

7-9: REMOTE MATHS

EDITION 14

NUMBER AND ALGEBRA - INVESTIGATIONS

Mathematical language: symmetrical, square numbers, consecutive numbers, squares, multiple, times, rule, times table, shift, consecutive, units, digit, odd, even, prime, difference, composite.

INVESTIGATION 1

SQUARES - HOLLOW SQUARES

Adapted from Nrich Maths

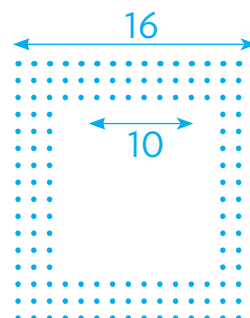
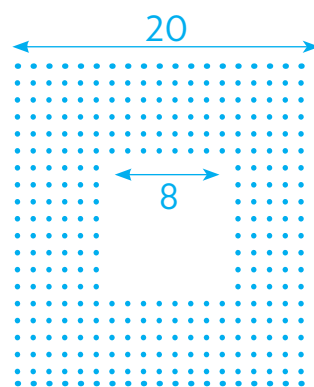
In Napoleonic battles a hollow square was a popular formation for an infantry battalion designed to cope with Cavalry charges. An example is shown in the picture which shows a recreation of Wellington's army at Waterloo.

Here are two diagrams showing symmetrical hollow square formations:

1. How could you quickly work out the number of dots in each?
2. Show two different methods of dividing the dots for a quick count.
3. A general has 960 soldiers. How many different ways can the general arrange the battalion in a symmetric hollow square?

Enabling prompt: Try a systematic way of listing these, starting with the smallest possible square number after 960.

Extending prompt: Can you find a general strategy for arranging all possible battalions into possible symmetric hollow squares?



INVESTIGATION 2

PART 1: PATTERNS AND PROBLEMS - SHIFTING TIMES TABLES *Adapted from Nrich Maths*

The numbers in the four times table are 4, 8, 12, 16... 36, 40, 44... 100, 104, 108...

We could shift the four times table up by 3 and end up with 7, 11, 15, 19... 39, 43, 47... 103, 107, 111...

- What do you notice about the differences between consecutive terms in each sequence?

Go to this website to access an interactive applet: <https://nrich.maths.org/shifting>

The applet has 4 levels, start at Level 1 and click "New Numbers". It will display five numbers from a **shifted** times table. On Levels 1 and 2 it will always display five consecutive terms from the shifted times table.

On Levels 3 and 4 it could display any five terms from the shifted times table.

- Use the interactivity to generate some sets of five numbers.
- Can you work out the times table and by how much it has been shifted?

Once you are confident that you can work out the times table and the shift quite easily, here are some questions to consider:

- What can you say if the numbers are all odd?
- What about if they are all even?
- Or a mixture of odd and even?
- What can you say if the units digits are all identical?
- What if there are only two different units digits?
- What can you say if the difference between two numbers is prime?
- What can you say if the difference between two numbers is composite (not prime)?
- Explain how you worked out the table and shift each time. Why will your method always work?

PART 2: CHARLIE'S DELIGHTFUL MACHINE *Adapted from Nrich Maths*

Go to <https://nrich.maths.org/delightful>. The machine has four lights, each light is controlled by a rule. If you choose a number that satisfies the rule, the light will go on. Some numbers may turn on more than one light!

The applet has 3 levels, start at Level 1, enter various numbers to see which lights each number switches on.

- Can you work out a strategy to switch on each of the lights?
- Once you have a strategy, challenge yourself to find some four-digit numbers that turn on each light.

Look out for more tasks next week!

