



Diagram Sequences



REVISE THIS TOPIC

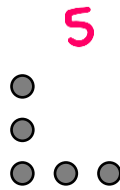
1 Here is a sequence of patterns made with counters.



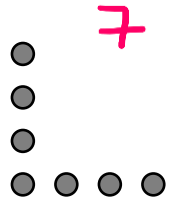
pattern number 1



pattern number 2



pattern number 3



pattern number 4

(a) Write down the number of counters needed for pattern number 5.

9

(1)

(b) Find an expression, in terms of n , for the number of counters in pattern n .



$2n - 1$

(2)

(c) Work out the number of counters in pattern number 50

$$2 \times 50 - 1$$

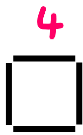
99

(2)

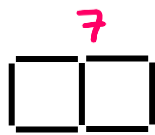
(Total for Question 1 is 5 marks)



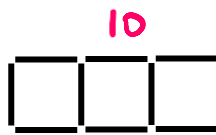
2 Here is a sequence of patterns made with sticks.



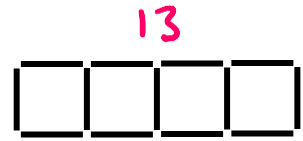
pattern number 1



pattern number 2



pattern number 3



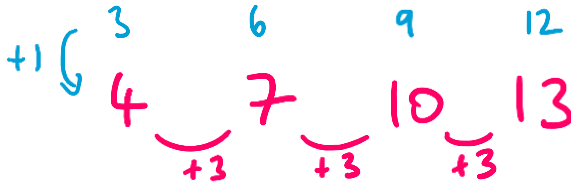
pattern number 4

(a) Write down the number of sticks needed for pattern number 5.

16

(1)

(b) Find an expression, in terms of n , for the number of sticks in pattern n .



$3n + 1$

(2)

(c) Work out the number of sticks in pattern number 100

$3 \times 100 + 1$

301

(2)

(d) Jamie has 61 sticks.

He can make one of the patterns in the sequence using all of his sticks.

Work out the pattern number that Jamie can making using all of his sticks.

$$\begin{aligned}
 3n + 1 &= 61 \\
 3n &= 60 \\
 n &= 20
 \end{aligned}$$

20

(2)

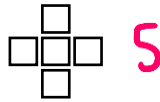
(Total for Question 2 is 7 marks)



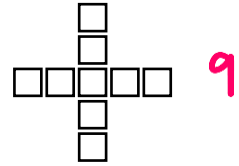
3 Here is a sequence of patterns made with squares.



pattern number 1



pattern number 2



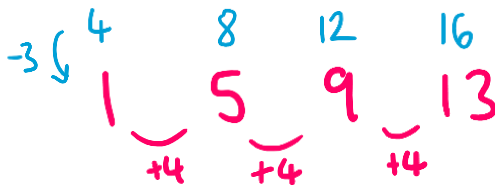
pattern number 3

(a) Write down the number of squares needed for pattern number 4.

13

(1)

(b) Find an expression, in terms of n , for the number of squares in pattern n .



$4n - 3$

(2)

(c) Work out the number of squares in pattern number 30

$$4 \times 30 - 3$$

117

(2)

(d) Lauren makes a pattern from the sequence using 57 squares.
Work out the pattern number that Lauren makes.

$$\begin{aligned}
 4n - 3 &= 57 \\
 4n &= 60 \\
 n &= 15
 \end{aligned}$$

15

(2)

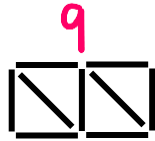
(Total for Question 3 is 7 marks)



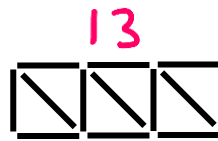
4 Here is a sequence of patterns made with sticks.



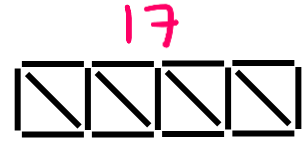
pattern number 1



pattern number 2



pattern number 3



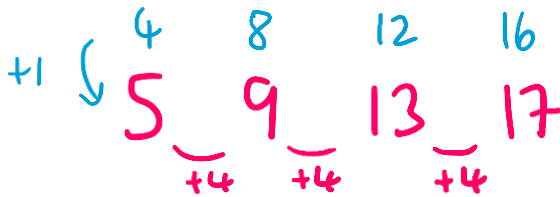
pattern number 4

(a) Write down the number of sticks needed for pattern number 6.

25

(1)

(b) Find an expression, in terms of n , for the number of sticks in pattern n .



$4n + 1$

(2)

(c) Work out the number of sticks in pattern number 60

$4 \times 60 + 1$

241

(2)

(d) Harriet has 91 sticks.

Show that it is not possible for Harriet to make a pattern from the sequence using **all** of her sticks.

$$\begin{aligned}
 4n + 1 &= 91 \\
 4n &= 90 \\
 n &= 22.5
 \end{aligned}$$

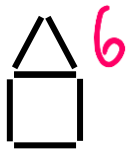
22.5 is not
an integer

(2)

(Total for Question 4 is 7 marks)



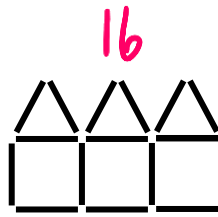
5 Here is a sequence of patterns made with sticks.



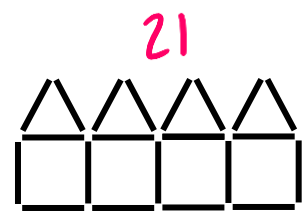
pattern number 1



pattern number 2



pattern number 3



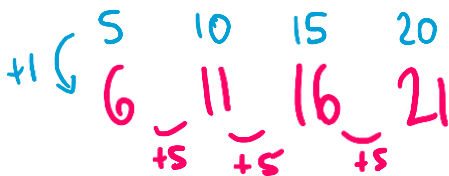
pattern number 4

(a) Write down the number of sticks needed for pattern number 5.

26

(1)

(b) Find an expression, in terms of n , for the number of sticks in pattern n .



$5n + 1$

(2)

(c) Work out the number of sticks in pattern number 1000

$5 \times 1000 + 1$

5001

(2)

(d) Mo has 69 sticks.

He uses as many of his sticks as possible to make a pattern from the sequence.

Work out the of extra sticks Mo has after making this pattern.

$5 \times 13 + 1 = 66 \quad \checkmark$

$69 - 66 = 3$

$5 \times 14 + 1 = 71 \quad \times$

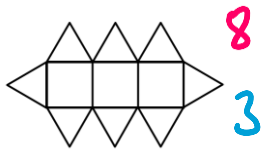
3

(2)

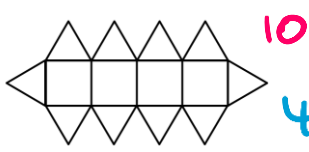
(Total for Question 5 is 7 marks)



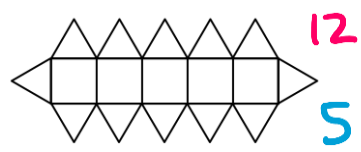
6 Here is a sequence of patterns made with triangles and squares.



pattern number 1



pattern number 2



pattern number 3

(a) Write down the number of **triangles** needed for pattern 4.

14

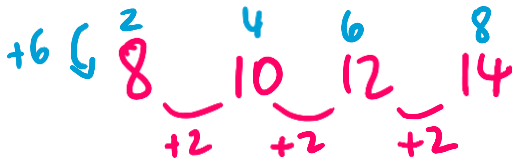
(1)

(b) Write down the number of **squares** needed for pattern 4.

6

(1)

(c) Find an expression, in terms of n , for the number of **triangles** in pattern n .



$2n + 6$

(2)

(d) One of the patterns in the sequence uses 68 **triangles**.
Work out the number of **squares** that are in this pattern.

$$\begin{aligned}
 2n + 6 &= 68 \\
 2n &= 62 \\
 n &= 31
 \end{aligned}$$

$$\begin{aligned}
 \text{squares} &= n + 2 \\
 &= 31 + 2 \\
 &= 33
 \end{aligned}$$

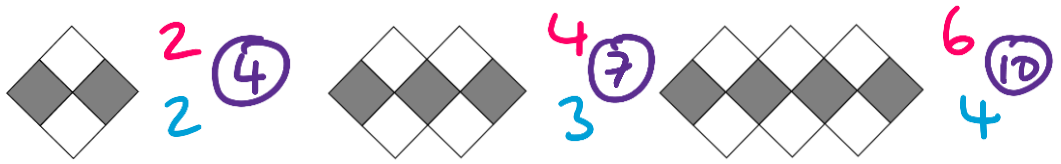
33

(3)

(Total for Question 6 is 7 marks)



7 Here is a sequence of patterns made with grey and white squares.



pattern number 1

pattern number 2

pattern number 3

(a) Write down the number of **white** squares needed for pattern 4.

8

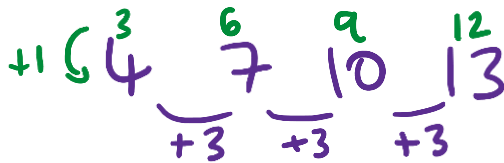
(1)

(b) Write down the number of **grey** squares needed for pattern 4.

5

(1)

(c) Find an expression, in terms of n , for the number of **squares** in pattern n .



$3n + 1$

(2)

(d) One of the patterns in the sequence uses 55 **grey** squares.
Work out the number of **white** squares that are in this pattern.

grey $n + 1$
white $2n$

$$\begin{aligned}
 n + 1 &= 55 \\
 n &= 54 \\
 2 \times 54 &= 108
 \end{aligned}$$

108

(3)

(Total for Question 7 is 7 marks)

