Cambridge Assessment International Education

# Cambridge O Level

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

Paper 2 **May/June 2021**

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.

Cambridge International will not enter into discussions about these mark schemes.

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**[Turn over**

## 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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| **Mathematics Specific Marking Principles** | |
|---|---|
| 1 | Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing. |
| 2 | Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected. |
| 3 | Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points. |
| 4 | Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw). |
| 5 | Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread. |
| 6 | Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear. |

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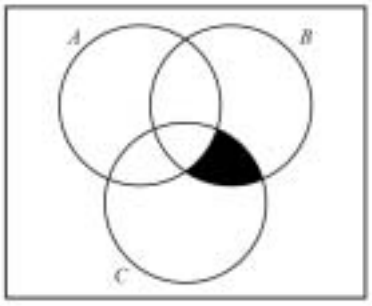
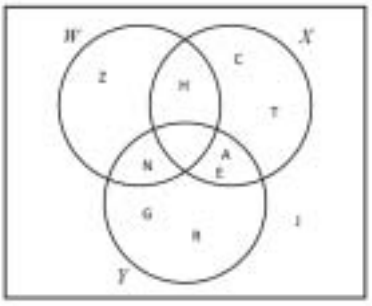
**Abbreviations**

| | |
|---|---|
| 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) | 32.7 or 32.72 to 32.73 | **2** | **M1** for $\frac{7200}{22000}[\times 100]$ |
| 1(b) | 22 880 | **2** | **M1** for $22000 + \frac{4}{100}\times 22000$ oe<br>or **B1** for 880 |
| 1(c)(i) | $2000\left(1+\frac{K}{100}\right)=2036$ soi | **M1** | |
| | $\left(1+\frac{K}{100}\right)=\frac{2036}{2000}$ leading to $K = 1.8$ | **A1** | **A0** for any incorrect working |
| 1(c)(ii) | 5 with<br>2147 to 2148 and 2186 to 2187<br>or<br>5 with $\left(1+\frac{1.8}{100}\right)^n = 1.075$ and<br>1.073 to 1.074 and 1.093 to 1.094<br>or<br>5 with 4.05 or 4.053 to 4.054 | **3** | **M2** for $[2000]\left(1+\frac{1.8}{100}\right)^4$ oe or<br>$[2000]\left(1+\frac{1.8}{100}\right)^5$ oe or<br>$1.018^n = 1.075$<br>or **M1** for $2000\left(1+\frac{1.8}{100}\right)^n$ oe where<br>$n > 1$<br>$\left(1+\frac{1.8}{100}\right)^n = \frac{2150}{2000}$ |
| 2(a) | 4 | **1** | |
| 2(b) | 3 | **1** | |
| 2(c) | 3.22 or $3\frac{11}{50}$ | **3** | **B1** for 7, 11, 10, 12, 6, and 4 soi<br>**M1** for $\frac{7\times1+11\times2+10\times3+12\times4+6\times5+4\times6}{50}$ |
| 2(d) | $\frac{10}{50}$ oe | **1** | |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 2(e) | $\frac{264}{1225}$ oe | **3** | **M2** for $\frac{6}{50}\times\frac{44}{49}[\times 2]$<br>or **M1** for $\frac{a}{50}\times\frac{50-a}{49}[\times 2]$ where $0 < a < 50$<br><br>After 0 scored, **SC1** for answer $\frac{528}{2500}$ oe |
| 3(a) | 3.125 or $\frac{25}{8}$ or $3\frac{1}{8}$ | **2** | **M1** for $[p =]$ $\frac{3\times 15+5}{(-4)^2}$ or better<br><br>After 0 scored, **SC1** for answer –3.125 or $-\frac{25}{8}$ or $-3\frac{1}{8}$ |
| 3(b) | $10x - 17$ final answer | **2** | **B1** for $6x + 3 + 4x - 20$ soi or answer $10x + k$ or $kx - 17$ |
| 3(c) | –1 | **2** | **M1** for $3 - k = 1 \times 4$ oe |
| 3(d) | 9 | **1** | |
| 3(e)(i) | $24 \times 30 - 4 \times x \times x = 576$ oe | **M1** | |
| | $x^2 = 36$ | **M1** | **FT** $x^2 = k$ from *their* equation |
| | 6 | **B1** | |
| 3(e)(ii) | $\frac{125}{162}$ cao nfww | **3** | **M2** for $\frac{1000}{(30-2\times \textit{their } 6)(24-2\times \textit{their } 6)(\textit{their } 6)}$<br>or **M1** for<br>$(30 - 2 \times \textit{their } 6)(24 - 2 \times \textit{their } 6)(\textit{their } 6)$ |
| 4(a)(i) | Correct quadrilateral with construction arcs | **3** | **B2** for triangle *ABC* correct with construction arcs or triangle *ADC* correct or **B1** for *ABC* correct with no/incorrect arcs or $D\hat{A}C = 50^o$ |
| 4(a)(ii) | *their* $A\hat{D}C$ | **1** | FT *their* diagram |
| 4(a)(iii) | 18.5 + *their DC* | **1** | FT *their* diagram |
| 4(b)(i) | $8^2 + 10^2 + 15^2$ oe | **M2** | **M1** for any correct 2D Pythag pair e.g. $8^2 + 10^2$ |
| | 19.72… | **A1** | |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 4(b)(ii) | 28.[0] to 28.2 | **5** | **M1** for $8^2 + \left(\frac{10}{2}\right)^2$<br>**M1** for $15^2 + \left(\frac{10}{2}\right)^2$<br>**M2** for $\cos\ldots = \frac{19.7^2 + RX^2 - TX^2}{2 \times 19.7 \times RX}$<br>or **M1** for<br>$TX^2 = 19.7^2 + RX^2 - 2 \times 19.7 \times RX \cos\ldots$ |
| 5(a) |  | **1** | |
| 5(b)(i) |  | **3** | **B2** for Venn diagram with 1 or 2 errors, omissions or repeats<br>or **B1** for Venn diagram with 3 or 4 errors, omissions or repeats |
| 5(b)(ii) | C, T | **1** | FT *their* diagram |
| 5(b)(iii) | 1 | **1** | |
| 5(b)(iv) | $W \cap X \cap Y$ oe | **1** | |
| 6(a) | 3 | **1** | |
| 6(b) | $-\frac{1}{2}$ or –0.5 | **2** | **M1** for $2x = 2 - 3$ or better |
| 6(c) | $\frac{12-5x}{3}$ or $4 - \frac{5}{3}x$ final answer | **3** | **B2** for $y + \frac{5}{3}x = 4$ or $-y = \frac{5}{3}x - 4$<br>or $3y = 12 - 5x$ or answer $4 - \frac{5}{3}y$<br>or answer $\frac{12-5y}{3}$<br>or **B1** for $5y = 12 - 3x$ or $y - \frac{12}{5} = -\frac{3x}{5}$ oe<br>or<br>$x = \frac{12-3y}{5}$ |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 6(d) | $\frac{17}{13}$ or $1\frac{4}{13}$ | **4** | **B1** for $4+\frac{12-3x}{5}=2x+3$ oe<br>**M1** for $[\pm]4\times5+12-3x=5(2x+3)$ oe<br>**M1** for $13x=k$ or $kx=17$ or $kx=-23$ |
| 7(a) | $[y=]\ 2x-1$ $[y=]\ -2x+1$ | **2** | **B1** for one correct |
| 7(b) | $a=1$ $b=-6$ | **2** | **B1** for one correct or<br>$(x+3)(x-2)$ or better seen or<br>$0=4+2a+b$ oe and $0=9-3a+b$ oe |
| 7(c)(i) | 8 to 8.5, – 4.3 to – 3.8 | **2** | **B1** for one correct |
| 7(c)(ii) | Ruled line $y=2x+1$ | **M2** | **M1** for short or unruled line or $2x+1$ seen |
| | Reading the three $x$ values of intersections between *their* non-horizontal ruled line and given curve | **B2** | **B1** for reading two correct<br>After B0 scored, **SC1** for 3 correct with no/incorrect line |
| 8(a) | 58° | **4** | **B2** for $x=8$<br>or **B1** for $P\hat{R}Q=4x$ or for $P\hat{O}R=180-2x$<br>**M1** for a correct equation involving $P\hat{Q}O$ |
| 8(b) | 58.99… to 59[.0] | **5** | **B2** for $JK=17.5$<br>or **M1** for $\frac{6}{10}=\frac{10.5}{JK}$ oe<br>**M2** for $\sin y=\frac{75}{0.5\times10\times\textit{their}\ 17.5}$ oe<br>or **M1** for<br>$0.5\times10\times\textit{their}\ 17.5\times\sin y=75$ oe<br>*Alternative*:<br>**B2** for area $MKL=27$<br>or **M1** for $\left(\frac{6}{10}\right)^2$ or $\left(\frac{10}{6}\right)^2$<br>**M2** for $\sin y=\frac{75\times\textit{their}\ \left(\frac{6}{10}\right)^2}{0.5\times6\times10.5}$ oe<br>or **M1** for<br>$0.5\times6\times10.5\times\sin y=75\times\textit{their}\ \left(\frac{6}{10}\right)^2$<br>oe |
| 9(a)(i) | 48 | **1** | |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 9(a)(ii) | 43 to 45 | **2** | **B1** for $80 - \frac{60}{100} \times 80$ soi<br><br>After 0 scored, **SC1** for answer 51 to 53 |
| 9(a)(iii) | 18, 32, 16, 6 | **2** | **B1** for 2 or 3 correct |
| 9(b) | $p = 24$ $q = 15$ | **5** | **B1** for $p + q = 39$ soi<br>**B1** for correct midpoints soi<br>**M1** for $\frac{8\times45+13\times55+65p+20\times75+85q}{80}$<br>**M1** for correct elimination of $p$ or $q$ |
| 10(a)(i) | 5.83 or 5.830 to 5.831 | **2** | **M1** for $(-3)^2 + 5^2$ oe |
| 10(a)(ii)(a) | (4, –3) | **1** | |
| 10(a)(ii)(b) | (–2, 7) | **2** | **B1FT** for answer (*their* 4 – 6, $k$) or answer ($k$, *their* (–3) + 10) |
| 10(b)(i) | $\mathbf{q} - \mathbf{p}$ | **1** | |
| 10(b)(ii) | $\frac{1}{2}\mathbf{p} + \frac{1}{2}\mathbf{q}$ oe simplified vectors | **2** | **M1** for a correct vector route along the lines of the diagram<br>or for correct unsimplified expression |
| 10(b)(iii) | $\frac{1}{6}\mathbf{q} - \frac{1}{2}\mathbf{p}$ oe simplified vectors | **2** | **M1** for correct vector route along the lines of the diagram but can include *OS*<br>or for correct unsimplified expression |

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