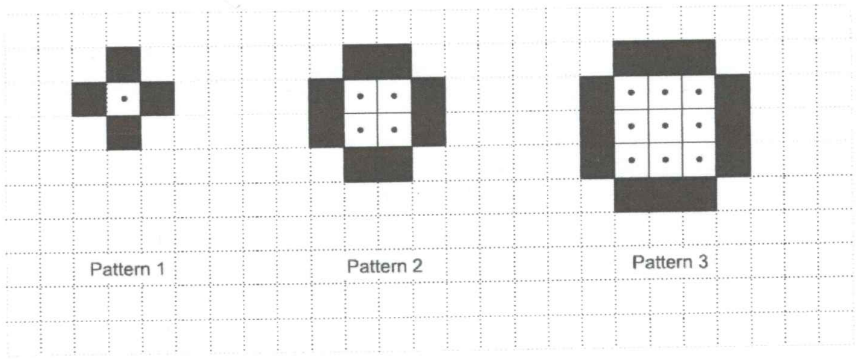
JustMaths

Sequences (F)

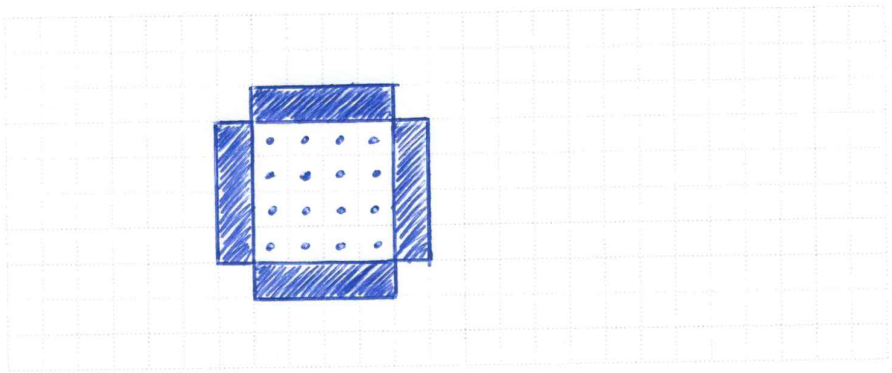
A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

Name:	ANSWERS BY
Total Marks:	KERRY DUNTON

1. Here are the first three patterns in a sequence.



(a) Draw Pattern 4 in this sequence on the grid below.



[2]

(b) Pattern 3 has 9 dotted squares and 12 black squares.

How many dotted squares will there be in Pattern 8?

8^2 ..... 64 ..... [2]

(c) Write an expression for the number of black squares in the nth pattern.

(c) ..... 4n ..... [2]

(d) Sally looks at the patterns. She says

If the pattern number is odd, the total number of squares will be odd.

If it is even, the total number of squares will be even.

Explain clearly why Sally is right for all patterns in the sequence.

odd when n is odd n^2 is odd, 4n is even — odd + even = odd

even when n is even n^2 is even, 4n is even — even + even = even

[6]

2. (a) The nth term of a sequence is given by 3n + 5.

Explain why 21 is not a term in this sequence.

$3n + 5 = 21$

(-5) $3n = 16$

$(\div 3)$ $n = 5\frac{1}{3}$

as n is not an integer 21 can't be in the sequence

[2]

(b) Here are the first three terms in a sequence.

1 2 4

This sequence can be continued in different ways.

(i) Find one rule for continuing the sequence and give the next two terms.

Rule 1 double the previous term

Next two terms ..... 8 ..... 16 .....

[2]

(ii) Find a second rule for continuing the sequence and give the next two terms.

Rule 2 add one more each time (+1, +2, +3, etc).

Next two terms ..... 7 ..... 11 .....

[2]

3. (a) The nth term of a sequence is given by $2n^2 + 1$.

Write down the first three terms of this sequence.

$2(1^2) + 1 = 2 + 1$

$2(2^2) + 1 = 8 + 1$

$2(3^2) + 1 = 18 + 1$

..... 3 ....., ... 9 ....., ... 19 ..... [2]

(b) Here are the first four terms of a different sequence.

2 +5→ 7 +5→ 12 17

Write an expression for the nth term of this sequence.

5n - 3 [2]

4. (a) Look at this table.

Odd numbers	Total
1	1^2
1 + 3	2^2
1 + 3 + 5	3^2
1+3+5+7	4^2

The pattern in the table continues.

(i) Complete the next row of the table.

[1]

(ii) What will be written in the Total column of the 100th row?

100^2 [1]

(b) Here is another table.

Even numbers	Total
2	$1^2 + 1$
2 + 4	$2^2 + 2$
2 + 4 + 6	$3^2 + 3$
2 + 4 + 6 + 8	$4^2 + 4$

The pattern in this table continues.

Write an expression for the total of the first *n* even numbers.

$n^2 + n$ [2]

5. A sequence is generated using the rule

- multiply the previous term by 2
- then subtract 30.

The first term of the sequence is 40.

(a) Find the second term.

40 x 2 - 30

50 ..... [2]

(b) Find the fourth term.

3rd 50 x 2 - 30 = 70

4th 70 x 2 - 30 = 110

110 ..... [2]

6. The nth term of a sequence is 2n + 1

The nth term of a different sequence is 3n - 1

Work out the three numbers that are

in both sequences

and

between 20 and 40

23, 29, 35

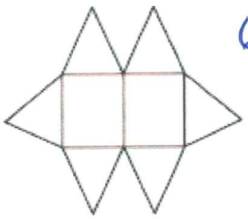
2n+1 : 21, (23), 25, 27, (29), 31, 33, (35), 37, 39

3n-1 : 20, (23), 26, (29), 32, (35), 38

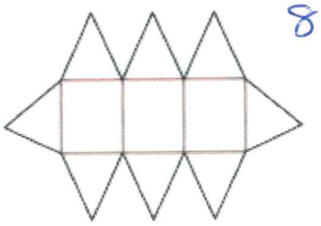
[3]

7. Here are the first three patterns in a sequence.

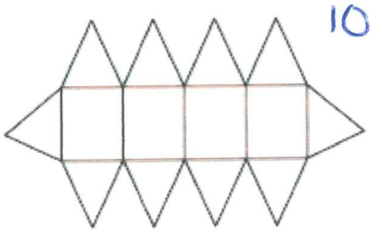
The patterns are made from triangles and rectangles.



pattern number 1



pattern number 2



pattern number 3

(a) How many triangles are there in pattern number 7?

6, 8, 10, ... 2n + 4

2 x 7 + 4

18 ..... [2]

Charlie says

"There are 4 rectangles in pattern number 3 so there will be 8 rectangles in pattern number 6"

(b) Is Charlie right? No

Give a reason for your answer.

There is one more rectangle than the pattern number so pattern number 6 will have 7 rectangles.

[1]

8. Here are the first four terms of an arithmetic sequence.

6 (+4) 10 14 18

(a) Write an expression, in terms of n, for the nth term of this sequence.

4n + 2 ..... [2]

The nth term of a different arithmetic sequence is 3n + 5

(b) Is 108 a term of this sequence?

Show how you get your answer. $3n+5=108$

$(-5)\quad 3n=103$

$(\div 3)\quad n=34\frac{1}{3}$

as n is not an integer, 108 is not in the sequence.

[2]

9. Here are the first six terms of a Fibonacci sequence.

1 1 2 3 5 8 13 21

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

13 + 21

34 ..... [1]

The first three terms of a different Fibonacci sequence are

a b a + b a+2b 2a+3b

(b) Show that the 6th term of this sequence is 3a + 5b

a + 2b + 2a + 3b = 3a + 5b

[2]

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

$a+b=7$ ①

$3a+5b=29$ ②

① x3 $3a+3b=21$

$2b=8$

$b=4$

$a+b=7$

$a+4=7$

$a=3$

a = 3

b = 4

[3]

10. Here are the first five terms of a sequence.

2 (+6) 8 (+10) 18 (+14) 32 (+18) 50 (+22)

(a) Find the next term of this sequence.

72 [1]

The nth term of a different sequence is $3n^2 - 10$

(b) Work out the 5th term of this sequence.

$3(5^2)-10$

$3 \times 25 - 10$

65 [1]

11. The first three terms of a number pattern are 1 2 4

Hester says the first five terms of this number pattern are 1 2 4 8 16

(a) Write down the rule Hester could have used to get the 4th and 5th terms.

double the previous term

[1]

(b) Write down the 6th term of Hester's number pattern.

32 [1]

Jack uses a different rule.

He says the first six terms of the number pattern are

1 (+1) 2 (+2) 4 (+3) 7 (+4) 11 (+5) 16 (+6) 22 (+7) 29

(c) Write down the 7th and 8th terms of Jack's number pattern.

..... 22 ..... , ... 29 ..... [1].

12. Here are the first five terms of an arithmetic sequence.

−3 (+4) 1 (+4) 5 (+4) 9 13

Find an expression, in terms of n, for the nth term of this sequence.

..... 4n − 7 ..... [2].

13. Which sequence is a geometric progression?

Circle your answer.

1 2 3 4

1 2 4 8

1 2 4 7

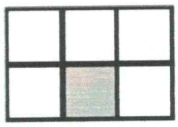
1 2 3 5

[1]

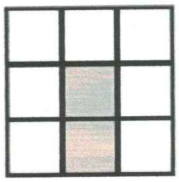
14. A sequence of patterns uses grey squares and white squares.

Here are the first four patterns.

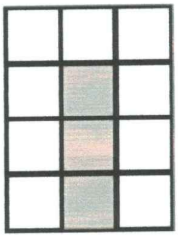
Pattern 1



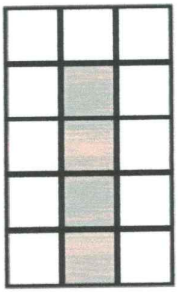
Pattern 2



Pattern 3



Pattern 4



(a) Work out the total number of squares in Pattern 100

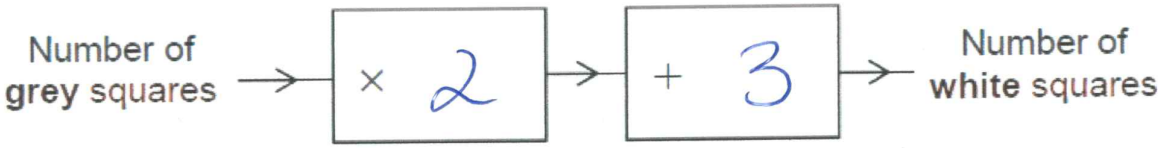
grey tiles = pattern number. = 100

white tiles = 2 × pattern number + 3 = 2 × 100 + 3 = 203

100 + 203 = 303

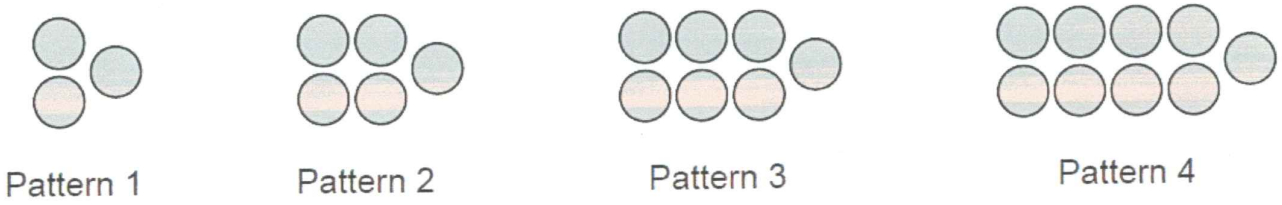
[3]

(b) Complete this number machine for the sequence of patterns.



[1]

15. The diagram shows a sequence of patterns.



Pattern 1 Pattern 2 Pattern 3 Pattern 4 3, 5, 7, 9, 11, 13

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

13

[1]

(b) Complete the rule below.

[1]

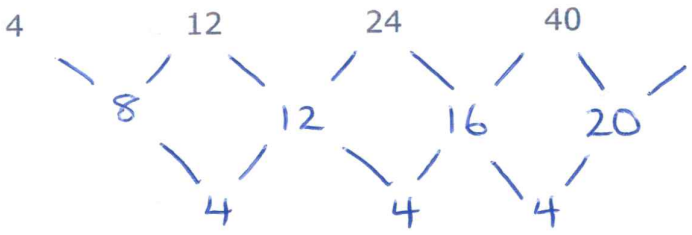
Number of circles = Pattern number × 2 + 1

(c) Which Pattern number has 51 circles?

25

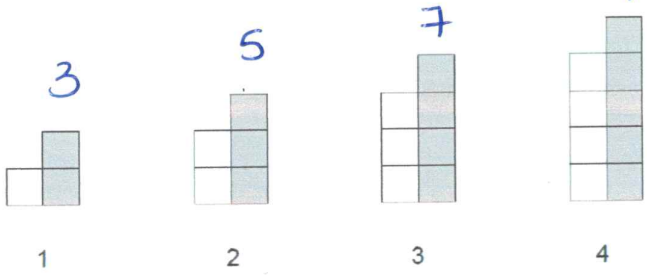
[1]

16. Work out the next term of this quadratic sequence.



[2]

17. The following patterns have been made using shaded and unshaded squares.



2n+1

Find the total number of squares in pattern 60.

$2 \times 60 + 1 = 121$

[2]

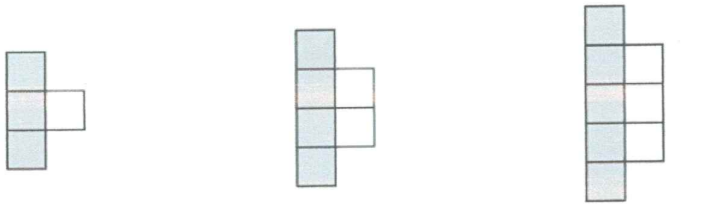
18. Find the *n*th term of the sequence 6, 13, 20, 27, ...

+7 +7

$7n - 1$

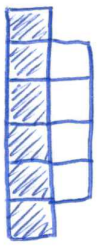
[2]

19. Here is a sequence of patterns made with grey square tiles and white square tiles.



pattern number 1 | pattern number 2 | pattern number 3

a) In the space below, draw pattern number 4



[2]

b) Find the total number of tiles in pattern number 20

grey = pattern number +2 = 20+2 = 22

white = pattern number = 20

22+20 = 42

42 ..... [2]

c) Write an expression, in terms of n, for the number of grey tiles in pattern number *n*.

n+2 ..... [2]

20. Here are the first three terms of a sequence.

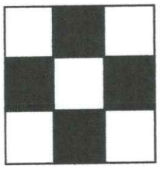
32 -6 26 -6 20 14 8 2 -4 -10

Find the first two terms in the sequence that are less than zero.

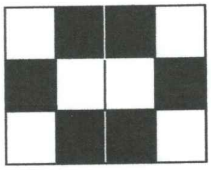
-4 ..... -10 ..... [3]

21. A sequence of patterns uses black squares and white squares.

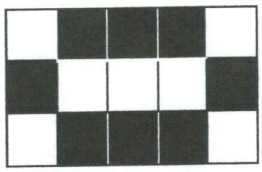
Here are the first three patterns.



Pattern 1



Pattern 2



Pattern 3

a) Circle the expression for the number of black squares in Pattern n.

4n n + 2 6n – 2 2n + 2

[1]

b) Will the number of black squares always be even? Tick a box.

Yes ☑ No ☐

Give a reason for your answer.

2n is always even 2x any number is even

even number +2 is even.

[1]

22. Here are the first three terms of a sequence.

23 −14 9

Each term is obtained by adding the previous two terms together.

a) Work out the next two terms in the sequence.

-5, 4

[1]

b) The sequence continues.

How many negative terms are in the sequence?

Circle your answer.

23, (-14) 9, (-5), 4, (-1) 3, 2, 5, ...

1 2 (3) 4 more than 4

JustMaths

Give a reason for your answer.

[2]

See sequence above, all further terms will be positive.