**GCSE Mathematics (1MA1)**

**Themed papers – Quadratic Sequences**

**Compiled from student-friendly mark schemes**

**Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn’t show follow-through marks (marks that are awarded despite errors being made) or special cases.**

**It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme.**

**NOTES ON MARKING PRINCIPLES**

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| --- |
| **Guidance on the use of codes within this mark scheme** |
| M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.  P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.  A1 – accuracy mark. This mark is generally given for a correct answer following correct working.  B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.  C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.  Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer). |

**Question 1 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a)(i) | 6, 9 | B1 | This mark is given for the correct answer only |
| (a)(ii) | “Yes” and  e.g “its the 11th term” or 112 + 5 = 126 | C1 | This mark is given for the correct answer and supporting evidence |
| (b) | –7*n* **or** –7*n* + *k* (where *k* ≠ 33) | M1 |  |
| –7*n* + 33 | A1 | Thi mark is given for a correct answer or a correct equivalent |

**Question 2 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 3 6 11 18 27 38 51  3 5 7 9 11 13  2 2 2 2 2 | M1 | This mark is given for a method to find 2nd differences |
| *n*2 + 2 | A1 | This mark is given for the correct answer only |
| (b) | 502 + 2 = 2502 | B1 | This mark is given for the correct answer only |

**Question 3 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 6 10 14 18 22  4 4 4 4 | M1 | This mark is given for a method to find the second differences |
| 2*n*2 | M1 | This mark is given for a method to recognise that a second difference of 4 means a 2*n*2 term will be used |
| 2*n*2 – 3 | A1 | This mark is given for the correct answer only |

**Question 4 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 4 11 22 37 56  7 11 15 19  4 4 4  2nd differences imply a term in 2*n*2 | M1 | This mark is given for a correct start to a method to find *n*th term |
| 2*n*2 + *n* gives 3, 10, 21, 36, 55… | M1 | This mark is given for a method leading to 2*n*2 and either *n* or 1 |
| 2*n*2 + *n* + 1 | A1 | This mark is given for the correct answer only |

**Question 5 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 3 8 15 24  5 7 9  2 2  2nd difference of 2 implies 1*n*2  or 12 + …, 22 + …, 32 + … | M1 | This mark is given for a correct deduction from differences |
| 3 = 12 + 2, 8 = 22 + 4, 15 = 32 + 6, 24 = 42 + 8 | M1 | This mark is given for a method link 12, 22, 32  with 2, 4, 6, |
| *n*2 + 2*n* | A1 | This mark is given for the correct answer only (or an equivalent expression) |
| (b) | 31 is not a power of 2 | C1 | This mark is given for a correct explanation |

**Question 6 (Total 6 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | (*a* × 22) + (*b* × 2) = –2  (*a* × 42) + (*b* × 4) = –2 | P1 | This mark is given for a process to find equations in *a* and *b* |
| 4*a* + 2*b* = –2  16*a* + 4*b* = 12 | P1 | This mark is given for a process to find a pair of simultaneous equations |
| *a* = 2 and *b* = –5 | A1 | This mark is given for correctly solving two simultaneous equations to find values of *a* and *b* |
| (2 × 62) + (–5 × 6) = 72 – 30  = 42 | A1 | This mark is given for a correct answer only |
| (b) | 0 2 6 12 20  2 4 6 8  2 2 2 | M1 | This mark is given for using the method of differences; second difference of 2 implies *n*2 |
| *n*2 – *n* | A1 | This mark is given for the correct answer only |

**Question 7 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | –1 0 3 8 15  1 3 5 7  2 2 2 | B1 | This mark is given for a correct deduction from differences: a second difference of 2 implies a term *n*2 |
| *n*2 – 2*n* | A1 | This mark is given for a correct expression |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | The terms of 2*n*2 – 1 are  1, 7, 17, 31, 49… | M1 | This mark is given for a method to generate at least three terms of the first sequence |
| The terms of 40 – *n*2 are  39, 36, 31, 24, 15… | M1 | This mark is given for a method to generate at least three terms of the second sequence |
| 31 | A1 | This mark is given for a correctly identifying the only number in both sequence |

**Question 9 (Total 5 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | + 1 = *k* × 1 | 1 | This mark is given for expressing the common ratio algebraically |
| = | 1 | This mark is given for setting up an appropriate equation in *x* |
| ( – 1) × ( + 1) = 1  *x* ­ – 1 = 1  *x* = 2 | 1 | This mark is given for the correct answer only |
| (b) | (√2 + 1) × (√2 + 1)2 | 1 | This mark s given for showing that the 5th term = 3rd term × (common ratio)2 |
| = 2√2 + 4 +√2 + 2 + 2√2 + 1  = 7 + 5√2 | 1 | This mark is given for a correct conclusion supported by working |

**Question 10 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 1.5 3 5.5 9 13.5  1.5 2.5 3.5 4.5  1 1 1 | P1 | This process mark is given for process to find common second differences |
| *n*2 | P1 | This process mark is given for *n*2 as part of an algebraic expression |
| *n*2 + 1 | A1 | This accuracy mark is given for the correct answer only (or an equivalent expression) |

**Question 11 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 1 3 7 13 21  2 4 6 8  2 2 2 | M1 | This mark is given for a correct deduction from differences: a second difference of 2 implies a term n2 |
| 12, 22, 32, .. linked with 1, 2, 3, ... | M1 |  |
| *n*2 – *n* + 1 | A1 | This mark is given for a correct answer or a correct equivalent |

**Performance data:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Q** | **Taken from** | | | **Total Marks available** | **TOPIC** | **Spec Ref** | **AO** | **% Mean marks** | **Edexcel mean averages Marks of candidates who achieved grade:** | | | | | | | | | | |
| **Q** | **Series** | **Paper** | **ALL** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **U** |
| 1a | 2a | Mock Set 4 | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1b | 2b | Mock Set 4 | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2a | 7a | Mock Set 2 | 1H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2b | 7b | Mock Set 2 | 1H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 16 | June 2019 | 3H | 3 | Algebra | A25 | 1 | 67 | 2.02 | 2.93 | 2.76 | 2.48 | 2.06 | 1.56 | 1.10 | 0.74 | - | - | 0.44 |
| 4 | 22 | June 2017 | 2H | 3 | Algebra | A24, A25 | 2 | 50 | 1.51 | 2.88 | 2.58 | 2.09 | 1.52 | 0.95 | 0.49 | 0.18 | - | - | 0.07 |
| 5a | 12a | Mock Set 1 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5b | 12b | Mock Set 1 | 2H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6a | 16a | June 2018 | 3H | 4 | Algebra | A16 | 2 | 25 | 0.99 | 3.52 | 2.56 | 1.44 | 0.62 | 0.21 | 0.05 | 0.02 | - | - | 0.00 |
| 6b | 16b | June 2018 | 3H | 2 | Algebra | A19 | 2 | 56 | 1.12 | 1.95 | 1.83 | 1.59 | 1.21 | 0.75 | 0.38 | 0.18 | - | - | 0.08 |
| 7 | 20 | Nov 2019 | 3H | 2 | Algebra | A25 | 1 | 23 | 0.45 | 1.67 | 1.54 | 1.41 | 0.94 | 0.53 | 0.20 | 0.07 | - | - | 0.00 |
| 8 | 6 | Nov 2019 | 2H | 3 | Algebra | A23, A24 | 2 | 20 | 0.60 | 1.00 | 0.49 | 0.75 | 0.73 | 0.76 | 0.67 | 0.33 | - | - | 0.06 |
| 9a | 23a | Nov 2017 | 2H | 3 | Algebra | A24 | 2 | 1 | 0.03 | 2 | 0.85 | 0.2 | 0.08 | 0 | 0 | 0 | - | - | 0 |
| 9b | 23b | Nov 2017 | 2H | 2 | Algebra | A24 N8 | 2 | 1 | 0.01 | 1.12 | 0.47 | 0.09 | 0 | 0 | 0 | 0 | - | - | 0 |
| 10 | 18 | Mock Set 1 | 1H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11 | 17 | Spec Set 1 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **32** |  |  | **14** | **243** | **6.73** | **17.07** | **13.08** | **10.05** | **7.16** | **4.76** | **2.89** | **1.52** | **-** | **-** | **0.65** |