**GCSE Mathematics (1MA1)**

**Themed papers – Complete the Square**

**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)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (i) | *x*2 – 6*x* + 9 = (*x* – 3)2  *a* = 3 | M1 | This mark is given for method to find a value for *a* |
| *x*2 – 6*x* + 1 = (*x* – 3)2 – 8  *b* = 8 | A1 | This mark is given for method to find a value for *b* |
| (ii) | (3, –8) | B1 | This mark is given for the correct answer only |

**Question 2 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  | M1 |  |
|  | A1 | This mark is given for the correct answer only |

**Question 3 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *x* = | M1 | This mark is given for a method to find the roots of *y* = 0 |
| *x* = 2 + , 2 – | M1 | This mark is given for finding the roots of *y* = 0 |
| *x*-coordinate for turning point =  (2 +  + 2 – ) = 2  When *x* = 2, *y* = –13 | M1 | This mark is given for the turning point of *y* = 2*x*2 – 8*x* – 5 |
| (2 + , 0)  (2 – , 0)  *y*  *x*  (0, –5)  (2, –13) | C2 | These marks are given for a fully correct parabola drawn with axes labelled, a turning point at (2, –13) and intercepts at (0, –5), (2 + , 0) and (2 – , 0) clearly shown |

**Question 4 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (*x* + 5)2 = *x*2 +10*x* + 25 | M1 | This mark is given for a method to start to complete the square |
| *x*2 +10*x* + 18 = (*x* + 5)2 – 7 | M1 | This mark is given for a method to complete the square |
| (– 5, – 7) | A1 | This mark is given for the correct answer only |

**Question 5 (Total 3 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | (*x* – 8)(*x* + 4) = *x*2 – 4*x* – 32  (*x* – *a*)2 + *b* = *x*2 – 2*ax* + *a*2 + *b* | P1 | This mark is given for a process to expand one set of brackets |
| –4*x* = –2*ax*, *a* = 2 | A1 | This mark is given for finding the correct value of *a* |
| 32 = *a*2 + *b*  32 = 4 + *b*  *b* = –36 | A1 | This mark is given for finding the correct value of *b* |

**Question 6 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | 2*x*2 + 16*x* + 35 = 2(*x*2 + …) | P1 | This mark is given for a process to find *a* |
| 2((*x* + 4)2 + …)) or *b* = 4 | P1 | This mark is given for a process to find *b* |
| 2(*x* + 4)2 + 3 | A1 | This mark is given for a correct equation or for *a* = 2, *b* = 4, *c* = 3 |
| (b) | (–4, 3) | B1 | This mark is given for the correct answer only, or follow through from answer in part (a) of form *a*(*x* *+* *b*)2 *+* *c* |

**Question 7 (Total 4 marks) – Version 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *x*2 – 3*x* = 0 | P1 | This process mark is given for a process to find the points where the curve meets the *x*-axis |
| *x* = 0 and *x* = 30 | P1 | This process mark is given for finding the points where the curve meets the *x*-axis |
| *x*2 – 3*x* when *x* = 15 | P1 | This process mark is given for finding the ­*x*­-coordinate for the deepest point on the curve (*x* = 15) and substituting |
| 22.5 (cm) | A1 | This accuracy mark is given for the correct answer only |

**Question 7 (Total 4 marks) – Version 2**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | *y* = (*x*2 – 30*x*) | P1 | This process mark is given for rearranging *y =*  – 3*x* |
| *y* = ((*x* – 15)2 – 225) | P1 | This process mark is given for process to rearrange the equation and complete the square |
| ((*x* – 15)2 – 225) when *x* = 15 | P1 | This process mark is given for finding the ­*x*­-coordinate for the deepest point on the curve (*x* = 15) and substituting |
| 22.5 (cm) | A1 | This accuracy mark is given for the correct answer only |

**Question 8 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (0, –5)  (5, 0)  When *x* = 0 and *y* = ­–5,  –5 = 02 + (*a* × 0) + *b*  *b* = –5 | P1 | This mark is given for a process to substitute to find the value of *b* |
| When *x* = 5 and *y* = 0,  0 = 52 + 5*a* – 5  *a* = –4 | P1 | This mark is given for a process to substitute to find the value of *a* |
| *y* = *x*2 – 4*x* – 5 = (*x* + 1)(*x* – 5)  Thus the other intercept is at (–­1, 0) | P1 | This mark is given for a complete process to find the turning point |
| Midpoint *x*-coordinate is 2  When *x* = 2, *y*-coordinate is –9  Turning point is (2, –9) | A1 | This mark is given for the correct answer only |

**Question 9 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | 5(16*t* – *t*2)  or  5*t*(16– *t*) | P1 | This mark is given for factorising |
| –5[(*t* – 8)2 – 64] | P1 | This mark is given for completing the square |
| (80 × 8) – (5 × 64) | P1 | This mark is given for a substitution of *t*= 8 into *s* = 80*t* –5*t*2 |
| 320 | 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** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **U** |
| 1i | 19i | June 2019 | 1H | 2 | Algebra | A11 | 2 | 33 | 0.66 | 1.80 | 1.40 | 0.90 | 0.49 | 0.24 | 0.13 | 0.08 | - | - | 0.06 |
| 1ii | 19ii | June 2019 | 1H | 1 | Algebra | A11 | 1 | 27 | 0.27 | 0.90 | 0.66 | 0.37 | 0.15 | 0.05 | 0.02 | 0.01 | - | - | 0.01 |
| 2 | 11 | Spec Set 1 | 3H | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 21 | Nov 2019 | 1H | 5 | Algebra | A18 | 1 | 5 | 0.23 | 4.11 | 2.05 | 1.03 | 0.37 | 0.18 | 0.03 | 0.01 | - | - | 0 |
| 4 | 19 | Mock Set 2 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 | 18 | Mock Set 3 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6a | 23a | Spec Set 2 | 3H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 6b | 23b | Spec Set 2 | 3H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 | 15 | Mock Set 1 | 1H | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 8 | 17 | Nov 2018 | 1H | 4 | Algebra | A11, A12 | 3 | 5 | 0.20 | 4.00 | 3.18 | 0.99 | 0.39 | 0.14 | 0.03 | 0.01 | - | - | 0.00 |
| 9 | 14 | Mock Set 3 | 1H | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | **32** |  |  |  |  | **1.36** | **10.81** | **7.29** | **3.29** | **1.4** | **0.61** | **0.21** | **0.11** | **-** | **-** | **0.07** |