**GCSE Mathematics (1MA1)**

**Themed papers – Speed Distance Time**

**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**

|  |
| --- |
| **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** |
| (a) |   | P1 | This mark is given for a process to find how long the signal took to reach Mars |
| = 1.3 × 102= 130 | A1 | This mark is given for finding the number of seconds the signal takes to reach Mars |
| (b) | The signal will take longer to reach Mars | C1 | This mark is given for a correct explanation |

**Question 2 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  = 200 | P1 | This mark is given for a process to estimate the number of hours Juan cycles |
|  | P1 | This mark is given for a process to estimate the number of days Juan cycles |
| 25 | A1 | This mark is given for the correct answer only |
| (b) | The estimated number of days will be fewer than 25 | C1 | This mark is given for a correct statement |

**Question 3 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 14 48 – 13 30 = 1 hour 18 minutes | P1 | This mark is given for a process to find the time taken for Nimer to arrive at the hotel |
| 1 hour 18 minutes = 1 hours = 1.3 hours | P1 | This mark is given for a process to find the number of hours taken |
|  = | P1 | This mark is given for a process to find the average speed (distance/time) |
| 50 (mph) | A1 | This mark is given for the correct answer only |

**Question 4 (Total 7 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a)(i) |  | B1 | This mark is given for a tangent drawn at *t* = 15 |
| 7.5 ÷ 9 | M1 | This mark is given for a method to use the tangent to find the gradient |
| 0.83 | A1 | This mark is given for a correct answer in the range 0.6 – 1 |
| (a)(ii) | Acceleration of the car (the change of speed with respect to time) | C1 | This mark is given for a correct description |
| (b) |  +  × 5 +  × 5 +  × 5 | P1 | This mark is given for splitting the area in to 4 strips (one triangle, three trapezia) |
| 10 + 40 + 75 + 95 | P1 | This mark is given for a process to find an estimate for the area under the curve the |
| 220 | A1 | This mark is given for a correct answer in the range 215 – 225 |

**Question 5 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 56 + 61 = 117 miles | P1 | This mark is given for a process to find total distance travelled from Liverpool to Sheffield |
| 56 ÷ 70 = 0.8 hrs (or 48 minutes) | P1 | This mark is given for a process to find time taken to travel from Liverpool to Manchester |
| 0.8 hrs + 1.25 hrs = 2.05 hrs | P1 | This mark is given for a correct process to find the total time taken to travel from Liverpool to Sheffield |
| 117 ÷ 2.05 = 57.1 (km/h) | A1 | This mark is given for a correct answer (in the range 57 to 57.1) |
| (b) | The time taken for the two parts of the journey must be the sameorThe distance from Leeds to York is  $\frac{3}{4}$of the distance from Barnsley to Leeds | C1 | This mark is given for a correct explanation |

**Question 6 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  ( × 5 × (0 + 22)) + (× 5 × (22 + 28)) + ( × 5 × (28 + 32)) + (× 5 × (32 + 35)= 55 + 125 + 150 + 167.5 | M1 | This mark is given for a method to find the area of one strip using a trapezium (or a triangle) |
| M1 | This mark is given for a method to find the area under the curve using four trapeziums |
| 497.5 | A1 | This mark is given for the correct answer only |
| (b) | This is an underestimate since there are small areas under the graph not included | C1 | This mark is given for a correct statement supported by working |

**Question 7 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | Between 0 and 20 seconds | 1 | This mark is given for the correct answer only |
| When the gradient of the graph is greatest | 1 | This mark is given for a correct comment |
| (b) |  = 18 | 1 | This 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** |
| (a) | 72 ×  | M1 | This mark is given for a method to find the distance travelled by the car |
| 21.6 | A1 | This mark is given for the correct answer only |
| (b) | 20 ×  = 72 | M1 | This mark is given for a method to convert 20 m/s to km/h |
| David is incorrect; 72 km/h is the same as 20 m/s, not faster | C1 | This mark is given for a valid conclusion supported by correct working |

**Question 9 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 265 to 275 km107.5 to 112.5 minutes | P1 | This mark is given for finding the range of values for the length of the track and the time taken |
| 107.5 to 112.5 minutes = 1.791666... to 1.875 hours | P1 | This mark is given for a process to work in consistent units of time |
|  to  141.33… to 153.488… mph  | P1 | This mark is given for a process to find the range of possible speeds |
| No, the greatest speed possible is 153.49 mph | C1 | This mark is given for a conclusion supported with correct working |
| (b) | A shorter track in the same time means the maximum speed would be lower | C1 | This mark is given for a correct statement |

**Question 10 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) |  | P1 | This mark is given for using time =  |
|  × 60 × 60  | P1 | This mark is given for a complete process to find a solution |
| 18 (seconds) | A1 | This mark is given for a correct answer in the range 18–20 |
| (b) | An overestimate, since the plane travels at more then 200 mph | C1 | This mark is given for a correct explanation related to the response to part (a) |

**Question 11 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  | P1 | This mark is given for drawing a tangent to the curve at time *t* = 5  |
|  =  | P1 | This mark is given for a process to find the gradient |
| 14 m/s | A1 | This mark is given for answer in the range 11 – 19 m/s |

**Question 12 (Total 5 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | Lower bound for distance = 486.5 kmUpper bound for distance = 487.5 km | B1 | This mark is given for finding the upper and lower bounds for the distance |
| Lower bound for time = 179.5 secondsUpper bound for time = 180.5 seconds | B1 | This mark is given for finding the upper and lower bounds for the time |
| Upper bound for average speed = Lower bound for average speed =  | P1 | This mark is given for a process to find the upper and lower bounds for the average speed |
| Upper bound for av speed = 2.7158774…Lower bound for av speed = 2.6952909… | A1 | This mark is given for finding correct values for the upper and lower bounds |
| Both upper and lower bounds round to 2.7 km per second | C1 | This mark is given for the correct answer only |

**Question 13 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 50 ÷ 2.5 = 20 | 1 | This mark is given for finding James’ speed |
| 15 ÷ 20 = 0.75 hrs = 45 mins | 1 | This mark is given for finding James’ time for 15 km |
| 45 – 40 = 40 mins | 1 | This mark is given for finding Peter’s time for 15 km |
| 15 ÷ 0.6666…. | 1 | This mark is given for finding Peter’s speed |
| 22.5 | 1 | 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** |
|  | *x* = 10 + 2*y*(10 + 2*y*)2 + *y*2 = 20 | 1 | This mark is given for a method to start the process by finding a value for *x* in terms of *y* and substituting |
| (100 + 20*y* + 20*y* + 4*y*2) + *y*2 = 204*y*2 + 20*y* + 20*y* = 100 | 1 | This mark is given for expanding brackets on the expression obtained |
| 5*y*2 + 40*y* + 80 = 0 | 1 | This mark is given for forming a quadratic equation to be solved |
| (5*y* + 20) (*y* + 4) = 0*y* = –4, *x* = 2 | 1 | This mark is given for solving the quadratic equation for *y* and so find the value of *x* |
| The line intersects the circle at only one point (2, –4), so must be a tangent | 1 | This mark is given for a fully correct statement to conclude the proof |

**Question 15 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 40 mph × 0.5 hour (= 20 miles) **or** *x*-axis scaled correctly | M1 | This method mark is given for a method to find the distance to the hospital |
| 40 miles **or** *y*-axis scaled correctly | M1 | This method mark is given for finding a total distance from home to the hospital |
| 40 miles at 32 mph takes 1.25 hours or a completed travel graph130014001500160017002040 | A1 | This accuracy mark is given for finding the time of the journey home from the hospital or for a fully a complete travel graph |
| Ria arrives home at 16 45 | C1 | This communication mark is given for a correct conclusion |

**Question 16 (Total 4 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
| (a) | 0.5 × 5 × 2 = 5 or0.5 × 5 × (2 + 5) = 17.5 or0.5 × 5 × (5 + 10) = 37.5 or0.5 × 5 × (10 + 18) = 70 | 1 | This mark is given for splitting the area into 4 strips and finding the area of one triangle or trapezium |
| 5 + 17.5 + 37.5 + 70 | 1 | This mark is given for a method to find and add up the totals of the four shapes |
| 130 | 1 | This mark is given for the correct answer only |
| (b) | My answer to part (a) is an overestimate because the area measured is greater than the area below the curve | 1 | This mark is given for a correct statement  |

**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** |
| 1a | 11a | June 2019 | 3H | 2 | Ratio | N9, R1, R10, R11 | 3 | 88 | 1.75 | 1.98 | 1.94 | 1.89 | 1.81 | 1.66 | 1.42 | 1.03 | - | - | 0.64 |
| 1b | 11b | June 2019 | 3H | 1 | Ratio | R10 | 3 | 84 | 0.84 | 0.98 | 0.95 | 0.92 | 0.87 | 0.79 | 0.66 | 0.45 | - | - | 0.25 |
| 2a | 4a | June 2018 | 1H | 3 | Ratio | R11/ N15/ N14 | 1 | 71 | 2.13 | 2.84 | 2.64 | 2.45 | 2.21 | 1.94 | 1.57 | 1.03 | - | - | 0.58 |
| 2b | 4b | June 2018 | 1H | 1 | Ratio | R11 | 3 | 90 | 0.9 | 0.98 | 0.96 | 0.95 | 0.92 | 0.89 | 0.82 | 0.71 | - | - | 0.51 |
| 3 | 6 | Nov 2019 | 3H | 4 | Ratio | R1, R11 | 3 | 55 | 2.21 | 4 | 3.78 | 3.59 | 3.23 | 2.54 | 1.89 | 1.36 | - | - | 0.85 |
| 4ai | 14ai | June 2019 | 2H | 3 | Algebra | A15, R15 | 1 | 49 | 1.47 | 2.83 | 2.62 | 2.19 | 1.47 | 0.70 | 0.23 | 0.07 | - | - | 0.03 |
| 4aii | 14aii | June 2019 | 2H | 1 | Algebra | A15, R15 | 1 | 41 | 0.41 | 0.89 | 0.72 | 0.54 | 0.37 | 0.23 | 0.12 | 0.05 | - | - | 0.02 |
| 4b | 14b | June 2019 | 2H | 3 | Algebra | A15 | 1 | 44 | 1.33 | 2.66 | 2.40 | 1.98 | 1.31 | 0.60 | 0.17 | 0.04 | - | - | 0.01 |
| 5a | 4a | June 2017 | 2H | 4 | Ratio | R1 R11 | 3 | 50 | 1.99 | 3.66 | 3.09 | 2.49 | 1.92 | 1.43 | 1 | 0.67 | - | - | 0.44 |
| 5b | 4b | June 2017 | 2H | 1 | Ratio | R11 | 3 | 6 | 0.06 | 0.14 | 0.08 | 0.07 | 0.06 | 0.05 | 0.04 | 0.02 | - | - | 0.01 |
| 6a | 15a | June 2018 | 3H | 3 | Algebra | A15 | 1 | 51 | 1.52 | 2.86 | 2.63 | 2.22 | 1.62 | 0.93 | 0.4 | 0.12 | - | - | 0.04 |
| 6b | 15b | June 2018 | 3H | 2 | Algebra | A15 | 3 | 44 | 0.44 | 0.92 | 0.83 | 0.67 | 0.45 | 0.22 | 0.07 | 0.02 | - | - | 0 |
| 7a | 10a | Nov 2017 | 2H | 2 | Algebra | A14 A15 | 2 | 45 | 0.89 | 2 | 1.79 | 1.68 | 1.43 | 1.35 | 0.98 | 0.62 | - | - | 0.4 |
| 7b | 10b | Nov 2017 | 2H | 1 | Algebra | A15 | 2 | 41 | 0.41 | 0.88 | 0.94 | 0.82 | 0.77 | 0.68 | 0.47 | 0.26 | - | - | 0.12 |
| 8a | 9a | Nov 2019 | 1H | 2 | Ratio | R1 | 1 | 47 | 0.94 | 2 | 1.86 | 1.55 | 1.38 | 1.06 | 0.78 | 0.6 | - | - | 0.38 |
| 8b | 9b | Nov 2019 | 1H | 2 | Ratio | R1 | 1 | 25 | 0.5 | 1.44 | 1.92 | 1.16 | 0.9 | 0.65 | 0.28 | 0.12 | - | - | 0.08 |
| 9a | 17a | June 2017 | 3H | 4 | Number | N16 | 3 | 34 | 1.35 | 3.4 | 2.72 | 1.98 | 1.21 | 0.59 | 0.19 | 0.04 | - | - | 0.01 |
| 9b | 17b | June 2017 | 3H | 1 | Number | N16 | 3 | 36 | 0.36 | 0.79 | 0.61 | 0.45 | 0.33 | 0.23 | 0.16 | 0.09 | - | - | 0.04 |
| 10a | 5a | Nov 2018 | 1H | 3 | Ratio | N14, R1, R11 | 3 | 27 | 0.81 | 2.7 | 2.24 | 1.85 | 1.39 | 1.17 | 0.63 | 0.29 | - | - | 0.19 |
| 10b | 5b | Nov 2018 | 1H | 1 | Number | N14, R1, R11 | 3 | 6 | 0.06 | 0.6 | 0.3 | 0.19 | 0.15 | 0.07 | 0.02 | 0 | - | - | 0 |
| 11 | 14 | June 2018 | 2H | 3 | Ratio | R15 | 2 | 21 | 0.63 | 2.55 | 1.7 | 0.87 | 0.33 | 0.09 | 0.02 | 0.01 | - | - | 0 |
| 12 | 18 | Nov 2018 | 3H | 5 | Number | N16, R11 | 3 | 16 | 0.79 | 4.4 | 2.56 | 2.41 | 1.84 | 1.13 | 0.42 | 0.12 | - | - | 0.04 |
| 13 | 9 | Nov 2017 | 1H | 5 | Ratio | R11 | 3 | 14 | 0.69 | 4.62 | 3.65 | 2.68 | 1.99 | 1.18 | 0.61 | 0.29 | - | - | 0.12 |
| 14 | 19 | Nov 2019 | 3H | 3 | Algebra | A15, R15 | 2 | 7 | 0.22 | 2.00 | 1.73 | 1.06 | 0.43 | 0.12 | 0.05 | 0.01 | - | - | 0.02 |
| 15 | 6 | Mock Set 1 | 1H | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 16a | 18a | Nov 2017 | 3H | 3 | Algebra | A15 | 1 | 4 | 0.12 | 2.5 | 1.71 | 1.04 | 0.53 | 0.18 | 0.04 | 0 | - | - | 0 |
| 16b | 18b | Nov 2017 | 3H | 1 | Algebra | A15 | 3 | 3 | 0.03 | 0.88 | 0.56 | 0.25 | 0.14 | 0.06 | 0.01 | 0 | - | - | 0 |
|  |  |  |  | **68** |  |  |  |  | **22.85** | **55.5** | **46.93** | **37.95** | **29.06** | **20.54** | **13.05** | **8.02** | **-** | **-** | **4.78** |