

Name: \_\_\_\_\_

# GCSE (1 – 9)

## Quadratic Sequences

### Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

### 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.*

### 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 Write down the next two terms in the following quadratic sequence.

9	13	19	27
+4	+6	+8	
	2	2	

$$27 + 10 = 37$$

$$37 + 12 = 49$$

..... 37 ..... , ..... 49 .....

(Total for Question 1 is 2 marks)

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- 2 Write down the next two terms in the following quadratic sequence.

-5	0	9	22
+5	+9	+13	
	4	4	

$$22 + 17 = 39$$

$$39 + 21 = 60$$

..... 39 ..... , ..... 60 .....

(Total for Question 2 is 2 marks)

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3 The  $n$ th term of a sequence is

$$2n^2 + 4n - 1$$

Work out the 10th term of the sequence.

$$2(10)^2 + 4(10) - 1$$

.....  
239

**(Total for Question 3 is 2 marks)**

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4 The  $n$ th term of a sequence is

$$n^2 + 2n$$

Work out the first 5 terms of the sequence.

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

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

$$(3)^2 + 2(3) = 15$$

$$(4)^2 + 2(4) = 24$$

$$(5)^2 + 2(5) = 35$$

.....  
3, 8, 15, 24, 35

**(Total for Question 4 is 2 marks)**

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

5                      11                      19                      29                      41

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

$$an^2 + bn + c$$

$$\begin{array}{cccccc} a + b + c & \longrightarrow & 5 & 11 & 19 & 29 & 41 \\ 3a + b & \longrightarrow & 6 & 8 & 10 & 12 & \\ 2a & \longrightarrow & 2 & 2 & 2 & & \end{array}$$

$$2a = 2 \qquad 3a + b = 6 \qquad a + b + c = 5$$

$$a = 1 \qquad 3(1) + b = 6 \qquad 1 + 3 + c = 5$$

$$3 + b = 6 \qquad 4 + c = 5$$

$$b = 3 \qquad c = 1$$

$$\dots\dots\dots n^2 + 3n + 1 \dots\dots\dots$$

(Total for Question 5 is 4 marks)

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

2                      10                      22                      38                      58

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

$$\begin{array}{cccccc} 2 & 10 & 22 & 38 & 58 \\ 8 & 12 & 16 & 20 & \\ 4 & 4 & 4 & & \end{array}$$

$$2a = 4 \qquad 3a + b = 8 \qquad a + b + c = 2$$

$$a = 2 \qquad 3(2) + b = 8 \qquad 2 + 2 + c = 2$$

$$6 + b = 8 \qquad 4 + c = 2$$

$$b = 2 \qquad c = -2$$

$$\dots\dots\dots 2n^2 + 2n - 2 \dots\dots\dots$$

(Total for Question 6 is 4 marks)

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

15                  19                  25                  33                  43

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

15    19    25    33    43  
      4    6        8    10  
          2    2        2

$$2a = 2$$

$$3a + b = 4$$

$$a + b + c = 15$$

$$a = 1$$

$$3(1) + b = 4$$

$$1 + 1 + c = 15$$

$$3 + b = 4$$

$$c = 13$$

$$b = 1$$

$$\dots\dots\dots n^2 + n + 13 \dots\dots\dots$$

(Total for Question 7 is 4 marks)

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

2                  10                  24                  44                  70

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

2    10    24    44    70  
      8    14    20    26  
          6    6        6

$$2a = 6$$

$$3a + b = 8$$

$$a + b + c = 2$$

$$a = 3$$

$$3(3) + b = 8$$

$$3 - 1 + c = 2$$

$$9 + b = 8$$

$$2 + c = 2$$

$$b = -1$$

$$c = 0$$

$$\dots\dots\dots 3n^2 - n \dots\dots\dots$$

(Total for Question 8 is 4 marks)

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

19            15            9            1            -9

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

19      15      9      1      -9  
          -4      -6      -8      -10  
                  -2      -2      -2

$$2a = -2$$

$$3a + b = -4$$

$$a + b + c = 19$$

$$a = -1$$

$$3(-1) + b = -4$$

$$-1 - 1 + c = 19$$

$$-3 + b = -4$$

$$-2 + c = 19$$

$$b = -1$$

$$c = 21$$

$$\underline{\underline{-n^2 - n + 21}}$$

(Total for Question 9 is 4 marks)

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

-2            -1            1            4            8

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

-2      -1      1      4      8  
          1      2      3      4  
                  1      1      1

$$2a = 1$$

$$3a + b = 1$$

$$a + b + c = -2$$

$$a = 0.5$$

$$3(0.5) + b = 1$$

$$0.5 - 0.5 + c = -2$$

$$1.5 + b = 1$$

$$c = -2$$

$$b = -0.5$$

$$\underline{\underline{0.5n^2 - 0.5n - 2}}$$

(Total for Question 10 is 4 marks)

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

6                  10                  16                  24                  34

(a) Show that the  $n$ th term is  $n^2 + n + 4$

6          10          16          24          34  
          4           6           8           10  
                  2           2           2

$$\begin{array}{l} 2a = 2 \\ a = 1 \end{array} \quad \begin{array}{l} 3a + b = 4 \\ 3(1) + b = 4 \\ 3 + b = 4 \\ b = 1 \end{array} \quad \begin{array}{l} a + b + c = 6 \\ 1 + 1 + c = 6 \\ 2 + c = 6 \\ c = 4 \end{array}$$

$$n^2 + n + 4 \quad (4)$$

(b) Hence, determine whether 136 is a term in the sequence.

$$\begin{aligned} n^2 + n + 4 &= 136 \\ n^2 + n - 132 &= 0 \\ (n + 12)(n - 11) &= 0 \\ n &= -12 \quad n = 11 \end{aligned}$$

136 is the 11th term

(2)

(Total for Question 11 is 6 marks)

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

-8                  2                  16                  34                  56

(a) Show that the  $n$ th term is  $2n^2 + 4n - 14$

-8      2      16      34      56  
10    14      18      22  
4        4        4

$$2a = 4 \quad 3a + b = 10 \quad a + b + c = -8$$

$$a = 2 \quad 3(2) + b = 10 \quad 2 + 4 + c = -8$$

$$6 + b = 10 \quad 6 + c = -8$$

$$b = 4 \quad c = -14$$

$$2n^2 + 4n - 14 \quad (4)$$

(b) Hence, determine whether 272 is a term in the sequence.

$$2n^2 + 4n - 14 = 272$$

$$2n^2 + 4n - 286 = 0$$

$$n^2 + 2n - 143 = 0$$

$$(n + 13)(n - 11) = 0$$

$$n = -13 \quad n = 11$$

272 is the 11th term

(2)

(Total for Question 12 is 6 marks)