**GCSE Mathematics (1MA1)**

**Themed papers – Direct and inverse 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 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | |  |  | | --- | --- | | **Type of proportionality** | **Graph** | | *y* ∝ *x* |  | | *y* ∝ *x*2 |  | | *y* ∝ √*x* |  | | *y* ∝ |  | | B2 | These marks are given for all four graphs identified correctly  (B1 is given for at least 2 identified correctly) |

**Question 2 (Total 2 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | |  |  | | --- | --- | | **Description of function** | **Graph** | | f(*x*) is inversely proportional to *x* | **B** | | f(*x*) is a trigonometrical function | **A** | | f(*x*) is an exponential function | **D** | | f(*x*) is directly proportional to √*x* | **C** | | B2 | These marks are given for all four graphs labelled correctly  (B1 is given for two graphs labelled correctly) |

**Question 3 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | *h* =  and *p* = *K*√*t* | P1 | This mark is given for a method to set up proportional relationships between *h* and *p* and between *p* and √*t* |
| 10 =  so *k* = 60  6 = *K* × 12 so *K* = 0.5 | P1 | This mark is given for a process to find values for both *k* and *K* |
| *h* =  *p* = 0.5√*t* | P1 | This mark is given for a process to find expressions for both *h* and *p* |
| *h* =  = | 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** |
| --- | --- | --- | --- |
|  | *y* ∝  or *y* = | M1 | This mark is given for a process to set up a correct proportional relationship |
| 4 =  = , *k* = 400 | P1 | This mark is given for a process to find a value of *k* |
| *d* ∝ *x*2 or *d* = *kx*2  24 = *k* × 4, *k* = 6 | P1 | This mark is given for a process to set up a second correct proportional relationship |
| *y* =  =  = | P1 | This mark is given for a process to find *y* in terms of *x* |
| *y* = | A1 | This mark is given for a correct and fully simplified answer only |

**Question 5 (Total 4 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| (a) | *y* =  Substituting,  9 =  or 2 =  or 1 =  or 2 =  so *k* = 9 | M1 | This mark is given for a method to find an equation for *y* in the form *y* =  and thus the constant *k* |
| *y* = | A1 | This mark is given for the correct answer only |
| (b) | 16 =  so *x*2 = , *x* = | M1 | This mark is given for a method to substitute *y* = 16 into the proportional formula and rearrange |
| *x* = | A1 | This mark is given for the correct answer only |

**Question 6 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *y* =  so 8 = | P1 | This mark is given for stating a correct relationship between *x* and *y* |
| *k* = 8 × 6.25 = 50 | P1 | This mark is given for a method to find the value of *k* |
| =  *x*2 =  = 56.25  *x* = 7.5 or – 7.5  Negative value of *x* = –7.5 | P1 | 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** |
| --- | --- | --- | --- |
|  | *y* ∝  or *y* = | M1 | This mark is given for constructing a proportional equation |
| 44 =  so *k* = 44*a*3 | M1 | This mark is given for a method to find a value for *k* |
| When *x* = 2*a, y* =  =  = 5.5 | C1 | This mark is given for a complete method to show *y* = 5.5. |

**Question 8 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *y* = *k*  = 2*k*  *k* = | 1 | This mark is given for substituting to find a value for *k* |
| *y*  =  × 4 | 1 | This mark is given for finding an expression for *y* when *x* = 64 |
| *y* = 2 | 1 | This mark is given for the correct answer only |

**Question 9 (Total 3 marks)**

| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
| --- | --- | --- | --- |
|  | *T* =  so 0.0096 =  , *T* = | M1 | This mark is given for a method to use the constant *k*  and substitute values for *u* and *T*. |
| *u* = | M1 | This mark is given for a method to find a value for *u* |
| 2 | 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** |
|  | *P* ∝  or *P* = | M1 | This mark is given for an interpretation of the first line |
| 10 =  so *k* = 5 | M1 | This mark is given for a method to find the constant of proportionality |
| = 2 so  = 2.5  *m* = 6 | A1 | This mark is given for the correct answer only |

**Question 11 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working an or answer examiner might expect to see** | **Mark** | **Notes** |
|  | E, C, D, A, B | B3 | These marks are given for all five graphs labelled correctly  (B2 for 3 or 4 graphs correct,  B1 for 1 or 2 graphs correct) |

**Question 12 (Total 3 marks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **Working or answer an examiner might expect to see** | **Mark** | **Notes** |
|  | *y* = | M1 | This mark is given for a forming an equation of proportionality |
| 1 =  so *k* = 100 | M1 | This mark is given for substituting value of *y* to find *k* |
| *y* = , so when *x* = 5  *y* =  =  = 4 | 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** |
| 1 | 12 | June 2018 | 2H | 2 | Ratio | R10 | 2 | 71 | 1.41 | 1.92 | 1.80 | 1.64 | 1.45 | 1.23 | 1.02 | 0.82 | - | - | 0.61 |
| 2 | 17 | June 2019 | 3H | 2 | Algebra | A12, R10, R14 | 2 | 51 | 1.02 | 1.85 | 1.59 | 1.28 | 0.95 | 0.67 | 0.49 | 0.40 | - | - | 0.37 |
| 3 | 20 | June 2019 | 1H | 4 | Ratio | R10 | 3 | 49 | 1.95 | 3.79 | 3.30 | 2.57 | 1.81 | 1.16 | 0.63 | 0.32 | - | - | 0.14 |
| 4 | 14 | June 2018 | 1H | 5 | Ratio | R13, A4 | 3 | 43 | 2.16 | 4.32 | 3.57 | 2.92 | 2.24 | 1.43 | 0.76 | 0.35 | - | - | 0.12 |
| 5a | 13a | June 2017 | 1H | 2 | Ratio | R13 | 1 | 43 | 0.85 | 1.91 | 1.71 | 1.32 | 0.81 | 0.36 | 0.11 | 0.02 | - | - | 0.01 |
| 5b | 13b | June 2017 | 1H | 2 | Ratio | R13 | 1 | 31 | 0.61 | 1.84 | 1.44 | 0.91 | 0.45 | 0.16 | 0.04 | 0.01 | - | - | 0.00 |
| 6 | 16 | Nov 2019 | 3H | 3 | Ratio | R13 | 1 | 20 | 0.61 | 3.00 | 2.30 | 2.05 | 1.36 | 0.69 | 0.22 | 0.02 | - | - | 0.00 |
| 7 | 14 | Nov 2018 | 3H | 3 | Ratio | R13 | 2 | 20 | 0.59 | 3.00 | 2.41 | 1.72 | 1.35 | 0.88 | 0.29 | 0.09 | - | - | 0.02 |
| 8 | 16 | Nov 2017 | 1H | 3 | Ratio | R13 | 1 | 7 | 0.22 | 3.00 | 2.29 | 1.58 | 0.94 | 0.37 | 0.10 | 0.03 | - | - | 0.00 |
| 9 | 18 | Mock Set 2 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 10 | 11 | Mock Set 3 | 1H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11 | 13 | Mock Set 3 | 2H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 12 | 16 | Mock Set 4 | 1H | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|  |  |  |  | **34** |  |  |  |  | **6.99** | **20.86** | **17.02** | **13.07** | **8.96** | **5.05** | **2.15** | **0.84** | **-** | **-** | **0.29** |