**GCSE Mathematics (1MA1)**

**Themed papers – Simultaneous Equations**

**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 3 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 3*x* – 3*x* = 0, *y* – –4*y* = 5*y*, ­4 – 6 = –105*y* = –10 | M1 | This mark is given for a method to eliminate one variable |
| *y* = –23*x* ­– 2 = –4 or 3*x* + 8 = 6 | M1 | This mark is given for substituting one found value in one of the equations |
| 3*x* = –2, (*y* = −2) | A1 | This mark is given for a correct pair of answers only |

**Question 2 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 6*x* – 4*y* = –102*x* – 4*y* = 24*x*  = –12or6*x* – 4*y* = –106*x* – 12*y* = 6 8*y* = –16 | M1 | This mark is given for a method to eliminate either *x* or *y* |
| *x* = –3–6 – 4*y* = 2or*y* = –26*x* + 8 = –10  | M1 | This mark is given for correct substitution of the value of *x* or *y* or for a method to eliminate the other unknown  |
| *x* = –3, *y* = –2 | A1 | 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** |
|  | 15*x* + 3*y* = 63 *x* – 3*y* = 9 | M1 | This mark is given for a method to eliminate one variable |
| 16*x* = 72 *x* = 4.5 | M1 | This mark is given for a method to find the value of one variable |
| 4.5 – 3*y* = 9*y* = –1.5 | A1 | This mark is given for both correct solutions |

**Question 4 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  | M1 | This mark is given for a method to eliminate one variable |
|  or  | A1 | This mark is given for find the value of one variable |
|  | M1 | This mark is given for substituting the value found into one of the equations |
|  and  | A1 | This mark is given for both correct solutions |

**Question 5 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 20*x* + 30*y* = 2542*x* + 30*y* = –63or28*x* + 42*y* = 3528*x* + 20*y* = –42  | M1 | This mark is given for a process to eliminate one variable or a rearrangement of one equation leading to substitution |
|  | *–*22*x* = 88, *x* = – 4 or 22*y* = 77, *y* = 3.5 | A1 | This mark is given for finding a correct value of *x* or a correct value of *y*  |
|  | *x* = –4, so –16 *x* + 6*y* = 5or*y* = 3.5, so 4*x* + 21 = 5 | M1 | This mark is given for *x* to find *y* or of a correct substitution of *y* to find *x* |
|  | *x* = – 4 *y* = 3.5 | 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** |
|  | *y* – 3*x* =13, so *y* = 3*x +* 13*x*2 + (3*x* + 13)2 = 25  | M1 | This mark is given for the substitution of *y* = 3*x* + 13 into *x*2 + *y*2 = 25 |
| *x*2 + 9*x*2 + 39*x* + 39*x* +169 = 25 | M1 | This mark is given for the expansion of *x*2 + (3*x* + 13)2 = 25 |
| 10*x*2 + 78*x* + 144 = 0 | M1 | This mark is given for forming a quadratic equation equal to zero |
|  | 2(5*x*2 + 39*x* + 72) = 02(5*x* + 24)(*x* + 3) = 0 | M1 | This mark is given for a method to solve the quadratic equation |
|  | *x* = −3, *y* = 4*x* = –, *y* = – | A1 | This mark is given for a pair of correct solutions only |

**Question 7 (Version 1) (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | *x* =   | M1 | This mark is given for a method to find an expression for *x* to substitute into *x*2 – 4*y*2 = 9 |
|  – 4*y*2 = 9 – 4*y*2 = 949 – 56*y* + 16*y*2 – 36*y*2 = 81 | M1 | This mark is given for a method to expand and simplify |
| 20*y*2 +56*y* + 32 = 0Dividing through by 4 gives5*y*2 + 14*y* = 8 = 0 | M1 | This mark is given for a method to form a quadratic equation to be solved |
| (5*y* + 4)(*y* + 2) = 0 | M1 | This mark is given factorising the quadratic to solve for *y* (and hence *x*) |
| *x* = 3, *y* = –*x* = 5, *y* = ­–2 | A1 | This mark is given for the correct answers only |

**Question 7 (Version 2) (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | *y* =   | M1 | This mark is given for a method to find an expression for *y* to substitute into *x*2 – 4*y*2 = 9 |
| *x*2 – 4  = 94*x*2 – 49 + 42*x* – 9*x*2 = 36 | M1 | This mark is given for a method to expand and simplify |
| 5*x*2 – 42*x* + 85 = 0 | M1 | This mark is given for a method to form a quadratic equation to be solved |
| (5*x* – 17)(*x* – 5) = 0 | M1 | This mark is given factorising the quadratic to solve for *x* (and hence *y*) |
| *x* = 3, *y* = –*x* = 5, *y* = ­–2 | A1 | This mark is given for the correct answers only |

**Question 8 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | (2*y* – 3)2 + *y*2 = 18 | M1 | This method mark is given for rearranging *x* – 2*y* = –3 to find an expression for *x* and substituting  |
| 4*y*2 – 6*y* – 6*y* + 9 | M1 | This method mark is given for the expansion of the expression (2*y* – 3)2 |
| 5*y*2 – 12*y* – 9 = 0 | M1 | This method mark is given for rearranging to find a quadratic equation to be solved |
| (5*y* + 3)(*y* – 3) = 0 | M1 | This method mark is given for factorising the quadratic equation |
| *x* = 3, *y* = 3; *x* = − 4.2, *y* = − 0.6 | A1 | This accuracy mark is given for the correct pair of solutions only |

**Question 9 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *y* = 2*x*2 – = 17 | M1 | This mark is given for a method to find *y* in terms of *x* and substitute |
| 2*x*2 –  = 178*x*2 – 1 + 2*x* – *x*2 = 68 | M1 | This mark is given for an expansion of the bracket after substitution |
| 7*x*2 + 2*x* – 69 = 0 | M1 | This mark is given for forming a quadratic equation to be solved |
| (7*x* + 23)(*x* – 3) = 0 | M1 | This mark is given for factorising the quadratic equation |
| *x* = – or *x* = 3*y* =  or *y* = –1 | A1 | This mark is given for two sets of correct solutions |

**Question 10 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 2*x* + 2 = 2*x*2 – 3*x*– 10 | M1 | This mark is given for eliminating one variable |
|  | M1 | This mark is given for rearranging to get a quadratic in one variable |
|  | M1 | use of factorisation or correct substitution into quadratic formula or completing the square to solve an equation of the form *ax*2 + *bx* + *c* = 0 |
| *x* = –1.5, *x* = 4 **or** *y* = –1, *y* = 10 | A1 |  |
| *x* = –1.5, *y* = –1 and *x* = 4, *y* = 10 | C1 | This mark is given for correctly matched *x* and *y* values |

**Performance data:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 1 | 2 | June 2017 | 3H | 3 | Algebra | A9 | 2 | 66 | 3.32 | 4.76 | 4.33 | 3.82 | 3.43 | 2.94 | 2.18 | 1.09 | - | - | 0.44 |
| 2 | 5 | Mock Set 3 | 1H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 6 | Nov 2018 | 1H | 3 | Algebra | A19 | 1 | 32 | 0.95 | 3.00 | 2.73 | 2.39 | 1.81 | 1.32 | 0.72 | 0.30 | - | - | 0.13 |
| 4 | 10 | Mock Set 4 | 2H | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 14 | Mock Set 2  | 2H | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 | 20 | June 2017 | 1H | 5 | Algebra | A19 | 1 | 20 | 1.02 | 3.62 | 2.36 | 1.45 | 0.72 | 0.26 | 0.07 | 0.01 | - | - | 0.00 |
| 7 | 20 | June 2019 | 3H | 5 | Algebra | A19 | 1 | 12 | 0.60 | 2.92 | 1.39 | 0.66 | 0.27 | 0.09 | 0.03 | 0.01 | - | - | 0.01 |
| 8 | 20 | Mock Set 1  | 1H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 9 | 19 | Nov 2018 | 3H | 5 | Algebra | A19 | 1 | 10 | 0.48 | 4.90 | 3.94 | 2.49 | 1.23 | 0.43 | 0.10 | 0.01 | - | - | 0.00 |
| 10 | 20 | Mock Set 4 | 3H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **42** |  |  |  |  | **6.37** | **19.2** | **14.75** | **10.81** | **7.46** | **5.04** | **3.1** | **1.42** | **0** | **0** | **0.58** |