HIGHER

8.5 The Nth Term of a Quadratic Sequence: 2-hour Pack

Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The first three terms of a sequence are 8, 20 and 40. The sequence is quadratic and its second difference is 8. Find an expression, in terms of n, for the nth term.

(Total for Question 1 is 4 marks)

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2 The nth term of a sequence is $2n^2 + 7n - 8$. Find and simplify an expression, in terms of n, for the difference between the (n + 1)th term and the nth term.

(Total for Question 2 is 3 marks)

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3 The first four terms of a quadratic sequence are -6, 2, 18, 42. Find the nth term of the sequence and hence work out the 24th term.

(Total for Question 3 is 5 marks)

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4 The first three terms of a sequence are 0, 11 and 26. The sequence is quadratic and its second difference is 4. Find an expression, in terms of n, for the nth term.

(Total for Question 4 is 4 marks)

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5 The nth term of a sequence is $-3n^2 + 3n + 4$. Is -163 a term of this sequence? You must show your working.

(Total for Question 5 is 3 marks)

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6 The nth term of a sequence is $5n^2 - 7n + 1$. Find and simplify an expression, in terms of n, for the difference between the (n + 1)th term and the nth term.

(Total for Question 6 is 3 marks)

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7 The first three terms of a sequence are 0, -4 and -10. The sequence is quadratic and its second difference is -2. Find an expression, in terms of n, for the nth term.

(Total for Question 7 is 4 marks)

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8 The first three terms of a sequence are -9, -18 and -31. The sequence is quadratic and its second difference is -4. Find an expression, in terms of n, for the nth term.

(Total for Question 8 is 4 marks)

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9 The first three terms of a sequence are 5, 2 and -5. The sequence is quadratic and its second difference is -4. Find an expression, in terms of n, for the nth term.

(Total for Question 9 is 4 marks)

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10 The nth term of a sequence is $6n^2 - 4n - 7$. Find and simplify an expression, in terms of n, for the difference between the (n + 1)th term and the nth term.

(Total for Question 10 is 3 marks)

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11 The first three terms of a sequence are -4, -11 and -22. The sequence is quadratic and its second difference is -4. Find an expression, in terms of n, for the nth term.

(Total for Question 11 is 4 marks)

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12 Here are the first five terms of a quadratic sequence:
3, 8, 15, 24, 35

(a) Find an expression, in terms of n, for the nth term of the sequence. **(3)**

.....

(b) Work out the 12th term of the sequence. **(1)**

.....

(Total for Question 12 is 4 marks)

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13 The first four terms of a quadratic sequence are 6, 27, 60, 105. Find the nth term of the sequence and hence work out the 17th term.

(Total for Question 13 is 5 marks)

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14 The first three terms of a sequence are 4, 11 and 26. The sequence is quadratic and its second difference is 8. Find an expression, in terms of n, for the nth term.

(Total for Question 14 is 4 marks)

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15 The first three terms of a sequence are -3, -12 and -23. The sequence is quadratic and its second difference is -2. Find an expression, in terms of n, for the nth term.

(Total for Question 15 is 4 marks)

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16 The nth term of a sequence is $-2n^2 + 7n + 12$. Find and simplify an expression, in terms of n, for the difference between the (n + 1)th term and the nth term.

(Total for Question 16 is 3 marks)

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17 The first four terms of a quadratic sequence are -7, -15, -25, -37. Find the nth term of the sequence and hence work out the 15th term.

(Total for Question 17 is 5 marks)

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18 Here are the first four terms of a quadratic sequence:
7, 16, 29, 46 Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 18 is 3 marks)

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19 Here are the first five terms of a quadratic sequence:
23, 20, 15, 8, -1 Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 19 is 3 marks)

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20 Here are the first five terms of a quadratic sequence:
5, 12, 25, 44, 69 Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 20 is 3 marks)

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21 Here are the first four terms of a sequence:
$3n^2 - n$ gives the nth term.

(a) Work out the 2nd and 4th terms of the sequence. **(2)**

(b) Find the value of n for which the nth term of the sequence is 140. **(3)**

(Total for Question 21 is 5 marks)

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22 Here are the first five terms of a quadratic sequence:
1.5, 4, 7.5, 12, 17.5 Find an expression, in terms of n, for the nth term of the sequence.

(Total for Question 22 is 3 marks)

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23 Sequence A has nth term $n^2 + 2$. Sequence B has nth term $4n - 1$. Find the values of n for which the nth term of Sequence A equals the nth term of Sequence B.

(Total for Question 23 is 4 marks)

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24 The nth term of a quadratic sequence is $n^2 + n + 41$.

(a) Work out the first four terms of the sequence. **(2)**

(b) Ben notices that 43, 47, 53 and 61 are all prime numbers and says, 'Every term in this sequence is a prime number.' Find a value of n that shows Ben is wrong. **(2)**

(Total for Question 24 is 4 marks)

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Mark scheme · 8.5 The Nth Term of a Quadratic Sequence: 2-hour Pack

Question 1

a = 8/2 = 4	**M1**
subtracts $4n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$4n^2 + 4$	**A1**

Answer: $4n^2 + 4$

Question 2

writes the (n + 1)th term as $2(n + 1)^2 + ...$	**M1**
expands and subtracts the nth term	**M1**
4n + 9	**A1**

Answer: 4n + 9

Question 3

first differences 8, 16, 24	**M1**
second difference 8, so a = 4	**M1**
subtracts the quadratic part to find the linear part	**M1**
$4n^2 - 4n - 6$	**A1**
2202	**A1**

Answer: $4n^2 - 4n - 6$; term 24 = 2202

Question 4

a = 4/2	**M1**
subtracts $2n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$2n^2 + 5n - 7$	**A1**

Answer: $2n^2 + 5n - 7$

Question 5

$-3n^2 + 3n + 4 = -163$	**M1**
tests values of n or solves the quadratic	**M1**
No with supporting working	**A1**

Answer: No

Question 6

writes the (n + 1)th term as $5(n + 1)^2 + ...$	**M1**
expands and subtracts the nth term	**M1**
10n - 2	**A1**

Answer: 10n - 2

Question 7

a = -2/2 = -1	**M1**
subtracts $-n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$-n^2 - n + 2$	**A1**

Answer: $-n^2 - n + 2$

Question 8

a = -4/2 = -2	**M1**
subtracts $-2n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$-2n^2 - 3n - 4$	**A1**

Answer: $-2n^2 - 3n - 4$

Question 9

a = -4/2 = -2	**M1**
subtracts $-2n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$-2n^2 + 3n + 4$	**A1**

Answer: $-2n^2 + 3n + 4$

Question 10

writes the (n + 1)th term as $6(n + 1)^2 + ...$	**M1**
expands and subtracts the nth term	**M1**
12n + 2	**A1**

Answer: 12n + 2

Question 11

a = -4/2 = -2	**M1**
subtracts $-2n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$-2n^2 - n - 1$	**A1**

Answer: $-2n^2 - n - 1$

Question 12

(a) finding the second difference (2) and halving it to get the coefficient of n^2 (a=1)	**M1**
(a) comparing the sequence to n^2 (1, 4, 9, 16, 25) to find the linear remainder 2n	**M1**
(a) $n^2 + 2n$ oe	**A1**

(a) Answer: $n^2 + 2n$

(b) 168 (ft from candidate's expression in (a))	**B1**

(b) Answer: 168

Question 13

first differences 21, 33, 45	**M1**
second difference 12, so a = 6	**M1**
subtracts the quadratic part to find the linear part	**M1**
$6n^2 + 3n - 3$	**A1**
1782	**A1**

Answer: $6n^2 + 3n - 3$; term 17 = 1782

Question 14

a = 8/2 = 4	**M1**
subtracts $4n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$4n^2 - 5n + 5$	**A1**

Answer: $4n^2 - 5n + 5$

Question 15

a = -2/2 = -1	**M1**
subtracts $-n^2$ from each term	**M1**
finds the linear part from the remainders	**M1**
$-n^2 - 6n + 4$	**A1**

Answer: $-n^2 - 6n + 4$

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Question 16

writes the (n + 1)th term as $-2(n + 1)^2$ + ...	**M1**
expands and subtracts the nth term	**M1**
-4n + 5	**A1**

Answer: -4n + 5

Question 17

first differences -8, -10, -12	**M1**
second difference -2, so a = -1	**M1**
subtracts the quadratic part to find the linear part	**M1**
$-n^2$ - 5n - 1	**A1**
-301	**A1**

Answer: $-n^2$ - 5n - 1; term 15 = -301

Question 18

finding the second difference (4) and halving it to get a=2	**M1**
comparing the sequence to $2n^2$ (2, 8, 18, 32) to find the linear remainder 3n+2	**M1**
$2n^2$ + 3n + 2 oe	**A1**

Answer: $2n^2$ + 3n + 2

Question 19

finding the second difference (-2) and halving it to get a=-1	**M1**
comparing the sequence to $-n^2$ (-1, -4, -9, -16, -25) to find the constant remainder 24	**M1**
24 - n^2 oe	**A1**

Answer: 24 - n^2

Question 20

finding the second difference (6) and halving it to get a=3	**M1**
comparing the sequence to $3n^2$ (3, 12, 27, 48, 75) to find the linear remainder -2n+4	**M1**
$3n^2$ - 2n + 4 oe	**A1**

Answer: $3n^2$ - 2n + 4

Question 21

(a) 10	**B1**
(a) 44	**B1**

(a) Answer: 10, 44

(b) forming the equation $3n^2$ - n - 140 = 0	**M1**
(b) solving using the quadratic formula or factorisation	**M1**
(b) n = 7 cao (rejecting the non-integer negative solution)	**A1**

(b) Answer: n = 7

Question 22

finding the second difference (1) and halving it to get a=0.5	**M1**
comparing the sequence to $0.5n^2$ (0.5, 2, 4.5, 8, 12.5) to find the linear remainder n	**M1**
$0.5n^2$ + n oe, e.g. $(n^2+2n)/2$	**A1**

Answer: $0.5n^2$ + n

Question 23

setting n^2 + 2 = 4n - 1	**M1**
rearranging to n^2 - 4n + 3 = 0	**M1**
factorising (n-1)(n-3) = 0, or using the quadratic formula	**M1**
both n = 1 and n = 3 cao	**A1**

Answer: n = 1 and n = 3

Question 24

(a) at least two of 43, 47, 53, 61 correct	**B1**
(a) all of 43, 47, 53, 61 correct	**B1**

(a) Answer: 43, 47, 53, 61

(b) testing a suitable value of n, such as n=40, in n^2+n+41	**M1**
(b) correct value shown to be non-prime, e.g. n=40 gives 1681 = 41 x 41, which is not prime	**A1**

(b) Answer: n = 40 gives 1681 = 41 x 41, which is not prime

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