



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2026

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.

General notes on the marking

In general, accept a candidate's work, whether correct or incorrect, for use in subsequent parts of the question, unless this oversimplifies the work involved.

Scales and Slips

Certain types of mistake – 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 – are referred to as a **slip** and are denoted with a *. In such cases, a mark that is one mark below the full-credit mark may be awarded. 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 scales above, or *Full Credit –1*.

Instructions regarding penalties for omitted or incorrect units are given in the scheme for each question to which they apply. A penalty for rounding is applied once per unit of marking (i.e., if parts (a) and (b) are marked as a single unit, a penalty for rounding is only applied once for (a) and (b) combined).

In general, an answer without sufficient supporting work is awarded the lowest level of credit on the scale above *No Credit* in Paper 1 (typically *Partial Credit* or *Low Partial Credit*, as appropriate), and the highest level of credit on the scale below *Full Credit* in Paper 2 (typically *Partial Credit* or *High Partial Credit*).

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. Note also that these steps may not need to be presented in the order specified in the Marking Notes. In general, it is specifically noted where these do not hold.

Errors

An error is a mistake in a candidate's work that is not considered a slip. 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 Errors

Where a candidate has a single * on their solution, this is ignored in the awarding of credit unless they would otherwise have *Full Credit*. If they would otherwise have *Full Credit*, then *Full Credit –1* is awarded. Where a candidate has multiple *s, this is generally treated as an error. This applies even where the *s are in different steps.

Multiple answers

Where a solution requires substantial work, all separate attempts are marked and the marks for the best one are awarded, regardless of crossing out.

Where a solution requires selection from the question:

- If a candidate has only one answer, which they have then crossed out, the crossing-out is ignored
- If a candidate has both crossed-out answer(s) and answer(s) that are not crossed out, ignore the crossed-out answer(s) and only mark those that are not crossed out
- If a candidate has multiple answers that are **not** crossed out, award the lowest mark associated with these answers (generally, such a set of answers will end up being considered incorrect).

Excess work

Where a solution requires substantial work, incorrect excess work (i.e. work presented after the answer) is generally not penalised.

This does not apply where candidates are asked to write a sentence, or number of sentences, to explain / justify / describe something. In such cases, the answer as a whole is considered.

Where a subsequent part of a question requires candidates to use their answer from a previous part, and an incorrect answer arising from incorrect excess work is used, this is generally treated as an error in the subsequent part, unless it oversimplifies the work involved (in which case a lower level of credit is generally awarded for the subsequent part).

Model solutions

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.

Square brackets

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

Work of merit

Where the scheme indicates “work of merit” (or “substantial work of merit”), examples are given to exemplify the standard of work required to be considered work of merit (or substantial work of merit) in that particular question.

Accept

Where it is indicated to “accept” work, this means that, for this year, such work is to be accepted for *Full Credit*, unless otherwise indicated.

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 <i>Partial Credit</i>
	L		The work presented in the body of the script merits <i>Low Partial Credit</i>
	M		The work presented in the body of the script merits <i>Mid Partial Credit</i>
	H		The work presented in the body of the script merits <i>High Partial Credit</i>
	F star		The work presented in the body of the script merits <i>Full Credit – 1</i>
	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 this page	
	Oversimplify	The candidate has oversimplified the work	
	Work of merit	The candidate has produced work of merit (in line with that defined in the scheme)	
	Stops early	The candidate has stopped early in this part	
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 that is not marked using steps, where * and and appear in the body of the work, then should be placed in the right margin. In the case of a D scale with the same annotations, should be placed in the right margin.			
Note: Where work is presented for a question in the answerspace provided, and a separate attempt is presented on additional pages, both attempts are marked. For each attempt, the annotation for the appropriate credit level is put in the right margin next to that attempt. The annotation for the lower credit level is then left-bracketed, and the mark for the higher credit level is awarded.			

Structure of the marking scheme – Paper 1

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	B	C	D
Number of categories	3	4	5
5-mark scales	0, 2, 5	0, 2, 3, 5	0, 2, 3, 4, 5
10-mark scales		0, 4, 7, 10	0, 3, 5, 8, 10
15-mark scale		0, 5, 11, 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.

Marking scales – level descriptors

A-scales (two categories)

- incorrect response
- correct response

B-scales (three categories)

- response of no substantial merit
- partially correct response
- correct response

C-scales (four categories)

- response of no substantial merit
- response with some merit
- almost correct response
- correct response

D-scales (five categories)

- response of no substantial merit
- response with some merit
- response about half-right
- almost correct response
- correct response

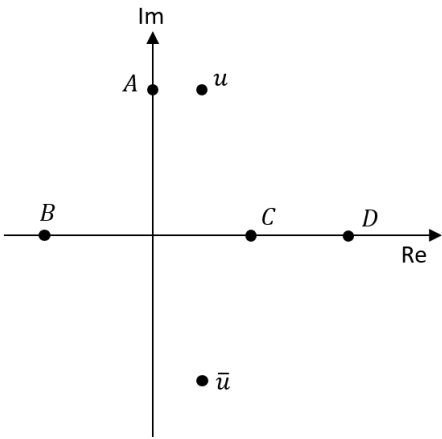
Model Solutions & Marking Notes

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)	$(34 \cdot 6 + 28 \cdot 9)1 \cdot 12 = [\text{€}]71 \cdot 12$	Scale 10C (0, 4, 7, 10) Accept correct answer without work <i>Low Partial Credit:</i> • Work of merit, for example $0 \cdot 12$ or $1 \cdot 12$ written or some relevant addition or multiplication <i>High Partial Credit:</i> • Finds the total cost for one person ($38 \cdot 752$ or $32 \cdot 368$) • Finds total service charge ($7 \cdot 62$)
(b) (i) (ii)	(i) $22\,600 \times 0 \cdot 18 = 4068$ (ii) $22\,600 - 4068 = 18\,532$ $18\,532 \times 0 \cdot 82 = [\text{€}]15\,196 \cdot 24$	Scale 10D (0, 3, 5, 8, 10) Accept correct answer without work in (i) <i>Low Partial Credit:</i> • Work of merit in (i), for example, depreciation formula, $0 \cdot 18$, or $0 \cdot 82$ written • Work of merit in (ii), for example, finds the value of the car at the end of the first year <i>Mid Partial Credit:</i> • Work of merit in (i) AND (ii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part
(c)	$20\,230 = 28\,000 \left(1 - \frac{k}{100}\right)^2$ $1 - \frac{k}{100} = \sqrt{\frac{20\,230}{28\,000}}$ $\frac{k}{100} = 0 \cdot 15$ $k = 15\%$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, some correct substitution or trial and improvement <i>High Partial Credit:</i> • Formula fully substituted

Q2	Model Solution – 30 Marks	Marking Notes
(a)	$9x^2 - 30x + 25 + 4x + 6$ $9x^2 - 26x + 31$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit for example, some relevant addition or multiplication <i>High Partial Credit:</i> • $9x^2 - 30x + 25$
(b)	$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-5)}}{(2)(3)}$ $x = 2.119 \dots$ $= 2.12$ $x = -0.786 \dots$ $= -0.79$	Scale 15C (0, 5, 11, 15) Three steps involved in solution: 1. Identifies a, b, and c 2. Formula fully substituted 3. Both correctly evaluated <i>Low Partial Credit:</i> • Quadratic formula written • Work of merit, for example, identifies one of a, b, or c or some correct substitution <i>High Partial Credit:</i> • Two steps correct <i>Full Credit (-1):</i> • Apply a * for no or incorrect rounding • Apply a * for second value of x not found
(c)	$\frac{5(x-3) - 5(x+3)}{(x+3)(x-3)} = 6$ $5(x-3) - 5(x+3) = 6(x+3)(x-3)$ $5x - 15 - 5x - 15 = 6(x^2 - 9)$ $6x^2 - 24 = 0$ $x^2 - 4 = 0$ $x = 2, -2$	Scale 5D (0, 2, 3, 4, 5) Note: Use of CD leading to linear equation then LPC at most Three steps involved in solution: 1. Application of the LCD on LHS 2. Sets up quadratic equation 3. Solves <i>Low Partial Credit:</i> • Work of merit, for example, one correct operation or common denominator found <i>Mid Partial Credit:</i> • One step correct <i>High Partial Credit:</i> • Two steps correct • Shows true for $x = 2$ or -2

Q3	Model Solution – 30 Marks	Marking Notes
(a)	$\frac{2200}{500} = 4.4$ $4.4 \times 25 = 110 \text{ [minutes]}$ OR $1 \text{ gram} = 0.05 \text{ minutes}$ $2200 \text{ grams} = 110 \text{ [minutes]}$	Scale 15C (0, 5, 11, 15) <i>Low Partial Credit:</i> - Work of merit, for example, finds the length of time taken for any different amount of bread <i>High Partial Credit:</i> - Finds 4.4 - Finds the length of time taken for an amount of bread that divides in evenly to 2200, for example, 1 gram = 0.05 or similar
(b)	$2 \times 2 \times 5 \times 7$	Scale 5C (0, 2, 3, 5) Accept correct answer without work <i>Low Partial Credit:</i> - Work of merit, for example, any pair of factors of 140 written or a prime factor of 140 identified <i>High Partial Credit:</i> - Three prime factors of 140 identified - A correct product of 140 including two prime factors
(c)	(i) (ii) Factor one = $x - 3$ Factor two = $x + 7$ (ii) $(x - 3)(x + 7)$ $= x^2 + 4x - 21$ $p = 4 \quad r = -21$	Scale 10D (0, 3, 5, 8, 10) Accept correct answer without work in (i) <i>Low Partial Credit:</i> - Work of merit in (i), for example, shows some understanding linking roots and factors or one factor correct - Work of merit in (ii), for example, relevant use of answer from (i) or 3 or -7 substituted <i>Mid Partial Credit:</i> - Work of merit in (i) AND (ii) - One part correct <i>High Partial Credit:</i> - One part correct and work of merit in the other part <i>Full Credit (-1):</i> $x^2 + 4x - 21$ (with work) but doesn't identify the p or the r

Q4	Model Solution – 30 Marks	Marking Notes
(a)	$z_1 = -2 + 3i$ $z_2 = 4 + i$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, a correct value for an a or a b <i>High Partial Credit:</i> • z_1 or z_2 correct <i>Full Credit (-1):</i> • Answers not given in the correct form
(b)	$2i - i^2 - 2 + i$ $2i + 1 - 2 + i$ $-1 + 3i$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, some correct multiplication or substitutes -1 for i^2 <i>High Partial Credit:</i> • $2i + 1 - 2 + i$ • Correct multiplication AND substitutes -1 for i^2
(c)	(i) (ii) (iii) Or similar (ii)  (iii) Box C ticked	Scale 10D (0, 3, 5, 8, 10) Note: In (ii) if $\bar{u}$ plotted correctly but not labelled apply * penalty for part (ii) <i>Low Partial Credit:</i> • Work of merit in (i), for example, a correct value for a or b • Work of merit in (ii), for example, shows some knowledge of conjugate • Work of merit in (iii), for example, some relevant addition <i>Mid Partial Credit:</i> • Work of merit in any two parts • One part correct <i>High Partial Credit:</i> • Two parts correct

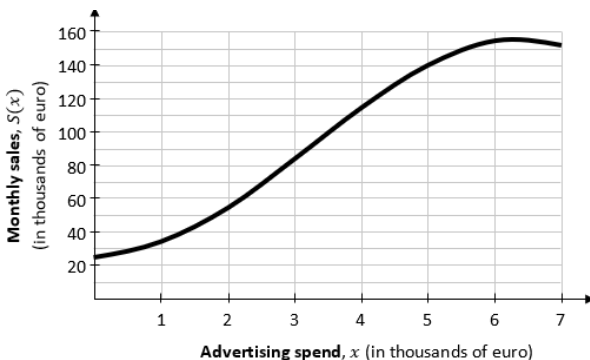
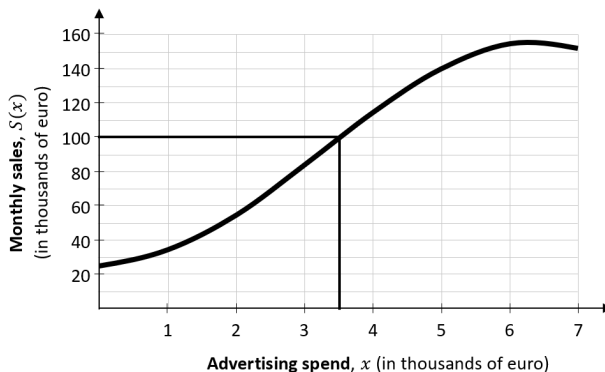
Q5	Model Solution – 30 Marks	Marking Notes
(a) (i)	27, 32, 37	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, identifies the common difference <i>High Partial Credit:</i> - Finds term four
(a) (ii) (iii)	(ii) $T_n = 12 + (n - 1)5$ $[T_n = 5n + 7]$ (iii) $T_{20} = 5(20) + 7 = 107$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> - Work of merit in (ii), for example, correct formula or identifies a or d - Work of merit in (iii), for example, continues the sequence to term seven <i>Mid Partial Credit:</i> - Work of merit in (ii) AND (iii) - One part correct <i>High Partial Credit:</i> - One part correct and work of merit in the other part
(b)	$-4 - 6 = -10$ $2d = -10$ $d = -5$ $x = 1$	Scale 10C (0, 4, 7, 10) Accept correct answer without work <i>Low Partial Credit:</i> - Work of merit, for example, $x - 6$ or $-4 - x$ or similar <i>High Partial Credit:</i> - Finds d
(c)	$\frac{n}{2}(2(43) + (n - 1)(-4)) < 0$ $\frac{n}{2}(90 - 4n) < 0$ $90 - 4n < 0$ $90 < 4n$ $n > 22.5$ $n = 23$	Scale 5D (0, 2, 3, 4, 5) <i>Low Partial Credit:</i> - Work of merit, for example, correct formula - Identifies a or d <i>Mid Partial Credit:</i> S_n formula fully substituted <i>High Partial Credit:</i> S_n formula fully substituted AND equated to 0 or < 0 <i>Full Credit (-1):</i> - Answer given as 22.5

Q6	Model Solution – 30 Marks	Marking Notes
(a) (i) (ii)	(i) $g(4) = 2(4) - 3 = 5$ (ii) $2x - 3 = 11$ $2x = 14$ $x = 7$	Scale 15C (0, 5, 11, 15) Accept correct answer without work in (i) <i>Low Partial Credit:</i> • Work of merit in (i), for example, correct substitution • Work of merit in (ii), for example, equates the $2x - 3$ to 11 • Work of merit in both parts <i>High Partial Credit:</i> • One part correct
(b)	$h'(x) = 6x - 2$ $6x - 2 = 0$ $x = \frac{1}{3}$ $\left(\frac{1}{3}, \frac{2}{3}\right)$	Scale 10D (0, 3, 5, 8, 10) Three steps involved in the solution: 1. Correct differentiation 2. Solves for x 3. Corresponding y value found <i>Low Partial Credit:</i> • Work of merit, for example, some correct differentiation or $h'(x) = 0$ written <i>Mid Partial Credit:</i> • One step correct <i>High Partial Credit:</i> • Two steps correct <i>Full Credit (-1):</i> • Answer not written as a couple
(c)	Box C ticked Justification: Positive slope AND positive x intercept Or similar	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> • Work of merit, for example, correct box ticked or some correct explanation, for example why A or B are not correct • Box A ticked with reference to positive slope • Box B ticked with reference to positive x intercept <i>High Partial Credit:</i> • Box C ticked and work of merit in explanation

Q7	Model Solution – 50 Marks	Marking Notes
(a) (i) (ii)	(i) Box D ticked (ii) $14:00 - 10:50 = 3:10$	Scale 10D (0, 3, 5, 8, 10) Accept correct answers without work <i>Low Partial Credit:</i> • Work of merit in (i), for example, 20:30 written • Work of merit in (ii), for example, 14:00 or 10:50 written <i>Mid Partial Credit:</i> • Work of merit in (i) AND (ii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part
(a) (iii)	$21:45 - 21:24 = 21 \text{ minutes}$ $x + (x + 3) = 21$ $2x = 18$ $x = 9$ $21:24 + 00:09$ $= 21:33$	Scale 10C (0, 4, 7, 10) Accept correct answer without work <i>Low Partial Credit:</i> • Work of merit, for example, 21:45 or 21:24 written <i>High Partial Credit:</i> • Finds 9 minutes

Q7	Model Solution – 50 Marks	Marking Notes
(b)	Method A $3x + 4y = 144$ $2x + y = 71$ $3x + 4y = 144$ $\underline{-8x - 4y = -284}$ $-5x = -140$ $x = [€]28$ $y = 71 - 56$ $y = [€]15$ Method B $3(28) + 4(15) = 144$ $144 = 144$ $2(28) + 15 = 71$ $71 = 71$	Scale 10D (0, 3, 5, 8, 10) Method A Four steps involved in solution. 1. Two equations in terms of x and y written. 2. Gets equation in one variable 3. Solves to find the value of one variable 4. Finds the value of the second variable <i>Low Partial Credit:</i> • Work of merit, for example, part of one equation written or trials a value for x or y <i>Mid Partial Credit:</i> • Two steps correct in Method A • Trials a value for x and finds the corresponding value for y for one equation in Method B <i>High Partial Credit:</i> • Three steps correct in Method A • Shows $x = 28$ and $y = 15$ for one equation in Method B
(c) (i)	Gross tax $37\,600 \times 0.2 = 7520$ Net annual tax $7520 - 4000 = 3520$ Net annual pay $37\,600 - 3520 = [€]34\,080$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> • Work of merit, for example 0.2 written <i>High Partial Credit:</i> • Finds 3520 with relevant work <i>Full Credit (-1):</i> • Apply a * if net annual tax is not written

Q7	Model Solution – 50 Marks	Marking Notes
(c) (ii)	Lower rate tax $44\,000 \times 0.2 = 8800$ Higher rate tax $(63\,400 - 44\,000) \times 0.4 = 7760$ Gross tax $8800 + 7760 = 16\,560$ Net annual tax $(16\,560) - 4000 = [\text{€}]12\,560$	Scale 10D (0, 3, 5, 8, 10) Four steps involved in solution. 1. Finds tax paid at lower rate 2. Finds tax paid at higher rate 3. Finds gross tax 4. Finds net annual tax <i>Low Partial Credit:</i> • Work of merit, for example, 0.2 or 0.4 or 19 400 written <i>Mid Partial Credit:</i> • Two steps correct <i>High Partial Credit:</i> • Three steps correct
(c) (iii)	$17\,000 + 4000 = 21\,000$ $21\,000 - 8800 = 12\,200$ $\frac{12\,200}{40} \times 100 = 30\,500$ $44\,000 + 30\,500$ $= [\text{€}]74\,500$ OR Using answer from (c)(ii) $17\,000 - 12\,560 = 4440$ $40\% = 4440$ $100\% = 11\,100$ $11\,100 + 63\,400$ $= [\text{€}]74\,500$	Scale 5D (0, 2, 3, 4, 5) Four steps involved in solution. 1. Finds tax paid at lower rate (8800) 2. Finds tax paid at higher rate (12 200) 3. Finds gross pay at which higher rate is paid (30 500) 4. Finds gross annual income <i>Low Partial Credit:</i> • Work of merit, for example, 0.2 or 0.4 or 8800 or 21 000 written <i>Mid Partial Credit:</i> • Two steps correct <i>High Partial Credit:</i> • Three steps correct

Q8	Model Solution – 50 Marks	Marking Notes																		
(a) (i) (ii)	(i) <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>$S(x)$</td><td>25</td><td>34</td><td>55</td><td>84</td><td>115</td><td>140</td><td>155</td><td>152</td></tr></table>	x	0	1	2	3	4	5	6	7	$S(x)$	25	34	55	84	115	140	155	152	
x	0	1	2	3	4	5	6	7												
$S(x)$	25	34	55	84	115	140	155	152												
	(ii)  Monthly sales, $S(x)$ (in thousands of euro) Advertising spend, x (in thousands of euro)	Scale 10D (0, 3, 5, 8, 10) Note: Solution requires 14 items, 5 values in table, 8 points plotted and the curve <i>Low Partial Credit:</i> • 1 to 3 items correct <i>Mid Partial Credit:</i> • 4 to 7 items correct <i>High Partial Credit:</i> • 8 to 12 items correct <i>Full Credit (-1):</i> • Apply a * if 13 items correct																		
(a) (iii)	 Monthly sales, $S(x)$ (in thousands of euro) Advertising spend, x (in thousands of euro) 3.5 or 3500	Scale 5B (0, 2, 5) <i>Partial Credit:</i> • Work of merit, for example, some relevant work on diagram																		

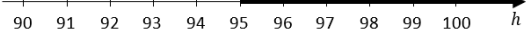
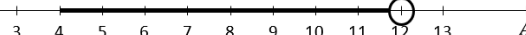
Q8	Model Solution – 50 Marks	Marking Notes
(a) (iv)	$S'(x) = -3x^2 + 19 \cdot 2x$ $-3x^2 + 19 \cdot 2x = 0$ $3x = 19 \cdot 2$ $x = 6 \cdot 4$	Scale 10D (0, 3, 5, 8, 10) Three steps involved in solution. 1. Correct differentiation 2. Equates $S'(x)$ to zero 3. Solves for x <i>Low Partial Credit:</i> • Work of merit, for example, some correct differentiation • $S'(x)$ or $\frac{dy}{dx}$ written <i>Mid Partial Credit:</i> • One step correct <i>High Partial Credit:</i> • Two steps correct
(a) (v)	$S(5) = 140\,000$ $\text{Error} = 140\,000 - 125\,000 = 15\,000$ $\frac{15\,000}{125\,000} \times 100 = 12\%$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, percentage error formula written or 140 000 written <i>High Partial Credit:</i> • Formula fully substituted
(b) (i)	$P = (15)(39) + 2(15)5$ $P = [\text{€}]735$	Scale 5C (0, 2, 3, 5) Accept correct answer without work <i>Low Partial Credit:</i> • Work of merit, for example, some correct substitution into P <i>High Partial Credit:</i> • Fully correct substitution into P

Q8	Model Solution – 50 Marks	Marking Notes
(b) (ii) (iii)	(ii) $P = r(h + 2t)$ $r = \frac{P}{h + 2t}$ (iii) $r = \frac{892.5}{35 + 2(8)}$ $= [\text{€}]17.5 \text{ [per hour]}$ OR $892.5 = r(35) + 2r(8)$ $51r = 892.5$ $= [\text{€}]17.5 \text{ [per hour]}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit in (ii), for example, identifies r as a common factor • Work of merit in (iii), for example, some correct substitution into P or 16 written <i>Mid Partial Credit:</i> • Work of merit in (ii) AND (iii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part

Q9	Model Solution – 50 Marks	Marking Notes
(a) (i) (ii)	(i) 80 [seconds] (ii) 164 [metres]	Scale 5C (0, 2, 3, 5) Accept correct answer without work <i>Low Partial Credit:</i> - Work of merit, for example, some relevant addition in (i) or (ii) <i>High Partial Credit:</i> - One part correct
(a) (iii)	$7 \times 60 = 420$ $80 \times 5 = 400$ 5 full sets plus 20 seconds $5 \times 164 = 820$ $820 + 38 = 858 \text{ m}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, relevant addition of distance after 80 seconds - Finds 420 <i>High Partial Credit:</i> - Finds 820 <i>Full Credit (-1):</i> - Apply a * for no units
(b)	$80 + 145 = 225$ $225 \times 4 = 900$ $\frac{900}{1020} = 0.8823 \dots$ €1 = [£]0.882 OR $\frac{1020}{4} = 255$ $\frac{225}{255} = 0.8823 \dots$ €1 = [£]0.882	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> - Work of merit, for example, some relevant operation <i>Mid Partial Credit:</i> - Finds 900 - Finds 225 AND 255 <i>High Partial Credit:</i> $\frac{900}{1020}$ or $\frac{225}{255}$ written
(c)	$\frac{5000}{25 \times 60} = 3.33 \dots$ $= 3.3 \text{ [m/s]}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, <i>DST</i> formula or 5000 or 25×60 written <i>High Partial Credit:</i> $\frac{5000}{25 \times 60}$

Q9	Model Solution – 50 Marks	Marking Notes
(d) (i)	2.4 km	Scale 5B (0, 2, 5) Accept correct answer without work <i>Partial Credit:</i> - Work of merit, for example, ‘half way’ written or midpoint marked on the diagram <i>Full Credit (-1):</i> - Apply a * for no units
(d) (ii)	$3x = 2.4$ $x = 0.8$ $2.4 + 0.8$ $= 3.2 \text{ [km]}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, relevant work on diagram, a relevant number written (0.8 or 1.6) or a value $2.4 \leq x < 4.8$ written <i>High Partial Credit:</i> - Identifies ratio as 2: 1 - Finds 6.4 (distance run by Kayla)

Q10	Model Solution – 50 Marks	Marking Notes																				
(a) (i) (ii)	(i) 2 [m] (ii) 40 [cm]	Scale 10C (0, 4, 7, 10) Accept correct answers without work <i>Low Partial Credit:</i> - Work of merit, for example, work on diagram for (i) or (ii) or both <i>High Partial Credit:</i> - One part correct <i>Full Credit (-1):</i> - In (ii) answer given as 0.4																				
(a) (iii)	$l'(x) = 2.5$ Slope of the ladder	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, mentions slope or rate of change - Some correct differentiation <i>High Partial Credit:</i> $l'(x) = 2.5$ written but explanation is incorrect																				
(a) (iv) (v)	(iv) <table><tr><td>x</td><td>0</td><td>0.2</td><td>0.4</td><td>0.6</td><td>0.8</td><td>1</td><td>1.2</td><td>1.4</td><td>1.6</td></tr><tr><td>$d(x)$</td><td>2</td><td>1.45</td><td>1.05</td><td>0.76</td><td>0.55</td><td>0.4</td><td>0.29</td><td>0.21</td><td>0.15</td></tr></table> (v)	x	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6	$d(x)$	2	1.45	1.05	0.76	0.55	0.4	0.29	0.21	0.15	Scale 10D (0, 3, 5, 8, 10) Note: Solution requires 14 items, 5 values in table, 8 points plotted and the curve <i>Low Partial Credit:</i> 1 to 3 items correct <i>Mid Partial Credit:</i> 4 to 7 items correct <i>High Partial Credit:</i> 8 to 12 items correct <i>Full Credit (-1):</i> - Apply a * if 13 items correct
x	0	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6													
$d(x)$	2	1.45	1.05	0.76	0.55	0.4	0.29	0.21	0.15													

Q10	Model Solution – 50 Marks	Marking Notes
(b) (c)	(b)(i)(ii) $h \geq 95$  (c)(i)(ii) $4 \text{ years} \leq A < 12 \text{ years}$ 	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit in (b), for example, inequality correct or relevant work on number line • Work of merit in (c), for example, inequality correct or relevant work on number line <i>Mid Partial Credit:</i> • Work of merit in (b) AND (c) <i>High Partial Credit:</i> • (b) OR (c) correct
(d)	$13 \times 4 = 52 \text{ hours}$ $4 \times 2 = 8 \text{ hours}$ $52 - 8 = 44 \text{ hours}$ $\frac{44}{3} = 14\frac{2}{3} \text{ hours}$ $= 14 \text{ [hours]} 40 \text{ [minutes]}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, 52 or 8 or 11 written or relevant unit conversion <i>High Partial Credit:</i> • Finds 44 <i>Full Credit (-1):</i> • Apply a * if answer given in hours or minutes

Structure of the marking scheme – Paper 2

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
Number of categories	2	3	4	5
5-mark scales	0, 5	0, 2, 5	0, 2, 3, 5	0, 2, 3, 4, 5
10-mark scales		0, 5, 10	0, 4, 7, 10	0, 3, 5, 8, 10
15-mark scale			0, 5, 10, 15	0, 4, 8, 12, 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.

Marking scales – level descriptors

A-scales (two categories)

- incorrect response
- correct response

B-scales (three categories)

- response of no substantial merit
- partially correct response
- correct response

C-scales (four categories)

- response of no substantial merit
- response with some merit
- almost correct response
- correct response

D-scales (five categories)

- response of no substantial merit
- response with some merit
- response about half-right
- almost correct response
- correct response

Model Solutions & Marking Notes– Paper 2

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 their Advising Examiner.

Q1	Model Solution – 30 Marks	Marking Notes
(a) (i)	$2(0) + 3(6) - 18 = 0$ $18 - 18 = 0$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, some relevant substitution <i>High Partial Credit:</i> - Point fully substituted into equation
(a) (ii)	$\frac{1}{2} \times 6 \times 9 = 27$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, relevant formula or relevant work on the diagram <i>High Partial Credit:</i> - Formula fully substituted
(b) (i)	$m = -\frac{6}{9}$ OR $-\frac{2}{3}$	Scale 5B (0, 2, 5) Accept correct answer without work <i>Partial Credit:</i> Work of merit, for example, $-\frac{a}{b}$ or $\frac{\text{rise}}{\text{run}}$ written or relevant work on the diagram
(b) (ii)	$\perp \text{ slope} = \frac{3}{2}$ $\frac{7 - (-2)}{r - 4} = \frac{3}{2}$ $9(2) = 3(r - 4)$ $18 = 3r - 12$ $30 = 3r$ $r = 10$ OR r found using a translation	Scale 10D (0, 3, 5, 8, 10) Three steps involved in solution: - Perpendicular slope found from (b)(i) - Slope formula fully substituted in terms of r - Solves for r <i>Low Partial Credit:</i> - Work of merit, for example, relevant formula or relevant work on the diagram <i>Mid Partial Credit:</i> - One step correct <i>High Partial Credit:</i> - Two steps correct

Q2	Model Solution – 30 Marks	Marking Notes																															
(a) (i)	<table><tr><th colspan="2" rowspan="2"></th><th colspan="4">Group 2</th></tr><tr><th>W</th><th>X</th><th>Y</th><th>Z</th></tr><tr><th rowspan="4">Group 1</th><th>A</th><td>AW</td><td>AX</td><td>AY</td><td>AZ</td></tr><tr><th>B</th><td>BW</td><td>BX</td><td>BY</td><td>BZ</td></tr><tr><th>C</th><td>CW</td><td>CX</td><td>CY</td><td>CZ</td></tr><tr><th>D</th><td>DW</td><td>DX</td><td>DY</td><td>DZ</td></tr></table>			Group 2				W	X	Y	Z	Group 1	A	AW	AX	AY	AZ	B	BW	BX	BY	BZ	C	CW	CX	CY	CZ	D	DW	DX	DY	DZ	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> 1 correct entry <i>High Partial Credit:</i> 7 correct entries
				Group 2																													
		W	X	Y	Z																												
Group 1	A	AW	AX	AY	AZ																												
	B	BW	BX	BY	BZ																												
	C	CW	CX	CY	CZ																												
	D	DW	DX	DY	DZ																												
(a) (ii) (iii)	(ii) $\frac{4}{16}$ OR $\frac{1}{4}$ (iii) $\frac{5}{12}$	Scale 5D (0, 2, 3, 4, 5) Accept correct answers without work <i>Low Partial Credit:</i> - Work of merit, for example, correct numerator or denominator in either part or relevant work on the table <i>Mid Partial Credit:</i> - Work of merit in (i) AND (ii) - One part correct <i>High Partial Credit:</i> - One part correct and work of merit in the other part																															
(b) (i)	$1 - 0.6 = 0.4$	Scale 5B (0, 2, 5) Accept correct answer without work <i>Partial Credit:</i> Use of 1																															
(b) (ii)	EE or EPE or PEE $(0.6)(0.6) + (0.6)(0.4)(0.6) + (0.4)(0.6)(0.6)$ $0.36 + 0.144 + 0.144$ $0.648 = \frac{81}{125}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> - Work of merit, for example one outcome identified <i>Mid Partial Credit:</i> - Probability of one outcome correctly formulated <i>High Partial Credit:</i> - Probability of two outcomes correctly formulated																															

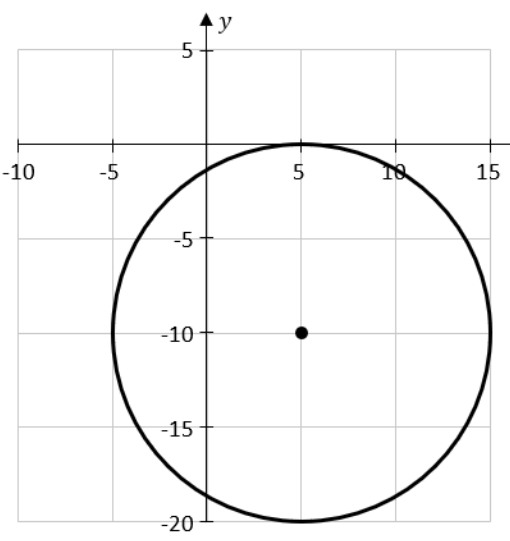
Q3	Model Solution – 30 Marks	Marking Notes
(a) (i) (ii)	(i) $5 \times 6 \times 4 = 120$ (ii) Category 2 box ticked Category 1: $4 \times 6 \times 4 = 96$ Category 2: $5 \times 5 \times 4 = 100$ Category 3: $5 \times 6 \times 3 = 90$	Scale 15D (0, 4, 8, 12, 15) Accept correct answer without work in (i) <i>Low Partial Credit:</i> • Work of merit in (i), for example, relevant number identified • Work of merit in (ii), for example, correct box ticked or relevant numbers identified <i>Mid Partial Credit:</i> • Work of merit in (i) AND (ii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part
(b) (i)	$7! = 5040$	Scale 5B (0, 2, 5) Accept correct answer without work <i>Partial Credit:</i> • Work of merit, for example, relevant multiplication to 7 or relevant setup
(b) (ii) (iii)	(ii) ${}^7P_3 = 210$ OR $7 \times 6 \times 5 = 210$ (iii) ${}^6P_2 = 30$ OR $6 \times 5 = 30$	Scale 10D (0, 3, 5, 8, 10) Accept correct answers without work <i>Low Partial Credit:</i> • Work of merit in (ii), for example, a relevant setup or relevant multiplication • Work of merit in (iii), for example, a relevant number identified <i>Mid Partial Credit:</i> • Work of merit in (ii) AND (iii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part

Q4	Model Solution – 30 Marks	Marking Notes
(a) (i)	$180 - 44 = 136$ $A = \frac{136}{2} = 68[^\circ]$ $B = 44 + 68 = 112[^\circ]$	Scale 10C (0, 4, 7, 10) Accept correct answers without work <i>Low Partial Credit:</i> - Work of merit, for example, some relevant addition or subtraction <i>High Partial Credit:</i> - One angle correct
(a) (ii)	$\frac{1}{2} \times 12 \times 12 \times \sin 44 = 50 \text{ cm}^2$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, correct formula <i>High Partial Credit:</i> - Formula fully substituted <i>Full Credit (-1):</i> - Apply a * for no or incorrect rounding - Apply a * for no units
(b)	$10^2 = 9^2 + 12^2 - 2(9)(12) \cos \theta$ $\cos \theta = \frac{125}{216}$ $\theta = 54.6 \dots$ $\theta \approx 55[^\circ]$	Scale 15D (0, 4, 8, 12, 15) <i>Low Partial Credit:</i> - Work of merit, for example, cosine rule formula or diagram attempted <i>Mid Partial Credit:</i> - Some correct substitution - Diagram fully labelled correctly <i>High Partial Credit:</i> - Formula fully substituted correctly <i>Full Credit (-1):</i> - Apply a * for no or incorrect rounding

Q5	Model Solution – 30 Marks	Marking Notes
(a) (i)	Mode: 20 Range: 15 [mins] (23 – 8)	Scale 15C (0, 5, 10, 15) Accept correct answers without work <i>Low Partial Credit:</i> - Work of merit, for example, some understanding of mode or range <i>High Partial Credit:</i> - Mode or range correct
(a) (ii) (iii)	(ii) Median: 17 [minutes] (iii) Less than or equal to 15 box ticked If = 15: 8, 11, 15, 15, 17, 20, 20, 23 Median = 16 Or similar	Scale 10D (0, 3, 5, 8, 10) Accept correct answer without work in (ii) <i>Low Partial Credit:</i> - Work of merit in (ii), for example, some understanding of median - Work of merit in (iii), for example, correct box ticked or a value trialled <i>Mid Partial Credit:</i> - Work of merit in (ii) AND (iii) - One part correct <i>High Partial Credit:</i> - One part correct and work of merit in the other part
(b)	$\left(19 \times \frac{1}{3}\right) + \left(-20 \times \frac{1}{2}\right) + \left(x \times \frac{1}{6}\right) = 0$ $\frac{19}{3} - 10 + \frac{x}{6} = 0$ $38 - 60 + x = 0$ $x = 22$	Scale 5D (0, 2, 3, 4, 5) <i>Low Partial Credit:</i> - Work of merit, for example, 180 or 360 or –20 written, a relevant fraction, or expected value formula <i>Mid Partial Credit:</i> - One correct term <i>High Partial Credit:</i> - Two correct terms

Q6	Model Solution – 30 Marks	Marking Notes
(a) (i)	$ AB = 4 \text{ [cm]}$ $ EF = 10 \text{ [cm]}$	Scale 10B (0, 5, 10) <i>Partial Credit:</i> One correct measurement
(a) (ii) (iii)	(ii) Scale Factor: $\frac{10}{4} = 2.5$ (iii)	Scale 10D (0, 3, 5, 8, 10) Accept correct answer without work in (ii) <i>Low Partial Credit:</i> - Work of merit in (ii), for example, relevant use of answers from (i) - Work of merit in (ii), for example, relevant work towards the construction of the centre of enlargement <i>Mid Partial Credit:</i> - Work of merit in (ii) AND (iii) - One part correct <i>High Partial Credit:</i> - One part correct and work of merit in the other part <i>Full Credit (-1):</i> - Apply a * for not labelling K
(b) (i)	$ OP $ and $ OQ $ are both radii of the circle u	Scale 5A (0, 5)
(ii)	$ \angle QOP = \angle ROS $ Common (120°) $\triangle QOP$ and $\triangle ROS$ are both isosceles triangles $ \angle OPQ = \angle OSR $ Isosceles triangles (30°) $\therefore \triangle QOP$ and $\triangle ROS$ are similar	Scale 5C (0, 2, 3, 5) Three steps involved in solution: - Common angle - Both triangles are isosceles - A second angle is equal, (30° or similar explanation given) <i>Low Partial Credit:</i> - Work of merit, for example, some understanding of similar triangles or relevant work on the diagram <i>High Partial Credit:</i> - Two steps correct

Q7	Model Solution – 30 Marks	Marking Notes
(a) (i)	Centre: (0, 0) Radius: $\sqrt{72}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, zero written <i>High Partial Credit:</i> • Centre or radius correct <i>Full Credit (-1):</i> • Apply a * for radius in incorrect form
(a) (ii)	$(-4)^2 + (9)^2$ $16 + 81$ $97 > 72$ Outside c	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, correct box ticked or some relevant substitution <i>High Partial Credit:</i> • Point substituted correctly
(b) (i)	$m = \frac{12 - 9}{0 + 4}$ $m = \frac{3}{4}$ $y - 9 = \frac{3}{4}(x + 4)$ $3x - 4y + 48 = 0$	Scale 10D (0, 3, 5, 8, 10) Three steps involved in solution: 1. Slope found 2. Slope substituted into line formula 3. Point substituted into line formula <i>Low Partial Credit:</i> • Work of merit, for example, a relevant formula <i>Mid Partial Credit:</i> • One step correct <i>High Partial Credit:</i> • Two steps correct <i>Full Credit (-1):</i> • Apply a * for incorrect form
(b) (ii)	$x = 12 - y$ $(12 - y)^2 + y^2 = 72$ $144 - 24y + y^2 + y^2 = 72$ $2y^2 - 24y + 72 = 0$ $y^2 - 12y + 36 = 0$ $(y - 6)^2 = 0$ $y = 6$ $[x = 12 - 6 = 6]$ $[(6, 6)]$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> • Work of merit, for example, one variable in terms of the other <i>High Partial Credit:</i> • Equation in terms of one variable

Q7	Model Solution – 30 Marks	Marking Notes
(c) (i) (ii)	(i)  (ii) $(x - 5)^2 + (y + 10)^2 = 10^2$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit in (i), for example, centre point plotted • Work of merit in (ii), for example, relevant formula <i>Mid Partial Credit:</i> • Work of merit in (i) AND (ii) • One part correct <i>High Partial Credit:</i> • One part correct and work of merit in the other part <i>Full Credit (-1):</i> • Apply a * for incorrect form
(d)	$y = k$, where $10 < k < 15$	Scale 5B (0, 2, 5) <i>Partial Credit:</i> • Work of merit, for example, relevant formula or relevant work on diagram

Q8	Model Solution – 30 Marks	Marking Notes
(a) (i)	$ SQ ^2 = 25^2 + 60^2$ $ SQ ^2 = 625 + 3600$ $ SQ ^2 = 4225$ $ SQ = 65$ OR $25^2 + 60^2 = 65^2$ $625 + 3600 = 4225$ $4225 = 4225$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, correct formula <i>High Partial Credit:</i> • Formula fully substituted
(a) (ii)	$\sin \theta = \frac{45}{65}$ $\theta = \sin^{-1} \frac{45}{65}$ $\theta = 43.813 \dots$ $\theta = 43.8[^\circ]$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> • Work of merit, for example, some understanding of trigonometric ratios or relevant work on the diagram <i>High Partial Credit:</i> • $\sin \theta = \frac{45}{65}$ <i>Full Credit (-1):</i> • Apply a * for no or incorrect rounding
(b)	$\frac{0.5}{2} [0 + 0 + 2(1.2 + 1.5 + 1.3 + 0.9 + 0.8)]$ $= 2.85 \text{ [km}^2\text{]}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit, for example, trapezoidal rule formula <i>Mid Partial Credit:</i> • Some correct substitution <i>High Partial Credit:</i> • Formula fully substituted

Q8	Model Solution – 30 Marks	Marking Notes
(c)	$90 - 42 = 48^\circ$ $180 - 65 - 48 = 67^\circ$ $\frac{ XY }{\sin 67} = \frac{122}{\sin 65}$ $ XY = \frac{122 \sin 67}{\sin 65}$ $ XY = 123.9 \dots$ $ XY = 124 \text{ [m]}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit, for example, the size of a relevant angle found • Sine rule formula written <i>Mid Partial Credit:</i> • Some correct substitution into sine rule formula <i>High Partial Credit:</i> • Sine rule formula fully substituted <i>Full Credit (-1):</i> • Apply a * for no or incorrect rounding
(d) (i)	$\frac{225}{360} \times 2 \times \pi \times 50$ $= 196.3495 \dots$ $196.3495 \dots + 2(50)$ $= 296 \text{ [m]}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> • Work of merit, for example, a relevant formula or relevant addition <i>Mid Partial Credit:</i> • Some correct substitution <i>High Partial Credit:</i> • Length of arc found <i>Full Credit (-1):</i> • Apply a * for no or incorrect rounding
(d) (ii)	$k^2 = 2$ $k = \sqrt{2}$ $50 \times \sqrt{2}$ $= 70.7 \text{ [m]}$ OR $2 \left(\frac{225}{360} \right) \pi (50^2) = \left(\frac{225}{360} \right) (\pi) (r^2)$ $2(2500) = r^2$ $5000 = r^2$ $r = 70.71 \dots$ $r = 70.7 \text{ [m]}$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> • Work of merit, for example, a relevant formula <i>High Partial Credit:</i> • Correct equation formed <i>Full Credit (-1):</i> • Apply a * for no or incorrect rounding

Q9	Model Solution – 30 Marks	Marking Notes
(a) (i)	Mean: 10.2 Standard Deviation: $2.088 \dots = 2.1$	Scale 15C (0, 5, 10, 15) Accept correct answers without work <i>Low Partial Credit:</i> - Work of merit, for example, effort at calculating mean or a relevant formula <i>High Partial Credit:</i> - One correct answer <i>Full Credit (-1):</i> - Apply a * for incorrect rounding
(a) (ii)	5 is an outlier It is more than 2 standard deviations below the mean OR The range halves when 5 is excluded	Scale 5B (0, 2, 5) <i>Partial Credit:</i> Correct box ticked or range found
(b)	$17 - 14.2 = 2.8$ $\sigma = 2.8 \div 2 = 1.4$ $H = 17 + 2.8 = 19.8$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, some understanding of the empirical rule <i>High Partial Credit:</i> - One correct answer
(c) (i)	$= \frac{1}{\sqrt{540}}$ $= 4.3[\%]$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, $n = 540$ or formula $\left(\frac{1}{\sqrt{n}}\right)$ written <i>High Partial Credit:</i> - Formula fully substituted <i>Full Credit (-1):</i> - Apply a * for incorrect rounding

Q9	Model Solution – 30 Marks	Marking Notes
(c) (ii)	$\frac{350}{540} = 0.648148 \dots$ $= 65[\%]$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, $\frac{350}{540}$ or $\times 100$ <i>High Partial Credit:</i> $\frac{350}{540} \times 100$ or $0.6481 \dots$ <i>Full Credit (-1):</i> - Apply a * for incorrect rounding
(c) (iii)	$65\% \pm 4.3\%$ $60.7\% \leq p \leq 69.3\%$ Conclusion: The percentage has not changed Reason: 67% is between 60.7% and 69.3%	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit:</i> - Work of merit, for example, answer from (c)(i) or (c)(ii) written $\hat{p} \pm \frac{1}{\sqrt{n}}$ <i>High Partial Credit:</i> - Relevant boundary formed: $65 + 4.3$ but no conclusion and reason <i>Full Credit (-1):</i> - Either conclusion or reason missing or incorrect
(c) (iv)	Increase box ticked A larger sample reduces the margin of error Example, if 1000 people were surveyed the $\frac{1}{\sqrt{1000}} = 3.16\%$ $3.16\% < 4.3\%$	Scale 5B (0, 2, 5) <i>Partial Credit:</i> Work of merit, for example, correct box ticked or formula written

Q10	Model Solution – 30 Marks	Marking Notes
(a)	$\frac{1}{3}\pi(2.8)^2(13.4) + \frac{2}{3}\pi(2.8)^3$ $[110.014 \dots + 45.976 \dots]$ $= 155.99 \dots$ $= 156 \text{ [cm}^3\text{]}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, a relevant formula <i>High Partial Credit:</i> - Volume of cone OR hemisphere formulated <i>Full Credit (-1):</i> - Apply a * for incorrect rounding
(b) (i)	$\pi r^2 h = 393.4$ $\pi(3^2)(h) = 393.4$ $h = \frac{393.4}{9\pi}$ $h = 13.91 \dots$ $h \approx 13.9 \text{ cm}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> - Work of merit, for example, formula written <i>High Partial Credit:</i> - Equation set up <i>Full Credit (-1):</i> - Apply a * for incorrect rounding - Apply a * for no units
(b) (ii)	$2\pi(3.3)^2 + 2\pi(3.3)(11.5)$ $[68.42 \dots + 238.44 \dots]$ $306.87 \dots$ Difference: $318.6 - 306.87 = 11.72 \dots$ $\% \text{ increase} = \frac{11.72 \dots}{306.87 \dots} \times 100$ $= 3.82 \dots$ $3.8 \text{ [\%]}$	Scale 10D (0, 3, 5, 8, 10) <i>Low Partial Credit:</i> - Work of merit, for example, a relevant formula or $\times 100$ <i>Mid Partial Credit:</i> - Curved surface area OR area of circle formulated <i>High Partial Credit:</i> - Total surface area found <i>Full Credit (-1):</i> - Apply a * for incorrect rounding

Q10	Model Solution – 30 Marks	Marking Notes
(b) (iii)	Old: $62 \div 6.6 = 9.39, \text{ so } 9 \text{ across}$ $32 \div 6.6 = 4.8484, \text{ so } 4 \text{ deep}$ $9 \times 4 = 36 \text{ cans}$ New: $62 \div 6 = 10.33, \text{ so } 10 \text{ across}$ $32 \div 6 = 5.33, \text{ so } 5 \text{ deep}$ $10 \times 5 = 50 \text{ cans}$ $50 - 36 = 14 \text{ extra cans}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit:</i> • Work of merit, for example, a relevant diameter • Relevant work on diagram • Division of 62 or 32 <i>High Partial Credit:</i> • 36 OR 50 correctly found
(c)	$35 \text{ g} = 330 \text{ ml}$ $35 \times 70\% = 24.5 \text{ g in 2021}$ $24.5 \times 80\% = 19.6 \text{ g in 2025}$ $19.6 \text{ g} = 330 \text{ ml}$ $\frac{19.6}{330} = 1 \text{ ml}$ $500 \left(\frac{19.6}{330} \right) = 500 \text{ ml}$ $29.\dot{6}\dot{9}$ $= 29.7 \text{ [g] of sugar}$	Scale 10D (0, 3, 5, 8, 10) Three steps involved in solution: 1. Finds 70% of a relevant number 2. Finds 80% of a relevant number 3. Converts a sugar content from 330 ml to 500 ml <i>Low Partial Credit:</i> • Work of merit, for example, a relevant fraction, decimal or percentage written <i>Mid Partial Credit:</i> • One step correct <i>High Partial Credit:</i> • Two steps correct <i>Full Credit (-1):</i> • Apply a * for incorrect rounding

