**GCSE Mathematics (1MA1)**

**Themed papers – Vectors**

**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)(i) | = | B1 | This mark is given for the correct answer only |
| (a)(ii) | 2**a** =  or 3**b** = | M1 | This mark is given for a method to use either  or |
| = | A1 | This mark is given for the correct answer only |
| (b) | Correct line from *P* drawn on diagram | B1 | This mark is given for a correct vector drawn |

**Question 2 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | = **a** + **c** | P1 | This mark is given for the first step to solve the problem |
| =  +  = **a** + **c + 3c –** **a**  =  –  = 3.5**c** – **c** = 2.5**c** | P1 | This mark is given for a process to find a vector expression for |
| :  = *k* : 1 = **c** + 2.5**c** | P1 | This mark is given for a process to find the value of *k* (using ratios) |
| *k* =  = | A1 | This mark is given for the correct answer only |

**Question 3 (Total 6 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** | |
| (a) | **=  +  +**  **= (a** – **b)** + **a** + **b** | M1 | This mark is given for a method to find a vector expression for | |
| = 2**a** | A1 | This mark is given for the correct answer only | |
| (b) | **= – –  –**  **= –b** – **a** – (**a** – **b**)  = **b** – 2**a** | P1 | This mark is given for a method to find a vector expression for | |
| **=  +**  **=  +  +**  **=  +**  **=  +**  **= a + b**  **= a + b** + (**b** – 2**a**)  = **a** – **a + b + b**  **= a** – **a + b + b**  = **a** **+ b**  **=** (2**a** –**b** ) + **b**  = **a – b** + **b**  = **a – b + b**  = **a + b** | | P1 | This mark is given for a method to find vector expressions for and |

**Question 3 continued (Total 6 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** | |
|  | **=  +**  **a** + **b** = **a** **+ b + a + b**  Thus  =  **or  =**  2(*n* + 1)(*n* – 1) = (*n* + 1)(*n* + 2)  2(*n* – 1) = *n* + 2  *n* – 2 = 2  **or**  4(*n* + 1) = *n*(*n* + 1) | | P1 | This mark is given for a process to find the value of *n* |
| *n* = 4 | A1 | This mark is given for the correct answer only | |

**Question 4 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | –2**a** | B1 | This mark is given for a correct vector drawn (including the arrow) |
| **a** = , **b** = | M1 | This mark is given for writing **a** and **b** as column vectors |
| **a** + 2**b** =  +  = | 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** |
| (a) | The curve cuts the *y* axis at *x* = 0  *y* = *ax* = *a*0 = 1  (0, 1) | B1 | This mark is given for the correct answer only |
| (b) |  | M1 | This mark is given for any one of a circle with radius 4, centre (3, 0) or points (−1, 0) and (7, 0) labelled |
|  | M1 | This mark is given for any further element of a circle with radius 4, centre (3, 0) or points (−1, 0) and (7, 0) labelled |
| (–1, 0)  (3, 0)  (7, 0) | A1 | This mark is given for a fully correct sketch only: a circle with radius 4 and centre (3, 0) and with the points (−1, 0) and (7, 0) labelled |

**Question 6 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  |  | M1 | This mark is given for showing a rotation of 180° about (–2, 0) followed by a translation |
| (–3.5, 1) | 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** |
|  | =  = **a**  =  = **b** | P1 | This mark is given a process to find  and |
| =  = **a** – **b**  = **a** | P1 | This mark is given for a process to use vector equivalence of opposite sides of a parallelogram to find vector expressions for  and |
| = **a** – **b** + **a**  = **a** – **b** + **b** |  | This mark is given for a process to find  and  in terms of **a** and **b** |
| 12 = 12**a** – 12**b** + 4**a** = 16**a** – 12**b**  12 = 12**a** – 12**b** + 3**b** = 12**a** – 9**b**  16**a** – 12**b =** (12**a** – 9**b**)so = |  | This mark is given for a process to write  and  as multiples of the same vector |
| 4 : 3 |  | This mark is given for the correct answer only (or an equivalent ratio) |

**Question 8 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *AB* = **b** – **a** | P1 | This mark is given for the start to a process by finding the vector *AB* |
| *OM* = *OA* + *AB*  = **a** + (**b** – **a**) | P1 | This mark is given for a process to find the vector *OM* |
| *AP* = *AO* + *OM*  = –**a** + (**a** + (**b** – **a**))  = –**a** + (**a** + **b**)  = –**a** + **b** | P1 | This mark is given for a process to find the vector *AP* |
| *AN* = –**a** + *k***b =** *AP*  = (–**a** + **b**) = –**a** + **b** | P1 | This mark is given for a process to find *k*=  using *AN* as a multiple of *AP* |
| Thus *ON*: *NB* = 3 : 4 | A1 | This mark is given for the correct answer only |

**Question 9 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | = 2**b** – 3**a**  = 3**a** – 2**b** | B1 | This mark is given for finding the vector equation for at least one of  or |
| =  +  =  + | M1 | This mark is given for a method to find the vector expression for at least one of  or |
| = 3**a** + (2**b** – 3**a**) = (2**b** + **a**)  = (3**a** – 3**b**) + 6**b** = (2**b** + **a**) | A1 | This mark is given for a method to find the vector equation for at least one of or |
| = 3 so vectors are parallel and have the point *D* in common  Thus *ADE* is a straight line | C1 | This mark is given for a complete correct conclusion |

**Question 10 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | = **b** − **a or**  = **a** – **b** | M1 | This mark is given for a start to the method |
| (**b**−**a**)+**a** | M1 | This mark is given for a complete method |
|  | A1 | This mark is given for a correct answer or an equivalent |

**Question 11 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | = **b** – **a** | 1 | This mark is given for finding a vector expression for |
| = –**b** + **a** + 2**a**  = –**b** + 3**a** | 1 | This mark is given for finding a vector expression for |
| = –*k*(**b** – **a**) + 2**a**  **= –***k***b** + (2 + *k*)**a** | 1 | This mark is given for finding a vector expression for |
| Since  is a multiple of  =  –(2 + *k*) = –3*k* | 1 | This mark is given for recognising that  is a multiple of and comparing coefficients of **a** and **b** |
| *k* = | 1 | This mark is given for the correct answer only |

**Question 12 (Total 5 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | = **a** – 3**b**  or  = (**a** – 3**b**) | M1 | This mark is given for a method to represent *BA* or *YA* as vectors |
| = **b +** (**a** – 3**b**)  or  = **a +** (**a** – 3**b**)  or   = 2**a**– 2**b** | M1 | This mark is given for a method to represent one of *XY*, *YZ* or *XZ* as vectors |
|  | M1 | This mark is given for a method to represent a second of *XY*, *YZ* or *XZ* as vectors |
| = (**a** – **b**)  or  = (**a** – **b**)  or   = 2(**a** – **b**) | M1 | This mark is given for a method to simplify at least two vector terms to enable comparison of two of ,  and |
| ,  and  are each multiples of (**a** – **b**) and so are parallel; point *Y* is common, so *X*, *Y* and *Z* lie on a straight line | C1 | This mark is given for a complete proof with reference to two of ,  and  being parallel and a common point |

**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 | 4a | Mock Set 2 | 3H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 1b | 4b | Mock Set 2 | 3H | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 19 | June 2017 | 1H | 4 | Geometry | G25R4R8 | 3 | 25 | 0.98 | 3.15 | 2.10 | 1.25 | 0.72 | 0.39 | 0.20 | 0.09 | - | - | 0.03 |
| 3a | 20a | June 2019 | 2H | 2 | Geometry | G25 | 1 | 65 | 1.29 | 1.98 | 1.94 | 1.78 | 1.41 | 0.84 | 0.35 | 0.10 | - | - | 0.03 |
| 3b | 20b | June 2019 | 2H | 4 | Geometry | N11, G25 | 3 | 20 | 0.80 | 2.03 | 1.49 | 1.06 | 0.66 | 0.38 | 0.18 | 0.08 | - | - | 0.05 |
| 4a | 10a | June 2018 | 2H | 3 | Geometry | G25 | 1 | 45 | 0.45 | 0.89 | 0.76 | 0.62 | 0.47 | 0.29 | 0.14 | 0.04 | - | - | 0.01 |
| 4b | 10b | June 2018 | 2H | 2 | Geometry | G25 | 1 | 34 | 0.67 | 1.67 | 1.32 | 0.95 | 0.62 | 0.34 | 0.15 | 0.08 | - | - | 0.04 |
| 5a | 20a | June 2017 | 3H | 1 | Algebra | A14 | 1 | 20 | 0.20 | 0.81 | 0.49 | 0.22 | 0.10 | 0.05 | 0.03 | 0.03 | - | - | 0.03 |
| 5b | 20b | June 2017 | 3H | 3 | Algebra | A13 | 2 | 25 | 0.76 | 2.66 | 2.01 | 1.10 | 0.44 | 0.14 | 0.04 | 0.02 | - | - | 0.01 |
| 6 | 20 | Nov 2018 | 3H | 2 | Geometry | G8 | 2 | 11 | 0.21 | 1.30 | 0.68 | 0.48 | 0.38 | 0.28 | 0.15 | 0.08 | - | - | 0.01 |
| 7 | 24 | Nov 2019 | 3H | 5 | Geometry | R4, R8, G25 | 3 | 7 | 0.34 | 4 | 2.41 | 1.59 | 0.75 | 0.24 | 0.04 | 0 | - | - | 0 |
| 8 | 21 | Nov 2018 | 1H | 5 | Geometry | G25 | 3 | 4 | 0.18 | 2.50 | 0.82 | 0.71 | 0.30 | 0.15 | 0.11 | 0.07 | - | - | 0.03 |
| 9 | 19 | Mock Set 3 | 3H | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10 | 19 | Mock Set 4 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11 | 21 | Nov 2017 | 3H | 5 | Geometry | G25 | 3 | 1 | 0.06 | 1.75 | 1.15 | 0.53 | 0.19 | 0.06 | 0.01 | 0.00 | - | - | 0.00 |
| 12 | 21 | Mock Set 1 | 2H | 5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **52** |  |  |  |  | **5.94** | **22.74** | **15.17** | **10.29** | **6.04** | **3.16** | **1.4** | **0.59** | **-** | **-** | **0.24** |