**GCSE Mathematics (1MA1)**

**Themed papers – Probability**

**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 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
| (a) | 1 – 0.2 = 0.8 | P1 | This mark is given for a method to solve the inequality |
| 0.4, 0.4 | A1 | This is mark is given for two correct answers (equivalent fractions acceptable) |
| (b) | 12 ÷ 0.2 | P1 | This mark is given for a process to find the number of blue cubes in the box |
| 60 | 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** |
| (a) | 1 – (0.2 + 0.35 + 0.4) = 0.05 | 1 | This mark is given for the correct answer only |
| (b) | 20 | 1 | This mark is given for stating that (at least) 20 counters are required |
| The number of counters of each colour must be a whole number | 1 | This mark is given for a correct explanation |

**Question 3 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | 1 – 0.17 – 0.18 – 0.09 – 0.15 – 0.1 = 0.31 | P1 | This mark is given for a process to find the probability of throwing a 1 |
| 0.31 × 200 = 62  0.18 × 200 = 36 | P1 | This mark is given for process to find an estimate of the number of 1s and 3s expected from 200 throws |
| 62 + 36 = 98 | A1 | This mark is given for the correct answer only |

**Question 4 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 1 – 0.45 – 0.25 = 0.3 | P1 | This mark is given for a process to find the sum of the unknown probabilities |
| 2*x* + *x* = 0.3  *x* = 0.1  P(red) = 0.2, P(white) = 0.1 | P1 | This mark is given for a process to find the probabilities of taking red and white counters |
| Number of counters in the bag =  = 40  Number of red counters = 40 × 0.2 | P1 | This mark is given for a process to find the number of red counters |
| 8 | A1 | This mark is given for the correct answer only |
| (b) | 0.5 multiplied by an odd number will never be a whole number of counters, so there must be an even number of marbles in the box | C1 | This mark is given for a correct explanation |

**Question 5 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | Median = 13th dress in order smallest to largest  Size 12 | B1 | This mark is given for the correct answer only |
| (b) | No , categories are not mutually exclusive (a woman could be in both categories) | C1 | This mark is given for a correct statement |

**Question 6 (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 probability of choosing a green counter followed by a blue counter |
| ×  = | P1 | This mark is given for a process to find the probability of choosing a blue counter followed by a green counter |
| + | P1 | This mark is given for a process to find the probability of choosing one counter of each colour |
| (=) | 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** |
|  | 3 + 17 represents 80% of the counters | P1 | This mark is given for using 1 – 0.2 = 0.8 |
| 3 : 17 : 5 | P1 | This mark is given for a process to find the ratio of purple counters |
|  | A1 | This mark is given for a correct answer only (or decimal equivalent) |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | B : Y = 2 : 1 | 1 | This mark is given for a correct ratio for the blue and yellow cubes |
| B : Y : G = 2 : 1 : 8 | 1 | This mark is given for a correct ratio for the blue, yellow and green cubes |
| = | 1 | This mark is given for the answer shown or an equivalent fraction |

**Question 9 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | Mel’s results will give the best estimate since she drops the greatest number of drawing pins | 1 | This mark is given for a correct comment |
| (b) | ×  =  × | 1 | This mark is given for a probability of point down multiplied by the probability of point up |
|  | 1 | This mark is given for the correct answer only |

**Question 10 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | 0.65 × (1 – 0.65) + 0.65 × (1 – 0.65) | M1 | This mark is given for a method to find the probability that counters of different colours are found |
| 0.455 | A1 | This mark is given for a correct answer only |
| (b) | 78 ÷ 0.65 = 120 | M1 | This mark is given for a method to find the total number of counters |
| 120 – 78 = 42 | A1 | This mark is given for a correct answer only |

**Question 11 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | = | P1 | This mark is given for a process to find an initial relationship between *r* and *g* |
| = | P1 | This mark is given for a process to find a second relationship between *r* and *g* |
| 7*g* = 3(*r* + *g*) = 3*r* + 3*g*  4*g* = 3*r*  13(*g* + 3) = 6(*r* + *g* + 5)  13*g* + 39 = 6*r* + 6*g* + 30  7*g* + 9 = 6*r* | P1 | This mark is given for simplifying the expressions for the relationships found |
| 4*g* = 3*r*  7*g* + 9 = 6*r*  7*g* + 9 = 8*g* | P1 | This mark is given for a process to form simultaneous equations to be solved |
| *g* = 9  *r* = 12 | A1 | This mark is given for the correct answer only (12 red, 9 green) |

**Question 12 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | ×  × | 1 | This mark is given for a method to find the probability of taking 3 red counters |
|  | 1 | This mark is given for the answer shown or an equivalent fraction |
| (b) | ×  × | 1 | This mark is given for calculating a relevant probability |
| = , so more likely since 0.022 > 0.018 | 1 | This mark is given for a correct conclusion supported by working |

**Question 13 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | ×  = | P1 | This mark is given for a process to find the probability that the product is an odd number |
| 1 – | P1 | This mark is given for a process to find the probability that the product is an even number |
|  | A1 | This mark is given for the correct answer only |

**Question 14 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | = | M1 | This mark is given for a method to find the probability of throwing one head |
| Probability of getting 4 tails = | A1 | This mark is given for the correct answer only |

**Question 15 (Total 6 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | Let *x* be the number of green pens in the box  The probability of taking two green pens is  ×  The probability of taking two blue pens is  × | P1 | This mark is given for a process to find the probability of taking two green pens or the probability of taking two blue pens |
| The probability of taking two pens of the same colour is  ×  +  ×  = | P1 | This mark is given for forming an equation for the probability Simon takes two pens of the same colour |
| 55(*x*(*x* – 1) + (*x* + 3)(*x* + 2))  = 27(2*x* + 3)(2*x* + 2) | P1 | This mark is given for a process to eliminate fractions from the algebraic expression |
| 55(2*x*2 + 4*x* + 6) = 27(4*x*2 + 10*x* + 6)  110*x*2 + 22*x* + 330 = 108*x*2 + 270*x* + 162  2*x*2 – 50*x* + 168 = 0  *x*2 – 25*x* + 84 = 0 | P1 | This mark is given for reducing the expression to a quadratic equation |
| (*x* – 21)(*x* – 4) = 0 | P1 | This mark is given for finding a method to solve the quadratic equation |
| 21 | A1 | This mark is given for the correct answer only |

**Question 16 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | or | P1 | This process mark is given for finding an expression to represent a black counter being drawn from bag **A** followed by a black counter being drawn from bag **B**  or  for finding an expression to represent a white counter being drawn from bag **A** followed by a black counter being drawn from bag **B** |
| + | P1 | This process mark is given for adding the two expressions to find the probability that there are now more black counters than white counters in bag **C** |
|  | A1 | This accuracy mark is given for the correct answer only (or an equivalent fraction) |

**Question 17 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | or | P1 | This mark is given for a process to start to solve problem |
| ×  = | P1 | This mark is given for a process to find the correct product |
| =  21*x*2 + 273*x* + 882 = 560*x*  21*x*2 – 287*x* + 882 = 0 | P1 | This mark is given for a process to rearrange and arrive at correct quadratic equation = 0 |
| or  7(3*x* ­– 14)(*x* – 9) = 0 | P1 | This mark is given for a correct substitution into the quadratic formula  or  factorisation of the quadratic expression |
| = 4.6667 and 9, so 9 counters | A1 | This mark is given for the correct answer only |

**Question 18 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | P(OOO) =  ×  ×  = | P1 | This mark is given for a process to find the probability of one combination of counters that give an odd number |
| P(OEE) =  ×  ×  = | P1 | This mark is given for a process to find the probability of a second combination of counters that give an odd number |
| P(EOE) =  ×  ×  = | P1 | This mark is given for a process to find the probability of a third combination of counters that give an odd number |
| P(EEO) =  ×  ×  = | P1 | This mark is given for a process to find the probability of all four combinations of counters that give an odd number |
| P(odd) =  +  +  +  = | 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** |
| 1a | 1a | June 2019 | 1H | 2 | Probability | P4 | 1 | 98 | 1.96 | 1.99 | 1.98 | 1.97 | 1.97 | 1.96 | 1.95 | 1.87 | - | - | 1.60 |
| 1b | 1b | June 2019 | 1H | 2 | Probability | P4 | 1 | 93 | 1.85 | 1.98 | 1.96 | 1.92 | 1.88 | 1.83 | 1.68 | 1.33 | - | - | 0.90 |
| 2a | 10a | Nov 2017 | 3H | 1 | Probability | P4 | 1 | 82 | 0.82 | 1 | 0.97 | 0.99 | 0.99 | 0.96 | 0.89 | 0.76 | - | - | 0.55 |
| 2b | 10b | Nov 2017 | 3H | 2 | Probability | P1 | 2 | 14 | 0.29 | 1.38 | 1.18 | 1.09 | 1 | 0.59 | 0.24 | 0.07 | - | - | 0.03 |
| 3 | 1 | June 2017 | 2H | 3 | Probability | P2 P4 | 3 | 76 | 2.29 | 2.8 | 2.66 | 2.51 | 2.37 | 2.17 | 1.84 | 1.27 | - | - | 0.76 |
| 4a | 6a | June 2018 | 3H | 4 | Probability | P4, A21, R6 | 3 | 76 | 3.04 | 3.84 | 3.64 | 3.42 | 3.17 | 2.83 | 2.34 | 1.68 | - | - | 1.06 |
| 4b | 6b | June 2018 | 3H | 1 | Probability | P4 | 2 | 46 | 0.46 | 0.77 | 0.67 | 0.57 | 0.47 | 0.38 | 0.27 | 0.14 | - | - | 0.06 |
| 5a | 3a | June 2017 | 3H | 1 | Statsitics | S4 | 1 | 73 | 0.73 | 0.95 | 0.89 | 0.81 | 0.75 | 0.67 | 0.55 | 0.38 | - | - | 0.25 |
| 5b | 3b | June 2017 | 3H | 1 | Probability | P8 | 2 | 9 | 0.09 | 0.2 | 0.09 | 0.07 | 0.07 | 0.08 | 0.08 | 0.05 | - | - | 0.03 |
| 6 | 17 | June 2017 | 1H | 4 | Probability | P8 | 3 | 63 | 2.5 | 3.87 | 3.68 | 3.3 | 2.72 | 1.94 | 1.04 | 0.39 | - | - | 0.14 |
| 7 | 16 | June 2018 | 1H | 3 | Probability | P4 | 3 | 46 | 1.39 | 2.85 | 2.41 | 1.88 | 1.39 | 0.93 | 0.46 | 0.11 | - | - | 0.03 |
| 8 | 4 | Nov 2017 | 2H | 3 | Ratio | R8 P7 R6 | 3 | 43 | 1.28 | 1.88 | 2.26 | 2.59 | 2.3 | 1.97 | 1.33 | 0.94 | - | - | 0.56 |
| 9a | 8a | Nov 2017 | 3H | 1 | Probability | P5 | 3 | 33 | 0.33 | 0.88 | 0.79 | 0.66 | 0.54 | 0.44 | 0.37 | 0.24 |  |  | 0.18 |
| 9b | 8b | Nov 2017 | 3H | 2 | Probability | P8, S2 | 2 | 9 | 0.17 | 1.62 | 1.44 | 1.01 | 0.81 | 0.32 | 0.07 | 0.02 |  |  | 0.00 |
| 10a | 16a | Nov 2018 | 2H | 2 | Probability | P9 | 1 | 27 | 0.54 | 1.9 | 1.56 | 1.38 | 1.17 | 0.83 | 0.33 | 0.11 | - | - | 0.04 |
| 10b | 16b | Nov 2018 | 2H | 2 | Probability | P9 | 1 | 42 | 0.84 | 1.9 | 1.85 | 1.61 | 1.52 | 1.14 | 0.75 | 0.28 | - | - | 0.17 |
| 11 | 22 | June 2019 | 1H | 5 | Probability | P8, A19 | 3 | 12 | 0.62 | 3.61 | 1.37 | 0.52 | 0.23 | 0.11 | 0.04 | 0.01 | - | - | 0.01 |
| 12a | 21a | Nov 2017 | 2H | 2 | Probability | P8 P9 | 1 | 7 | 0.14 | 1.25 | 1.59 | 1.08 | 0.6 | 0.25 | 0.05 | 0.01 | - | - | 0 |
| 12b | 21b | Nov 2017 | 2H | 2 | Probability | P8 | 2 | 3 | 0.05 | 0.38 | 0.85 | 0.42 | 0.2 | 0.06 | 0.01 | 0 | - | - | 0 |
| 13 | 16 | Nov 2019 | 2H | 3 | Probability | P6, P9 | 3 | 6 | 0.19 | 1.78 | 1.22 | 0.61 | 0.4 | 0.17 | 0.05 | 0.03 | - | - | 0.01 |
| 14 | 21 | Nov 2019 | 3H | 2 | Probability | P7, P8 | 3 | 5 | 0.09 | 1.56 | 0.76 | 0.52 | 0.17 | 0.02 | 0.01 | 0 | - | - | 0 |
| 15 | 22 | Nov 2018 | 1H | 6 | Probability | P9, A19, A21 | 3 | 1 | 0.04 | 2.80 | 0.67 | 0.21 | 0.04 | 0.02 | 0.00 | 0.00 | - | - | 0.00 |
| 16 | 24 | Mock Set 1 | 1H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 17 | 25 | Mock Set 2 | 2H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 18 | 20 | Mock Set 3 | 3H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **67** |  |  |  |  |  | **41.19** | **34.49** | **29.14** | **24.76** | **19.67** | **14.35** | **9.69** | **-** | **-** | **6.38** |