**GCSE Mathematics (1MA1) – Higher Tier Paper 3H**

**Summer 2022 student-friendly mark scheme**

**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** |
| (b) | 8.52 – 42 = 72.25 – 16 = 56.25  √56.25 = | M1 | This mark is given for a method to use Pythagoras’ theorem to find *x* |
| 7.5 | A1 | This mark is given for the correct answer only |

**Question 2 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 4 × (–3)2 – 11  = 36 – 11 | M1 | This mark is given for a method to substitute –3 into the equation |
| 25 | A1 | This mark is given for the correct answer only |
| (b) | *d* – 4 = 3*p*  or  –  = *p* | M1 | This mark is given for a first step to make *p* the subject of the formula |
| *p* = | 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** |
|  | R = *n*, S = 2*n*, T = 2*n* – 6 | P1 | This mark is given for a process to develop three algebraic expressions (with at least two correct) |
| *n* + 2*n* + 2*n* – 6 = 54 | P1 | This mark is given for a process to sum the three algebraic expressions to 54 |
| 5*n* – 6 = 54  *n* = 12 | P1 | This mark is given for a process to solve the linear equation |
| Ratio = 12: (2 × 12 – 6) = 12 : 18 | P1 | This mark is given for a process to find the ratio of the number of counters Rick and Tony have |
| *p* = 1.5 | A1 | This mark is given for the correct answer only |

**Question 4 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | × 36 = £180 | P1 | This mark is given for a process to find the cost of 15 rolls from Chic Decor |
| 70 × (15 ÷ 5) × 0.12 = £25.20 | P1 | This mark is given for a process to find the discount available at Style Papers |
| (3 × 70) – 25.20 = £184.80 | P1 | This mark is given for a process to find the cost of 15 rolls from Style Papers |
| Jo should by the wallpaper from Chic Decor | C1 | This mark is given for a valid statement supported by correct working |

**Question 5 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | For example:  40 is missing from the frequency scale | C1 | This mark is given for a mistake identified on the frequency polygon |
| For example:  An incorrect point (50, 5) is mapped | C1 | This mark is given for a mistake identified on the frequency polygon |

**Question 6 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 6 ×  = 1.5 9 ×  = 6 | P1 | This mark is given for a process to find the distance of either of the two parts of Jessica’s journey |
| 1.5 + 6 = 7.5 | P1 | This mark is given for a process to find the total distance of Jessica’s journey |
| 45 minutes = 0.75 hours  = | P1 | This mark is given for a process to find Amy’s average speed |
| 10 | A1 | This mark is given for the correct answer only |

**Question 7 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *A* = *h*(*a* + *b*) where  *h* = 4*x*, *a* = 5 and *b* = (3*x* + 5) – 2*x* = *x* + 5 | M1 | This mark is given for a method to find an algebraic representation of the lengths used to work out the area of the trapezium *QUVR* |
| *A* =  × 4*x* × (5 + *x* + 5) | M1 | This mark is given for a method to find an algebraic representation of the area of the trapezium *QUVR* |
| *A* = 2*x*(*x* + 10) = 2*x*2 + 20*x* | C1 | This mark is given for the correct expansion of brackets seen and simplification to the given answer |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | For example:  or | M1 | This mark is given for a method to find the gradient |
| 0.14 | A1 | This mark is given for correct answer in the range 0.135 to 0.145 |
| (b) | For exmaple: the cost per unit of electricity | C1 | This mark is given for a valid explanation of what the gradient represents |

**Question 9 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | For example:  10150 × 1090 = 10240 or  10360 ÷ 10150 = 10210 or  10360 ÷ 1090 = 10270 or  = 10180 | M1 | This mark is given for a correct first step using the rules of indices |
| or | P1 | This mark is given for a method to use the rules of indices to simplify |
| 1060 | A1 | This mark is given for the correct answer only |
| (b) | For example:  Liam should multiply the powers of 12 to get 50 × 2 rather than 502 | C1 | This mark is given for a correct explanation |

**Question 10 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  | P1 | This mark is given for a process to use either 0.875 or 0.9 × 0.9 (or 0.92) |
| P1 | These marks are given for a process to find out the original value of the car |
| 24 000 | A1 | This mark is given for the correct answer only |

**Question 11 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 16 × 5 × 3 | M1 | This mark is given for a method to work out how may outfits Rayheem can choose |
| 240 | A1 | This mark is given for the correct answer only |

**Question 12 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *AC* = 8 or *AC* = 8 × tan 45° = 8 | M1 | This mark is given for a method to find the distance *AC* |
| sin 20° = | A1 | This mark is given for a method to find the length *AB* |
| *AB* =  =  = 23.4 | A1 | This mark is given for a correct answer in the range 23.3 to 23.4 |

**Question 13 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 3**a** =  = | M1 | This mark is given for a method to find a column vector for 3**a** |
| 2**b** =  –  = | M1 | This mark is given for a method to find a column vector for 2**b** |
| **b** = | A1 | This mark is given for the correct answer only |

**Question 14 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 4(*p*2 – 9) or (4*p* – 12)(*p* + 3) or  (*p* – 3)(4*p* + 12) or (2*p* – 6)(2*p* + 6) | P1 | This mark is given for a method to find a partial factorisation |
| 4(*p* – 3)(*p* + 3) | A1 | This mark is given for a correct answer only (allow 2(*p* – 3)2(*p* + 3)) |
| (b) | For example:  6*m*2 + 2*m* – 15*m* – 5 or  2*m*2 + 8*m* – 5*m* – 20 or  3*m*2 + 12*m* + *m* + 4 | M1 | This mark is given for a method to find the product of at least two linear expressions |
| 6*m*3 + 2*m*3 – 15*m*2 + 24*m*2 + 8*m* – 60*m* – 5*m* – 20 | M1 | This mark is given for a complete method to find all the terms |
| 6*m*3 + 11*m*2 – 57*m* – 20 | A1 | This mark is given for a correct answer only |

**Question 15 (Total 3 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | For example:  angle *PXQ* = angle *SXR* since vertically opposite angles are equal | C1 | This mark is given for identifying one pair of corresponding equal angles with a correct reason given |
| For example:  angle *QPX* = angle *RSX* since angles in the same segment are equal | C1 | This mark is given for identifying two pairs of corresponding equal angles with correct reasons given |
| For example:  angle *PQX* = angle *SRX* since angles in the same segment are equal  The triangles are similar because all three pairs of corresponding angles are equal | C1 | This mark is given for a fully correct proof |

**Question 16 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 6.75 < *e* ≤ 6.85  0.045 < *f* ≤ 0.055 | B1 | This mark is given for stating any correct upper of lower bound |
| *p* =  =  = | M1 | This mark is given for using the upper bound of *e* and the lower bound of *f* to work out the upper bound for *p* |
| 17.4 (to 3 significant figures) | A1 | This mark is given for a correct answer in the range 17.4 to 17.5 |

**Question 17 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | B3 | These marks are given for a fully correct histogram drawn with relative height 90, 96, 44, 8 and 6  (B2 are given for 4 correct blocks **or** all 5 frequency ÷ class interval and one correct block)  (B1 is given for at least 2 correct blocks of different widths or for frequency ÷ class interval for at least 3 different frequencies) |
| (b) | For example:  height of 1–2 bar = 3.0 units and height of 3–5 bar = 0.6 unit (so areas = 6 and 2.4 respectively)  area of 1–2 bar = 150 small squares and area of 3–5 bar = 60 small squares | M1 | This mark is given for a method to compare the heights or areas of the bars of the two intervals 1–2 and 3–5 |
| 0.4*n* | A1 | This mark is given for a correct answer only (or equivalent) |

**Question 18 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *TC* = 14 ×  = 6 | P1 | This mark is given for a process to find the length of *TC* |
| *TD* = =  = 15.23… | P1 | This mark is given for a process to find the length of *TD* |
| 147 = 0.5 × (*SD* + 12) × 14  *SD* =  – 12 = 9 | P1 | This mark is given for a process to use the area of a trapezium to find the length of *SD* |
| tan–1 = tan-1 0.59 | P1 | This mark is given for a process to find the size of the angle between the line *ST* and the base *ABCD* |
| 30.6 (to one decimal place) | A1 | This mark is given for a correct answer in the range 30.4 to 30.7 |

**Question 19 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | For example:  or  or | M1 | This mark is given for a method to write one of the three terms with a denominator of (*x*2 – 4) |
| –  – | M1 | This mark is given for a method to find the expression with a common denominator |
|  | M1 | This mark is given for a method to find a single numerator |
|  | A1 | This mark is given for the correct answer only (or *a* = –11 and *b* = 2) |

**Question 20 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 29 600 = 24 000*a* + 800  *a* =  =1.2 | P1 | This mark is given for a process to find the value of *a* |
| *P*2020 = 1.2 × 29 600 + 800 = 36 320 | P1 | This mark is given for a process to find the profit made by the shop in 2020 |
| *P*2021 = 1.2 × 36 320 + 800 | P1 | This mark is given for a process to find the profit made by the shop in 2021 |
| 44 384 | A1 | This mark is given for the correct answer only |

**Question 21 (Total 4 marks)**

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| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | For example:  ×  ×  where *a*, *b* and *c* are < 9 | P1 | This mark is given for a process to form any triple product of probabilities of the form |
| Odd, odd, even:  ×  ×  =  Odd, even, odd:  ×  ×  =  Even, odd, odd:  ×  ×  =  Even, even, even:  ×  ×  = | P1 | This mark is given for at least one of the four products of three probabilities of cards which will give an even sum |
| +  +  + | P1 | This mark is given for finding the sum of at least three of the four correct probabilities of cards which will give an even sum |
| = | A1 | This mark is given for the correct answer only (or equivalent) |

**Question 22 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (2*x* – 5)2 = 6*x*2 – 25*x* – 8 | M1 | This mark is given for a method to equate two expressions for *y*2 |
| 4*x*2 – 20*x* + 25 = 6*x*2 – 25*x* – 8 | M1 | This mark is given for a method to expand the squared term |
| 2*x*2 – 5*x* – 33 = 0  (2*x* – 11)(*x* + 3) = 0 | M1 | This mark is given for rearranging and finding a quadratic to be solved |
| (–3, –11) | A1 | This mark is given for the correct answer only |
| (5.5, 6) | A1 | This mark is given for the correct answer only |