



# Cambridge O Level

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**MATHEMATICS (SYLLABUS D)**

**4024/02**

Paper 2 Calculator paper

**For examination from 2025**

MARK SCHEME

Maximum Mark: 100

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**Specimen**

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This document has **10** pages.

**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 descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

<p><b>GENERIC MARKING PRINCIPLE 1:</b></p> <p>Marks must be awarded in line with:</p> <ul style="list-style-type: none"> <li>• the specific content of the mark scheme or the generic level descriptions for the question</li> <li>• the specific skills defined in the mark scheme or in the generic level descriptions for the question</li> <li>• the standard of response required by a candidate as exemplified by the standardisation scripts.</li> </ul>
<p><b>GENERIC MARKING PRINCIPLE 2:</b></p> <p>Marks awarded are always <b>whole marks</b> (not half marks, or other fractions).</p>
<p><b>GENERIC MARKING PRINCIPLE 3:</b></p> <p>Marks must be awarded <b>positively</b>:</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• marks are awarded when candidates clearly demonstrate what they know and can do</li> <li>• marks are not deducted for errors</li> <li>• marks are not deducted for omissions</li> <li>• 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.</li> </ul>
<p><b>GENERIC MARKING PRINCIPLE 4:</b></p> <p>Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptions.</p>
<p><b>GENERIC MARKING PRINCIPLE 5:</b></p> <p>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).</p>

**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 descriptions in mind.

**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, non-integer 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 A or B 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.

**MARK SCHEME NOTES**

The following notes are intended to help with understanding of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct. M marks and B marks are independent unless marked ‘dep’ to show they depend on previous marks.

When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘dep’ is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

**Types of mark**

**M** Method mark, awarded for a valid method applied to the problem.

**A** Accuracy mark, given for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

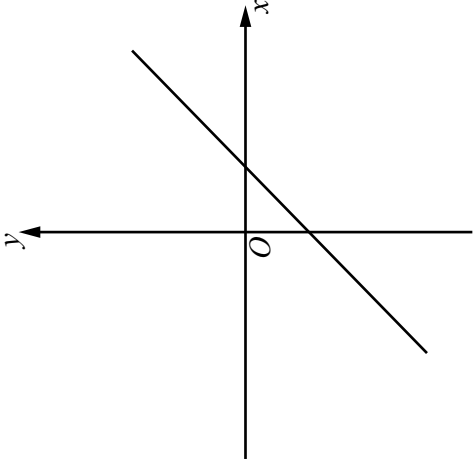
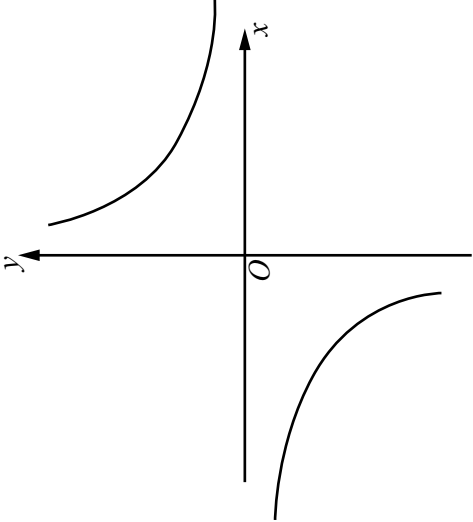
**B** Mark for a correct result or statement independent of Method marks.

**Abbreviations**

awrt	answers which round to
cao	correct answer only
dep	dependent on the previous mark(s)
FT	follow through after error
isw	ignore subsequent working (after correct answer obtained)
nfww	not from wrong working
oe	or equivalent
SC	special case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	80	1	
2	212	1	
3(a)	10 [hours] 25 [minutes]	1	
3(b)	104 [minutes]	1	
4(a)	28 [pens]	2	M1 for $\frac{1500}{53}$ oe
4(b)	16 [cents change]	1	FT 1500 – 53 $\times$ their 28
5(a)	216, 36, 108	2	B1 for one correct
5(b)	Correct labelled pie chart	2	angle tolerance $\pm 2^\circ$ FT for 1 or 2 marks provided <i>their</i> 3 angles add to $360^\circ$ B1 for one correct sector
6	208	1	
7	1.78	2	M1 for $\frac{14.75}{0.73}$ oe
8	$2x + 152 + x - 30 + 144 + 100 + 120 = 720$ oe	M2	M1 for $(6 - 2) \times 180$ oe or B1 for $3x + 486$
	78	A2	M1 for reaching $ax = b$ FT <i>their</i> equation Dep on $a$ and $b$ same sign
9(a)	12	1	
9(b)	8	1	
9(c)	5	1	
9(d)	$\sqrt{7}$	1	
10(a)	$\frac{6}{10}, \frac{6}{9}, \frac{4}{9}, \frac{5}{9}$ in correct positions	2	B1 for 2 correct
10(b)	$\frac{12}{90}$ oe	1	

Question	Answer	Marks	Partial Marks
11(a)	2510 or 2513.274... to 2513.6	4	<b>M3</b> for $2500 \times \pi \times 2^2 \times 0.08$ or <b>M2</b> for $\pi \times 2^2 \times 0.08$ or <b>M1</b> for $\pi \times 2^2$ [ $\times$ figs 8] or for $2500 \times$ by <i>their</i> volume oe
11(b)	16.8 or 16.755... to 16.7573 with correct conclusion, e.g. 16.8 is not an integer number of tiles	3	<b>M2</b> for $2 \times \pi \times 2 \div 0.75$ oe or <b>M1</b> for $2 \times \pi \times 2$ or for <i>their</i> circumference $\div 0.75$ oe
12	-2, -1, 0, 1	2	<b>M1</b> for $-2 \leq x < 2$ or <b>B1</b> for answer -2, -1, 1
13(a)	Tangent drawn at $t = 2$ 0.3–0.8	<b>B1</b> <b>B1</b>	 Dependent on previous <b>B1</b> or close attempt at tangent
13(b)	accelerating or increasing in speed oe	1	
14	10.4[0] to 10.41	4	<b>B1</b> for correct midpoints soi <b>M1</b> for use of $\Sigma fx$ where $x$ is in the correct interval including boundaries <b>M1</b> (dep on 2nd <b>M1</b> ) for $\Sigma fx \div$ total frequency
15	Rotation 90° clockwise [centre] (2, 1)	3	<b>B1</b> for each accept 270° anticlockwise

Question	Answer	Marks	Partial Marks
16(a)	Correct sketch 	<b>1</b>	Line with positive gradient and negative $y$ intercept
16(b)	Correct sketch 	<b>2</b>	<b>B1</b> for only one branch or attempt at correct shape

Question	Answer	Marks	Partial Marks
17	11	3	<p><b>B2</b> for 10.2... OR</p> <p><b>M2</b> for <math>[3.7 \times 10^6] \left(1 - \frac{12}{100}\right)^{10}</math> oe or</p> <p><math>[3.7 \times 10^6] \left(1 - \frac{12}{100}\right)^{11}</math> oe or</p> <p><math>0.88^n = \frac{10}{37} = 0.270</math> oe</p> <p>or <b>M1</b> for <math>3.7 \times 10^6 \left(1 - \frac{12}{100}\right)^n</math> oe where <math>n &gt; 1</math></p> <p><math>\left(1 - \frac{12}{100}\right)^n &lt; \frac{1}{3.7}</math></p>
18	$\frac{5}{4}$ or $1\frac{1}{4}$ or 1.25	3	<p><b>M1</b> for stating <math>y = \frac{k}{\sqrt[3]{x}}</math> oe</p> <p>and <b>M1</b> for <math>y = \frac{\textit{their } k}{\sqrt[3]{64}}</math> oe</p> <p>or <b>M2</b> for <math>2.5 \times \sqrt[3]{8} = y \times \sqrt[3]{64}</math> oe</p>
19(a)	787 or 787.39 to 787.4	3	<p><b>M2</b> for <math>\sqrt{350^2 + 500^2} - 2 \times 350 \times 500 \times \cos 135</math> oe</p> <p>OR</p> <p><b>M1</b> for <math>350^2 + 500^2 - 2 \times 350 \times 500 \times \cos 135</math> oe</p> <p><b>A1</b> for 619987 to 620000</p>
19(b)	107.33 to 107.43	4	<p><b>B3</b> for 72.57 to 72.66... OR</p> <p><b>M2</b> for <math>\sin[\dots] = \frac{787 \times \sin 52}{650}</math></p> <p>or <b>M1</b> for <math>\frac{650}{\sin 52} = \frac{787}{\sin[\dots]}</math></p> <p><b>M1</b> dep on <b>M2</b> for 180 – <i>their</i> acute angle <i>BCD</i></p> <p><b>FT</b> <i>their DB</i> for M marks</p>
20(a)	$\frac{720}{x}$ oe	1	



Question	Answer	Marks	Partial Marks
20(b)	$\frac{720}{x-20}$ oe	<b>1</b>	
20(c)	$\text{their } \frac{720}{x-20} - \text{their } \frac{720}{x} = 15$ oe	<b>M1</b>	<b>FT</b> <i>their</i> expressions in $x$
	$720x - 720(x-20) = 15x(x-20)$	<b>M1</b>	<b>FT</b> correct removal of <i>their</i> algebraic fractions dependent on two different algebraic fractions in the three-term equation
	$720x - 720x + 14400 = 15x^2 - 300x$	<b>M1</b>	<b>FT</b> correct removal of <i>their</i> algebraic brackets dependent on two different algebraic fractions in the 3 term equation
20(d)	$48x - 48x + 960 = x^2 - 20x$ or $14400 = 15x^2 - 300x$ leading to $x^2 - 20x - 960 = 0$	<b>A1</b>	After full working shown and no errors or omissions
	$\frac{-(-20) \pm \sqrt{(-20)^2 - 4[ \times 1 ] \times -960}}{2[ \times 1 ]}$ oe or $\frac{-(-20) \pm \sqrt{\left(\frac{-20}{2[ \times 1 ]}\right)^2 - (-960)}}{2[ \times 1 ]}$ oe	<b>B2</b>	<b>B1</b> for $\sqrt{(-20)^2 - 4[ \times 1 ] \times -960}$ oe or for $\frac{-(-20) \pm \sqrt{\text{their discriminant}}}{2[ \times 1 ]}$ or $\left(x + \frac{-20}{2}\right)^2$
	42.56 and -22.56	<b>B1</b>	
20(e)	31 [m] 52 [s] to 31 [m] 55.1 [s]	<b>3</b>	<b>B2</b> for 31.8 to 31.92 minutes or <b>M1</b> for $\frac{720}{\text{their } 42.56 - 20}$ where <i>their</i> 42.56 is their positive root
21(a)	2.0 and 8.0	<b>2</b>	<b>B1</b> for each
21(b)	Correct smooth curve	<b>4</b>	<b>B3FT</b> for 9 or 8 correct plots or <b>B2FT</b> for 7 or 6 correct plots or <b>B1FT</b> for 5 correct plots

Question	Answer	Marks	Partial Marks
21(c)	Ruled line $y = -\frac{1}{2}x + 4$  -2.45 to -2.3 0.7 to 0.85 1.55 to 1.7	M2	M1 for short or unruled line or $-\frac{1}{2}x + 4$ soi or either $y = -\frac{1}{2}x + k$ or $y = mx + 4$ , $m \neq 0$ drawn  B1 for 2 correct values
22	1.85	3	B1 for 14.65 soi B1 for 16.5 soi
23	$4x^3 - 27x^2 + 33x + 10$ final answer	3	B2 for correct unsimplified expression or simplified expression with 3 terms correct in a 4-term expression of required form  or B1 for correct expansion of two of the brackets with at least 3 terms correct
24(a)	2	1	
24(b)	$FC^2 = \left(\frac{12}{2}\right)^2 + \left(\frac{8}{2}\right)^2$ oe	M2	M1 for $AC^2 = 12^2 + 8^2$ oe
	$[EF^2 = ] 16^2 - \text{their } FC^2$ oe	M1	Dep on M2
	14.28[...] or 14.283	A1	
24(c)	63.18 to 63.35	2	M1 for $\sin[...] = \frac{14.3}{16}$ oe
25	1390 or 1394.867... to 1395	5	M4 for $\frac{1}{3}\pi \times 8^2 \times 36 - \frac{1}{3}\pi \times 6^2 \times 27$ oe or M3 for $\frac{1}{3}\pi \times 8^2 \times 36$ oe or $\frac{1}{3}\pi \times 6^2 \times 27$ oe or B2 for [height of cone] 36 or B1 for scale factor $\frac{3}{4}$ or 0.75 soi