Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2025

Marking Scheme

Mathematics

Ordinary Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Mathematics

Ordinary Level

Paper 1

Marking scheme

300 marks

Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect). Scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

Scale label	A	B	C	D
No of categories	2	3	4	5
5-mark scale		0, 2, 5	0, 2, 3, 5	
10-mark scale		0, 5, 10	0, 4, 6, 10	0, 3, 5, 7, 10
15-mark scale			0, 5, 10, 15	0, 4, 8, 10, 15

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

B-scales (three categories)
- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

D-scales (five categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (mid partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work, or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may also be awarded. Such cases are denoted with a * and this level of credit is referred to as *Full Credit -1*. Thus, for example, in Scale 10C, *Full Credit -1* of 9 marks may be awarded.

The only marks that may be awarded for a question are those on the scale below, or *Full Credit -1*.

A rounding penalty is applied each time it occurs in the scheme. There is no penalty for omitted units if the question specifies the unit to be used in the answer, and there is generally no penalty for an omitted euro symbol in questions involving money.

In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

In general, an answer without sufficient supporting work is awarded the lowest non-zero level of credit (typically Partial Credit or Low Partial Credit, as appropriate).

In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

Steps

Where steps are listed in the Marking Notes, unless otherwise specified, it is to be taken that they can be independently correct / incorrect – that is, in a candidate's solution, step n can be considered correct even if previous step(s) have not been correctly presented, as long as the work done to arrive at step n from the previous step(s) has not been oversimplified. It is specifically noted where this does not hold. Note also that these steps may not need to be presented in the order specified in the Marking Notes.

Errors

Where a question is **not** marked using steps, if a candidate has a single error, they are generally awarded one level of credit below that which they would otherwise have been awarded. Similarly, where they have two errors, they are generally awarded two levels of credit below that which they would otherwise have been awarded. (If they present sufficient work for *Low Partial Credit*, they will be awarded this at a minimum, regardless of the number of errors.) For example, on a C-scale:

- *High Partial Credit*: One error, otherwise fully correct (or fully correct with a *)
- *Low Partial Credit*: Two errors, otherwise fully correct (or fully correct with a *)

Where a question **is** marked using steps, this does not apply. Instead, an error in a step means that the step has not been completed correctly; this does not affect the completion of other steps (unless it oversimplifies the work). So if a candidate has multiple errors on a single step, they could still be awarded up to *High Partial Credit*, depending on the marking scheme.

Slips and *

Where a candidate has a single * on their solution, this is ignored in the awarding of credit unless they would otherwise have *Full Credit*. Where a candidate has multiple *s, this is generally treated as an error.

Multiple answers

Where the solution requires substantial work, mark all attempts and award the marks for the best one, regardless of crossing out.

Where a solution requires selection from the question, for example "tick the correct box only":

- If a candidate has crossed out answer(s), ignore the crossed-out answers
- If a candidate has multiple answers that are **not** crossed out, award the lowest mark associated with these answers (generally, this will be considered incorrect)

Square brackets

Where something is contained in square brackets in the model solution, it is **not** required for *Full Credit*.

Palette of annotations available to examiners

Symbol	Name	Meaning in the body of the work	Meaning when used in the right margin
✔	Tick	Work of relevance	The work presented in the body of the script merits full credit
✖	Cross	Incorrect work (distinct from an error)	The work presented in the body of the script merits 0 credit
✳	Star	Rounding / Unit / Arithmetic error Misreading	
〜	Horizontal wavy	Error	
P			The work presented in the body of the script merits partial credit
L			The work presented in the body of the script merits low partial credit
M			The work presented in the body of the script merits mid partial credit
H			The work presented in the body of the script merits high partial credit
F*	F star		The work presented in the body of the script merits Full Credit (– 1)
[	Left Bracket		Another version of this solution is presented elsewhere and it merits equal or higher credit
〰	Vertical wavy	No work on this page (portion of the page)	
o	Oversimplify	The candidate has oversimplified the work	
WOM	Work of Merit	Nothing correct but **Work of Merit** within the body of work	

Note: Where work of substance is presented in the body of the script, the annotation on the right margin should reflect a combination of annotations in the work

In a **C scale** where ✳ and 〜 and 〜 appear in the body of the work, then **L** should be placed in the right margin.

In the case of a **D scale** with the same annotations, **M** should be placed in the right margin.
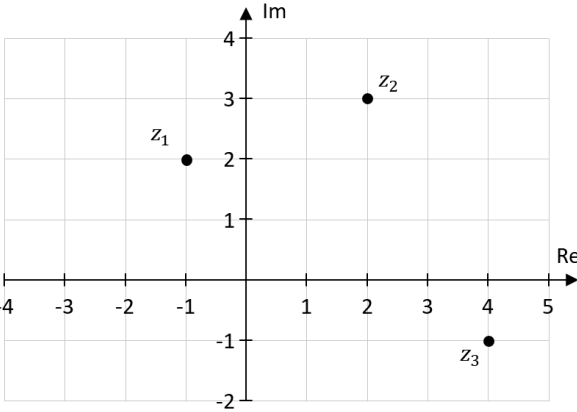
A ✔ in the body of the work may sometimes be used to indicate where a portion of the work presented has value and has merited one of the levels of credit described in the marking scheme. The level of credit is then indicated in the right margin.

Detailed marking notes

Model Solutions & Marking Notes

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

Q1	Model Solution – 30 Marks	Marking Notes
(a) **(i)**	$$30 \times 1 \cdot 23 = [€]36 \cdot 90$$	**Scale 10C (0, 4, 6, 10)** Accept correct answer without work *Low Partial Credit:* • Work of merit, for example, writes $0 \cdot 23$ or $1 \cdot 23$ *High Partial Credit:* • Finds 23% ($6 \cdot 90$)
(a) **(ii)**	$$35 - 28 = 7$$ $$\frac{7}{35} \times 100 = 20\%$$	**Scale 10C (0, 4, 6, 10)** Accept correct answer without work *Low Partial Credit:* • Work of merit, for example, $26 + 9$ OR 7 written *High Partial Credit:* • $\frac{7}{35}$
(b) **(i)** **(ii)**	**(i)** 36 minutes **(ii)** $$35 \div 7 = 5$$ $$5 \times 36 = 180 \text{ minutes}/ 3 \text{ hours}$$ **OR** $$\frac{1}{9} + \frac{1}{12} = \frac{7}{36}$$ $$\frac{35}{\frac{7}{36}} = 180 \text{ minutes}/ 3 \text{ hours}$$	**Scale 10D (0, 3, 5, 7, 10)** In **(i)** Accept correct answer without work *Low Partial Credit:* • Work of merit in **(i)**, for example, some multiples of 9 or 12 written • Work of merit in **(ii)**, for example, relevant **use** of answer from **(i)** OR $7, \frac{1}{9}$ OR $\frac{1}{12}$ written *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part

Q2	Model Solution – 30 Marks	Marking Notes
(a) **(i)**		**Scale 10B (0, 5, 10)** *Partial Credit:* • z_2 or z_3 plotted correctly *Full Credit -1:* • Both points plotted correctly but no or incorrect labels
(a) **(ii)** **(iii)**	**(ii)** $$\sqrt{1^2 + 2^2}$$ $$\sqrt{5}$$ **(iii)** $$1 + i$$ or similar	**Scale 10D (0, 3, 5, 7, 10)** Accept correct answers without work *Low Partial Credit:* • Work of merit in **(ii)**, for example, correct substitution • Work of merit in **(iii)**, for example, a point with a modulus $< \sqrt{5}$ plotted and labelled z_4 • Modulus formula written in **(ii) OR (iii)** *Mid Partial Credit:* • Work of merit in **(ii) AND (iii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part *Full Credit -1:* • **(ii)** correct and **(iii)** not in correct form

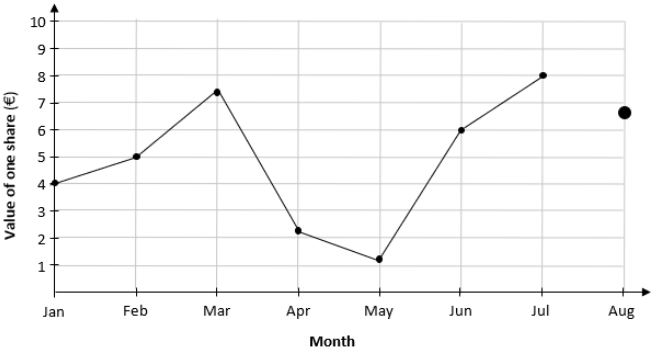| Q2	Model Solution – 30 Marks	Marking Notes
(b)	$$\frac{4-6i}{1+i} \times \frac{1-i}{1-i}$$ $$= \frac{-2-10i}{2}$$ $$= -1-5i$$	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* - Work of merit, for example, correct substitution OR correct conjugate written - Some relevant correct multiplication *Mid Partial Credit:* - Correct substitution AND correct conjugate written - Correct substitution AND some correct multiplication by an incorrect conjugate *High Partial Credit:* $\frac{4-6i}{1+i} \times \frac{1-i}{1-i}$ with some correct multiplication *Full credit -1:* - Apply a * if in the form $\frac{-2-10i}{2}$

Q3	Model Solution – 30 Marks	Marking Notes
(a)	Offer A Offer A cost per bar $$\frac{6{\cdot}60}{3} = 2{\cdot}20$$ Offer B cost per bar $$\frac{29{\cdot}99}{12} = 2{\cdot}50$$ **OR** $$6{\cdot}60 \times 4 = 26{\cdot}40$$ $$26{\cdot}40 < 29{\cdot}99$$ **OR** $$29{\cdot}99 \div 4 = 7{\cdot}50$$ $$7{\cdot}50 > 6{\cdot}60$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Correct box ticked • Work of merit, for example, $6{\cdot}60$ written or a correct calculation/setup, $\frac{6{\cdot}60}{3}$ or similar *High Partial :* • A full comparable calculation worked out, for example, $26{\cdot}40$ or similar calculated OR the per unit cost of both • Correct box ticked and work of merit
(b)	$$2x - 6x \geq -8 - 4$$ $$-4x \geq -12$$ $$4x \leq 12$$ $$x \leq 3$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • One correct transposition • Fully trial any value ≤ 3 *High Partial Credit:* • $-4x \geq -12$
(c) **(i)** **(ii)**	**(i)** $$k = 6 \quad t = 2$$ Or similar **(ii)** $$(x + 6)(x + 2)$$ $$[x^2 +] \, 8x \, [+12]$$ Or similar	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, one factor of 12 given • Work of merit in **(ii)**, for example, **use** of the answer from **(i)** *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • Part **(i)** correct *High Partial Credit:* • Part **(ii)** correct • Part **(i)** correct and work of merit in part **(ii)**

Q4	Model Solution – 30 Marks	Marking Notes
(a)	$$5a - 15 = 2a + 7$$ $$5a - 2a = 7 + 15$$ $$a = \frac{22}{3}$$	**Scale 5C (0, 2, 3, 5)** **Three steps involved in solution:** **1.** Distribution of 5 **2.** Transposing **3.** Solves *Low Partial Credit:* • Work of merit, for example, one correct operation *High Partial Credit:* • Two steps correct
(b)	$$f'(x) = 3x^2 - 6x + 4$$ $$f'(2) = 3(2)^2 - 6(2) + 4$$ $$= 4$$	**Scale 10D (0, 3, 5, 7, 10)** **Three steps involved in solution:** **1.** Correct differentiation **2.** Substitutes $x = 2$ into $f'(x)$ **3.** Finds the slope *Low Partial Credit:* • Work of merit, for example, some correct differentiation *Mid Partial Credit:* • One step correct *High Partial Credit:* • Two steps correct Note: zero credit for substituting 2 into f
(c) (i) (ii)	**(i)** 	Point	Derivative	 |---|---
Q	$g'(x) < 0$
P	$g'(x) = 0$
R	$g'(x) > 0$	 **(ii)** Reason: P is a turning point **OR** The slope of the tangent is equal to zero	**Scale 15D (0, 4, 8, 10, 15)** **Four items involved in solution:** **1.** Q **2.** P **3.** R **4.** Reason *Low Partial Credit:* • Work of merit on the diagram • One item correct *Mid Partial Credit:* • Two items correct *High Partial Credit:* • Three items correct

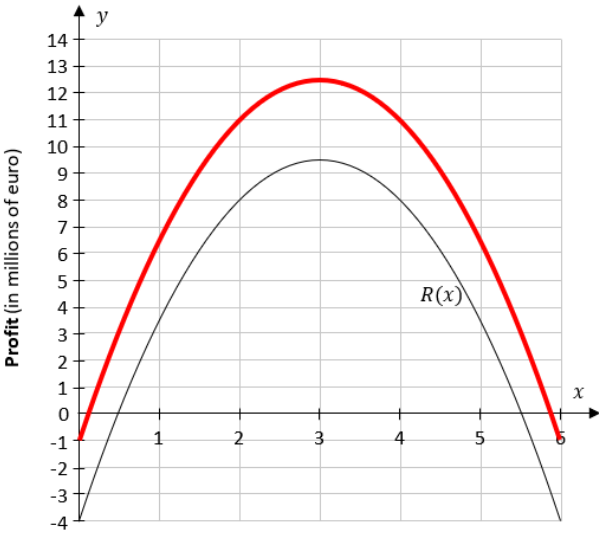| Q5	Model Solution – 30 Marks	Marking Notes
(a)	$$6x + 4y = 22$$ $$\underline{x - 4y = -1}$$ $$7x = 21$$ $$x = 3$$ $$6(3) + 4y = 22$$ $$4y = 4$$ $$y = 1$$ **OR** $$3x + 2y = 11$$ $$\underline{-3x + 12y = 3}$$ $$14y = 14$$ $$y = 1$$ $$3x + 2(1) = 11$$ $$3x = 9$$ $$x = 3$$	**Scale 10D (0, 3, 5, 7, 10)** **Four steps involved in solution.** **1.** Multiplies equation(s) so that one variable will cancel / express one variable in terms of the other **2.** Equation in one variable **3.** Solves to find the value of one variable **4.** Finds the value of the second variable *Low Partial Credit:* • Some work of merit, for example, correct relevant work in isolating one variable in one equation OR indicates multiplying one equation by a constant OR finds a correct matching x and y value for either equation *Mid Partial Credit:* • Two steps correct *High Partial Credit:* • Three steps correct
(b)	$$\frac{2 \pm \sqrt{(-2)^2 - 4(3)(-4)}}{2(3)}$$ $$x = 1 \cdot 5351 \dots \quad \text{or} \quad x = -0 \cdot 8685 \dots$$ $$x = 1 \cdot 54 \quad \text{or} \quad x = -0 \cdot 87$$	**Scale 10C (0, 4, 6, 10)** **Three steps involved in solution:** **1.** Identifies **a, b,** and **c** **2.** Fully substituted formula **3.** Both correctly evaluated *Low Partial Credit:* • Quadratic formula written • Work of merit, for example, identifies one of a, b, or c OR some correct substitution *High Partial Credit:* • Two steps correct *Full Credit -1:* • Apply a * for no or incorrect rounding

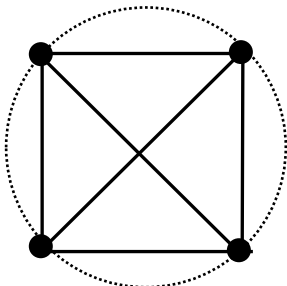| Q5	Model Solution – 30 Marks	Marking Notes
(c) (i) (ii)	**(i)** $$x = -2 \text{ and } x = 8$$ **(ii)** $$\left[x = \frac{-2 + 8}{2}\right]$$ $$x = 3$$	Accept correct answers without work **Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, some correct work on the graph • Work of merit in **(ii)**, for example, minimum point indicated on the graph OR work with the roots towards finding the minimum OR $h'(x) = 0$ *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part Note: Correct answer without work in **(ii)** must be consistent with answer from **(i)**

Q6	Model Solution – 30 Marks	Marking Notes
(a) **(i)** **(ii)**	**(i)** $$90 \times 1 \cdot 25 = €112 \cdot 50$$ **(ii)** $$\frac{22 \cdot 50}{112 \cdot 50} \times 100 = 20\%$$	**Scale 10D (0, 3, 5, 7, 10)** Accept correct answer without work for **(i)** *Low Partial Credit:* • Work of merit in **(i)**, for example, writes $0 \cdot 25$ or $1 \cdot 25$ • Work of merit in **(ii)**, for example, relevant **use** of answer from **(i)** OR writes down the profit • Profit ($22 \cdot 50$) written in **(i) OR (ii)** *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part
(b)	$$5 \cdot 8 \times 10^4$$ $$3 \cdot 6 \times 10^{-2}$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, $5 \cdot 8$ OR $3 \cdot 6$ written OR shows some understanding of scientific notation *High Partial Credit:* • One correct answer
(c)	$$3 \times 10^5 \times 60 \times 60 \times 24 \times 365$$ $$= 9 \cdot 4608 \times 10^{12}$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, $D = S \times T$, 24, 60 written OR one relevant multiplication, for example 60×365 • Finds total number of seconds (31 536 000) *High Partial Credit:* • Distance formula fully substituted

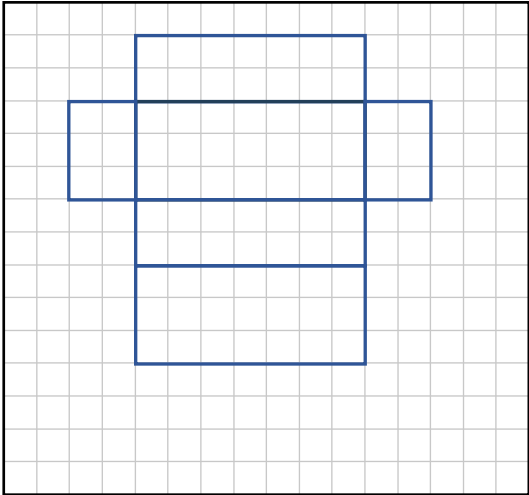| Q7	Model Solution – 50 Marks	Marking Notes
(a) **(i)** **(ii)**	**(i)** [€]7·30 **(ii)** May	Accept correct answers without work **Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, relevant work on the graph • Work of merit in **(ii)**, for example, relevant work on the graph *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part
(b)	$8 \times 0{\cdot}85 = [€]6{\cdot}80$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, work on the diagram, 8 written, 0·85 written OR 0·15 written • Point plotted on graph without calculations *High Partial Credit:* • €6·80 written but no plotting on the diagram
(c)	$\dfrac{1{\cdot}5}{true\ value} = 0{\cdot}163$ $= 9{\cdot}202 \ldots$ $= [€]9{\cdot}20$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit* • Work of merit, for example, correct formula or 0·163 written • Accept values from 9·18 to 9·23 inclusive as the correct answer *High Partial Credit* • Correct equation created

Q7	Model Solution – 50 Marks								Marking Notes

(d)
(i)
(ii)

(i)

m	0	1	2	3	4	5	6
P	2	**2·58**	3·33	**4·29**	**5·54**	**7·14**	9·22

(ii)

Scale 10D (0, 3, 5, 7, 10)

Note: Solution requires 12 items, 4 values in table, 7 points plotted and joined

Low Partial Credit:
- 1 to 3 items correct

Mid Partial Credit:
- 4 to 7 items correct

High Partial Credit:
- 8 to 10 items correct

Full Credit -1:
- Apply a * if 11 items correct

(d)
(iii)

March

Scale 5B (0, 2, 5)

Partial Credit:
- Relevant work on the graph

(e)
(i)
(ii)

(i)

$$Q_n = \boxed{\textbf{9·22}} -0\cdot3n$$

(ii)

$$2 = 9\cdot22 - 0\cdot3n$$
$$n = \frac{7\cdot22}{0\cdot3} = 24\cdot06 \dots$$
$$n = 25$$

Scale 10C (0, 4, 6, 10)

Low Partial Credit:
- **(i)** correct
- Work of merit in **(ii)**, for example, indicates subtraction of 0·3 OR relevant use of equation from **(i)**

High Partial Credit:
- **(i)** correct and work of merit in **(ii)**
- **(ii)** correct

Full Credit -1
- **(i)** correct and answer to **(ii)** given as $n = 24$

Q8	Model Solution – 50 Marks	Marking Notes
(a) **(i)**	$P(0) = -4$ If the company produces zero phones, they will make a loss of 4 million	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, $x = 0$ written, some relevant substitution • Work of merit in the explanation *High Partial Credit:* • $P(0)$ found
(a) **(ii)** **(iii)**	**(ii)** | x	0	1	2	3	4	5	6	7
---	---	---	---	---	---	---	---	---
$P(x)$	**−4**	5	**11**	**14**	**14**	11	**5**	**−4** | **(iii)** 	**Scale 10D (0, 3, 5, 7, 10)** **Note:** Solution requires 15 items, 6 values in table, 8 points plotted and the curve *Low Partial Credit*: • 1 to 3 items correct *Mid Partial Credit:* • 4 to **8** items correct *High Partial Credit:* • 9 to 13 items correct *Full Credit -1:* • Apply a * if 14 items correct
(a) **(iv)**	 $1 \cdot 2 \leq x \leq 5 \cdot 8$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Some correct work on graph • 1·2 OR 5·8 written *High Partial Credit:* • 1·2 AND 5·8 written in the answer grid OR on the graph • $1 \cdot 2 \leq x \leq 5 \cdot 8$ but no work on the graph

Q8	Model Solution – 50 Marks	Marking Notes
(b) **(i)** **(ii)**	**(i)** $$Q'(x) = -3x + 9\cdot6$$ $$-3x + 9\cdot6 = 0$$ $$x = 3\cdot2$$ **(ii)** $$Q(3\cdot2) = -1\cdot5(3\cdot2)^2 + 9\cdot6(3\cdot2) - 3\cdot5$$ $$= 11\cdot86$$	**Scale 15D (0, 4, 8, 10, 15)** **Four steps involved in solution:** **1.** Correct differentiation **2.** Equates derivative to zero **3.** Solves for x **4.** Finds the maximum value *Low Partial Credit:* • Work of merit in **(i),** for example, some correct differentiation OR $Q'(x) = 0$ written • Work of merit in **(ii),** for example, some relevant substitution into $Q(x)$ • One step correct *Mid Partial Credit:* • Two steps correct *High Partial Credit:* • Three steps correct
(c) **(i)** **(ii)**	**(i)** $$R(2) = 8$$ $$R(2) + 3 = 8 + 3$$ $$= 11$$ **(ii)**	**Scale 15D (0, 4, 8, 10, 15)** *Low Partial Credit:* • Work of merit in **(i)**, for example, work on diagram OR $R(2)$ found • Work of merit in **(ii)**, for example, a correct point plotted *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part *Full Credit -1:* • Apply a * if one point plotted incorrectly or incorrect or no joining

Q9	Model Solution – 50 Marks	Marking Notes
(a) **(i)** **(ii)**	**(i)** $$4500 \times 1{\cdot}028 = [€]4626$$ **(ii)** $$4500 \times 1{\cdot}028^3 = [€]4888{\cdot}68$$	**Scale 10D (0, 3, 5, 7, 10)** Accept correct answer without work for **(i)** *Low Partial Credit:* • Work of merit in **(i)**, for example 0·028 OR 1·028 OR 126 written • Work of merit in **(ii)**, for example, uses answer from **(i)** *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part
(b) **(i)**		**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • One correct line segment drawn *High Partial Credit:* • Four correct line segments drawn
(b) **(ii)**	<table><tr><td>**Pattern**</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>**Dots**</td><td>2</td><td>3</td><td>**4**</td><td>**5**</td><td>**6**</td></tr><tr><td>**Line segments**</td><td>1</td><td>**3**</td><td>**6**</td><td>10</td><td>**15**</td></tr></table>	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • One correct entry *High Partial Credit:* • Four correct entries

Q9	Model Solution – 50 Marks	Marking Notes
(b) **(iii)**	1001	**Scale 5B (0, 2, 5)** *Partial Credit:* • Work of merit, for example, finds the next term OR correct formula OR a or d identified
(b) **(iv)** **(v)**	**(iv)** $$S_n = \frac{n}{2}(2(2) + (n-1)1)$$ $$\left[S_n = \frac{n(n+3)}{2} \right]$$ **(v)** $$\frac{n(n+3)}{2} = 740$$ $$n^2 + 3n - 1480 = 0$$ $$n = 37$$	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(iv)**, for example, correct formula OR a or d identified • Work of merit in **(v)**, for example answer from **(iv)** let equal to 740 OR more than one value of n trialled *Mid Partial Credit:* • Work of merit in **(i)** AND **(ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part
(b) **(vi)**	$$T(1) = 0 \cdot 5(1)^2 + b(1) = 1$$ $$0 \cdot 5 + b = 1$$ $$b = 1 - 0 \cdot 5$$ $$b = 0 \cdot 5$$ Or similar	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, some relevant substitution into $T(n)$ *High Partial Credit:* • Equation fully substituted

Q10	Model Solution – 50 Marks	Marking Notes
(a)(i)		**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, one correct face OR sketch with at least five faces OR correct scaled measurement written *High Partial Credit:* • Four correct faces • Correct net with excess faces
(a) (ii)	$70 \times 30 = [2100]$ $70 \times 20 = [1400]$ $20 \times 30 = [600]$ 4100×2 $= 8200 \text{ [cm}^2]$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, two relevant lengths multiplied OR relevant formula ($l \times w$) *High Partial Credit:* • Three relevant areas found *No credit:* • Finds the volume
(a) (iii)	$\dfrac{353\,819{\cdot}34}{7{\cdot}61}$ $= 46\,494$ $+1890$ $= [\text{€}]48\,384$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, relevant fraction created OR addition of 1890 *High Partial Credit:* • Cost of machine in euro found ($46\,494$)

Q10	Model Solution – 50 Marks	Marking Notes
(b)	$780 \div 40 = 19{\cdot}5$ $19{\cdot}5 \times 1{\cdot}5 = 29{\cdot}25$ $1043{\cdot}25 - 780 = 263{\cdot}25$ $263{\cdot}25 \div 29{\cdot}25$ $n = 9$ [hours]	**Scale 10D (0, 3, 5, 7, 10)** **Four steps involved in solution:** **1.** Find hourly pay $(19{\cdot}5)$ **2.** Find hourly pay for overtime $(29{\cdot}25)$ **3.** Find pay for overtime $(263{\cdot}25)$ **4.** Solves for n *Low Partial Credit:* • Work of merit, for example, relevant addition or multiplication • One step correct *Mid Partial Credit:* • Two steps correct *High Partial Credit:* • Three steps correct
(c) **(i)** **(ii)**	**(i)** $$C = \frac{20(3) + (3{\cdot}5)3}{1{\cdot}1}$$ $$= [€]64{\cdot}09$$ **(ii)** $$\frac{20(4) + 4x}{1{\cdot}2} = 76$$ $$x = 2{\cdot}8$$	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, some correct substitution • Work of merit in **(ii)**, for example, some correct substitution *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part
(c) **(iii)**	The charge will increase	**Scale 5B (0, 2, 5)** *Partial Credit:* • Work of merit, for example, trialling a value of $d < 1$

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Mathematics

Ordinary Level

Paper 2

Marking scheme

300 marks

Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect). Scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

Scale label	A	B	C	D
No of categories	2	3	4	5
5-mark scale		0, 2, 5	0, 2, 3, 5	0, 2, 3, 4, 5
10-mark scale		0, 5, 10	0, 4, 6, 10	0, 3, 5, 7, 10
15-mark scale			0, 5, 10, 15	0, 6, 8, 10, 15

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

B-scales (three categories)
- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

D-scales (five categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (mid partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work, or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may also be awarded. Such cases are denoted with a * and this level of credit is referred to as *Full Credit -1*. Thus, for example, in Scale 10C, *Full Credit -1* of 9 marks may be awarded.

The only marks that may be awarded for a question are those on the scale below, or *Full Credit -1*.

A rounding penalty is applied each time it occurs in the scheme. There is no penalty for omitted units if the question specifies the unit to be used in the answer, and there is generally no penalty for an omitted euro symbol in questions involving money.

In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

In general, an answer without sufficient supporting work is awarded the lowest non-zero level of credit (typically Partial Credit or Low Partial Credit, as appropriate).

Steps
Where steps are listed in the Marking Notes, unless otherwise specified, it is to be taken that they can be independently correct / incorrect – that is, in a candidate's solution, step n can be considered correct even if previous step(s) have not been correctly presented, as long as the work done to arrive at step n from the previous step(s) has not been oversimplified. It is specifically noted where this does not hold. Note also that these steps may not need to be presented in the order specified in the Marking Notes.

Errors
Where a question is **not** marked using steps, if a candidate has a single error, they are generally awarded one level of credit below that which they would otherwise have been awarded. Similarly, where they have two errors, they are generally awarded two levels of credit below that which they would otherwise have been awarded. (If they present sufficient work for *Low Partial Credit*, they will be awarded this at a minimum, regardless of the number of errors.) For example, on a C-scale:

- *High Partial Credit*: One error, otherwise fully correct (or fully correct with a *)
- *Low Partial Credit*: Two errors, otherwise fully correct (or fully correct with a *)

Where a question **is** marked using steps, this does not apply. Instead, an error in a step means that the step has not been completed correctly; this does not affect the completion of other steps (unless it oversimplifies the work). So if a candidate has multiple errors on a single step, they could still be awarded up to *High Partial Credit*, depending on the marking scheme.

Slips and *
Where a candidate has a single * on their solution, this is ignored in the awarding of credit unless they would otherwise have *Full Credit*. Where a candidate has multiple *s, this is generally treated as an error.

Multiple answers
Where the solution requires substantial work, mark all attempts and award the marks for the best one, regardless of crossing out.

Where a solution requires selection from the question, for example "tick the correct box only":

- If a candidate has crossed out answer(s), ignore the crossed-out answers
- If a candidate has multiple answers that are **not** crossed out, award the lowest mark associated with these answers (generally, this will be considered incorrect)

Square brackets
Where something is contained in square brackets in the model solution, it is **not** required for *Full Credit*.

Palette of annotations available to examiners

Symbol	Name	Meaning in the body of the work	Meaning when used in the right margin
✔	Tick	Work of relevance	The work presented in the body of the script merits full credit
✖	Cross	Incorrect work (distinct from an error)	The work presented in the body of the script merits 0 credit
*	Star	Rounding / Unit / Arithmetic error Misreading	
〰	Horizontal wavy	Error	
P			The work presented in the body of the script merits partial credit
L			The work presented in the body of the script merits low partial credit
M			The work presented in the body of the script merits mid partial credit
H			The work presented in the body of the script merits high partial credit
F*	F star		The work presented in the body of the script merits Full Credit (– 1)
[	Left Bracket		Another version of this solution is presented elsewhere and it merits equal or higher credit
⸾	Vertical wavy	No work on this page (portion of the page)	
o	Oversimplify	The candidate has oversimplified the work	
wom	Work of Merit	There is some value in the work	

Note: Where work of substance is presented in the body of the script, the annotation on the right margin should reflect a combination of annotations in the work

In a **C scale** where * and 〰 and 〰 appear in the body of the work, then **L** should be placed in the right margin.

In the case of a **D scale** with the same annotations, **M** should be placed in the right margin.

A ✔ in the body of the work may sometimes be used to indicate where a portion of the work presented has value and has merited one of the levels of credit described in the marking scheme. The level of credit is then indicated in the right margin.
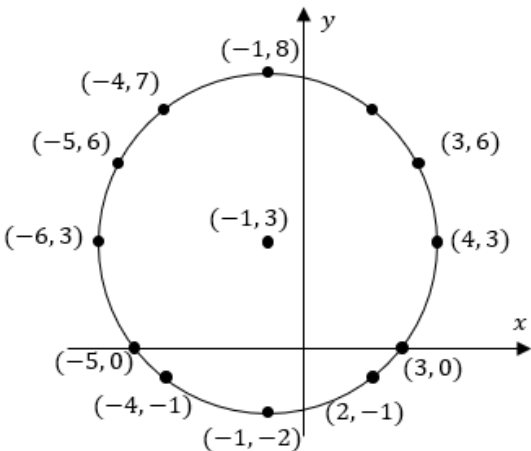
Detailed marking notes

Model Solutions & Marking Notes

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

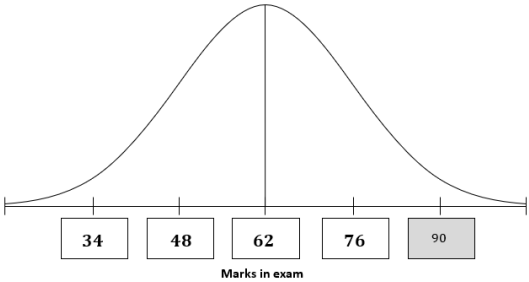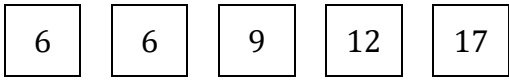| Q1	Model Solution – 30 Marks	Marking Notes
(a) (i)	$$94 - 72 = 22$$ $$\frac{22}{94} \times 100 = 23 \cdot 4[\%]$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, $94 - 72$ or a relevant numerator or denominator *High Partial Credit:* • $\frac{22}{94}$
(a) (ii)	Mean = 133 mm Standard Deviation = 54 mm	**Scale 10C (0, 4, 6, 10)** Accept correct answers without work *Low Partial Credit:* • Work of merit, for example, effort at calculating mean or correct relevant formula *High Partial Credit:* • One correct formula fully substituted • One correct answer *Full Credit (-1):* • Apply a * for no or incorrect rounding • Apply a * for no units
(b)	$$Q_1 = \frac{94 + 93}{2}$$ $$Q_1 = \frac{187}{2}$$ $$= 93 \cdot 5 \text{ [mm]}$$ $$\text{IQR} = 183 - 93 \cdot 5 = 89 \cdot 5 \text{ [mm]}$$	**Scale 10C (0, 4, 6, 10)** Accept correct answers without work *Low Partial Credit:* • Work of merit, for example, shows understanding of IQR • Relevant work towards finding Q_1 • Relevant work on the table *High Partial Credit:* • Q_1 found

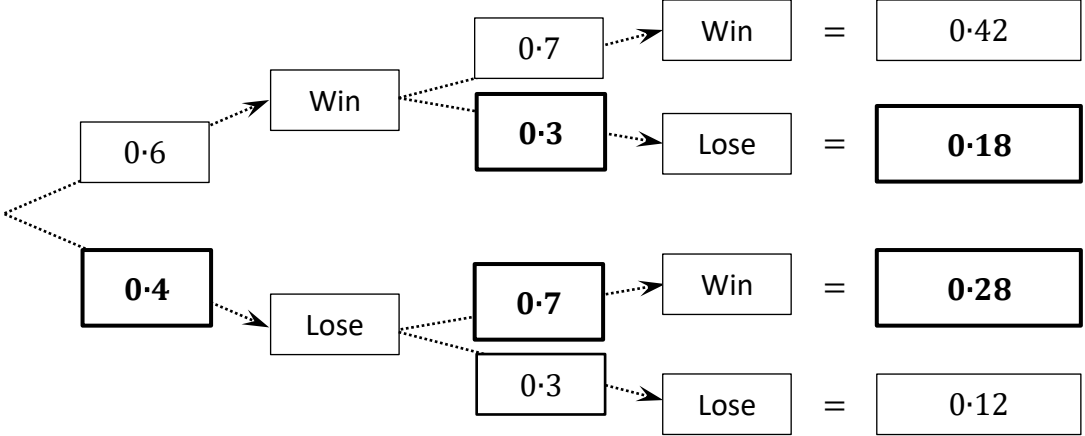| Q2	Model Solution – 30 Marks	Marking Notes
(a) (i)	$$A + 2A = 90$$ $$3A = 90$$ $$A = 30[°]$$	**Scale 5B (0, 2, 5)** *Partial Credit:* • Work of merit, for example, $3A$, 180°, 60°, or 90° written • $2A + A = 90°$
(a) (ii)	$$\tan 30 = \frac{x}{10}$$ $$x = 5 \cdot 7735 \dots$$ $$x = 5 \cdot 77 \text{ cm}$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, some understanding of trigonometric ratios or sine rule formula *High Partial Credit:* • $\tan 30 = \frac{x}{10}$ or similar *Full Credit (-1):* • Apply a * for no or incorrect rounding • Apply a * for no units
(b)	$$180 - (104 + 41) = 35$$ $$\frac{\|PR\|}{\sin 35} = \frac{11}{\sin 104}$$ $$\|PR\| = 6 \cdot 502 \dots$$ $$\|PR\| = 6 \cdot 5 \text{ [cm]}$$	**Scale 15D (0, 6, 8, 10, 15)** *Low Partial Credit:* • Work of merit, for example, sine rule formula or work towards finding $\|\angle PQR\|$ *Mid Partial Credit:* • Some correct substitution into the formula *High Partial Credit:* • Sine rule correctly substituted *Full Credit (-1):* • Apply a * for no or incorrect rounding

Q3	Model Solution – 30 Marks	Marking Notes
(a)		**Scale 10B (0, 5, 10)**
		Partial Credit:
		• One equation correct
		• One correct radius or centre written

p, q or r
q
r
p

(b)	$(x-3)^2 + (y+4)^2 = 7^2$ $(x-3)^2 + (y+4)^2 = 49$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, a relevant formula • h, k, or r identified *High Partial Credit:* • Two elements substituted correctly
(c) **(i)** **(ii)**	**(i)** $\sqrt{(7-3)^2 + (2+1)^2} = 5$ **(ii)** Any two of: 	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, relevant formula • Work of merit in **(ii)**, for example, relevant work on the diagram or **use** of answer from **(i)** or one correct x or y value • Relevant labelling in **(i) OR (ii)** *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part Note: *Zero credit:* Points (2,7), (−1,3), or (0,0) written in **(ii)**

Q4	Model Solution – 30 Marks	Marking Notes
(a) (i)	$$m = \frac{0-3}{2+5}$$ $$m = -\frac{3}{7}$$	**Scale 5C (0, 2, 3, 5)** Accept correct answer without work *Low Partial Credit:* • Work of merit, for example, relevant formula OR a point labelled for substitution • $\frac{Rise}{Run}$ *High Partial Credit:* • Correct formula fully substituted
(a) (ii)	$$y - 3 = \frac{-3}{7}\big(x - (-5)\big)$$ $$3x + 7y - 6 = 0$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, equation of a line formula • Answer from **(i)** written *High Partial Credit:* • Equation of a line formula fully substituted *Full Credit (-1):* • Apply a * for answer given as $3x + 7y = 6$ or similar Note: Award HPC at most if using an integer value as the slope from **(a)(i)**
(a) (iii)	Area $= \frac{1}{2}(9)(3) = 13{\cdot}5$ units² **OR** $(2,0) \to (0,0)$ $(-5,3) \to (-7,3)$ $(4,3) \to (2,3)$ $\frac{1}{2}\lvert(-7)(3) - (2)(3)\rvert$ $= 13{\cdot}5$ units² Or similar	**Scale 10C (0, 4, 6, 10)** Accept correct answer without work *Low Partial Credit:* • Work of merit, for example, relevant work on diagram OR relevant formula • Some correct work on translating a point *High Partial Credit:* • Correct formula fully substituted *Full Credit (-1):* • Apply a * for no units

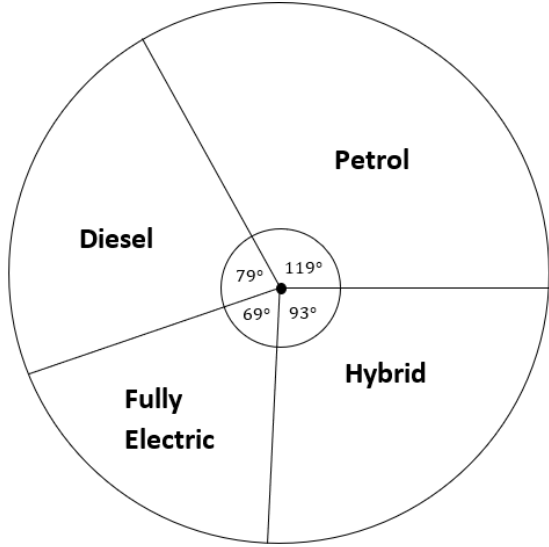| Q4	Model Solution – 30 Marks	Marking Notes
(b)	Neither $$m_l = \frac{2}{3}$$ $$m_k = \frac{-2}{3}$$	**Scale 5C (0, 2, 3, 5)** **Three items involved in solution:** **1.** Correct box ticked **2.** Slope of l **3.** Slope of k *Low Partial Credit:* • Work of merit, $-\frac{a}{b}$ or $y = m + c$ • One item correct *High Partial Credit:* • Two items correct

Q5	Model Solution – 30 Marks	Marking Notes
(a)	$\lvert\angle A\rvert = 60[°]$ $\lvert\angle B\rvert = 180 - (75 + 60) = 45[°]$ $\lvert\angle C\rvert = 180 - (120 + 40) = 20[°]$	**Scale 10C (0, 4, 6, 10)** Accept correct answers without work *Low Partial Credit:* • Work of merit, for example, relevant work on diagram, 180 written • One angle correct *High Partial Credit:* • Two angles correct
(b) (i)	$5^2 + \lvert AD\rvert^2 = 9^2$ $\lvert AD\rvert^2 = 56$ $\lvert AD\rvert = 7{\cdot}483\ \ldots$ $\lvert AD\rvert = 7{\cdot}5$ cm	**Scale 5D (0, 2, 3, 4, 5)** *Low Partial Credit:* • Work of merit, for example, correct formula *Mid Partial Credit:* • Some correct substitution into the formula *High Partial Credit:* • Correct formula fully substituted *Full Credit (-1):* • Apply a * for no or incorrect rounding • Apply a * for no units
(b) (ii)	$\lvert AB\rvert = \lvert AC\rvert$ given (isosceles) $\lvert BD\rvert = \lvert DC\rvert$ D is midpoint of $[BC]$ $\lvert AD\rvert = \lvert AD\rvert$ common $\Delta ABD \equiv \Delta ACD$ (SSS) Or similar	**Scale 15C (0, 5, 10, 15)** *Low Partial Credit:* • Work of merit, for example, some understanding of congruency or relevant markings on the diagram or one element of proof written, for example, $\lvert AD\rvert = \lvert AD\rvert$ *High Partial Credit:* • Two elements of proof written *Full Credit (-1):* • Apply a * for no reasons • Apply a * for no conclusion

Q6	Model Solution – 30 Marks	Marking Notes
(a) (i)		**Scale 10C (0, 4, 6, 10)** Accept correct answers without work *Low Partial Credit:* • Work of merit, for example, one correct entry or relevant addition *High Partial Credit:* • Three entries correct
(a) (ii) (iii)	**(ii)** 95% **(iii)** $0{\cdot}68 \times 150 = 102$ students	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Some understanding of the empirical rule in **(ii) OR (iii)** • Work of merit in **(iii)**, for example, $p \times 150$ *Mid Partial Credit:* • Work of merit in **(ii) AND (iii)** • One part correct *High Partial Credit:* • One part correct and additional work of merit in the other part
(b)	6 6 9 12 17	**Scale 10D (0, 3, 5, 7, 10)** **Four items involved in solution:** **1.** Median of 9 **2.** Mode of 6 , 6 **3.** Range of 11 **4.** Mean of 10 *Low Partial Credit:* • Work of merit, for example, displays some knowledge of mean or median or range or mode • One item correct *Mid Partial Credit:* • Two items correct *High Partial Credit:* • Three items correct

Q7	Model Solution – 50 Marks	Marking Notes
(a) **(i)** **(ii)**	Tree Diagram	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit, for example, relevant addition or subtraction • One entry correct *Mid Partial Credit:* • Two or three entries correct *High Partial Credit:* • Four entries correct

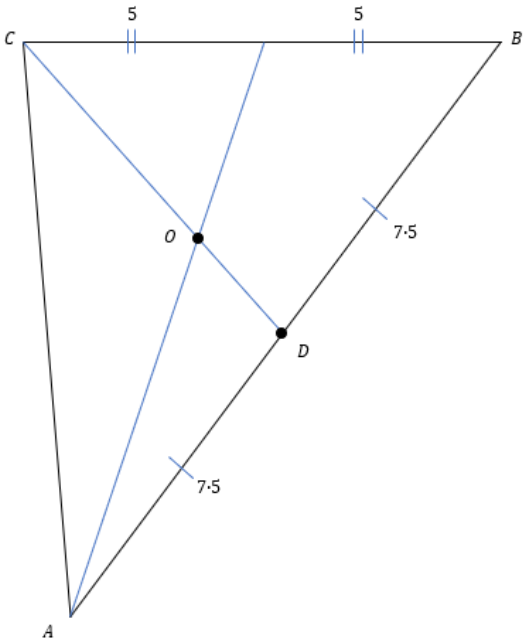|		
(a) **(iii)**	$1 - 0\cdot12$ $= 0\cdot88$ **OR** $WW + WL + LW$ $0\cdot42 + 0\cdot18 + 0\cdot28$ $= 0\cdot88$	**Scale 10B (0, 5, 10)** *Partial Credit:* • Work of merit, for example, relevant addition or subtraction or relevant outcome written

Q7	Model Solution – 50 Marks	Marking Notes
(b) (i) (ii)	**(i)** $$P(S_L) = 1 - 0 \cdot 78$$ $$= 0 \cdot 22$$ **(ii)** $$P(W, W, L) = 0 \cdot 78 \times 0 \cdot 78 \times 0 \cdot 22$$ $$= 0 \cdot 133848$$ $$= 0 \cdot 134$$	**Scale 10D (0, 3, 5, 7, 10)** Accept correct answer without work in **(i)** *Low Partial Credit:* - Work of merit in **(i)**, for example, mentions 1 - Work of merit in **(ii)**, for example, Win, Win, Lose written OR two relevant probabilities multiplied *Mid Partial Credit:* - Work of merit in **(i) AND (ii)** - One part correct *High Partial Credit:* - One part correct and work of merit in the other part *Full Credit (-1):* - Apply a * for no or incorrect rounding
(c) (i)	$$V = \frac{4}{3}\pi(9)^3$$ $$= 972\pi \ [\text{cm}^3]$$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* - Work of merit, for example, volume of sphere formula OR radius identified as 9 *High Partial Credit:* - Correct formula fully substituted *Full Credit (-1):* - Apply a * for answer not in terms of π

Q7	Model Solution – 50 Marks	Marking Notes
(c) **(ii)**	$$V = \frac{4}{3}\pi\, r^3 = 5424{\cdot}6$$ $$r^3 = 1295{\cdot}027\ldots$$ $$r = 10{\cdot}899\ldots$$ $$r = 10{\cdot}9 \text{ cm}$$	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit, for example, volume of sphere formula *Mid Partial Credit* • $\frac{4}{3}\pi\, r^3 = 5424{\cdot}6$ *High Partial Credit:* • r^3 isolated *Full Credit (-1):* • Apply a * for no or incorrect rounding • Apply a * for no units
(d)	$$E(x) = \sum x\, P(x)$$ $$E(x) = 6(0{\cdot}1) + 5(0{\cdot}2) + 3(0{\cdot}4) + 1(0{\cdot}7)$$ $$E(x) = 3{\cdot}5$$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, correct relevant formula • One correct term or operation indicated, for example, $6(0{\cdot}1)$ or similar *High Partial Credit:* • Two correct terms indicated

Q8	Model Solution – 50 Marks	Marking Notes
(a) (i)		**Scale 5C (0, 2, 3, 5)** Accept correct answers without work *Low Partial Credit:* • Work of merit, for example, a relevant fraction • One correct entry *High Partial Credit:* • Two or three correct entries *Full Credit (-1):* • Apply a * for no or incorrect rounding in percentage • Apply a * for no or incorrect rounding in degree

Diesel:	22·06%	79°
Fully Electric:		69°
Hybrid:	25·81%	

| **(a) (ii)** | | **Scale 15C (0, 5, 10, 15)** *Low Partial Credit:* • Work of merit, for example, three sectors drawn but not correct angles *High Partial Credit:* • One sector correct *Full Credit (-1):* • Pie chart not fully labelled |

Q8	Model Solution – 50 Marks	Marking Notes
(b) (i) (ii)	**(i)** Strong negative Cars with greater engine size are less fuel efficient **(ii)** r cannot be greater than 1	**Scale 15D (0, 6, 8, 10, 15)** *Low Partial Credit:* • Work of merit in **(i)**, for example, correct box ticked, or some merit in the explanation • Work of merit in **(ii)**, for example, some merit in the explanation *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part Note: In this case, accept answer to **(ii)** based on the diagram
(c) (i)	$$= \frac{1}{\sqrt{815}}$$ $$= 0 \cdot 035028$$ $$= 3 \cdot 5 \, [\%]$$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit for example $n = 815$, $\times 100$ • Correct relevant formula $\left(\frac{1}{\sqrt{n}} \right)$ *High Partial Credit:* • Correct formula fully substituted *Full Credit (-1):* • Apply a * for no or incorrect rounding
(c) (ii)	$$\frac{106}{815}$$ $$= 0 \cdot 13006 \dots$$ $$= 13 \, [\%]$$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, $\frac{106}{815}$ **OR** $\times 100$ *High Partial Credit:* • $\frac{106}{815} \times 100$ **OR** $0 \cdot 13006 \dots$ *Full Credit (-1):* • Apply a * for no or incorrect rounding

Q8	Model Solution – 50 Marks	Marking Notes
(c) (iii)	**Calculations:** $$\hat{p} \pm \frac{1}{\sqrt{n}}$$ $$13 - 3{\cdot}5 \le p \le 13 + 3{\cdot}5$$ $$9{\cdot}5 \le p \le 16{\cdot}5$$ **Conclusion:** There is evidence to say that the percentage of new electric cars being bought in 2024 is different to 2023. **Reason:** 19·2% is not inside the range found. It is outside the CI.	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, writes answer from **(c)(i)** or **(c)(ii)** in this part • $\hat{p} \pm \frac{1}{\sqrt{n}}$ *High Partial Credit:* • Relevant boundary formed: $13 + 3{\cdot}5$ but no conclusion and reason *Full Credit (-1):* • Either conclusion **OR** reason missing **OR** incorrect

Q9	Model Solution – 50 Marks	Marking Notes
(a) **(i)(ii)**	**(i)** Midpoint of [AB] constructed **(ii)** 	**Scale 15D (0, 6, 8, 10, 15)** *Low Partial Credit:* • Work of merit in **(i)**, for example, a relevant work on diagram or a relevant measurement written (15 cm or 7·5 cm) • Work of merit in **(ii)**, for example, shows some understanding of centroid, relevant work on the diagram or a relevant measurement written (10 cm, 5 cm, 12 cm, or 6 cm). *Mid Partial Credit:* • **(i)** correct • Work of merit in **(i) AND (ii)** • A relevant arc in **(i) AND** an additional arc in **(ii)** *High Partial Credit:* • **(i)** correct and work of merit in **(ii)** *Full Credit (-1):* • D and/or O not labelled
(b) **(i)** **(ii)**	**(i)** $$k = \frac{45}{36} = 1\cdot25$$ **(ii)** $$25\cdot5 \times 1\cdot25 = 31\cdot875$$ $$= 31\cdot9 \text{ cm}$$	**Scale 10D (0, 3, 5, 7, 10)** *Low Partial Credit:* • Work of merit in **(i)**, for example, relevant numerator or denominator • Work of merit in **(ii)**, for example, use of $25\cdot5$ **and** $1\cdot25$ *Mid Partial Credit:* • Work of merit in **(i) AND (ii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part *Full Credit (-1):* • Apply a * for no or incorrect rounding • Apply a * for no units

Q9	Model Solution – 50 Marks	Marking Notes
(b) (iii)	$724 = 1{\cdot}25^2 \times Area$ $Area = 463{\cdot}36$ $Area = 463 \ [\text{cm}^2]$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, some correct substitution into formula or k^2 written *High Partial Credit:* • $724 = 1{\cdot}25^2 \times Area$ *Full Credit (-1):* • Apply a * for no or incorrect rounding
(c) (i)	$\dfrac{250}{360} \times \pi(160)^2 - \dfrac{250}{360} \times \pi(120)^2$ $\dfrac{160\,000\pi}{9} - 10\,000\pi$ $\dfrac{70\,000\pi}{9}$ $= 24\,434{\cdot}6 \dots$ $= 24\,435 \ [\text{cm}^2]$ **OR** $\dfrac{250}{360} \times [\pi(160)^2 - \pi(120)^2]$ $= 24\,434{\cdot}6 \dots$ $= 24\,435 \ [\text{cm}^2]$	**Scale 10D (0, 3, 5, 7, 10)** **Three steps involved in solution:** **1.** Area of larger sector (55 850·5 …) **2.** Area of smaller sector (31 415·9 …) **3.** Subtract both areas *Low Partial Credit:* • Some work of merit in any step, for example, area of a circle formula written, $\dfrac{250}{360}$ or 120 written *Mid Partial Credit:* • One step correct • Area of a relevant sector found *High Partial Credit:* • Two steps correct *Full Credit (-1):* • Apply a * for no or incorrect rounding
(c) (ii)	$\dfrac{250}{360} \times 2\pi(160) = 698{\cdot}1 \dots$ $\dfrac{698{\cdot}1 \dots}{60} = 11{\cdot}6 \dots$ $= 11 \ [\text{people}]$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example, circumference of a circle formula written or $\dfrac{250}{360}$ or division by 60 *High Partial Credit:* • Correct formula fully substituted • Length of arc found (698·1 …) *Full Credit (-1):* • Apply a * for answer given as 12

10	Model Solution – 50 Marks	Marking Notes
(a) (i)	$$4 \times 200 + 2 \times 150 = 1100 \text{ m}$$	**Scale 10B (0, 5, 10)** Accept correct answer without work *Partial Credit:* • Work of merit, for example, relevant addition *Full Credit (-1):* • Apply a * for no units
(a) (ii)	$$= \frac{1}{2}(150)(200) \sin 110$$ $$= 14\,095 \cdot 389 \dots$$ $$= 14\,095 \text{ [m}^2\text{]}$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, correct relevant formula *High Partial Credit:* • Correct formula fully substituted *Full Credit (-1):* • Apply a * for no or incorrect rounding
(a) (iii)	$$|AC|^2 = 150^2 + 200^2 - 2(150)(200) \cos 110$$ $$|AC|^2 = 83\,021 \cdot 2086 \dots$$ $$|AC| = 288 \cdot 13 \dots$$ $$|AC| = 288 \text{ [m]}$$	**Scale 10C (0, 4, 6, 10)** *Low Partial Credit:* • Work of merit, for example, cosine rule formula *High Partial Credit:* • Correct formula fully substituted *Full Credit (-1):* • Apply a * for no or incorrect rounding
(a) (iv)	$$Area = 2(14\,095) + (200 \times 288)$$ $$= 85\,790 \text{ m}^2$$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • Work of merit, for example, answer from **(ii)** or **(iii)** written or relevant work on the diagram or relevant area formula *High Partial Credit* • $2(14\,095) + (200 \times 288)$ *Full Credit (-1):* • Apply a * for no units

10	Model Solution – 50 Marks	Marking Notes
(b) (i)	$D \ C \ F \ B \ E$ Or similar	**Scale 10B (0, 5, 10)** *Partial Credit:* • Work of merit, for example, writes a letter other than A
(b) (ii) (iii)	**(ii)** $5! = 120$ **(iii)** $^5P_2 = 20$ **OR** $5 \times 4 = 20$	**Scale 5D (0, 2, 3, 4, 5)** Accept correct answers without work *Low Partial Credit:* • Work of merit in **(ii)**, for example, writing a different route or some relevant multiplication • Work of merit in **(iii)**, for example, writing a different route or 5, 4, or 2 written *Mid Partial Credit:* • Work of merit in **(ii) AND (iii)** • One part correct *High Partial Credit:* • One part correct and work of merit in the other part