Elf Houses Maths Investigation

The elves in the Elf Village live in houses. Every house has three storeys (floors) so that the elves can use some of the space as a workshop and to store all the toys that they make. Each different storey must be painted either with a different colour or the same colours – that's the rule in Elf Village.

How many ways could the houses be painted if you have two colours?

For example, imagine the two colours are red and blue.

This might be a good way to start.

B
B
B

All the storeys are painted blue, so this is the first way the house can be painted.

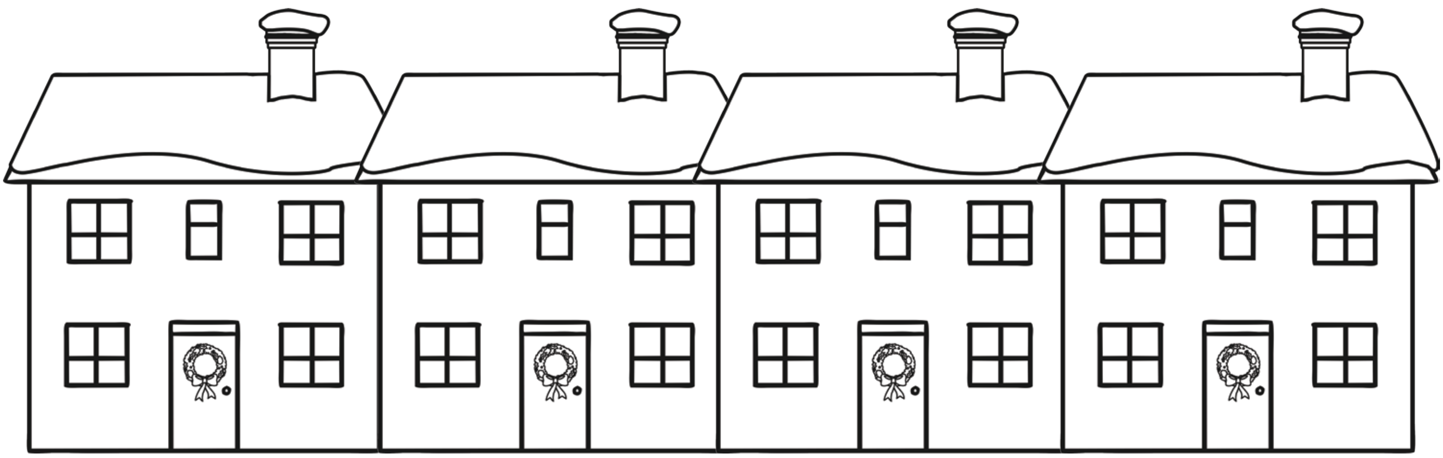
B
B
R

The first two storeys are blue, with the bottom floor red, so this is the second way the house can be painted.

B
R
R

This might be the third way to paint the houses.

Can you carry this on and work out how many different ways there are to paint the houses?



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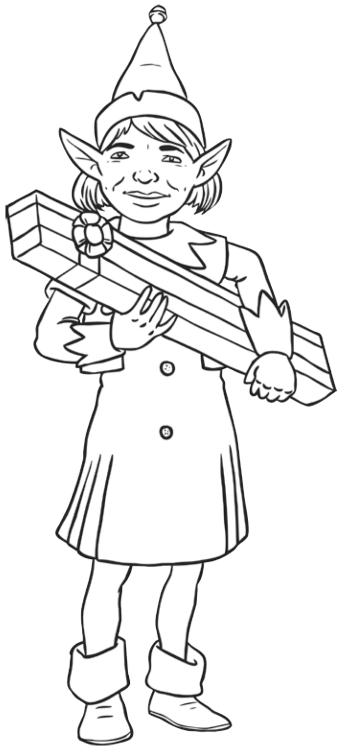
The elves in the Elf Village live in houses. Every house has three storeys (floors) so that the elves can use some of the space as a workshop and to store all the toys that they make.

How many ways could the houses be painted if you have:



Two colours?

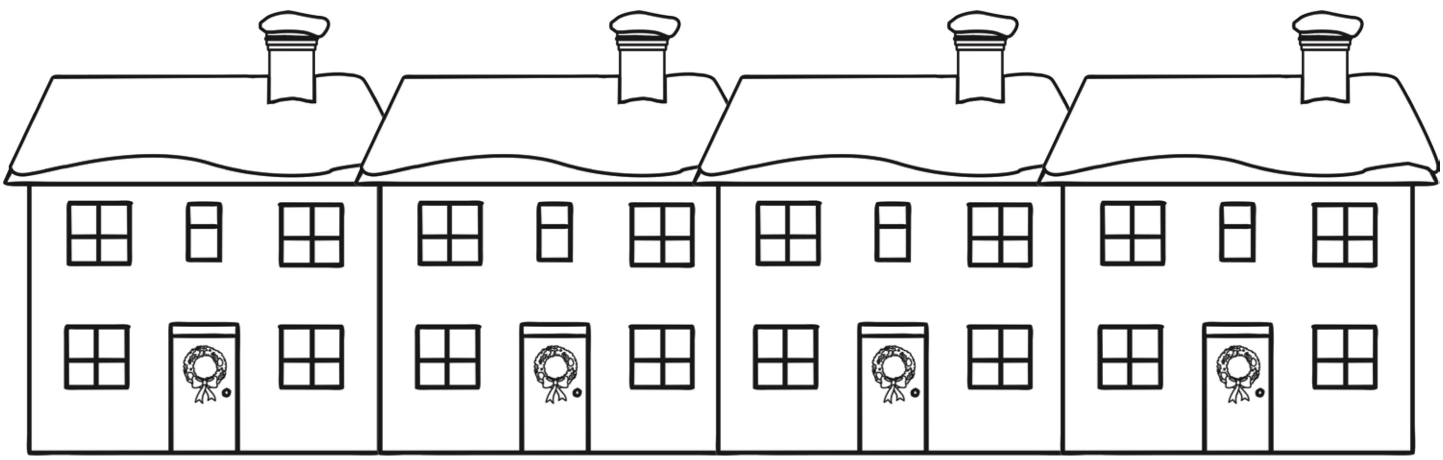
Three colours?

Four colours?

Five colours?

Investigation

Can you keep investigating with more and more colours? Do you see any patterns? Can you explain any patterns to a friend? Is there any advantage in working systematically on this problem?



Elf Houses Maths Investigation
Answers

This investigation is to encourage children to work systematically to ensure they have all combinations. They may not set out working systematically to begin with, so this can be worked on during the task.

Example: (B = blue, R= red)

B B B

B R B

B R R

R B B

R B R

R R R

B B R

R R B

For three colours: There are 3 permutations that use only 1 colour. There are 6 permutations with 2 purples, 6 permutations with 2 blues and 6 permutations with 2 red. There are then 6 further permutations with 1 of each. This makes 27 altogether.

For four colours there are 64 permutations.

For five colours there are 125 permutations.