Westminster Kingsway
central London's College

Sequences

GCSE MATHS

Name: _____

Teacher: _____

Learning objectives

By the end this pack you will be able to:

1. Continue number patterns by adding, subtracting, multiplying or diving a number
2. Give the term by term rule for number patterns
3. Find the nth term of a number pattern
4. Decide whether or not a number is in a number pattern

Algebra

Finding the n^{th} term of a Linear Sequence.

Learning Objectives

Use linear expressions to describe the n^{th} term of an arithmetic sequence.

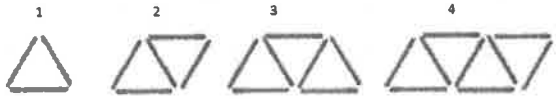
First

- Lets define a sequence

First

- Lets define a sequence
- A particular order that related events follow each other.
- How can we apply that to maths

Can you tell me how many match sticks are required to make 5 Triangles



But can you tell me

- How many matchsticks would be needed to make 20 triangles?.....100 triangles?

Can you find

The next term in the sequence

- 5 8 11 14 17
- 5 11 17 23 29

Find the n^{th} term of the following sequence.

- 5 8 11 14 17

If the 1^{st} difference is a constant the n^{th} term

is of the form

$dn + a$

Step 1
Create a differences table

n	Term	1^{st} Difference
0		
1	5	
2	8	3
3	11	3
4	14	3
5	17	3

The first difference gives the value of d

So d = 3

Step 2
Go back to the differences table.

n	Term	1^{st} Difference
0	2	
1	5	3
2	8	3
3	11	3
4	14	3
5	17	3

When n = 0 we get the value of a

So a = 2

The n^{th} term is

- n^{th} term = 3n + 2

Step 3
Check it works

- When n = 2 the term is 8
- So 3n + 2 =
- 3x2 + 2 = 8
- It works!

Find the n^{th} term of the following sequence.

- 5 11 17 23 29

If the 1^{st} difference is a constant the n^{th} term

is of the form
dn + a

Step 1
Create a differences table

n	Term	1^{st} Difference
0		
1	5	
2	11	6
3	17	6
4	23	6
5	29	6

The first difference gives the value of d

So d = 6

Step 2 Go back to the differences table.

n	Term	1st Difference
0	-1	
1	5	6
2	11	6
3	17	6
4	23	6
5	29	6

When n = 0 we get the value of a

So a = -1

The n^{th} term is

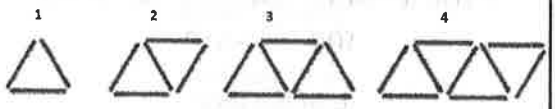
- n^{th} term = 6n - 1

Step 3
Check it works

- When n = 2 the term is 11
- So 6n - 1 =
- 6x2 - 1 = 11
- It works!

Going back

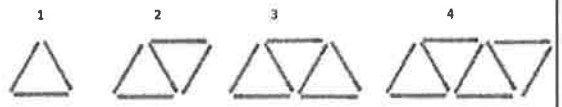
- Going back to our original problem



How many match sticks are required to make 20 triangles and 100 triangles?

Going back

- Going back to our original problem



How many match sticks are required to make 20 triangles and 100 triangles?

What would be the first step in solving this?

Draw a table

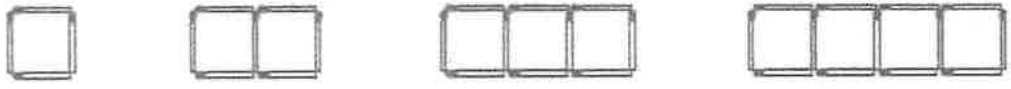
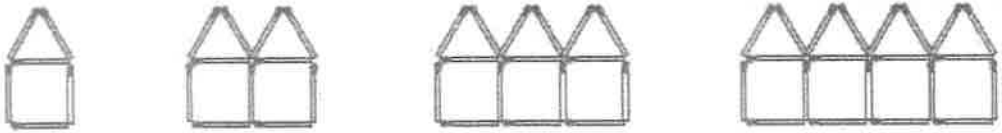
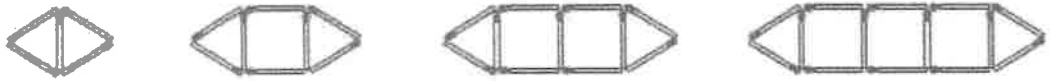
Number of triangles, t	Number of matches, m
1	
2	
3	
4	

Draw a table

Number of triangles, t	Number of matches, m
1	3
2	5
3	7
4	9

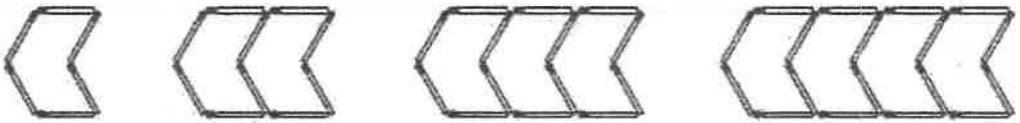
Key Words

- Differences Table
- First Difference
- Constant
- Formula
- $n^{th.}$ Term

Sequences	Number of matches in each pattern					Rule	Number of matches in pattern 10
Draw the next pattern in the sequence	1	2	3	4	5		
 Pattern 1 Pattern 2 Pattern 3 Pattern 4							
 Pattern 1 Pattern 2 Pattern 3 Pattern 4							
 Pattern 1 Pattern 2 Pattern 3 Pattern 4							

Pattern 1 Pattern 2 Pattern 3 Pattern 4

Pattern 1 Pattern 2 Pattern 3 Pattern 4



Pattern 1 Pattern 2 Pattern 3 Pattern 4

Dinky King 4 – Sequence Escape

The damsel in distress is locked in a room guarded by Dinky King. In order to escape, she needs to describe some sequences to Murrio can't talk or Dinky King will discover their plan. Once Murrio has the rules he can key them into a lock and release a secret door.

This is a two player game, so some of the sequences you have to describe, and some you have to generate.

Sequence 1:

Description	
Rule	Add 3
Start	5

Sequence				

Sequence 2:

Description	
Rule	Add 9
Start	2

Sequence				

Sequence 3:

Description	
Rule	
Start	

Sequence				
8	13	18	23	28

Sequence 4:

Description	
Rule	Divide by 2
Start	100

Sequence				

Sequence 5:

Description	
Rule	
Start	

Sequence				
1	3	9	27	81

Sequences Revision

Section A:

Write down the nth terms of each of these sequences:

eg **1, 3, 5, 7, 9, ... nth term = 2n – 1** (it goes up in 2s so is based on the 2x table and you need to subtract 1 from the 2x table to get the sequence)

Sequence	nth term		Sequence	nth term
5, 10, 15, 20, 25, ...			14, 16, 18, 20, 22, ...	
6, 11, 16, 21, 26, ...			7, 14, 21, 28, 35, ...	
10, 20, 30, 40, 50, ...			-5, -1, 3, 7, 11, ...	
8, 18, 28, 38, 48, ...			10, 8, 6, 4, 2, ...	
1, 4, 7, 10, 13, ...			3, 4, 5, 6, 7, ...	

Section B:

Fill in the gaps in these sequences (all go up or down by the same amount each time):

9, 18, 27, ... , 45, ...,

75, ..., 63, 57, ...,

....., 4, 9, ..., 19,

4, ..., ..., 8.5, 10,

10, ..., ..., ..., 50

24, ..., ..., 9,

Section C:

Write down the first three terms of these sequences:

nth term	Sequence		nth term	Sequence
11n			$n^2 + 1$	
n - 1			$2n^2$	
2n + 3			1/n	
10 – n			n^3	
50 – 2n			$100 - n^2$	

What is the first negative term of...

10 – n

50 – 2n

$100 - n^2$

Finding the nth term

In each question there are four terms of a sequence of numbers:

a) Write down the rule using n to represent the nth term.
b) Find the 10^{th} and 15^{th} terms.

Term	1	2	3	4	Nth	10	15
Sequence	1	4	7	10			

Term	1	2	3	4	Nth	10	15
Sequence	1	3	5	7			

Term	1	2	3	4	Nth	10	15
Sequence	1	4	7	10			

Term	1	2	3	4	Nth	10	15
Sequence	8	13	18	23			

Term	1	2	3	4	Nth	10	15
Sequence	9	13	17	21			

Term	1	2	3	4	Nth	10	15
Sequence	6	9	12	15			

Term	1	2	3	4	Nth	10	15
Sequence	1	3	5	7			

Term	1	2	3	4	Nth	10	15
Sequence	3	7	11	15			

Term	1	2	3	4	Nth	10	15
Sequence	7	10	13	16			

Term	1	2	3	4	Nth	10	15
Sequence	1	6	11	16			

Term	1	2	3	4	Nth	10	15
Sequence	7	11	15	19			

Term	1	2	3	4	Nth	10	15
Sequence	3	8	13	18			

Term	1	2	3	4	Nth	10	15
Sequence	0	4	8	12			

Term	1	2	3	4	Nth	10	15
Sequence	5	11	17	23			

Term	1	2	3	4	Nth	10	15
Sequence	6	11	16	21			

Term	1	2	3	4	Nth	10	15
Sequence	8	14	20	26			

Centre No						Paper Reference							Surname	Initial(s)
Candidate No.						1	3	8	0	/	3	H	Signature	

Paper Reference(s)

1380/3H

Edexcel GCSE

Mathematics (Linear) – 1380

Paper 3 (Non-Calculator)

Sequences

Past Paper Questions

Arranged by Topic

Examiner's use only

Team Leader's use only

Materials required for examination
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.
Tracing paper may be used.

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
You must NOT write on the formulae page.
Anything you write on the formulae page will gain NO credit.
If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 26 questions in this question paper. The total mark for this paper is 100.
There are 24 pages in this question paper. Any blank pages are indicated.
Calculators must not be used.

Advice to Candidates

Show all stages in any calculations.
Work steadily through the paper. Do not spend too long on one question.
If you cannot answer a question, leave it and attempt the next one.
Return at the end to those you have left out.

N 3 4 7 3 0 A 0 1 2 4

Turn over

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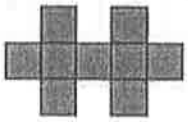
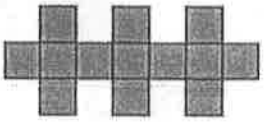
Leave blank

1. Here are some patterns made from squares.

Pattern number 1

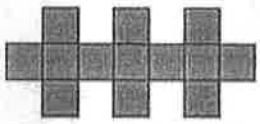


Pattern number 2



Pattern number 3

(a) The diagram below shows part of Pattern number 4
Complete the diagram for Pattern number 4



Pattern number 4

(1)

(b) Complete the table.

Pattern number	1	2	3	4	5
Number of squares	5	9	13		

(1)

(c) Find the number of squares used for Pattern number 10

.....

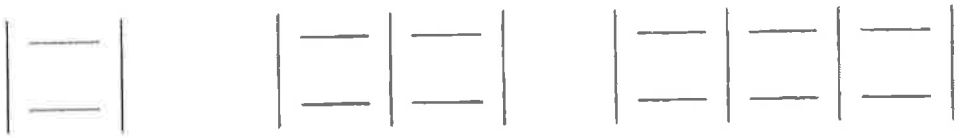
(1)

Q1

(Total 3 marks)

Leave blank

2. Here are some patterns made using sticks.



Pattern number 1 Pattern number 2 Pattern number 3

(a) In the space below, complete Pattern number 4.

Pattern number 4

(1)

(b) Complete the table.

Pattern number	1	2	3	4	5
Number of sticks	4	7	10		

(1)

(c) How many sticks are used in Pattern number 10?

.....

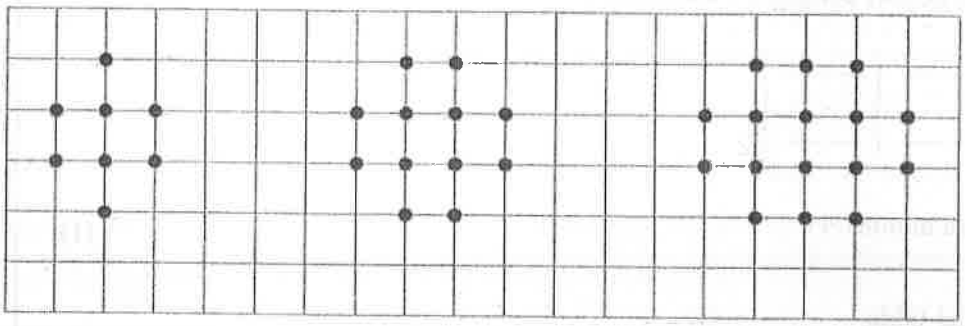
(1)

(Total 3 marks)

Q2

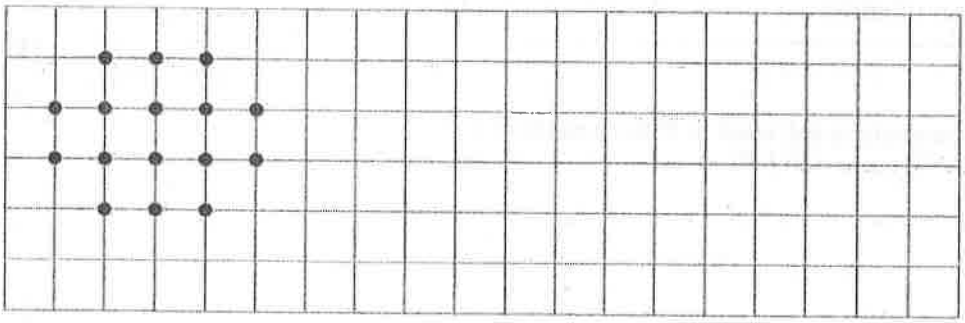
Leave blank

3. Here are some patterns made with dots.



Pattern number 1 Pattern number 2 Pattern number 3

(a) In the space below, complete Pattern number 4



Pattern number 4

(1)

(b) Complete the table.

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

(2)

Q3

(Total 3 marks)

Leave blank

4. The first even number is 2

(a) Write down the 3rd even number.

.....

(1)

Here are some patterns made from sticks.

Pattern number 1 Pattern number 2 Pattern number 3

(b) Complete Pattern number 4

Pattern number 4

(1)

(c) Complete the table.

Pattern number	1	2	3	4	5
Number of sticks	3	6	9		

(2)

Jenny wants to find the number of sticks in Pattern number 100

(d) Write down a method she could use.

.....

.....

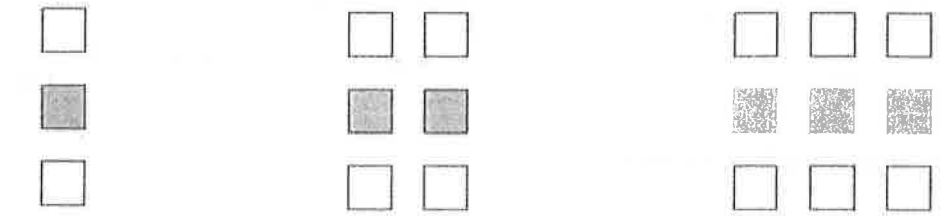
(1)

(Total 5 marks)

Q4

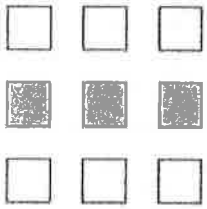
Leave blank

5. Here is a sequence of patterns made from grey squares and white squares.



Pattern Number 1 | Pattern Number 2 | Pattern Number 3

(a) Complete Pattern Number 4



Pattern Number 4

(1)

(b) Complete the table.

Pattern Number	1	2	3	4	5
Total number of squares	3	6	9		

(1)

One of the patterns in the sequence has 10 grey squares.

(c) How many white squares does this pattern have?

.....

(1)

Another pattern in the sequence has a total of 18 squares.

(d) How many grey squares does the pattern have?

.....

(1)

Q5

(Total 4 marks)

Leave blank

6. Here are the first four terms of a number sequence.

5 9 13 17

(a) (i) Write down the next term of the number sequence.

.....

(ii) Explain how you found your answer.

.....

.....

(2)

The 25 th term of the number sequence is 101

(b) Work out the 26 th term of the number sequence.

.....

(1)

(Total 3 marks)

Q6

7 . The nth term of a number sequence is given by $3n+1$

(a) Work out the first **two** terms of the number sequence.

.....

(1)

Here are the first four terms of another number sequence.

1 5 9 13

(b) Find, in terms of n, an expression for the nth term of this number sequence.

.....

(2)

(Total 3 marks)

Q7

Edexcel GCSE
Mathematics (Linear) – 1MA0

SEQUENCES

Materials required for examination
Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.
Tracing paper may be used.

Items included with question papers
Nil

Instructions

Use black ink or ball-point pen.
Fill in the boxes at the top of this page with your name, centre number and candidate number.
Answer all questions.
Answer the questions in the spaces provided – there may be more space than you need.
Calculators may be used.

Information

The marks for each question are shown in brackets – use this as a guide as to how much time to spend on **each** question.
Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed – you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.

Advice

Read each question carefully before you start to answer it.
Keep an eye on the time.
Try to answer every question.
Check your answers if you have time at the end.

1. Here are the first 5 terms of an arithmetic sequence.

6, 11, 16, 21, 26

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

.....

(Total 2 marks)

2. Here are the first five terms of a number sequence.

3 8 13 18 23

(a) Write down the next **two** terms of the sequence.

....., ...

(2)

(b) Explain how you found your answer.

.....

(1)

(c) Explain why 387 is **not** a term of the sequence.

.....

.....

(1)

(Total 4 marks)

3. Here are the first five terms of a number sequence.

126 122 118 114 110

(a) Write down the next two terms of the number sequence.

..... , ...

(1)

(b) Explain how you found your answer.

.....

(1)

The 20th term of the number sequence is 50

(c) Write down the 21st term of the number sequence.

.....

(1)

(Total 3 marks)

4. Here are the first five terms of a number sequence.

3 7 11 15 19

(a) Work out the 8th term of the number sequence.

.....

(1)

(b) Write down an expression, in terms of n, for the nth term of the number sequence.

.....

(2)

(Total 3 marks)

5. The first five terms of an arithmetic sequence are

2 9 16 23 30

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

.....

(Total 2 marks)

6. The first five terms of an arithmetic sequence are

2 7 12 17 22

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

.....

(Total 2 marks)

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

$$-1 \quad 3 \quad 7 \quad 11 \quad 15$$

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

.....

(2)

In another arithmetic sequence the nth term is $8n - 16$

John says that there is a number that is in both sequences.

(b) Explain why John is wrong.

.....

.....

(2)
(Total 4 marks)

8. The first four terms of an arithmetic sequence are

$$21 \quad 17 \quad 13 \quad 9$$

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

.....

(Total 2 marks)

9. The nth term of a sequence is $2n^2$

(i) Find the 4th term of the sequence.

.....

(ii) Is the number 400 a term of the sequence?

.....

Give reasons for your answer.

.....

.....

(Total 3 marks)

10. Here are the first 5 terms of an arithmetic sequence.

3 9 15 21 27

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

.....

(2)

Ben says that 150 is in the sequence.

(b) Is Ben right?

You must explain your answer.

.....

.....

.....

.....

(1)

(Total 3 marks)

11. Here are the first 5 terms of an arithmetic sequence.

2 9 16 23 30

(a) Write down the 12th term of this sequence.

.....

(1)

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

.....

(2)

(Total 3 marks)

12. The first four terms of an arithmetic sequence are

21 17 13 9

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

.....

(Total 2 marks)

13. Here are the first 5 terms of an arithmetic sequence.

6, 11, 16, 21, 26

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

.....

(Total 2 marks)

14. The first five terms of an arithmetic sequence are

2 9 16 23 30

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

.....

(Total 2 marks)

15. Here are the first five terms of a number sequence.

3 8 13 18 23

(a) Write down the next **two** terms of the sequence.

....., ...

(2)

(b) Explain how you found your answer.

.....

(1)

(c) Explain why 387 is **not** a term of the sequence.

.....

.....

.....

(1)

(Total 4 marks)

16. Here are the first five terms of a number sequence.

3 7 11 15 19

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

.....

(2)

Adeel says that 319 is a term in the number sequence.

(b) Is Adeel correct?
You must justify your answer.

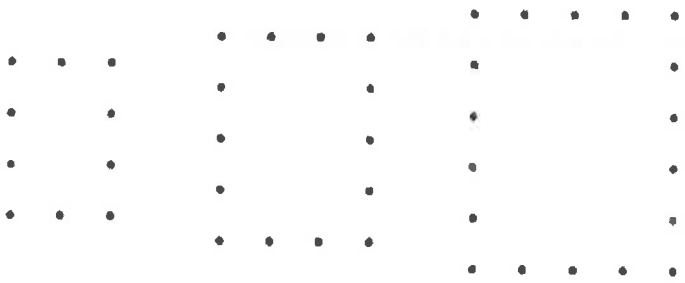
.....

.....

(2)

(Total 4 marks)

17. Here are some patterns made up of dots.



Pattern number 1 Pattern number 2 Pattern number 3

(a) In the space below, draw Pattern number 4.

(1)

(b) Complete the table.

Pattern number	1	2	3	4	5
Number of dots	10	14	18		

(1)

(c) How many dots are used in Pattern number 10?

.....

(1)
(Total 3 marks)