**GCSE Mathematics (1MA1)**

**Themed papers – Ratio and Proportion**

**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 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | For 15 biscuits:Flour needed = 3 × 50 g = 150 g | P1 | This mark is given for a process to find the amount of flour needed for 15 biscuits |
| For 60 biscuits: × 150 | P1 | This mark is given for a process to find the amount of flour needed for 60 biscuits |
| 600 | A1 | This mark is given for the correct answer only |
| (b) | For 15 biscuits:Butter needed = 2 × 50 g = 100 gFor 60 biscuits: × 100 = 400 | P1 | This mark is given for a process to find the amount of butter needed for 60 biscuits |
|  = 1.6, so 2 packets needed | A1 | This mark is given for the correct answer only |

**Question 2 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 420 ×  = 120 | P1 | This mark is given for a process to find the number of vanilla cakes |
| 420 ×  = 147 | P1 | This mark is given for a process to find the number of banana cakes |
| 420 – 120 – 147 = 153 | P1 | This mark is given for a full process to find the total number of lemon cakes and chocolate cakes |
| (153 ÷ 9) = 1717 × 4 = | P1 | This mark is given for a process to find the number of lemon cakes |
| 68 | A1 | This mark is given for the correct answer only |

**Question 3 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Chloe and Denesh each receive 1.5 × 2 | P1 | This mark is given for a process to find out the proportion that Chloe and Denesh each share |
| A : B : C : D = 2 : 7 : 3 : 3 | P1 | This mark is given for a process to find the ratio of money that each person shares |
|  × 360 =  × 360 | P1 | This mark is given for a process to find the amount of money that Ben gets |
| 168 | A1 | This mark is given for the correct answer only |

**Question 4 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | Number of flats = 50 ÷ 5 × 8 = 80 | P1 | This mark is given for a process to find the number of flats in the village |
| Number of houses = 80 ÷ 4 × 7 | P1 | This mark is given for a process to find the number of houses in the village |
| 140 | A1 | This mark is given for the correct answer only |

**Question 5 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Number of women in the choir: 60 ÷ 2 = 30Number of men in the choir: 30 ÷ 3 = 10 | P1 | This mark is given for a process to find out the number of men in the choir |
| Number of children in the choir: 60 – 30 – 10 = 20 | P1 | This mark is given for a process to find out the number of children in the choir |
| 20 : 10 | P1 | This mark is given for a process to find out the ratio of the number of children in the choir to the number of men in the choir |
| = 2 : 1 so *n* = 2 | 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** |
|  |  × 3 = 72 | P1 | This mark is given for a process to find out how many stamps Tom originally had |
|  × 3 = 90 | P1 | This mark is given for a process to find out how many stamps Tom had after buying some from Adam |
| 90 – 72 | P1 | This mark is given for a process to find how many stamps Tom bought from Adam |
| 18 | A1 | This mark is given for the correct answer only |

**Question 7 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 117 × 4 = 468 | P1 | This mark is given for a process to work out the total number of children in the theatre |
| 468 × 5 ÷ 2 = 1170 | P1 | This mark is given for a process to work out total number of adults in the theatre |
| 468 + 1170 = 1638  | A1 | This mark is given for a correct answer for the number of people in the theatre |
|  × 100 = 63 | P1 | This mark is given for a process to work out the percentage of theatre seats being used |
| Yes, there were people on 63% of the seats | C1 | This mark is given for a correct conclusion supported by correct working |

**Question 8 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 2 × 7 : 5 × 3 : 6 × 414 : 15 : 24 | P1 | This mark is given for a process to find the ratio of the number of pens of each colour sold |
| 212 ÷ (14 + 15 + 24) | P1 | This mark is given for a process to find the proportion of green pens sold |
|  × 24 | P1 | This mark is given for a process to find the number of green pens sold |
| 96 | A1 | This mark is given for the correct answer only |

**Question 9 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 20 litres of yellow paint and 30 litres of blue paint | P1 | This mark is given for the a process to find the overall ratio of litres |
| (20 ÷ 5) = 4 tins of yellow paint needed(30 ÷ 10) = 3 tins of blue paint neededCost = (4 × 26) + (3 × 48)  = 104 + 144 = 248 | P1 | This mark is given for a process to find the total cost of making 50 litres of green paint |
| 50 litres of green paint costs £24810 litres of green paint costs £49.60  | A1 | This mark is given for finding out the cost of making 10 litres of green paint |
|  = 0.35 | P1 | This mark is given for a process to find Robert’s percentage profit |
| 35% | A1 | This mark is given for the correct answer only |

**Question 10 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *x*, *x* + 7, 2*x* + 14 | 1 | This mark is given for representing the ages algebraically |
| *x* + *x* + 7 + 2*x* + 14 = 774*x* + 21 = 77 | 1 | This mark is given for a sum of the three expressions |
| *x* = 14 | 1 | This mark is given for finding a value of *x* as the age of Jay |
| 14 : 21 : 42 | 1 | This mark is given for the answer shown or an equivalent ratio (e.g. 2 : 3 : 6) |

**Question 11 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | *π* × *r* 2 × 25 = 225*π* | P1 | This mark is given for a process to find the volume of the container C |
| Vol of Liquid A: 225*π* ×  = 30*π*Vol of Liquid B: 225*π* ×  = 195*π* | P1 | This mark is given for a process to find the volume of Liquid A and the volume of Liquid B |
| Mass of Liquid A: 30*π* × 1.21 = 114.04Mass of Liquid B: 195*π* × 1.02 = 624.86 | P1 | This mark is given for a process to find the combined mass of Liquid A and Liquid B |
| 114.04 + 624.86 = 739 (3 sf) | A1 | This mark is given for a correct answer to 3 significant figures |

**Question 12 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  =  | P1 | This mark is given for a process to form an equation |
| 2*x*2 = 3*x* + 52*x*2 – 3*x* – 5 = 0 | P1 | This mark is given for a process to write a quadratic equation to be solved |
| (2*x* – 5)(*x* + 1) = 0 | P1 | This mark is given for a process to factorise the quadratic equation |
| *x* = 2.5, *x* = –1 | A1 | This mark is given for the correct answers only |

**Question 13 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  ×  =  ×  =  =   | P1 | This mark is given for a process to find the proportion of shapes which are white circles |
|  |  ×  =  ×  =  =   | P1 | This mark is given for a process to find the proportion of shapes which are black circles |
|  +  | P1 | This mark is given for a process to find the proportion of all shapes which are circles |
|  | A1 | This mark is given for the correct answer only |

**Question 14 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 1 + 5 = 6 and 7 + 11 = 18 and 6 × 3 = 18 | P1 | This mark is given for a process to start to solve the problem using multipliers |
| (7 + 11) ÷ (1 + 5) = 3 and 1 × 3 : 7 − (3 × 1) : 11  | P1 | This mark is given for a complete process to find ratios |
| 3 : 4 : 11 | A1 | This mark is given for the correct answer only |

**Question 15 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 120 ÷  = 120 ×  | M1 | This mark is given for a method to find a solution |
| 200 | A1 | This mark is given for the correct answer only |
| (b) | Each tap fills the pool at the same rateRate of filling does not change over time | C1 | This mark is given for a correct explanation |

**Question 16 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | The lowest common multiple (LCM) of (4 + 7) and (3 + 5) is 88 | C1 | This mark is given for a correct explanation |
| (b) | Small cubes =  × 4 = 32Large cubes =  × 7 = 56 | P1 | This mark is given for a process to find the number of small cubes and the number of large cubes |
| Red cubes =  × 3 = 33Yellow cubes =  × 5 = 55 | P1 | This mark is given for a process to find the number of red cubes and the number of yellow cubes |
| All small cubes are yellow, so the least number of large yellow cubes = 55 – 32 = 23 | A1 | This mark is given for the correct answer only |

**Question 17 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Fraction choosing soup =  = Fraction choosing prawns =  =  | P1 | This mark is given for a process to find the proportion of people who chose soup or prawns as a starter |
| Soup and curry =  × Prawns and curry =  ×  | P1 | This mark is for a process to find out the proportion of people who chose soup and curry and the proportion of people who chose prawns and curry |
|  +  | P1 | This mark is given for a full process to find the fraction of people who chose curry |
|  | A1 | This mark is given for a correct answer only (or an equivalent faction) |

**Question 18 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Ratio of blue pens : green pens : red pens is 8 : 20 : 5 | 1 | This mark is given for a method to find ratios of the three colours of pens |
|  pens are red; greatest number of pens = 99 | 1 | This mark is given for finding the fraction of red pens |
| 15 | 1 | This mark is given for the correct answer only |

**Question 19 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  |  =  ;  =  | P1 | This mark is given for a process to represent the ratios given |
| *p* – 5 = 5(*q* – 5) ; 2(*p* + 20) = 5(*q* + 20) | P1 | This mark is given for a method to find two simultaneous equations in *p* and *q* |
| 5*q* – *p* = 205*q* – 2*p* = –60 *p* = 80 | M1 | This mark is given for a method to rearrange to find a value for *p* |
| 5*q* = 100 *q* = 20 | M1 | This mark is given for a method to find a value for *q* |
| *p* : *q* = 80 : 20 = 4 : 1 | A1 | This mark is given for the correct answer only |

**Question 20 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | (*y* + *x*)= *k*(*y* − *x*) | 1 | This mark is given for setting up an equations from the information given |
| *ky* – *y* = *x* + *kx* | 1 | This mark is given for isolating x and y on opposite sides |
| *y*(*k* – 1) = *k*(*x* + 1) so *y* =  | 1 | This mark is given for using correct algebra to reach a conclusion |

**Question 21 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 5*a* = 8*b* = 6*c* or two ratios with common value for *b* 24 : 15 and 15 : 20 | P1 | This mark is given for a process to form an equation linking 3 variables |
| e.g. 48 : 30 : 40 | P1 | This mark is given for a process to find an unsimplified ratio |
| 24 : 15 : 20 | A1 | This mark is given for the correct answer only |

**Question 22 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 8600 ÷ 15 | P1 | This mark is given for process to use density and mass |
| 1 m3 of A has mass 8600 ÷ 15 × 13 (= 573.33) | P1 | This mark is given for process to use ratio to find the density of A |
| 5 m3 of A has mass 573.33 × 5 (= 37266.67) | P1 | This mark is given for a full process to find mass of alloy A |
| 3 m3 of C has mass 3 × × 8600 (= 36120)  | P1 | This mark is given for a full process to find mass of alloy C |
| 37266.67 – 36120 = 1146.67 | A1 | This mark is given for the correct answer in the range 1146 – 1150 |

**Question 23 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | √( 9 × 7) + √(9*c*) | M1 | This mark is given for a valid first step |
| 3(√7 + √*c*) | M1 | This mark is given for a complete method to show a multiplicative relationship |
| 1:3 | A1 | This mark is given for the correct answer only |

**Question 24 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | $\frac{3}{7}$ and $\frac{6}{11}$ | P1 | This mark is given for starting the process by converting the ratios into fractions |
| $\frac{3}{7}$ × $\frac{6}{11}$ | P1 | This mark is given for a complete process to multiply the fraction |
| $$\frac{18}{77}$$ | A1 | This mark is given for a correct answer or a correct equivalent |

**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 | 2a | June 2019 | 1H | 3 | Ratio | N2, R10 | 3 | 96 | 2.88 | 2.98 | 2.96 | 2.94 | 2.91 | 2.86 | 2.74 | 2.47 | - | - | 2.06 |
| 1b | 2b | June 2019 | 1H | 2 | Ratio | R10 | 3 | 90 | 1.80 | 1.94 | 1.90 | 1.86 | 1.82 | 1.78 | 1.65 | 1.40 | - | - | 1.06 |
| 2 | 4 | June 2017 | 3H | 5 | Number | N8, N12, R5 | 3 | 89 | 4.44 | 4.96 | 4.85 | 4.73 | 4.59 | 4.38 | 3.83 | 2.66 | - | - | 1.26 |
| 3 | 7 | June 2019 | 2H | 4 | Ratio | R5, R7 | 1 | 79 | 3.16 | 3.89 | 3.75 | 3.55 | 3.31 | 2.93 | 2.15 | 1.12 | - | - | 0.51 |
| 4 | 2 | June 2018 | 1H | 3 | Ratio | R6, | 3 | 78 | 2.34 | 2.95 | 2.85 | 2.70 | 2.47 | 2.18 | 1.71 | 1.07 | - | - | 0.51 |
| 5 | 2 | Nov 2019 | 1H | 4 | Ratio | N12, R4, R6 | 3 | 76 | 3.02 | 3.89 | 3.81 | 3.71 | 3.55 | 3.23 | 2.95 | 2.48 | - | - | 2.12 |
| 6 | 3 | Nov 2019 | 2H | 4 | Ratio | R4, R5 | 3 | 74 | 2.95 | 4.00 | 4.00 | 3.81 | 3.61 | 3.39 | 2.84 | 2.25 | - | - | 1.38 |
| 7 | 2 | June 2017 | 2H | 5 | Ratio | R3, R5, R8, R9 | 3 | 66 | 3.32 | 4.76 | 4.33 | 3.82 | 3.43 | 2.94 | 2.18 | 1.09 | - | - | 0.44 |
| 8 | 6 | June 2019 | 1H | 4 | Ratio | R3R5 | 3 | 59 | 2.35 | 3.84 | 3.42 | 2.83 | 2.35 | 1.79 | 1.12 | 0.61 | - | - | 0.43 |
| 9 | 10 | Nov 2018 | 2H | 5 | Ratio | R5, R9, R10 | 3 | 40 | 2.02 | 4.20 | 3.94 | 3.53 | 3.39 | 2.76 | 1.83 | 0.93 | - | - | 0.37 |
| 10 | 2 | Nov 2017 | 1H | 4 | Ratio | R4, A21 | 3 | 38 | 1.51 | 4.00 | 3.53 | 3.16 | 2.89 | 2.25 | 1.64 | 1.11 |  |  | 0.48 |
| 11 | 13 | Nov 2019 | 3H | 4 | Ratio | R5, R11, G16 | 3 | 25 | 1.00 | 4.00 | 3.11 | 2.61 | 1.91 | 1.14 | 0.59 | 0.24 | - | - | 0.09 |
| 12 | 17 | June 2019 | 1H | 4 | Algebra | R6, R8, A18 | 3 | 23 | 0.92 | 3.64 | 2.50 | 1.16 | 0.38 | 0.12 | 0.04 | 0.02 | - | - | 0.02 |
| 13 | 14 | June 2017 | 1H | 4 | Ratio | R810 | 1 | 21 | 0.84 | 3.03 | 1.86 | 1.05 | 0.57 | 0.29 | 0.12 | 0.06 | - | - | 0.02 |
| 14 | 12 | June 2017 | 3H | 3 | Ratio | R6 | 3 | 22 | 0.65 | 2.36 | 1.49 | 0.85 | 0.46 | 0.19 | 0.06 | 0.02 | - | - | 0.01 |
| 15a | 4a | Nov 2018 | 1H | 2 | Ratio | R10 | 1 | 20 | 0.39 | 1.80 | 1.58 | 1.01 | 0.76 | 0.50 | 0.28 | 0.12 | - | - | 0.10 |
| 15b | 4b | Nov 2018 | 1H | 1 | Ratio | R10 | 3 | 36 | 0.36 | 0.70 | 0.82 | 0.72 | 0.66 | 0.51 | 0.30 | 0.14 | - | - | 0.13 |
| 16a | 17a | June 2019 | 2H | 1 | Ratio | R5, R7 | 2 | 19 | 0.19 | 0.59 | 0.36 | 0.22 | 0.14 | 0.08 | 0.04 | 0.02 | - | - | 0.00 |
| 16b | 17b | June 2019 | 2H | 3 | Ratio | R5, R7 | 1 | 40 | 1.20 | 2.44 | 1.88 | 1.41 | 1.10 | 0.83 | 0.53 | 0.25 | - | - | 0.15 |
| 17 | 14 | Nov 2019 | 3H | 4 | Ratio | R5, R8 | 3 | 20 | 0.81 | 3.56 | 3.22 | 2.47 | 1.75 | 0.93 | 0.31 | 0.13 | - | - | 0.06 |
| 18 | 4 | Nov 2017 | 3H | 3 | Ratio | R5 | 3 | 13 | 0.38 | 2.88 | 2.47 | 2.12 | 1.49 | 0.79 | 0.21 | 0.07 |  |  | 0.03 |
| 19 | 17 | Nov 2018 | 2H | 5 | Algebra | A1, A21, R4-6, R8 | 3 | 10 | 0.48 | 4.30 | 3.18 | 1.56 | 0.77 | 0.56 | 0.28 | 0.16 | - | - | 0.07 |
| 20 | 14 | Nov 2017 | 1H | 3 | Ratio | R4 R8 A5 | 2 | 2 | 0.06 | 2.25 | 1.59 | 0.51 | 0.22 | 0.05 | 0.02 | 0.01 |  |  | 0 |
| 21 | 8 | Mock Set 1 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 22 | 9 | Mock Set 2 | 3H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 23 | 14 | Mock Set 2 | 3H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 24 | 14 | Mock Set 4 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **94** |  |  |  |  | **37.07** | **72.96** | **63.4** | **52.33** | **44.53** | **36.48** | **27.42** | **18.43** | **-** | **-** | **11.3** |