**GCSE Mathematics (1MA1)**

**Themed papers – Linear equations and inequalities**

**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 6 marks)**

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| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 13 + 1 = 223 + 2 = 10 | C1 | This mark is given for substituting both 1 and 2 into *x*3 + *x* |
| 2 is < 7 and 10 > 7 which implies there is a solution between 1 and 2 | C1 | This mark is given for a correct statement |
| (b) | *x*3 + *x* = 7*x*3 = 7 – *x* (subtracting *x* from both sides)*x* =  (cube root of both sides) | C1 | This mark is given for a correct algebraic rearrangement |
| (c) | *x*1 =  =  = 1.70997 | M1 | This mark is given for a substitution of 2 into the equation to find *x*1 |
| *x*2 =  =  = 1.74241 | M1 | This mark is given for a substitution of *x*1 into the equation to find *x*2 |
| *x*3 =  =  = 1.73885 | A1 | This mark is given for a substitution of *x*2 into the equation to find *x*3 |

**Question 2 (Total 5 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | *x*1 = –2.64 | M1 | This mark is given for the substitution of −2.5 into the equation to find a value for *x*1 |
| *x*2 = –2.57392 | M1 | This mark is given for the substitution of *x*1 to give*x*2 |
| *x*3 = –2.603767255 | A1 | This mark is given for the substitution of *x*3 to give*x*3 |
| (b) | The iterative form is a rearrangement of the equation | C1 | This mark is given for a correct statement |
| Each iteration gives an estimation of a solution to the equation | C1 | This mark is given for a correct statement |

**Question 3 (Total 9 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | f(0) = –5 and f(1) = 3,  | 1 | This mark is given for showing the sign changes between f(0) and f(1) |
| Thus since there is a sign change, the solution is between *x* = 0 and *x* = 1 | 1 | This mark is given for a correct comment |
| (b) | *x*2 + 7 =  (dividing both sides by *x*) | 1 | This mark is given for the first step in a rearrangement |
| Thus *x* =  | 1 | This mark is given for clear steps showing the complete rearrangement |
| (c) | *x*1 = 0.625 | 1 | This mark is given for the first correct iteration |
| *x*2 = 0.6765327696 | 1 | This mark is given for the second correct iteration |
| *x*3 = 0.6704483001 | 1 | This mark is given for the third correct iteration |
| (d) | (0.670)2 + (7 × 0.670) – 5 = 0.134 | 1 | This mark is given for substituting 0.670 into *x*2 + 7*x* – 5 |
| This is an accurate estimate of the root since the calculation is very close to zero | 1 | This mark is given for a correct comment |

**Question 4 (Total 7 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
| (a) | *x*2 + 5*x* – 4 = –4 when *x* = 0,*x*2 + 5*x* – 4 = 2 when *x* = 1 | M1 | This mark is given for a method to establish at least one root in the interval 0 < *x* < 1 |
| Since there is a sign change, there must be at least one root in 0 < *x* < 1 | C1 | This mark is given for a correct statement |
| (b) | *x*3 + 5*x* = 4*x*2 + 5 =  | C1 | This mark is given for at least one correct step in rearrangement |
| *x* =  | C1 | This mark is given for a fully correct chain of reasoning |
| (c) |  = 0.8 or  =  | B1 | This mark is given for a correct answer only |
| =  | M1 | This mark is given for a method to substitute  into the iteration formula to find  |
| 0.709… or  | A1 | This mark is given for a correct answer only |

**Question 5 (Total 6 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | f(2) = ­–1, f(3) = 3  | M1 | This mark is given for a method to establish that there is at least one root in the interval (2, 3) |
| Since there is a sign change, there must be at least one root in 2 < *x* < 3 | A1 | This mark is given for a supporting explanation |
| (b) | *x*3 = 3*x*2 – 3*x* =  | C1 | This mark is given for a correct rearrangement  |
| (c) | *x*1 =  | M1 | This mark is given for finding an expression for *x*1 |
| *x*1 = 2.080… | A1 | This mark is given for correctly evaluating *x*1 |
| *x*2 = 2.153… | A1 | This mark is given for correctly evaluating *x*2 |

**Question 6 (Total 6 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | M1 | This mark is given for rearranging to *x*3 = |
|  | C1 | This mark is given for a clear step to show rearrangement |
| (b) | $x\_{1} $= 3.29296875$x\_{2}$ = 3.276659786$x\_{3}$ = 3.279420685 | M1 | This mark is given for one correct iteration |
| M1 | This mark is given for 2 further iterations seen |
| A1 | This mark is given for a fully correct answer only |
| (c) | “iteration is an estimation of the solution” | C1 | This mark is given for a correct statement |

**Performance data:**

|  |  |  |  |  |  |  |  |
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| **Q** | **Taken from**  | **Total Marks available** | **TOPIC** | **Spec Ref** | **AO** | **% Mean marks** | **Edexcel mean averagesMarks of candidates who achieved grade:** |
| **Q** | **Series** | **Paper** | **ALL** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **U** |
| 1a | 18a | June 2018 | 3H | 2 | Algebra | A4 | 2 | 38 | 0.76 | 1.77 | 1.44 | 1.05 | 0.70 | 0.43 | 0.23 | 0.11 | - | - | 0.04 |
| 1b | 18b | June 2018 | 3H | 1 | Algebra | A20 | 2 | 70 | 0.70 | 0.98 | 0.95 | 0.90 | 0.80 | 0.59 | 0.33 | 0.14 | - | - | 0.05 |
| 1c | 18c | June 2018 | 3H | 3 | Algebra | A20 | 1 | 58 | 1.75 | 2.95 | 2.86 | 2.57 | 1.95 | 1.13 | 0.51 | 0.21 | - | - | 0.06 |
| 2a | 16a | June 2017 | 3H | 3 | Ratio | R16 | 1 | 41 | 1.23 | 2.70 | 2.29 | 1.78 | 1.18 | 0.65 | 0.27 | 0.09 | - | - | 0.03 |
| 2b | 16b | June 2017 | 3H | 2 | Ratio | R16 | 3 | 7 | 0.14 | 0.81 | 0.35 | 0.14 | 0.05 | 0.02 | 0.01 | 0.00 | - | - | 0.00 |
| 3a | 15a | Nov 2017 | 3H | 2 | Algebra | A20 | 2 | 9 | 0.17 | 1.50 | 1.15 | 0.65 | 0.37 | 0.22 | 0.16 | 0.11 | - | - | 0.02 |
| 3b | 15b | Nov 2017 | 3H | 2 | Algebra | A4 | 2 | 17 | 0.34 | 2.00 | 1.82 | 1.40 | 1.13 | 0.66 | 0.28 | 0.10 | - | - | 0.03 |
| 3c | 15c | Nov 2017 | 3H | 3 | Algebra | A20 | 1 | 8 | 0.25 | 2.62 | 2.06 | 1.22 | 0.81 | 0.50 | 0.18 | 0.05 | - | - | 0.01 |
| 3d | 15d | Nov 2017 | 3H | 2 | Algebra | A20 | 1 | 3 | 0.05 | 0.88 | 0.94 | 0.19 | 0.20 | 0.08 | 0.02 | 0.00 | - | - | 0.00 |
| 4a | 13a | Mock Set 1  | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4b | 13b | Mock Set 1  | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4c | 13c | Mock Set 1  | 3H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5a | 16a | Mock Set 3 | 2H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5b | 16b | Mock Set 3 | 2H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5c | 16c | Mock Set 3 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6a | 21a | Spec Set 1  | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6b | 21b | Spec Set 1  | 3H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6c | 21c | Spec Set 1  | 3H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **39** |  |  |  |  | **5.39** | **16.21** | **13.86** | **9.9** | **7.19** | **4.28** | **1.99** | **0.81** | **-** | **-** | **0.24** |