

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic

Algebra

Position-to-term rules for sequences of patterns

v1.0

Name _____

Materials

For this paper you must have:

- Mathematical instruments



Information

- The marks for questions are shown in brackets

Advice

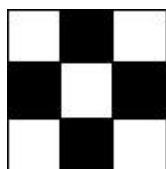
- In all calculations, show clearly how you work out your answer

For question 1 you must **NOT** use a calculator.

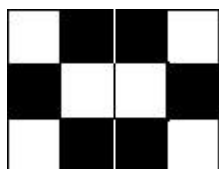


Q1.

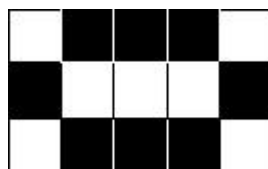
A sequence of patterns uses black squares and white squares.
Here are the first three patterns.



Pattern 1



Pattern 2



Pattern 3

- (a) How many black squares are in Pattern 4? (1)
- (b) Circle the expression for the number of black squares in Pattern n
- $4n$
 $n + 2$
 $6n - 2$
 $2n + 2$
- (1)

- (c) Will the number of black squares always be even?
Tick a box.

Yes

☐

No

☐

Give a reason for your answer.

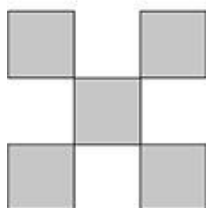
(1)
(Total 3 marks)

For the rest of the questions, you may use a calculator.

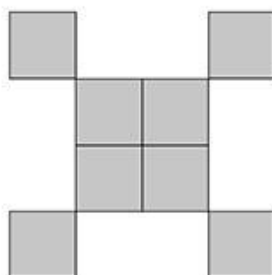


Q2.

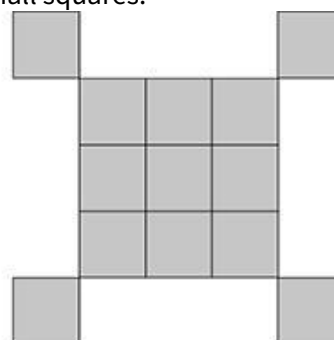
Here are the first three Patterns in a sequence made up of small squares.



Pattern 1



Pattern 2



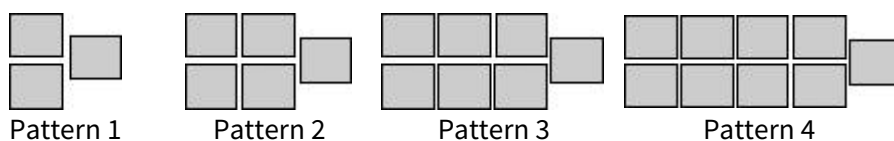
Pattern 3

- (a) Draw Pattern 4 (1)
- (b) The expression for the number of small squares in Pattern n is $n^2 + 4$
Work out the least value of n for which the number of small squares is greater than 500

(1)
(Total 2 marks)

Q3.

The diagram shows a sequence of patterns.



(a) Work out the number of shapes in Pattern 5.

(1)

(b) Complete the rule below.

Number of rectangles = Pattern number $\times$ +

(1)

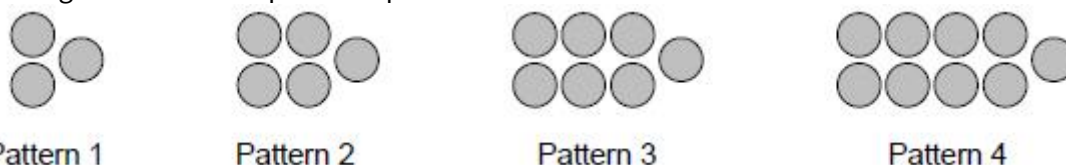
(c) Which pattern number has 33 rectangles?

(1)

(Total 3 marks)

Q4.

The diagram shows a sequence of patterns.



(a) Work out the number of circles in Pattern 6

(1)

(b) Complete the rule below.

Number of circles = Pattern number $\times$ +

(1)

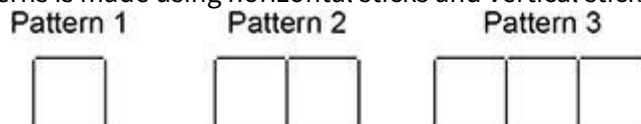
(c) Which Pattern number has 51 circles?

(1)

(Total 3 marks)

Q5(H).

A sequence of patterns is made using horizontal sticks and vertical sticks.



The table shows the number of horizontal sticks and vertical sticks in each pattern.

Pattern	Number of horizontal sticks	Number of vertical sticks
1	2	2
2	4	3
3	6	4

What fraction of the total number of sticks in Pattern n are horizontal?

Give your answer in terms of n .

(Total 3 marks)