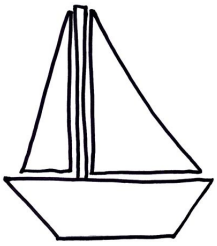
How many ways?

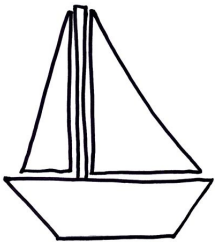
How many ways can you colour in the sails on this boat using only red and blue?

Use the sheet of blank boats to help. Both of the sails can be the same colour.



This time, you have three colours to choose from: green, yellow and purple. How many ways can you colour the sails in this time?

Use the sheet of blank boats to help



This time, you can choose four colours to fill in the sails. How many ways are there with four colours?

Use the sheet of blank boats to help

Challenge question…

Without colouring them in, how many ways could you colour in the sails if you have five colours? Write down an explanation of how you worked out your answer.

If you need a clue, use the pattern of how many ways so far. Is it a number pattern you know?

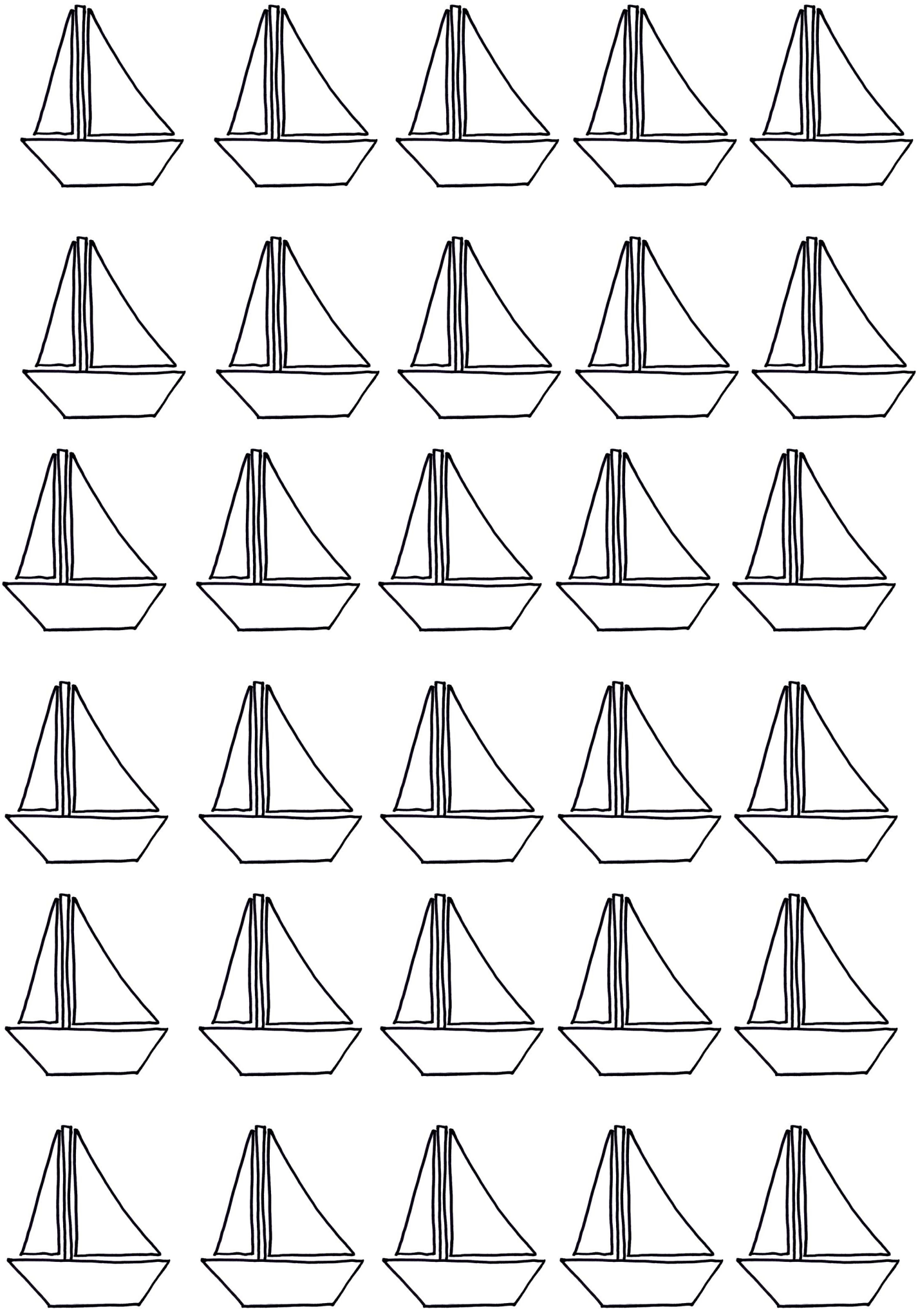
How many ways would there be if you used the seven rainbow colours?

Super Challenge questions…

1. How many ways would there be if you could colour in the bottom of the boat too? Start with two colours, then three and so on. Build up a number pattern you can use to predict for the whole rainbow.

2. How many ways would there be if you could not repeat a colour on the sails? Start with two colours , then three and so on. This is a trickier pattern, can you spot what it is? Explain the pattern and use it to predict the number of ways for the whole rainbow.

We would love to see your solutions. Send a photo of them to the Maths Department at the Park Hall email address



Teacher notes

The answers are:

Two colours: 4

Three colours: 9

Four colours :16

These should fit on one sheet of boats.

Encourage a system so that they know they have them all with no repeats. Perhaps they could be cut out and the pupils group them with all the same first colour sail so that they can see that there are say 4 piles with 4 boats in each. This maybe as far as some pupils get.

For two sails the pattern is the square numbers—they need to times the number of colours by itself. For some pupils, they may be able to write this using symbols like c^2. So for the rainbow, there are 7x7=49 ways

If the boat is coloured too, then there are 8, 27, 64 ways. This follows the cube numbers. Again, these can be organised say for three colours into three piles, each with a certain colour boat. Each of these piles can be split into three piles of three based on the colour of the first flag. So 3x3x3 = 27. Some may want to write this in symbols

If colours cannot be repeated, then through an organised system of sorting the boats, the pupils will see that the number of ways is 2x1, 3x2, 4x3 etc

This is a branch of maths studied at GCSE called combinations and permutations.

It could be taken further through these nrich tasks

https://nrich.maths.org/108

https://nrich.maths.org/7397

https://nrich.maths.org/2873