**GCSE Mathematics (1MA1)**

**Themed papers – 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 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 15 + 6 = 21 | B1 | This mark is given for the 6th term of the sequence |
| 21 + 7 = 28 | B1 | This mark is given for the 7th term of the sequence |

**Question 2 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (i) | –1 | B1 | This mark is given for the correct answer only |
| (ii) | For example, sequence decreases –3 each time | C1 | This mark is given for a correct explanation. |

**Question 3 (Total 1 mark)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (23 × 2) + 1 = 47 | 1 | 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** |
| (a)(i) | 30 | B1 | This mark is given for the correct answer only |
| (a)(ii) | Add 7 each time  or  *n*th term is 7*n* – 5 | C1 | This mark is given for a correct explanation |
| (b) | 7*n* – 5, so 10th term = (7 × 10) – 5  65 | B1 | This mark is given for the correct answer only |

**Question 5 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 6*n* – 1 | M1 | This mark is given for 6*n* + *k*, where *k* ≠ –1 |
| A1 | This mark is given for the correct answer only |

**Question 6 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | 3 + 4 = 7, 6 + 4 = 10, 9 + 4 = 13,  12 + 4 = 16, 15 + 4 = 19, 18 + 4 = 22,…  or  (21 – 4) ÷ 3 is not a whole number *n* | B2 | This mark is given for a full explanation  (B1 is given for a partial explanation) |
| (b) | 7, 11  or  8, 16 | B1 | This mark is given for two correct numbers |
| Add one more each time  or  Double the number each time | C1 | This mark is given for a correct explanation |

**Question 7 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 23, 17, 11, 5… | M1 | This mark is given for a method to find the number sin the sequence (subtracting 6 each time) |
| –1 | A1 | This mark is given for the correct answer only |
| (b) | Yes; –100 is even whereas all the other numbers in the sequence are odd | B1 | This mark is given for a correct statement, supported by calculations |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 9 + 15 = 24  15 + 24 = 39 | B1 | This mark is given for the correct answer only |
| (b) | 4th term = *a* + 2*a* = 3*a*  5th term = 2*a* + 3*a* = 5*a* | M1 | This mark is given for a method to find them 4th and 5th terms of the sequence |
| 6th term = 3*a* + 5*a* = 8*a* | A1 | This mark is given for the correct answer only |

**Question 9 (Total 6 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | Number of square tiles are 1 (12) in pattern 1, 4 (22) in pattern 2, 9 (32) in pattern 3, … | M1 | This mark is given finding a method that could lead to the answer |
| 36 (62) in pattern 6 | A1 | This mark is given for the correct answer only |
| (b) | Number of circular tiles are 4 (1 × 4) in pattern 1, 8 (2 × 4) in pattern 2, 9 (3 × 4) in pattern 3, … | M1 | This mark is given finding a method that could lead to the answer |
| 80 (20 × 4) in pattern 20 | A1 | This mark is given for the correct answer only |
| (c) | 1 × 1 = 1, 3 × 3 = 9, 5 × 5 = 25, etc | M1 | This mark is given for a method to generate square numbers for odd patterns |
| odd × odd = odd  or (2*n* – 1)2 = 4*n*2 – 4*n* – 1 = 2(2*n*2 –2*n*) – 1, so always odd | C1 | This mark is given for a correct explanation with supportive evidence |

**Question 10 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | 4 7 10  3 3 | 1 | This mark is given for a method to find the *n*th term |
| 3*n* + 1 | 1 | This mark is given for the correct answer only |
| (b) | If 3*n* + 1 = 90, then *n* = 29.666….. | 1 | This mark is given for showing that 89 is not divisible by 3 |
| No, the pattern can’t be made. | 1 | This mark is given for a correct conclusion supported by argument |

**Question 11 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 5*n* ± … | B1 | This mark is given for finding 5*n* |
| 5*n* – 2 | B1 | This mark is for finding – 2 |
| (b) | No, since 3 × 42 = 48  or  No, since it would mean that *n*2 = 48 but *n* must have an integer value | C1 | This mark is given for a correct comment with evidence shown |

**Question 12 (Total 5 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | 8, 11, or 16 seen | M1 | This mark is given for a method to substitute 1, 2 or 3 into *n*2 + 7 |
| 8, 11, 16 | A1 | This mark is given for the correct answer only |
| (b) | √(128 – 7) = 11; 11th term | B1 | This mark is given for the correct answer only |

**Question 13 (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 14 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | No, because:  numbers in the sequence are even and 603 is not even  or  numbers in the sequence are multiples of 6 and 603 is not a multiple of 6  or  6*n* + 12 = 603 means *n* is not an integer | C1 | This mark is given for a correct statement with an explanation |
| (b) | 42 (or multiple of 42) is a term in the sequence | B1 | This mark is given for a correct answer only |

**Question 15 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  | |  |  |  |  |  |  | | C1 | This mark is given for a correct pattern drawn |
| (b) | 4, 6, 8, 10, 12, 14, … | M1 | This mark is given for a evidence of interpretation: a number sequence or further patterns drawn |
| 16 | A1 | This mark is given for the correct answer only |
| (c) | e.g. pattern 10 has 22 squares | C1 | This mark is given for a start to an explanation or counterexample |
| No; pattern number 10 has 22 squares and pattern number 20 has 42 squares, not 44 squares | C1 | This mark is given for a complete explanation |

**Question 16 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a)(i) | 6, 9 | B1 | This mark is given for a correct answer only |
| (ii) | Yes and it’s the 11th term  **or**  Yes and 112 + 5 = 126 | C1 | This mark is given for a conclusion and a reason |
| (b) | –7*n* **or** –7*n* + *k* (where *k* ≠ 33 or missing) | M1 |  |
| –7*n* + 33 | A1 | This mark is given for a correct answer or an equivalent |

**Question 17 (Total 2 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  Next term = 51 + 15 = 66 | B1 | This mark is given for the correct answer only |
| (b) | (2 × 62) + 5 = (2 × 36) + 2 = 77 | B1 | This mark is given for the correct answer only |

**Question 18 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 2 7 12 17 22  5 5 5 5  *n*th term of sequence is 5*n* – 3 | B1 | This mark is given for a process to find the *n*th term of the given sequence |
| 5*n* – 3 = 4*n* + 15  (5*n* – 4*n*) = 15 + 3 | P1 | This mark is given for setting up an equation in *n* to be solved |
| *n* = 18 | A1 | This mark is given for the correct answer only |

**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** | **5** | **4** | **3** | **2** | **1** | **U** |
| 1 | 8 | Nov-19 | 3F | 2 | Algebra | A24 | 1 | **95** | 1.89 | 1.97 | 1.95 | 1.91 | 1.81 | 1.52 | 0.75 |
| 2 | 8 | Mock Set 2 | 2F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 3 | 5 | Nov-17 | 1F | 1 | Algebra | A23 | 1 | **88** | 0.88 | 0.94 | 0.92 | 0.9 | 0.86 | 0.74 | 0.62 |
| 4ai | 4ai | Jun-18 | 3F | 1 | Algebra | A23 | 1 | **96** | 0.96 | 0.98 | 0.98 | 0.97 | 0.96 | 0.92 | 0.68 |
| 4aii | 4aii | Jun-18 | 3F | 1 | Algebra | A23 | 1 | **91** | 0.91 | 0.96 | 0.94 | 0.92 | 0.91 | 0.85 | 0.56 |
| 4b | 4b | Jun-18 | 3F | 1 | Algebra | A23, A24 | 1 | **79** | 0.79 | 0.91 | 0.86 | 0.81 | 0.75 | 0.62 | 0.27 |
| 5 | 26 | Nov-18 | 3F | 2 | Algebra | A23 | 2 | **42** | 0.83 | 1.39 | 1.23 | 0.79 | 0.43 | 0.19 | 0 |
| 6a | 9a | Nov-18 | 2F | 2 | Algebra | A23, A24 | 2 | **39** | 0.78 | 1.61 | 1.14 | 0.76 | 0.39 | 0.15 | 0.02 |
| 6b | 9b | Nov-18 | 2F | 2 | Algebra | A23, A24 | 2 | **60** | 1.2 | 1.46 | 1.33 | 1.23 | 1.05 | 0.71 | 0.38 |
| 7a | 8a | Mock Set 3 | 2F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 7b | 8b | Mock Set 3 | 2F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 8a | 28a | Jun-19 | 2F | 1 | Algebra | A24 | 1 | **34** | 0.34 | 0.67 | 0.5 | 0.35 | 0.2 | 0.09 | 0.02 |
| 8b | 28b | Jun-19 | 2F | 2 | Algebra | A24 | 1 | **28** | 0.55 | 1.26 | 0.86 | 0.52 | 0.25 | 0.11 | 0.04 |
| 9a | 11a | Jun-17 | 1F | 2 | Algebra | A23 | 1 | **57** | 1.15 | 1.7 | 1.46 | 1.19 | 0.9 | 0.57 | 0.22 |
| 9b | 11b | Jun-17 | 1F | 2 | Algebra | A23 | 1 | **70** | 1.4 | 1.76 | 1.64 | 1.49 | 1.28 | 0.85 | 0.31 |
| 9c | 11c | Jun-17 | 1F | 2 | Number | N4 | 2 | **24** | 0.47 | 0.92 | 0.65 | 0.46 | 0.28 | 0.11 | 0.03 |
| 10a | 18a | Nov-17 | 3F | 2 | Algebra | A25 | 1 | **28** | 0.57 | 1.27 | 0.88 | 0.54 | 0.3 | 0.15 | 0.01 |
| 10b | 18b | Nov-17 | 3F | 2 | Algebra | A25 | 2 | **21** | 0.41 | 1.06 | 0.63 | 0.38 | 0.21 | 0.09 | 0.06 |
| 11a | 25a | Jun-17 | 2F | 2 | Algebra | A24, A25 | 1 | 42 | 0.84 | 1.62 | 1.23 | 0.83 | 0.45 | 0.15 | 0.02 |
| 11b | 25b | Jun-17 | 2F | 1 | Algebra | A2, A23, | 1 | **16** | 0.16 | 0.48 | 0.27 | 0.11 | 0.03 | 0.01 | 0 |
| 12a | 15a | Mock Set 1 | 3F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 12b | 15b | Mock Set 1 | 3F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 13 | 26 | Nov-19 | 2F | 3 | Algebra | A23, 24 | 2 | **10** | 0.3 | 0.82 | 0.53 | 0.27 | 0.06 | 0.01 | 0.02 |
| 14a | 6a | Mock Set 1 | 2F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 14b | 6b | Mock Set 1 | 2F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 15a | 5a | Mock Set 1 | 3F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 15b | 5b | Mock Set 1 | 3F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 15c | 5c | Mock Set 1 | 3F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 16ai | 21ai | Mock Set 4 | 3F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 16aii | 21aii | Mock Set 4 | 3F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 16b | 21b | Mock Set 4 | 3F | 2 | − | − | − | **−** | − | − | − | − | − | − |  |
| 17a | 24a | Mock Set 2 | 1F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 17b | 24b | Mock Set 2 | 1F | 1 | − | − | − | **−** | − | − | − | − | − | − |  |
| 18 | 27 | Mock Set 3 | 1F | 3 | − | − | − | **−** | − | − | − | − | − | − |  |
|  |  |  |  | **55** |  |  |  |  | **14.43** | **21.78** | **18** | **14.43** | **11.12** | **7.84** | **4.01** |