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

**November 2020 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 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | *n*3 + 5  = *n*8 | B1 | This mark is given for the correct answer only |
| (b) | *c* 3 – 2 × *d* 4 – 1 | M1 | This mark is given for either *c* or *d* 3 seen |
| *cd* 3 | A1 | This mark is given for the correct answer only |
| (c) | 5*x* > 14 | M1 | This mark is given for a method to remove the fraction from the inequality |
| *x* >  | A1 | This mark is given for the correct answer only |

**Question 2 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  = 1.25,  = 1.5 | P1 | This mark is given for a process to find out how many hours Andy cycles and runs for |
| 1 hour 15 minutes + 1 hour 30 minutes | P1 | This mark is given for a process to convert into hours and minutes |
| 2 hours and 45 minutes | A1 | This mark is given for the correct answer only |

**Question 3 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 9.35 ≤ *m* < 9.45 | B1 | This mark is given for 9.35 in the correct position |
| B1 | This mark is given for 9.45 in the correct position |

**Question 4 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 5 × 9 = 45 3 kg 10 × 14 = 140 5 boxes = 10 kg | P1 | This mark is given for a process to find the areas of the lawns and the amount of grass seed required |
|  = 3.111… | P1 | This mark is given for a process to find the comparative sizes of the lawns |
| 3 × 3.111… = 9.333… kg | P1 | This mark is given for a process to find the amount of grass seed needed for the larger lawn |
| Yes, Maisie has enough grass seed | C1 | This mark is given for a valid conclusion supported by correct working |
| (b) | Yes, there is an effect. 9 kg is not enough grass seed since 9.333… kg is required | C1 | This mark is given for a valid conclusion supported by correct working |

**Question 5 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | , ; , , ,  | B2 | These marks are given for six fully correct probabilities(B1 is given for at least two correct probabilities) |
| (b) |  ×  | M1 | This mark is given for a method to find the probability |
|  | A1 | This mark is given for the correct answer only |

**Question 6 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | *x* = –2, *y* = 4 | B1 | This mark is given for the correct answer only |
| (b) | 0.6, 3.4 | M1 | This mark is given for correct answers shown on the graph or given as coordinates (for example (0.6, 0) and (3.4, 0) |
| A1 | This mark is given for the correct answer only (in the ranges 0.55 to 0.6 and 3.4 to 3.45 |

**Question 7 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 18 × 16.2 = 291.627 × 16.7 = 450.9 | M1 | This mark is given for a method to find the total ages of the boys and the total ages of the girls |
|  | M1 | This mark is given for a method to find the mean age |
| 16.5 | A1 | This mark is given for the correct answer only |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 1 – 0.32 – 0.2 = 0.48 | P1 | This mark is given for a process to find the total of the unknown probabilities |
| 0.48 ×  = 0.08 | P1 | This mark is given for a process to find the probability the counter will be yellow |
| 0.08 × 300 = 24 | A1 | This mark is given for a correct answer only |

**Question 9 (Total 5 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | *h* = 5 tan 40° | P1 | This mark is given for a process to find the height of the triangle |
| = 4.195 | P1 | This mark is given for finding the height of the triangle |
| ( × 10 × 4.195) + (10 × 12) = 140.975 | P1 | This mark is given for a process to find the area of the cross-section of the prism |
| 140.975 × 20 | P1 | This mark is given for a process to find the volume of the cross-section of the prism |
| 2820 (to 3 significant figures) | A1 | This mark is given for a correct answer only |

**Question 10 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 105 × 81 × 365 = 2.9565 × 109 | P1 | This mark is given for a process to estimate the number of heartbeats |
| 3.0 × 109 (to 2 significant figures) | A1 | This mark is given for a correct answer in the range 2.4 × 109 to 3.2 × 109 |
| (b) |  | P1 | This mark is given for a process to find the mass of one blood cell |
| 4.5 × 10–11 | A1 | This mark is given for a conclusion and reason |

**Question 11 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | **Q****R** | M1 | This mark is given for a method to find the positions of triangles **Q** and **R** **Q** has coordinates (−1, −2), (−1, −5) and (−2, −5) **R has** coordinates (4, −4), (4, −7) and (3, −7) |
| Rotation of 180° about (2.5, –1) | A2 | These marks are given for a fully described transformation(A1 is given for any two of the three aspects) |
| (b ) | (2.5, –1) | A1 | This mark is given for the correct answer only |

**Question 12 (Total 6 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | M1 | This mark is given for a method to find a common denominator |
| M1 | This mark is given for a method to find an unsimplified numerator |
|  | A1 | This mark is given for a correct answer only |
| (b) | (*x* – 3)(2*x* + 3) = 2*x*2 – 6*x* + 3*x* – 9or(2*x* + 3)(4*x* + 5) = 8*x*2 + 12*x* + 20*x* + 15 | M1 | This mark is given for a method to find the product of two brackets |
| (2*x*2 – 3*x* – 9)(4*x* + 5) =or(*x* – 3)(8*x*2 + 22*x* + 15) = | M1 | This mark is given for a method to find the product of two further brackets |
| 8*x*3 ‒ 2*x*2 ‒ 51*x* ‒ 45  | A1 | This mark is given for a correct answer only |

**Question 13 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | M2 | These marks are given for a method to draw 3 of lines *x* = 2, *y* = *x* + 3, 2*x* + 3*y =* 6 correctly(M1 is given for 2 lines drawn correctly) |
| M1 | This mark is given for region a region *R* which satisfies at least 2 of the inequalities *x* ≤ 2, *y* ≤ *x* + 3 and 2*x* + 3*y* ≥ 6  |
| A1 | This mark is given for a fully correct graph |
| (b) | Geoffrey in incorrect; 4 < 8, 4 > 1 and 2 + 4 = 6 so (2, 4) satisfies all the inequalities | B1 | This mark is given for a valid conclusion with a correct reason given |

**Question 14 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | ∠ *DBF* = 180 ‒ 100 = 80 Opposite angles of a cyclic quadrilateral add up to 180° | M1 | This mark is given for a method to find the size of ∠ *DBF* |
| ∠ *BFD* = 180 ‒ 80 ‒ 40 = 60 Angles in a triangle add up to 180  | M1 | This mark is given for a method to find the size of ∠ *BFD* |
| ∠ *ABD* = 60Alternate segment theorem  | A1 | This mark is given for the correct answer only |
|  | C1 | This mark is given for all three reasons stated |

**Question 15 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Let 10*x* = 7.333…Then 100*x* = 73.333…90*x* = 66 | M1 | This mark is given for a method to find an equation without a recurring decimal  |
| *x* =  =  | A1 | This mark is given for showing the recurring decimal in as a rational number  |

**Question 16 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | M1 | This mark is given for a method to find the area of a triangle with coordinates (0, 0), (30, 0) and (30, 9) |
| 135 | A1 | This mark is given for a correct estimate of the distance the car travelled |
| (b) | underestimate, since the area between the line and the curve is not included | C1 | This mark is given for a valid conclusion and reason given |
| (c) | For example:Julian’s method gives average speed in first 60 seconds Julian has not drawn a tangent at time 60 seconds Julian has not worked out the gradient at time 60 seconds  | C1 | This mark is given for a correct explanation |

**Question 17 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (7.2 − 6.4) × 10 = 8 (7.6 − 7.2) × 50 = 20 (8.0 – 7.6) × 100 = 40 (8.2 − 8.0) × 60 = 12  | P1 | This mark is given for a process to find at least one frequency |
| P1 | This mark is given for a process to find at all frequencies |
| =  | P1 | This mark is given for a process to find an estimate of the mean |
| 7.645 | A1 | This mark is given for the correct answer only |

**Question 18 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | Lower bound for *AH* = 11.25  | M1 | This mark is given for a method to find the lower bound for the length *AH* |
| Let *a* = the length of one side of the cube*a*2 + *a*2 + *a*2 = 11.2523*a*2 = 11.252 | M1 | This mark is given for a method to use *a*2 + *a*2 + *a*2 as the length of the diagonal |
| M1 | This mark is given for a method to write an equation to find the length of a side |
| *a* = 6.5  | A1 | This mark is given for the correct answer in the range 6.49 – 6.50 |

**Question 19 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Area *ABCDEF* = 6 ×  × *x* × *x* × sin 60 | P1 | This mark is given for a start to the process to find the area of *ABCDEF* |
|  = *x*2  = *x*2 | P1 | This mark is given for a full process to find the area of *ABCDEF* |
| Area *FGHIJK* = 6 × × *px* × *px* × sin 60 = *p*2*x*2  =  *p*2*x*2 | P1 | This mark is given for a process to find the area of *FGHIJK* |
| The shaded region of the diagram is  *p*2*x*2 – *x*2 = (*p*2 ­– 1)*x*2 | C1 | This mark is given for fully correct algebra to show the result required |

**Question 20 (Total 1 mark)**

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| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 9891 | B1 | This mark is given for a process to find the total amount of money shared |

**Question 21 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
| (a) | 5*c* + *d* = *c* +4*d*4*c* = 3*d* | P1 | This mark is given for process to isolate terms in *c* to obtain 4*c* = 3*d* |
| 3 : 4  | A1 | This mark is given for the correct answer only |
| (b) | 6*x*2 − 7*xy* − 20*y*2 = 0 | P1 | This mark is given for a process to form a quadratic equation equal to 0 |
| (2*x* ‒ 5*y*)(3*x* + 4*y*) = 0 | P1 | This mark is given for a process to factorise the quadratic equation |
| 5 : 2 | A1 | This mark is given for the correct answer only |