Cambridge O Level

**Cambridge Assessment International Education**
Cambridge Ordinary Level

**MATHEMATICS (SYLLABUS D)** **4024/21**

Paper 2 **May/June 2019**

MARK SCHEME

Maximum Mark: 100

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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## Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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**Abbreviations**

| | |
|---|---|
| cao | correct answer only |
| dep | dependent |
| FT | follow through after error |
| isw | ignore subsequent working |
| oe | or equivalent |
| SC | Special Case |
| nfww | not from wrong working |
| soi | seen or implied |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 1(a) | 21 600 | **1** | |
| 1(b)(i) | 34.4 or 34.44 to 34.45 | **3** | **M2** for $\frac{1800 - their1180}{1800}$ [× 100] oe or $\frac{their1180}{1800} \times 100$ **or** **M1** for $\frac{their1180}{1800}$ [× 100] oe **or** **B1** for 620 |
| 1(b)(ii) | 518 | **2** | **M1** for 500 × 1.036 oe |
| 1(c) | 2400 | **2** | **M1** for $\frac{100 - 25}{100} x = 1800$ soi |
| 2(a) | (14.7, 32.5) (13.7, 28.4) (12.9, 26.1) (15.2, 33.5) (16.1, 36.0) plotted | **2** | **B1** for 3 or 4 correct |
| 2(b) | positive | **1** | |
| 2(c) | Ruled line of best fit | **1** | |
| 2(d) | Strict FT *their* ruled line of best fit | **1** | |
| 3(a)(i) | 64 | **B1** | |
| | *QBC* alternate to angle *BCA* oe | **B1** | |
| | *ABC* is isosceles triangle or angle sum of triangle [=180] | **B1** | |
| 3(a)(ii) | 75 | **1** | |
| 3(b) | 117 | **3** | **B2** for [interior angles] 108 and 135 soi or [exterior angles] 72 and 45 soi **or** **B1** for [interior angle] 108 or 135 soi or [exterior angle] 72 or 45 soi |

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| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 4(a)(i) | $\frac{3}{25y}$ final answer | **2** | **B1** for $\frac{3}{25y}$ seen or $\frac{42y}{350y^2}$ or better |
| 4(a)(ii) | $\frac{k+4}{k+2}$ final answer | **3** | **B1** for $(k+4)(k-4)$<br>**B1** for $(k-4)(k+2)$ |
| 4(b) | $\frac{14}{3}$ or $4\frac{2}{3}$ or 4.67 or 4.666 to 4.667 | **2** | **M1** for $3x - 12 = 7 - 5$ **or** $x - 4 = \frac{7-5}{3}$ |
| 4(c) | $\frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-4)}}{2 \times 3}$ oe | **B2** | **B1** for $\sqrt{5^2 - 4 \times 3 \times -4}$ oe **or** $\frac{-5 \pm \sqrt{r}}{2 \times 3}$ oe |
| | 0.59 and –2.26 | **B1** | |
| 5(a)(i) | Correct parallelogram with construction arcs at $B$ and $C$ | **3** | **B2** for correct parallelogram without arcs **or**<br>**B1** for two of $AB = 8$ or $DC = 8$ **or** $BD = 11$ or $BC = 6$ |
| 5(a)(ii) | 101 to 105 | **1** | FT *their* triangle $ABD$ |
| 5(a)(iii) | 4[.0] to 4.4 with A$E$ drawn | **1** | FT *their*$AE$ from correct parallelogram |
| 5(b)(i) | 7.95 or 7.948 to 7.949 | **2** | **M1** for $\cos 58 = \frac{PS}{15}$ oe |
| 5(b)(ii) | 133.7 or 133.72 to 133.73 | **4** | **B1** for 32 **and**<br>**M2** for $\sin R = \frac{15 \times \sin \textit{their}32}{11}$ **or**<br>**M1** for $\frac{15}{\sin R} = \frac{11}{\sin \textit{their}32}$ oe |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 6(a)(i) | $\frac{7}{3} < x \leqslant 7$ oe final answer | **3** | **B2** for $\frac{7}{3} < x \leqslant 7$ seen **or** final answer $\frac{7}{3} < x$ **or** final answer $x \leqslant 7$<br>**B1** for either correct inequality seen **or**<br>**M1** for $\frac{10}{3}$ […] $x + 1$ […] $\frac{24}{3}$ **or** 10 – 3 […] $3x$ […] 24 – 3 soi |
| 6(a)(ii) | 5 | **1** | |
| 6(b) | $y \geqslant 0$<br>$x \geqslant y$ oe<br>$2x + y \leqslant 6$ oe | **3** | **B1** for each inequality<br>If 0 scored, **SC1** for 3 correct equations soi |
| 7(a) | 23 | **1** | |
| 7(b) | $3x - 4$ final answer | **2** | **B1** for $3y = x + 4$ **or** $y - \frac{4}{3} = \frac{x}{3}$ **or** $3y - 4$ **or** $x = \frac{y+4}{3}$ |
| 7(c) | $\frac{19}{14}$ or $1\frac{5}{14}$ or 1.36 or 1.357 to 1.358 | **3** | **B2** for answer $14p = k$ or $kp = 19$ **or**<br>**M1** for $5p - 7 = \frac{p+4}{3} - 2$ |
| 7(d) | $a = \frac{5}{3}$ oe $b = -1$ | **3** | **B2** for either correct **or**<br>**M1** for $\frac{5x - 7 + 4}{3}$ |
| 8(a) | $\frac{22}{80}$ or $\frac{11}{40}$ oe | **1** | |
| 8(b) | 33.875 or 33.9 nfww | **3** | **B1** for correct use of midpoints<br>**M1** for $\frac{\sum fx}{80}$ |
| 8(c) | Correct cumulative frequency diagram | **3** | **B2** for at least 5 correct points plotted **or**<br>**B1** for 6, 22, 47, 65, 78, 80 soi |

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| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 8(d)(i) | 32.5 to 34 | **1** | FT *their* cumulative frequency diagram |
| 8(d)(ii) | 8 to 9.5 | **2** | FT *their* cumulative frequency diagram<br>**M1** for [LQ] 29 to 30 nfww **or** [UQ] 38 to 39 nfww |
| 8(e) | 6, 7 or 8 | **2** | **M1** for attempt to read at 43 |
| 9(a)(i)(a) | $\frac{3}{2}$(**p** + 2**q**) oe simplified expression | **1** | |
| 9(a)(i)(b) | $\frac{5}{2}$**p** or $2\frac{1}{2}$**p**<br>**or** 2.5**p** | **2** | **M1** for a correct vector route |
| 9(a)(ii) | Trapezium | **B1** | |
| | $\overrightarrow{PQ}$ is a multiple of $\overrightarrow{SR}$<br>**or** PQ is parallel to SR since $\overrightarrow{PQ}$=4**p** and $\overrightarrow{SR}$ =2.5**p** oe | **B1** | |
| 9(a)(iii) | 8 : 5 | **2** | FT *their* $\overrightarrow{SR}$ of form *k***p**<br>**B1** for 4 : 2.5 oe |
| 9(b)(i) | $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ final answer | **1** | |
| 9(b)(ii) | 6.32 or 6.324 to 6.325 | **2** | **M1** for $6^2 + (-2)^2$ |
| 9(b)(iii) | $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$ final answer | **2** | **B1** for $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ |
| 10(a) | $\frac{1}{2}(8-x)x \times \frac{1}{2} \times 20$ | **M2** | **M1** for $\frac{1}{2}(8-x)x \times \sin 30$ isw |
| | $(40x - 5x^2)$ nfww | **A1** | |
| 10(b) | Curve through (1, 35) (2, 60) (3, 75) (4, 80) (5, 75) (6, 60) (7, 35) | **3** | **B2** for 3 or 4 more correct points plotted **or**<br>**B1** for at least 2 more correct points soi |
| 10(c) | 1.5 to 1.6 and 6.4 to 6.5 | **2** | **B1** for either |
| 10(d) | $V = 12x$ ruled | **M2** | **M1** for $V = 4 \times 3 \times x$ soi |
| | 5.5 to 5.6 | **B1** | |

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| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 11(a) | 128[.0]° or 128.03° to 128.04° | **4** | **B3** for 66[.0] or 66.03 to 66.04<br>**or**<br>**M2** for [cos $L$] = $\frac{14^2+8^2-13^2}{2\times14\times8}$ **or**<br>**M1** for $13^2 = 14^2 + 8^2 - 2 \times 14 \times 8 \times \cos L$<br><br>After 0 scored, **SC1** for 62 + *their* $B\hat{L}A$ |
| 11(b) | 6.93 or 6.92 | **2** | **M1** for $13^2 - 11^2$ isw |
| 11(c) | 3 hours 28 minutes | **2** | **M1** for $\frac{13}{3.75}$ |

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