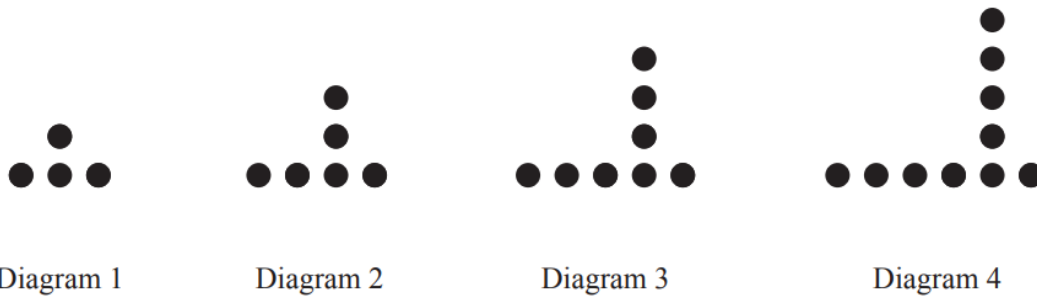


1. 4024/11/M/J/16 Q17

A sequence of diagrams is made using counters.



(a) Complete the table.

Diagram number	1	2	3	4	5
Number of counters	4	6	8		

[1]

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

Answer [1]

(c) In this sequence, Diagram p has 200 counters.

Find the value of p .

Answer $p =$ [2]

2. 4024/12/M/J/16 Q25

(a) The n th term of a sequence is given by $n^2 - 5n$.

(i) Find the 2nd term in the sequence.

Answer [1]

(ii) The p th term in the sequence is 150.

Find the value of p .

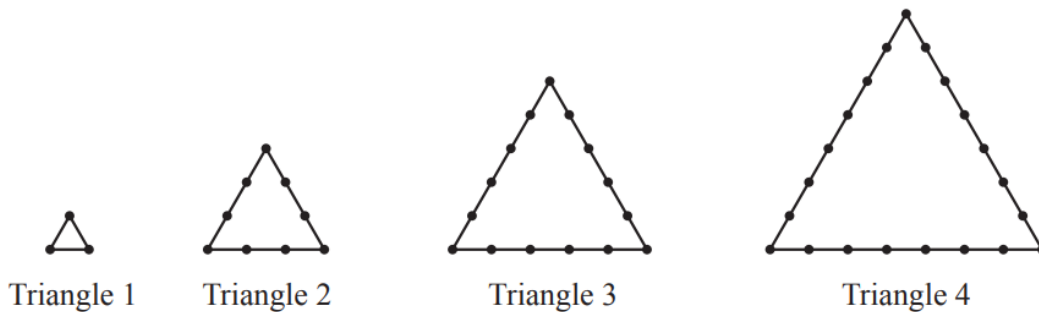
Answer $p =$ [2] Act

(b) The n th term of another sequence is given by $3n^2 - kn$.
The 5th term in this sequence is 55.

Find the value of k .

Answer $k =$ [2]

3. 4024/11/O/N/16 Q23



The diagrams show a sequence of triangles made up of identical sticks. Each triangle has two more sticks on each edge than its previous triangle. The table shows information relating to this sequence.

Triangle number	1	2	3	4		n
Number of sticks on each side	1	3	5			x
Number of sticks in the triangle	3	9	15			y

(a) Complete the column for triangle 4. [1]

(b) Find an expression, in terms of n , for x .

Answer $x = \dots\dots\dots$ [1]

(c) Find an expression, in terms of n , for y .

Answer $y = \dots\dots\dots$ [1]

- (d) The total number of sticks in the first triangle = 3
 The total number of sticks in the first two triangles = 12
 The total number of sticks in the first three triangles = 27

(i) Write down the total number of sticks in the first four triangles.

Answer $\dots\dots\dots$ [1]

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- (ii) Find an expression, in terms of n , for the total number of sticks in the first n triangles.

Answer [2]

4. 4024/12/O/N/16 Q26

Two sequences have 1, 3, 5 as their first three terms.

- (a) In the first sequence, each term is 2 more than the term before it.

- (i) Find an expression, in terms of n , for the n th term.

Answer [1]

- (ii) The k th term of this sequence is 841.

Find the value of k .

Answer $k =$ [1]

- (b) The n th term of the second sequence is

$$2^{n-1} - \frac{(n-1)(n-4)}{2}.$$

- (i) Find the fourth term of this sequence.

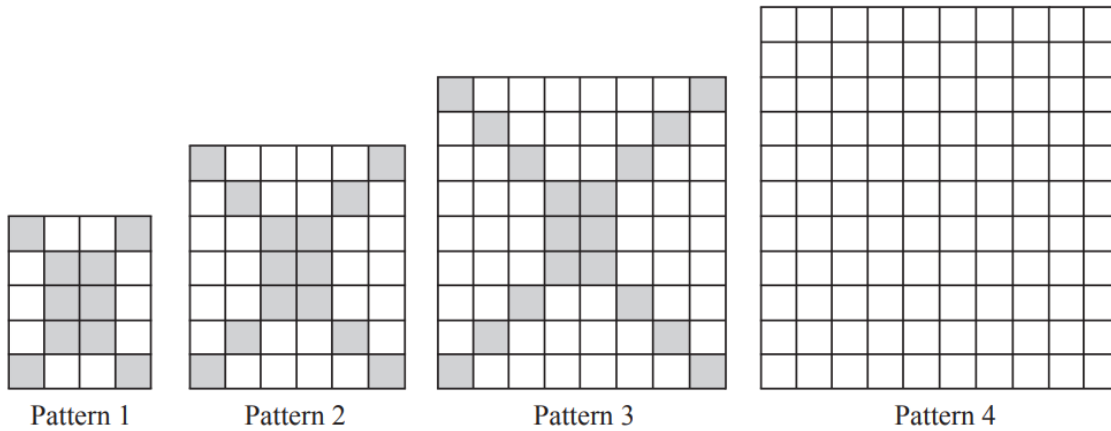
Answer [1]

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(ii) Find the fifth term of this sequence.

Answer [1]

5. 4024/21/M/J/17 Q8



(a) Complete the diagram for pattern 4. [1]

The table below shows some of the information for the number of tiles in pattern n .

Pattern n	1	2	3	4	5
Number of grey tiles	10	14	18		
Number of white tiles	10	28	54		
Total number of tiles	20	42	72	110	156

(b) Complete the table. [2]

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

Answer [2]

(d) Pattern x has 110 grey tiles.

Find x .

Answer $x =$ [1]

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- (e) By considering the number of tiles along the outer edges of each pattern, show that the total number of tiles in pattern n is $4n^2 + 10n + 6$.

[2]

- (f) Hence find an expression, in terms of n , for the number of white tiles in pattern n .

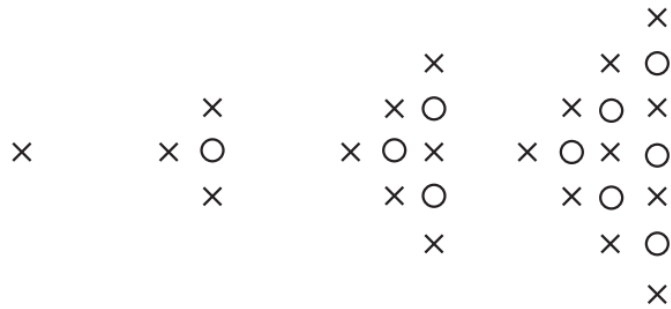
Answer [1]

- (g) In pattern p , the **total** number of tiles is equal to 8 times the number of **grey** tiles.

Find p .

Answer $p =$ [3]

6. 4024/22/M/J/17 Q7



Pattern 1 Pattern 2 Pattern 3 Pattern 4 Pattern 5

The diagrams show patterns made from crosses (X) and circles (O).

(a) Draw pattern 5 above. [1]

The table shows the number of crosses and circles in each pattern.

Pattern number (n)	1	2	3	4	5	6
Number of crosses	1	3	6	10		
Number of circles	0	1	3	6		
Total number of crosses and circles	1	4	9	16	25	36

(b) Complete the table. [2]

(c) Find an expression, in terms of n , for the total number of crosses and circles in pattern n .

Answer [1]

(d) An expression, in terms of n , for the number of crosses in pattern n is $\frac{1}{2}n^2 + \frac{1}{2}n$.

How many crosses are there in pattern 30?

Answer [1]

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(e) Show that the number of circles in pattern n is $\frac{1}{2}n^2 - \frac{1}{2}n$.

[1]

(f) The number of **crosses** in pattern m is equal to $5m$.

Find m .

Answer $m = \dots\dots\dots$ [3]

7. 4024/11/O/N/17 Q25



Diagram 1



Diagram 2



Diagram 3



Diagram 4

(a) Complete the table.

Diagram number	1	2	3	4	5
Number of rows	3	5	7	9	
Number of beads	4	9	16	25	

[1]

(b) Find an expression, in terms of N , for

(i) the number of rows in Diagram N ,

Answer [1]

(ii) the number of beads in Diagram N .

Answer [1]

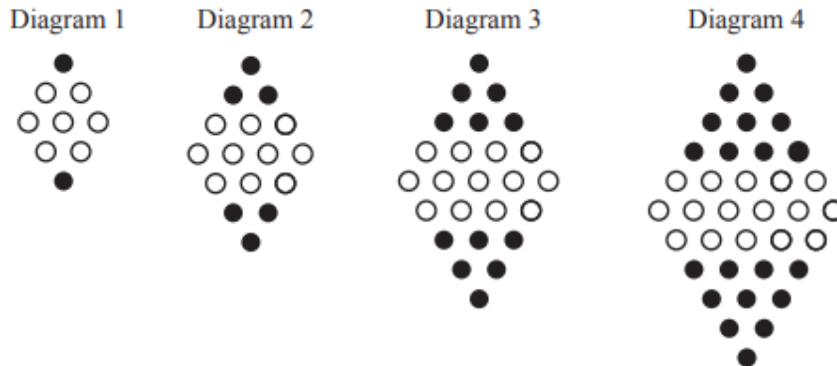
(c) Julia asks Mary to make her a pendant with 25 rows.

How many beads are used to make this pendant?

Answer [2]

8. 4024/12/O/N/17 Q26

The sequence of diagrams shows patterns made from some black beads and some white beads. Each diagram has two rows more than the previous diagram.



(a) Complete the table for Diagram 5.

Diagram number	1	2	3	4	5
Total number of beads	9	16	25	36	
Number of white beads	7	10	13	16	
Number of black beads	2	6	12	20	

[1]

(b) Write down an expression, in terms of n , for

(i) the number of white beads in Diagram n ,

Answer [1]

(ii) the total number of beads in Diagram n .

Answer [1]

(c) Find an expression, in terms of n , for the number of black beads in Diagram n . Give your answer in its simplest form.

Answer [2]

9. 4024/12/M/J/18 Q21

21 The first four terms, u_1 , u_2 , u_3 and u_4 , in a sequence of numbers are given below.

$$u_1 = 1 \times 3 + 2^2 = 7$$

$$u_2 = 2 \times 4 + 3^2 = 17$$

$$u_3 = 3 \times 5 + 4^2 = 31$$

$$u_4 = 4 \times 6 + 5^2 = 49$$

(a) Evaluate u_5 .

Answer [1]

(b) The n th term of the sequence, u_n , is of the form $n(n+p) + (n+q)^2$.

Write down the value of p and the value of q .

Answer $p =$

(c) u_n can also be written in the form $An^2 + Bn + C$.

Find the values of A , B and C .

Answer $A =$

$B =$

$C =$ [2]

10. 4024/21/M/J/18 Q5

(a) 1, 7, 13, 19, 25, ...

(i) Find an expression, in terms of n , for the n th term of this sequence.

Answer [2]

(ii) Explain why 251 is not a term in this sequence.

Answer
..... [1]

(b) Here is another sequence.

5, 8, 13, 20, 29, ...

The p th term of this sequence is $p^2 + 4$.

Write down an expression, in terms of p , for the p th term of these sequences.

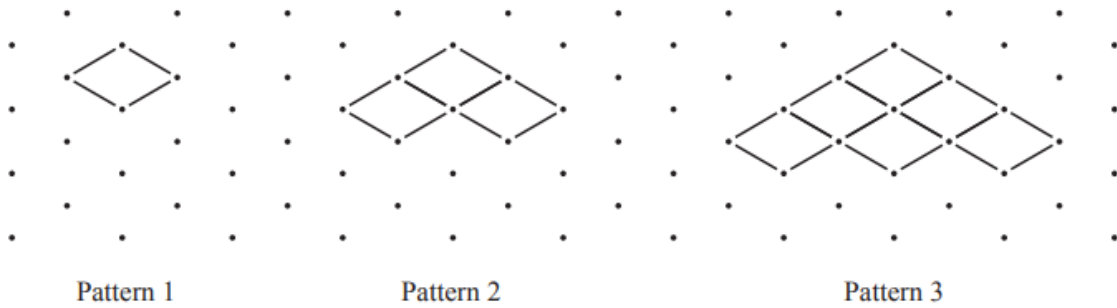
(i) -2, 1, 6, 13, 22, ...

Answer [1]

(ii) 7, 12, 19, 28, 39, ...

Answer [1]

- (c) The diagrams below show the first three patterns in a sequence. The patterns are made from short diagonal lines.



- (i) Draw Pattern 4 on the dotted grid below.



[1]

- (ii) Complete the table below for the number of short lines in Patterns 4 and 5.

Pattern	1	2	3	4	5
Number of short lines	4	10	18		

[2]

- (iii) Find an expression, in terms of t , for the number of short lines in Pattern t .

Answer [2]

11. 4024/11/O/N/18 Q7

The value of each term of a sequence is 4 more than the value of the term before it.
The third term is 17 and the fourth term is 21.

(a) Find the first term.

Answer [1]

(b) Find an expression for the n th term of this sequence.
Give your answer in its simplest form.

Answer [2]

12. 4024/12/O/N/18 Q11

Here are the first five terms of a sequence.

$$\frac{3}{4} \quad \frac{7}{8} \quad \frac{11}{12} \quad \frac{15}{16} \quad \frac{19}{20}$$

(a) Write down the next two terms.

Answer , [1]

(b) The k th term is $\frac{1199}{1200}$.

Find k .

Answer $k =$ [1]

(c) Find an expression, in terms of n , for the n th term.

Answer [2]

13. 4024/21/O/N/18 Q8

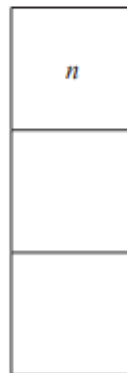
The diagram shows part of a number grid.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

A vertical rectangle enclosing three numbers, as shown, can be placed anywhere on the grid.

The grid is continued downwards.

- (a) If n represents the number in the top of the rectangle, complete the rectangle with expressions, in terms of n , for the other two numbers.



[1]

- (b) Omar multiplies the top number in the rectangle by the bottom number. He then squares the middle number in the rectangle. He finds the difference between these two results.

Using your answers to part (a), show that this difference is always 25.

[2]

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- (c) Lena places a rectangle on the grid.
She adds the three numbers in her rectangle.
The sum of the three numbers is 174.

Find the **largest** number in Lena's rectangle.

Answer [3]

14. 4024/11/M/J/19 Q12

The r th term of a sequence, u_r , is given by $u_r = 3r + 2$.

- (a) Find the third term, u_3 , in this sequence.

..... [1]

- (b) Given that $u_k = 50$, find the value of k .

$k =$ [1]

15. 4024/12/M/J/19 Q22

Here are the first three patterns in a sequence made using dots and lines.



Pattern 1



Pattern 2



Pattern 3

(a) Complete the table for the first five patterns in this sequence.

Pattern number	1	2	3	4	5
Number of dots	3	6			
Number of lines	2	7			

[2]

(b) Find an expression, in terms of n , for the number of lines in Pattern n .

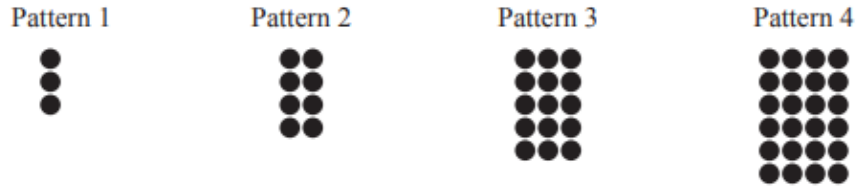
..... [2]

(c) Anwar makes one of these patterns using 92 lines.

Find the number of dots in Anwar's pattern.

..... [2]

These are the first four patterns in a sequence made using counters.



(a) Complete the table for the patterns in this sequence.

Pattern number	1	2	3	4	5
Number of counters	3	8	15		

[1]

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

..... [2]

(c) Ken has a bag containing 1358 counters.
 He makes the largest possible pattern in the sequence, Pattern p , using these counters.

(i) Find the value of p .

$p = \dots\dots\dots$ [3]

(ii) He uses all of the remaining counters to make another pattern in the sequence, Pattern q .

Find the value of q .

$q = \dots\dots\dots$ [2]

17. 4024/11/M/J/20 Q3

The numbers in this sequence increase by the same amount each time.

..... 1.4 2.3 3.2

Fill in the missing numbers.

[2]

18. 4024/11/M/J/20 Q23

(a) The formula for the n th term of a sequence is $2n^3$.

Find the 3rd term of this sequence.

..... [1]

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

$\frac{4}{3}$ $\frac{9}{5}$ $\frac{16}{7}$ $\frac{25}{9}$

(i) Write down the next term of this sequence.

..... [1]

(ii) Find a formula for the n th term of this sequence.

..... [3]

19. 4024/11/O/N/20

Some numbers are arranged in rows.

Each row contains one more number than the previous row.

The numbers in each row are two more than the numbers in the previous row.

Row 1	3	3			
Row 2	5	5	5		
Row 3	7	7	7	7	
Row 4	9	9	9	9	9
Row 5					

(a) Complete Row 5. [1]

(b) Write down an expression, in terms of n , for each number in Row n .

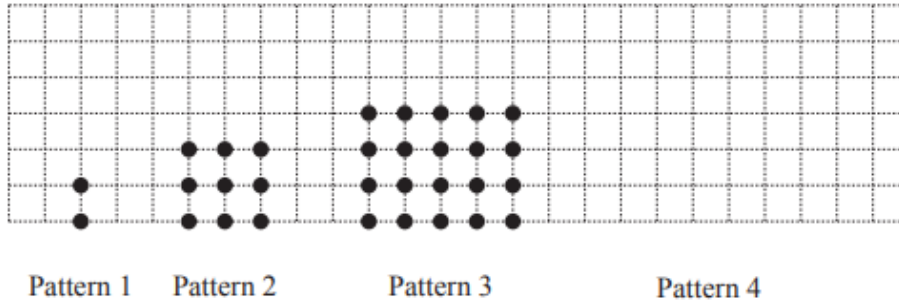
..... [1]

(c) Write down an expression, in terms of n , for the number of numbers in Row n .

..... [1]

(d) Write down an expression, in terms of n , for the sum of the numbers in Row n .

..... [1]



The diagram shows a sequence of patterns.

Each pattern has one more row, and two more dots in each row, than the pattern before it.

(a) On the diagram, draw Pattern 4. [1]

(b) (i) Complete the table for the first four patterns in this sequence.

Pattern number	1	2	3	4		<i>n</i>
Number of rows	2	3	4			<i>p</i>
Number of dots in each row	1	3				<i>q</i>
Total number of dots	2	9				

[1]

(ii) Find an expression, in terms of *n*, for *p*.

$$p = \dots\dots\dots [1]$$

(iii) Find an expression, in terms of *n*, for *q*.

$$q = \dots\dots\dots [1]$$

(iv) Find an expression, in terms of *n*, for the **total** number of dots in Pattern *n*.

$$\dots\dots\dots [1]$$

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21. 4024/12/M/J/21 Q20

Here are the first four terms of a sequence.

$$\frac{12}{16} \quad \frac{17}{25} \quad \frac{22}{36} \quad \frac{27}{49}$$

Find an expression for the n th term of the sequence.

..... [4]

22. 4024/11/O/N/21 Q20

These are the first five terms of a sequence.

4 8 16 32 64

(a) Find the next number in the sequence.

..... [1]

(b) The n th term of the sequence above is 2^{n+1} .

Write down an expression, in terms of n , for the n th term of these sequences.

(i) 1 5 13 29 61 ...

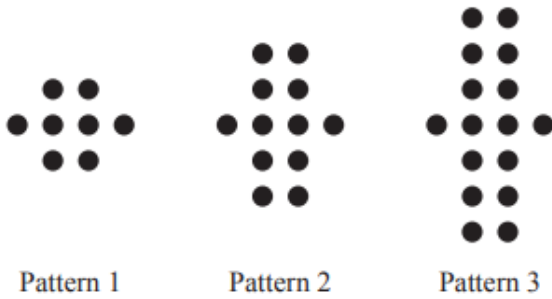
..... [1]

(ii) 10 19 32 53 90 ...

..... [2]

23. 4024/22/O/N/21 Q4

(a) Here are the first three patterns in a sequence made from counters.



(i) Complete the table for the patterns in this sequence.

Pattern number	1	2	3	4	5
Number of counters	8	12	16		

[1]

(ii) Find an expression, in terms of n , for the number of counters in Pattern n .

..... [2]

(iii) Jamal has 150 counters.
He uses these counters to make the largest pattern possible, Pattern p .

Find the value of p .

$p =$ [2]

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- (b) The 4th term in a different sequence is 26.
This sequence is linear and the 8th term is 2.

(i) Find the first term of this sequence.

..... [2]

(ii) Find an expression, in terms of n , for the n th term of this sequence.

..... [2]

24. 4024/12/M/J/22 Q9

Shani makes a sequence of patterns using counters.



Pattern 1



Pattern 2



Pattern 3

(a) Complete the table.

Pattern number	1	2	3	4	5
Number of counters	5	8	11		

[1]

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

..... [2]

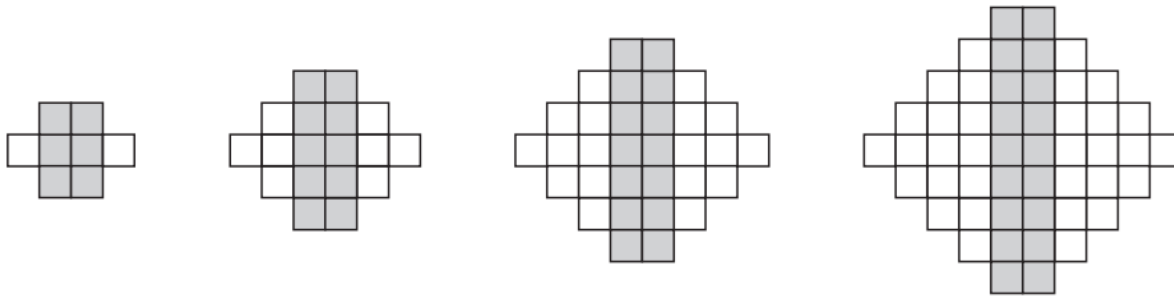
(c) Shani has 100 counters.
 She uses some of the counters to make Pattern 20.
 She uses all the remaining counters to make Pattern k .

Find the value of k .

$k =$ [3]

25. 4024/21/M/J/22 Q2

Here are the first four patterns in a sequence made using grey tiles and white tiles.



Pattern 1

Pattern 2

Pattern 3

Pattern 4

(a) Complete the table for the first five patterns in this sequence.

Pattern number	1	2	3	4	5
Number of grey tiles	6	10	14		
Number of white tiles	2	8	18		
Total number of tiles	8	18	32		

(b) Find an expression, in terms of n , for the number of grey tiles in Pattern n .

..... [2]

(c) Pattern k has 98 grey tiles.

Find k .

$k =$ [2]

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(d) Find an expression, in terms of n , for the number of white tiles in Pattern n .

..... [2]

(e) Find the **total** number of tiles in Pattern 20.

..... [2]

26. 4024/11/O/N/22 Q13

- (a) The n th term of a sequence is $3n^2 - 1$.

Find the first three terms of the sequence.

.....,, [2]

- (b) These are the first five terms of a different sequence.

1 3 9 27 81

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

..... [2]