

# Sequences (H)

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

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1. (a) Find the  $n$ th term of the sequence 6, 13, 20, 27, ...

$+7$

$$7n - 1$$

[2]

- (b) In a sequence of four numbers, the difference between each number is 7.

The sum of the four numbers is 6.

What are the numbers in the sequence?

You must show all your working.

$$a + a + 7 + a + 14 + a + 21 = 4a + 42 = 6$$

$$4a = -36$$

$$a = -9$$

$$-9, -2, 5, 12$$

[3]

2. The  $n$ th term of a sequence is  $2n + 1$

The  $n$ th 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]

3. 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]

4. A sequence is defined by the term-to-term rule  $u_{n+1} = u_n^2 - 8u_n + 17$ .

(a) Given that  $u_1 = 4$ , find  $u_2$  and  $u_3$ .

$$u_2 = 4^2 - 8(4) + 17 = 1$$

$$u_3 = 1^2 - 8(1) + 17 = 10$$

(a) ..... 1 ..... 10 ..... [2]

(b) Given instead that  $u_1 = 2$ , find  $u_2$ ,  $u_3$  and  $u_{100}$ .

$$u_2 = 2^2 - 8(2) + 17 = 5$$

$$u_3 = 5^2 - 8(5) + 17 = 2$$

(b) ..... 5 ..... 2 ..... 5 ..... [3]

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

6      10    14    18

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

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

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

(b) Is 108 a term of this sequence?  $3n + 5 = 108$

Show how you get your answer.  $(-5)$   $3n = 103$   
 $(\div 3)$   $n = 34\frac{1}{3}$

as  $n$  is not an integer, 108 is not in the sequence. [2]

6. 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

$$a \quad b \quad a + b \quad a + 2b \quad 2a + 3b$$

(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,

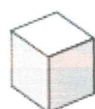
(c) find the value of  $a$  and the value of  $b$ .

$$\begin{aligned} a + b &= 7 \quad (1) \\ 3a + 5b &= 29 \quad (2) \\ (1) \times 3 \quad 3a + 3b &= 21 \\ \hline 2b &= 8 \\ b &= 4 \\ a + b &= 7 \\ a + 4 &= 7 \\ a &= 3 \end{aligned}$$

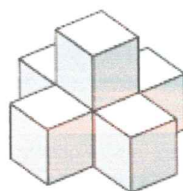
$$\begin{aligned} a &= \dots\dots\dots 3 \\ b &= \dots\dots\dots 4 \end{aligned}$$

[3]

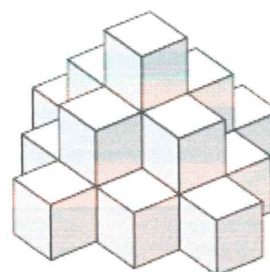
7. Here is a picture of three towers.



Tower 1



Tower 2



Tower 3

Not all the cubes can be seen in the towers.

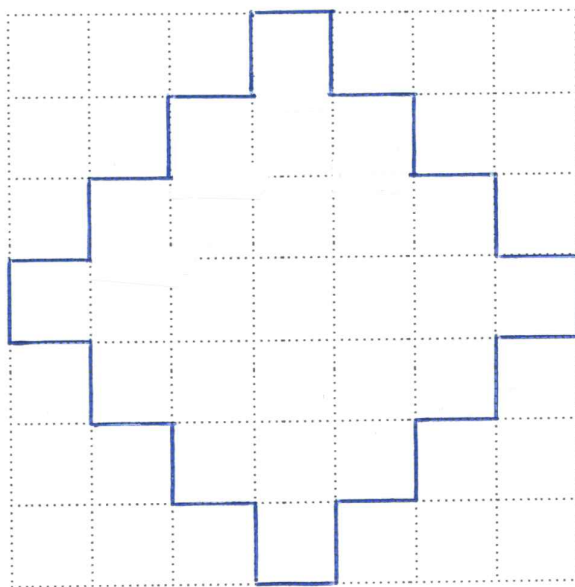
Edith uses 1 cube to build tower 1.

Edith uses 6 cubes to build tower 2. There are 5 cubes on the bottom layer.

a) Write down the total number of cubes in tower 3.

$$(a) \dots\dots\dots 19 \dots\dots\dots [1]$$

b) Draw a plan view of the arrangement of cubes Edith will use for the bottom layer of tower 4.



[1]

c) Continue this sequence to show the number of cubes used for the bottom layer of each tower.

Tower 1

1

Tower 2

5

Tower 3

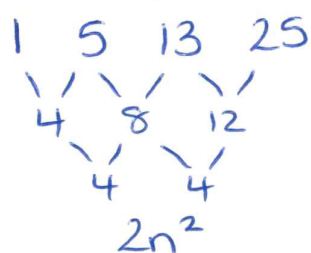
13

Tower 4

25

[2]

d) Find an expression for the number of cubes used in the bottom layer of tower  $n$ .



$$2n^2 \quad \begin{array}{cccc} 1 & 5 & 13 & 25 \\ 2 & 8 & 18 & 32 \\ \hline -1 & -3 & -5 & -7 \end{array} \quad -2n+1$$

(d)  $2n^2 - 2n + 1$  [4]

8. This expression can be used to generate a sequence of numbers.

$$n^2 - n + 11$$

(i) Work out the first three terms of this sequence.

$$1^2 - 1 + 11 = 11$$

$$2^2 - 2 + 11 = 13$$

$$3^2 - 3 + 11 = 17$$

(i) 11, 13, 17 [2]

(ii) Show that this expression does not only generate prime numbers.

e.g.  $12^2 - 12 + 11 = 143$

$$143 = 11 \times 13$$

[2]

9. a) The  $n$ th term of a sequence is  $2^n + 2^{n-1}$

Work out the 10th term of the sequence.

$$2^{10} + 2^9 = 1536$$

[1]

b) The  $n$ th term of a different sequence is  $4(2^n + 2^{n-1})$

Circle the expression that is equivalent to  $4(2^n + 2^{n-1})$

$$\begin{aligned} 2^2(2^n + 2^{n-1}) \\ = 2^{n+2} + 2^{n-1+2} \\ = 2^{n+2} + 2^{n+1} \end{aligned}$$

$$\begin{aligned} 2^{n+2} + 2^{n+1} \\ 8^n + 8^{n-1} \end{aligned}$$

$$\begin{aligned} 2^{2n} + 2^{2(n-1)} \\ 2^{n+2} + 2^{n-1} \end{aligned}$$

[1]

10. a) Find the  $n$ th term of this linear sequence.

8                      11                      14                      17

a) .....  $3n + 5$  ..... [2]

b) Here is a quadratic sequence.

2                      14                      36                      68

The expression for the  $n$ th term of this sequence is  $pn^2 + qn$ .

Find the value of  $p$  and the value of  $q$ .

$$\begin{array}{cccc} 2 & 14 & 36 & 68 \\ \backslash & / & \backslash & / \\ 12 & 22 & 32 & \\ \backslash & / & \backslash & / \\ 10 & 10 & & \\ 5n^2 & & & \end{array}$$

$$\begin{array}{cccc} 2 & 14 & 36 & 68 \\ - & 5 & 20 & 45 & 80 \\ \hline -3 & -6 & -9 & -12 & -3n \end{array}$$

b)  $p = \dots\dots\dots 5$   
 $q = \dots\dots\dots -3$  [4]

11. Here is a sequence

40       $\xrightarrow{-5}$       35       $\xrightarrow{-5}$       30                      25                      20

Circle the expression for the  $n$ th term of the sequence.

$5n + 35$

$5n - 45$

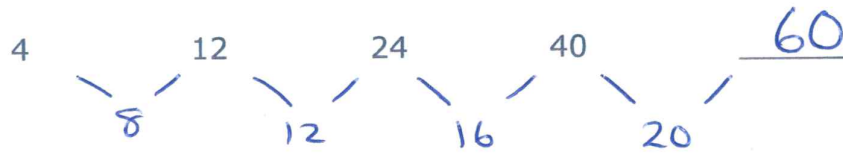
$45 - 5n$

$n - 5$

[1]



12 Work out the next term of this quadratic sequence.

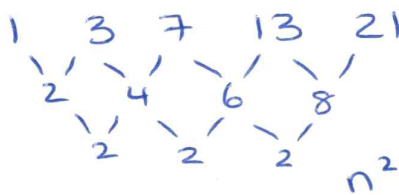


[2]

13. Here are the first 5 terms of a quadratic sequence.

1                  3                  7                  13                  21

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



$$\begin{array}{r} 1 \quad 3 \quad 7 \quad 13 \quad 21 \\ -1 \quad 4 \quad 9 \quad 16 \quad 25 \\ \hline 0 \quad -1 \quad -2 \quad -3 \quad -4 \end{array}$$

[3]

$$\underline{\underline{n^2 - n + 1}}$$

14. Here is a sequence.

2                   $2\sqrt{7}$                   14                   $14\sqrt{7}$

a) Work out the next term.

$14\sqrt{7} \times \sqrt{7} = 14 \times 7 = 98$  a) ..... 98 [1]

b) Find the  $n$ th term.

b) .....  $2(\sqrt{7})^{n-1}$  [3]

c) Find the value of the 21st term divided by the 17th term.

$\frac{2(\sqrt{7})^{20}}{2(\sqrt{7})^{16}} = (\sqrt{7})^4 = 7^2 = 49$  c) ..... 49 [2]

15. Here is a linear sequence.

5       $+8$       13       $+8$       21                  29

Circle the expression for the  $n$ th term of the sequence.

$n + 8$

$5n + 8$

$8n$

$8n - 3$

[1]