



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2016

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.

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Paper 1

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, 5	0, 2, 5	0, 2, 4, 5	0, 2, 3, 4, 5
10-mark scale		0, 5, 10	0, 4, 8, 10	0, 4, 6, 8, 10
15-mark scale			0, 5, 10, 15	0, 5, 9, 12, 15
20-mark scale				0, 6, 11, 16, 20

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

A-scales (two categories)

- incorrect response (no credit)
- correct response (full credit)

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 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.

No marks may be awarded other than those on the appropriate scale, and *Full Credit –1*.

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.

Summary of mark allocations and scales to be applied

Question 1 (30)

- (a)(i)&(ii) 10C
- (b)(i)-(iv) 20D

Question 2 (30)

- (a) 10C
- (b)(i)&(ii) 10C
- (c) 10D

Question 3 (20)

- (a)&(b) 20D

Question 4 (20)

- (a)&(b) 20D

Question 5 (30)

- (a) 10C
- (b) 10B
- (c) 10C

Question 6 (20)

- (a)&(b) 15D
- (c) 5C

Question 7 (10)

- (a)-(c) 10D

Question 8 (15)

- (a)&(b) 15D

Question 9 (25)

- (a)&(b) 10B
- (c)&(d) 10C
- (e) 5B

Question 10 (5)

- (a)-(c) 5D

Question 11 (15)

15D

Question 12 (30)

- (a) 15D
- (b) 15C

Question 13 (20)

- (a)&(b) 10C
- (c)&(d) 10C

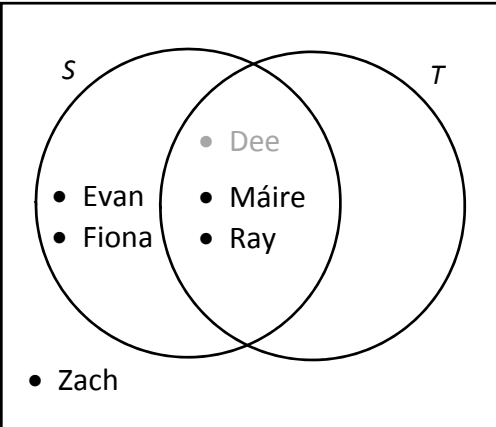
Question 14 (30)

- (a)(i)&(ii) 15D
- (b) 15C

Model Solutions and 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)&(ii)	(i) 999 999 (ii) 100 000	Scale 10C (0, 4, 8, 10) Accept correct answers without work <i>Low Partial Credit</i> <ul style="list-style-type: none"> Any 6-digit number <i>High Partial Credit</i> <ul style="list-style-type: none"> One part correct 6-digit numbers with correct first digit in (i) and (ii)
(b)(i)-(iv)	(i) 11 (ii) 25 (iii) 32 (iv) 7	Scale 20D (0, 6, 11, 16, 20) Accept correct answers without work <i>Low Partial Credit</i> <ul style="list-style-type: none"> One part correct Work of merit, e.g. finds 1st difference <i>Mid Partial Credit</i> <ul style="list-style-type: none"> Two parts correct <i>High Partial Credit</i> <ul style="list-style-type: none"> Three parts correct

Q2	Model Solution – 30 Marks	Marking Notes																		
(a)	<p style="text-align: center;">U</p> 	<p>Scale 10C (0, 4, 8, 10)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One or two correct entries <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Three correct entries 																		
(b)(i)&(ii)	<p>(i) Dee, Máire, Ray</p> <p>(ii) Zach</p>	<p>Scale 10C (0, 4, 8, 10)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct element <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct 																		
(c)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Statement</th> <th style="padding: 5px;">True</th> <th style="padding: 5px;">False</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">$\# S = 3$</td> <td style="padding: 5px;"></td> <td style="padding: 5px;">✓</td> </tr> <tr> <td style="padding: 5px;">$Dee \in T$</td> <td style="padding: 5px;">✓</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">$S \cup T = T \cup S$</td> <td style="padding: 5px;">✓</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">$T \subset S$</td> <td style="padding: 5px;">✓</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">$S \setminus T = \{\}$</td> <td style="padding: 5px;"></td> <td style="padding: 5px;">✓</td> </tr> </tbody> </table>	Statement	True	False	$\# S = 3$		✓	$Dee \in T$	✓		$S \cup T = T \cup S$	✓		$T \subset S$	✓		$S \setminus T = \{\}$		✓	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answer without work</p> <p>If a candidate ticks both True and False for a statement without clearly indicating which is the final answer, consider it to be incorrect</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 part correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • 3 parts correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 4 parts correct
Statement	True	False																		
$\# S = 3$		✓																		
$Dee \in T$	✓																			
$S \cup T = T \cup S$	✓																			
$T \subset S$	✓																			
$S \setminus T = \{\}$		✓																		

Q3	Model Solution – 20 Marks	Marking Notes
(a)&(b)	(a)(i) 3 (a)(ii) 2 (b) right-hand box: 4 (b) left-hand box: 8	<p>Scale 20D (0, 6, 11, 16, 20)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (a) or (b) E.g. finds a value with x and y swapped (i.e. (a)(i) = 6, (a)(ii) = 0, (b) right-hand box = 10, or (b) left-hand box = 3·5); or indicates relevant point on graph (i.e. (4,3), (2,1), (6,4), or (8,5)) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • 1 value correct (out of the 4) • Work of merit in (a) and (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 values correct (out of the 4)

Q4	Model Solution – 20 Marks	Marking Notes
(a)&(b)	(a) $0.2 \times 2450 = \text{€}490$ (b) $2450 - (490 - 275)$ $= 2450 - 215$ $= \text{€}2235$	<p>Scale 20D (0, 6, 11, 16, 20)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part E.g. in (a) mentions 100, 0·2, or similar E.g. in (b) subtracts tax credit, or subtracts some figure from gross income <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part

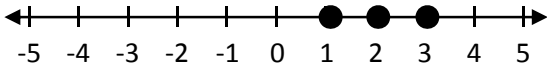
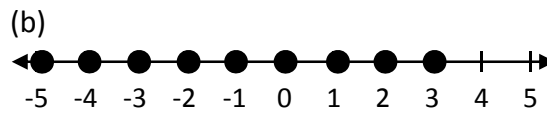
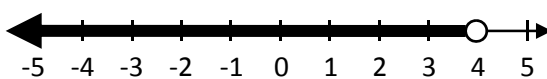
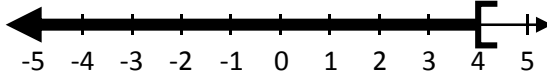
Q5	Model Solution – 30 Marks	Marking Notes
(a)	$40 + (3 \times 30)$ $= \text{€}130$	<p>Scale 10C (0, 4, 8, 10)</p> <p>Accept correct answer without work Accept correct answer without € sign</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Mentions 3 hours • Adds €40 to something • Multiplies €30 by something <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Mostly correct but uses incorrect time (eg. 2:45) or swops 30 and 40
(b)	$24.83 \div 0.71$ $= 34.9718\dots$ $= \text{€}34.97 \text{ (2 DP)}$	<p>Scale 10B (0, 5, 10)</p> <p>Accept correct answer without work Accept correct answer without € sign</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> • Multiplies by 0.71 or divides by 24.83 <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Correct answer with incorrect or no rounding
(c)	$\frac{75.90}{330} \times 100 = 23\%$	<p>Scale 10C (0, 4, 8, 10)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Some relevant work, e.g. uses 100, inverted fraction, adds VAT to €330, etc. <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • $\frac{75.90}{330}$ or 0.23 or equivalent • 77%

Q6	Model Solution – 20 Marks	Marking Notes
(a)&(b)	<p>(a) $3.60 \div 2 = \text{€}1.80$</p> <p>(b) Brand A is cheaper per litre</p> <p><i>Calculation:</i></p> <p>B: $1.50 \div 0.75 = \text{€}2$</p> <p style="text-align: center;">OR</p> <p>A: $1.80 \times 0.75 = \text{€}1.35$</p> <p><i>or any other valid calculation(s) that allow a price per litre comparison</i></p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>In (a), accept correct answer without work</p> <p>In (b), correct answer without supporting work is considered work of merit (not correct).</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in the other part <p><i>Full Credit – 1</i></p> <ul style="list-style-type: none"> • Calculations fully correct but cheaper brand not clearly indicated
(c)	<p>Lowest price = $\text{€}9.60$</p> <p>Combination 1: $3 \times 2\text{L} = 3 \times 3.60 = \text{€}10.80$</p> <p>Combination 2: $(2 \times 2\text{L}) + (2 \times 0.75\text{L})$ $= (2 \times 3.60) + (2 \times 1.50) = \text{€}10.20$</p> <p>Combination 3: $(1 \times 2\text{L}) + (4 \times 0.75\text{L})$ $= (1 \times 3.60) + (4 \times 1.50) = \text{€}9.60$</p> <p>Combination 4: $7 \times 0.75\text{L} = 7 \times 1.50 = \text{€}10.50$</p>	<p>Scale 5C (0, 2, 4, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Some attempt at combining quantities to make up at least 5 litres • Uses price per litre from (a) or (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Correct total for any combination making up at least 5 litres • Correct answer with no work <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • $\text{€}9.60$ as answer, with price of 1 other relevant combination calculated • All 4 possible totals calculated, cheapest not selected

Q7	Model Solution – 10 Marks	Marking Notes
(a)-(c)	(a) 89270 (b) 89000 (c) 8.93×10^4	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in 1 part: In (a): answers 89 260, 89 300, or 89 000 In (b): answers 90 000 or 89 300 In (c): incorrect relevant answer in the correct format <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • 1 part correct • Work of merit in 2 parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 parts correct • 1 part correct and work of merit in other 2 parts

Q8	Model Solution – 15 Marks	Marking Notes
(a)&(b)	(a) $x(2x - 1) + 9(2x - 1)$ $= 2x^2 - x + 18x - 9$ $= 2x^2 + 17x - 9$ (b) $a(3x + y) + c(3x + y)$ $= (3x + y)(a + c)$ <p style="text-align: center;">OR</p> $3x(a + c) + y(a + c)$ $= (a + c)(3x + y)$	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>In (a), accept correct answer without work</p> <p>In (b), correct answer without supporting work is considered substantial work (not correct)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, e.g. in (a) sets up multiplication (including 2 arrows), or any correct relevant multiplication (including sign); in (b) indication of grouping of relevant terms <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • Substantial work in (a) or (b), e.g. in (a) 3 terms correctly multiplied with correct signs, or all 4 terms correct in absolute value; in (b) one common factor correctly taken out of each pair, or correct answer with no supporting work <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Substantial work in one part and work of merit in the other

Q9	Model Solution – 25 Marks	Marking Notes
(a)&(b)	(a) 30 m (b) 25 m	Scale 10B (0, 5, 10) Accept correct answer without work <i>Partial Credit</i> • (a) or (b) correct <i>Full Credit –1</i> • Correct answers for (a) & (b) swapped
(c)&(d)	(c) 10 seconds (d) $\frac{\text{Distance}}{\text{Time}} = \frac{25}{10} = 2.5 \text{ m/s}$ or $\frac{5}{2} \text{ m/s}$	Scale 10C (0, 4, 8, 10) Accept correct answer without work Accept correct answer without unit in (d) <i>Low Partial Credit</i> • Part (c) correct • Work of merit in part (d) <i>High Partial Credit</i> • Part (d) correct • Part (c) correct and work of merit in (d) <i>Full Credit –1</i> • $\frac{25}{10}$
(e)	<i>Answer:</i> No <i>Reason:</i> The graph does not go in a straight line or any other valid reason	Scale 5B (0, 2, 5) <i>Partial Credit</i> • Correct answer, incorrect or no reason • Incorrect or no answer, correct reason

Q10	Model Solution – 5 Marks	Marking Notes
(a)-(c)	(a)  (b)  (c)  OR 	Scale 5D (0, 2, 3, 4, 5) Accept 0 as an element in (a) Accept correct answer without work <i>Low Partial Credit</i> • Any correct element in any part <i>Mid Partial Credit</i> • One part correct <i>High Partial Credit</i> • Two parts correct <i>Full Credit – 1</i> • 4 included in one or more solutions, otherwise fully correct

Q11	Model Solution – 15 Marks	Marking Notes
	<p>Row 2: 2^5</p> <p>Row 3: 2^6</p> <p>Row 4: $2^{7+10} = 2^{17}$</p> <p>Row 5: $2^{4 \times 6} = 2^{24}$</p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part e.g. expansion such as $32 = 2 \times 2 \times 2 \times 2 \times 2$, or one relevant formula <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Two parts correct • Work of merit in three parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Three parts correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Misreading: Correct powers given instead of numbers in form 2^p, i.e. 5, 6, 17, 24

Q12	Model Solution – 30 Marks	Marking Notes
(a)	<p>Row 3: $J + 5$</p> <p>Row 4: $J - 4$</p> <p>Row 5: $2 \times J$ OR $2J$</p> <p>Row 6: $\frac{1}{3} \times J$ OR $J \div 3$ OR $\frac{J}{3}$</p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in one part, e.g. shows operation described (+5, -4, etc.) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Two parts correct • Work of merit in 3 parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Three parts correct • Work of merit in all 4 parts
(b)	$5M - 2M = 35 - 2$ $\Rightarrow 3M = 33$ $\Rightarrow M = 11$	<p>Scale 15C (0, 5, 10, 15)</p> <p>Note: 5 operations are needed to complete the question algebraically: 2 transpositions, 2 subtractions, and 1 division.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 correct relevant operation • Substitutes a value in for M <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 3 correct relevant operations • Correct answer with no supporting work • Substitutes a number of values in for M, including 11, but answer not indicated, or both sides not fully worked out in case of $M = 11$

Q13	Model Solution – 20 Marks	Marking Notes
(a)&(b)	<p>(a) $f(x)$ is the straight line. $h(x)$ is the curve.</p> <p>(b) <i>Function: $f(x)$</i> <i>Reason: There's no x^2 term</i> or any other valid reason</p> <p style="text-align: center;">OR</p> <p><i>Function: $h(x)$</i> <i>Reason: It has an x^2 term</i> or any other valid reason</p>	<p>Scale 10C (0, 4, 8, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (a) or (b), e.g. in (a): 1 answer correct in (b): mentions linear, straight, curved and/or quadratic, or similar <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (a) or (b) correct. In (b), accept answer of $f(x)$ and reference to e.g. it being straight / linear, or to point on line; or answer of $h(x)$ and reference to e.g. it being quadratic / curved, or to point on curve
(c)&(d)	<p>(c) -0.45</p> <p>(d) $8^2 - 24 - 1$ $= 64 - 24 - 1 = 39$</p>	<p>Scale 10C (0, 4, 8, 10)</p> <p>Accept correct answer without work</p> <p>In (c), accept answer from -0.3 to -0.5, inclusive</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (c) or (d), e.g. in (c): indicates correct point on graph, or indicates answer from y-axis; in (d): any correct substitution <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (c) correct and work of merit in (d) • (d) correct

Q14	Model Solution – 30 Marks	Marking Notes
(a) (i)&(ii)	(i) $(x + 7)(x - 1)$ (ii) $x + 7 = 0$ $\Rightarrow x = -7$ AND $x - 1 = 0$ $\Rightarrow x = 1$	Scale 15D (0, 5, 9, 12, 15) Accept correct answers without additional supporting work <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Work of merit in (i) or (ii), e.g. In (i): Correct factorising of x^2 or 7, ignoring signs In (ii): Puts answer(s) from (i) = 0, or substitutes in a value for x, or quadratic formula. <i>Mid Partial Credit</i> <ul style="list-style-type: none"> • (i) or (ii) correct • Work of merit in both parts <i>High Partial Credit</i> <ul style="list-style-type: none"> • One part correct and work of merit in the other part
(b)	Equation 1 – Equation 2: $2x = 14$ $\Rightarrow x = 7$ Equation 2: $7 + 2y = 25$ $\Rightarrow 2y = 25 - 7 = 18$ $\Rightarrow y = 9$	Scale 15C (0, 5, 10, 15) Accept solution by inspection, or by trial and improvement, if it is verified for both equations <i>Low Partial Credit</i> <ul style="list-style-type: none"> • One correct operation • Substitution of incorrect solution into both equations <i>High Partial Credit</i> <ul style="list-style-type: none"> • One correct solution for x or y, by algebra • x and y correct, with no supporting work • Finds x incorrectly by algebra, finishes correctly to find y

Paper 2

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:

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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.

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- incorrect response (no credit)
- correct response (full credit)

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- 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 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.

No marks may be awarded other than those on the appropriate scale, and *Full Credit –1*.

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.

Summary of mark allocations and scales to be applied

Question 1 (25)

(a)&(b) 15D
(c)&(d) 10C

Question 5 (25)

(a)&(b) 20D
(c) 5A

Question 8 (15)

(a) 10C
(b) 5C

Question 2 (20)

(a)&(b) 10D
(c)&(d) 10D

Question 6 (40)

(a) 10C
(b) 10C
(c) 20C

Question 9 (30)

(a)&(b) 10D
(c)&(d) 15D
(e) 5C

Question 3 (35)

(a)&(b) 20D
(c) 10C
(d) 5B

Question 7 (35)

(a) 5B
(b) 10C
(c) 10C
(d) 10C

Question 10 (30)

(a) 10C
(b)(i) 15D
(b)(ii) 5B

Question 4 (20)

(a) 10C
(b) 10C

Question 11 (25)

(a)(i)&(ii) 10C
(a)(iii)&(iv) 5C
(b) 10C

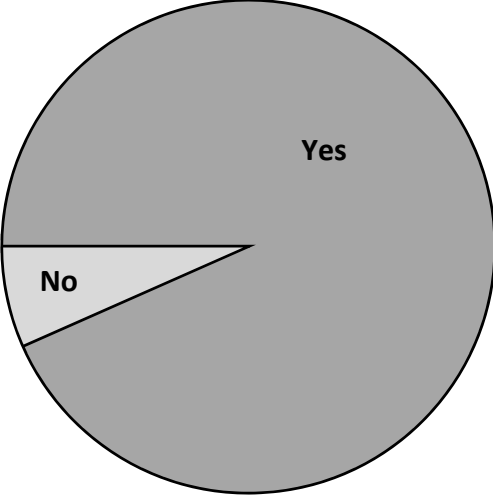
Model Solutions and Marking Notes

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 – 25 Marks	Marking Notes										
(a)&(b)	<p>(a) 18</p> <p>(b)</p> <table border="1"> <tr> <td>Size</td> <td>S</td> <td>M</td> <td>L</td> <td>XL</td> </tr> <tr> <td>Freq</td> <td>3</td> <td>7</td> <td>6</td> <td>2</td> </tr> </table>	Size	S	M	L	XL	Freq	3	7	6	2	<p>Scale 15D (0, 4, 8, 12, 15)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 or 2 correct frequencies in (b) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • (a) correct or 3 correct frequencies in (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (b) correct • (a) correct and 2 correct frequencies in (b)
Size	S	M	L	XL								
Freq	3	7	6	2								
(c)&(d)	<p>(c) $\frac{6}{18}$ or $\frac{1}{3}$ or 0.333...</p> <p>(d) $\frac{3}{17}$ or 0.176...</p>	<p>Scale 10C (0, 4, 7, 10)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Numerator or denominator correct in one part of unsimplified fraction <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct 										

Q2	Model Solution – 20 Marks	Marking Notes
(a)&(b)	<p>(a) No number happens more than once <i>or any other valid reason</i></p> <p>(b) 3, 7, 19, 23, 31 <i>or any sample from the table where 19 is the median</i></p>	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>In (b), the order of entries in the boxes does not matter</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in 1 part, e.g. In (a): shows understanding of mode; In (b): shows understanding of median, or list including 19 given <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • 1 part fully correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (a) correct and list from the table including 19 given in (b) • (b) correct and work of merit in (a)

Q2	Model Solution – 20 Marks	Marking Notes
(c)&(d)	<p>(c)</p> <p>Sample: 2, 13, 17, 23, 37 <i>or any sample from the table including 2 and 37</i></p> <p>Range: $37 - 2 = 35$</p> <p>(d)</p> <p>Sample: 2, 3, 5, 7, 11</p> <p>Mean: $\frac{2+3+5+7+11}{5}$</p> $= \frac{28}{5} \text{ or } 5\frac{3}{5} \text{ or } 5.6$	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answers without work</p> <p>The order of entries in the boxes does not matter</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> 1 part half correct, i.e. sample or value correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> 1 part fully correct Both parts half correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> 1 part fully correct and other part half correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> Range as interval instead of value, otherwise fully correct

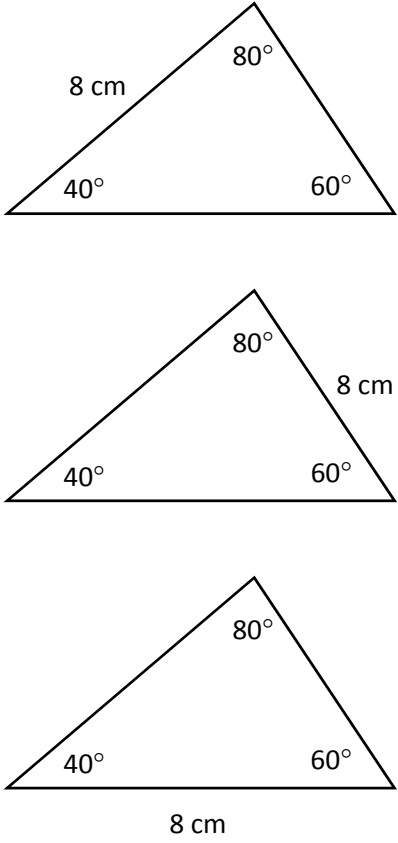
Q3	Model Solution – 35 Marks	Marking Notes
(a)&(b)	<p>(a) Angle No: $\frac{20}{300} \times 360 = 24^\circ$</p> <p>$\Rightarrow$ Angle Yes: $360 - 24 = 336^\circ$</p>  <p>(b) Data: Categorical Reason: They are not numbers <i>or any other valid reason</i></p>	<p>Scale 20D (0, 9, 12, 16, 20)</p> <p>An angle tolerance of 3° applies</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> Work of merit in (a) or (b), e.g. in (a) mentions 360°, relevant fraction in (b) data type or reason correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> Angle correctly calculated or drawn in (a) (b) correct Work of merit in (a) and (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> (a) correct (including calculation for one angle shown) (b) correct and angle correctly calculated or drawn in (a) <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> All correct, except no labels on diagram or incorrect labelling

Q3	Model Solution – 35 Marks	Marking Notes
(c)	(i) No angle: 50° Yes angle: 310° (ii) # No: $\frac{50}{360} \times 72 = 10$ # Yes: $72 - 10 = 62$	Scale 10C (0, 4, 7, 10) Accept correct answers without work An angle tolerance of 3° applies <i>Low Partial Credit</i> <ul style="list-style-type: none"> • 1 angle correct in (i) • Work of merit in (ii) <i>High Partial Credit</i> <ul style="list-style-type: none"> • One part correct • Work of merit in (i) and (ii) <i>Full Credit –1</i> <ul style="list-style-type: none"> • Yes and No values swapped, but otherwise correct
(d)	More reliable: Company A Reason: They asked more people <i>or any other valid reason</i>	Scale 5B (0, 2, 5) <i>Partial Credit</i> <ul style="list-style-type: none"> • Picks correct company • Work of merit in reason

Q4	Model Solution – 20 Marks	Marking Notes
(a)	$9 \times 14 = 126 \text{ cm}^2$	Scale 10C (0, 4, 7, 10) Accept correct answer without work <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Correct area formula • Some work with screen or eReader measurements, e.g. finds perimeter <i>High Partial Credit</i> <ul style="list-style-type: none"> • Finds area of front of eReader <i>Full Credit –1</i> <ul style="list-style-type: none"> • Correct answer with no / incorrect unit
(b)	Answer: No Justification: $\frac{126}{16 \times 11} = \frac{126}{176} = 0.7159... = 71.59...% < 80\%$ <p style="text-align: center;">OR</p> $80\% \text{ of } (11 \times 16) = 140.8 > 126 \text{ (ans (a))}$ <p style="text-align: center;">OR</p> $\frac{100}{80} \times 126 = 157.5 < 11 \times 16 = 176$	Scale 10C (0, 4, 7, 10) Accept 0.7159 or 140.8 or similar as correct justification <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Answer correct • Work of merit in justification <i>High Partial Credit</i> <ul style="list-style-type: none"> • Answer correct and work of merit in justification • Justification fully correct but incorrect / no answer

Q5	Model Solution – 25 Marks	Marking Notes
(a)&(b)	<p>(a) <i>Line 2:</i> 0.55 <i>Line 3:</i> 40</p> <p>(b) <i>In m³:</i> $1.5 \times 0.55 \times 0.4 = 0.33 \text{ m}^3$</p> <p><i>In cm³:</i> $150 \times 55 \times 40 = 330\,000 \text{ cm}^3$</p>	<p>Scale 20D (0, 9, 12, 16, 20)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (a) or (b), e.g. in (a), work of merit in conversion; in (b), volume formula correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (a) and (b) • (a) or (b) correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 1 part correct and work of merit in other part <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • All correct, except for no / incorrect unit in (b) • Table correct, and $1.5 \times 0.55 \times 0.4$ or $150 \times 55 \times 40$ evaluated incorrectly or not evaluated
(c)	<p>The bath is not exactly a rectangular box</p> <p style="text-align: center;">OR</p> <p>The measurements might not be totally accurate <i>or any other valid reason</i></p>	<p>Scale 5A (0, 5)</p>

Q6	Model Solution – 40 Marks	Marking Notes
(a)	$180 - (40 + 60)$ $= 180 - 100$ $= 80^\circ$	<p>Scale 10C (0, 4, 7, 10)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Any relevant step , e.g. mention of 180° <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Relevant use of 180° • Indicates 3 angles sum to 180°

Q6	Model Solution – 40 Marks	Marking Notes
(b)	 <p>The diagram shows three triangles, each with interior angles of 40°, 60°, and 80°. The first triangle has a side of 8 cm opposite the 80° angle. The second triangle has a side of 8 cm opposite the 40° angle. The third triangle has a side of 8 cm opposite the 60° angle.</p>	<p>Scale 10C (0, 4, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Sketch of a triangle <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Sketch of a triangle with two correct values (angle or side)
(c)	<p>Appropriate triangle constructed accurately.</p>	<p>Scale 20C (0, 10, 15, 20)</p> <p>Tolerance: 2 angles correct within 3°, and 1 side within 2 mm of 8 cm.</p> <p>Accept correct answer without construction lines.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Any triangle constructed <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Triangle constructed with 2 correct angles • Triangle constructed with 1 correct angle and correct side <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Constructs correct triangle that is different to that sketched in (b)

Q7	Model Solution – 35 Marks	Marking Notes
(a)	$r = 6 \div 2 = 3 \text{ m}$	<p>Scale 5B (0, 2, 5)</p> <p>Accept correct answer without work.</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Answer correct, but no / incorrect unit
(b)	$\begin{aligned} & 2 \pi r \\ = & 2 \pi (3) \\ = & 6 \pi \\ = & 18.8... \\ = & 19 \text{ m [nearest m]} \end{aligned}$	<p>Scale 10C (0, 4, 7, 10)</p> <p>Accept correct answer without unit</p> <p>The same work in (a) and (b) can only be given credit in one part</p> <p>If a candidate correctly finds the area in (b) and the perimeter in (c), award <i>High Partial Credit</i> in (b) and <i>Full Credit</i> in (c)</p> <p>Consider solution as requiring 3 steps:</p> <p>Step 1: Correct formula</p> <p>Step 2: Substitution of r into formula</p> <p>Step 3: Evaluates answer</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 step correct • Product of two relevant numbers <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 correct steps <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Perimeter found but given in terms of π, or in decimal form but not correct to nearest metre

Q7	Model Solution – 35 Marks	Marking Notes
(c)	πr^2 $= \pi (3^2)$ $= 9\pi$ $= 28.27\dots$ $= 28.3 \text{ m}^2 \text{ [1 DP]}$	<p>Scale 10C (0, 4, 7, 10)</p> <p>Accept correct answer without unit</p> <p>The same work in (a) and (b) can only be given credit in one part</p> <p>If a candidate correctly finds the area in (b) and the perimeter in (c), award <i>High Partial Credit</i> in (b) and <i>Full Credit</i> in (c)</p> <p>Consider solution as requiring 3 steps:</p> <p>Step 1: Correct formula</p> <p>Step 2: Substitution of r into formula</p> <p>Step 3: Evaluates answer</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 step correct • Relevant number squared <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 steps correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Area found but given in terms of π, or in decimal form but not correct to one decimal place.
(d)	<p><i>Time</i> : 15 mins</p> <p><i>Speed</i> :</p> $1 \text{ min} = \frac{25}{15} \text{ km}$ $60 \text{ min} = 60 \times \frac{25}{15} = 100 \text{ km/hr}$ <p style="text-align: center;">OR</p> <p><i>Time</i> : 15 mins = 0.25 hours</p> <p><i>Speed</i> : $\frac{\text{Distance}}{\text{Time}} = \frac{25}{0.25} = 100 \text{ km/hr}$</p> <p style="text-align: center;">OR</p> <p><i>Time</i> : 15 mins</p> <p><i>Speed</i> : $25 \times 4 = 100 \text{ km/hr}$</p>	<p>Scale 10C (0, 4, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Some attempt at calculating time • Correct speed formula <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Time correct and formula correct using any relevant units, e.g. $\frac{25}{15}$

Q8	Model Solution –15 Marks	Marking Notes
(a)	$0: t$ $1: p$ $-1: k$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit</i> <ul style="list-style-type: none"> • 1 correct <i>High Partial Credit</i> <ul style="list-style-type: none"> • 2 correct
(b)	$y = 3x + 5$ OR $y - 5 = 3(x - 0)$ $\Rightarrow y - 5 = 3x$ $\Rightarrow y = 3x + 5$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit</i> <ul style="list-style-type: none"> • m or c correctly identified • Correct equation of line formula (other than the one given) • Substitutes $x = 0$ or $y = 5$ • Substitutes $x = 5$ and $y = 0$ <i>High Partial Credit</i> <ul style="list-style-type: none"> • Correct equation not in correct format, e.g. $y - 5 = 3(x - 0)$

Q9	Model Solution – 30 Marks	Marking Notes
(a)&(b)	(a) $A(5, 1)$ $B(3, 4)$ (b) $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ $= \left(\frac{5+3}{2}, \frac{1+4}{2}\right)$ $= (4, 2.5)$	Scale 10D (0, 4, 6, 8, 10) Accept correct answer without work <i>Low Partial Credit</i> <ul style="list-style-type: none"> • 1 ordinate correct • Mid-point formula correct or mid-point marked on diagram but not written down • 1 point correct with co-ordinates reversed <i>Mid Partial Credit</i> <ul style="list-style-type: none"> • Part (a) correct or part (b) correct • Work of merit in both parts <i>High Partial Credit</i> <ul style="list-style-type: none"> • One part correct and work of merit in other part • All 3 points correct, with co-ordinates reversed <i>Full Credit –1</i> <ul style="list-style-type: none"> • Leaves x-ordinate as $\frac{8}{2}$ in (b), otherwise fully correct • One ordinate in (a) incorrect, otherwise fully correct

Q9	Model Solution – 30 Marks	Marking Notes
(c)&(d)	<p>(c) $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(3 - 5)^2 + (4 - 1)^2}$ $= \sqrt{(-2)^2 + (3)^2}$ $= \sqrt{13}$ [units]</p> <p>(d) $\frac{1}{2} \times \text{base} \times \text{height}$ $= \frac{1}{2} \times 4 \times 3$ $= 6$ [square units]</p>	<p>Scale 15D (0, 4, 8, 12, 15)</p> <p>Accept correct answers without units</p> <p>In (d), accept correct answer without work</p> <p>In (c), correct answer without work is considered substantial work (not correct)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, eg. Correct formula, or length of base or height identified <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • Substantial work in 1 part, e.g. in (c): correctly fills in formula, or fills formula incorrectly but finishes correctly, or correct answer without work; in (d): correctly fills in formula, or finds correct area of rectangle (4 × 3) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 1 part correct • Substantial work in 1 part and work of merit in the other part
(e)	<p>Triangle drawn with vertices (5, 5), (7,2), and (9, 5)</p>	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answer without construction lines</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Shows understanding of central symmetry, e.g. draws line from 1 vertex through <i>D</i> • Draws a different transformation correctly, e.g. translation <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 1 image point correctly plotted • 2 or 3 image points worked out correctly <p><i>Full Credit – 1</i></p> <ul style="list-style-type: none"> • Three points correctly transformed but not joined • Central symmetry correct in point other than <i>D</i>

Q10	Model Solution – 30 Marks	Marking Notes
(a)	$ \angle K = 110^\circ$ $ \angle L = 30^\circ$	<p>Scale 10C (0, 4, 7, 10)</p> <p>Accept correct answers without work. Answers may be in diagram.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> Some relevant calculation with given angles, e.g. $30^\circ + 40^\circ$ Reference to vertically opposite or alternate angles <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> $\angle K$ or $\angle L$ correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> $\angle K = 30^\circ$ and $\angle L = 110^\circ$
(b)(i)	<ol style="list-style-type: none"> Always true Never true Always true Sometimes true 	<p>Scale 15D (0, 4, 8, 12, 15)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> 1 part correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> 2 parts correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> 3 parts correct
(b)(ii)	<p>The sum of the angles in a rectangle is 360°</p> <p style="text-align: center;">OR</p> <p>The sum of the angles in a triangle is 180°, and a rectangle is made up of 2 triangles</p> <p style="text-align: center;"><i>or any other valid justification</i></p>	<p>Scale 5B (0, 2, 5)</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> Some work of merit in justification

Q11	Model Solution – 25 Marks	Marking Notes
(a)(i)&(ii)	(i) 260 (ii) $\frac{20}{260}$ or $\frac{1}{13}$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit</i> <ul style="list-style-type: none"> Part (i) correct Work of merit in (ii) e.g. Numerator or denominator correct in unsimplified fraction, or fraction inverted <i>High Partial Credit</i> <ul style="list-style-type: none"> (ii) correct <i>Full Credit –1</i> <ul style="list-style-type: none"> 0.0769
(a)(iii)&(iv)	(iii) $A = \tan^{-1}\left(\frac{1}{13}\right)$ $= 4.39\dots$ $= 4^\circ$ [nearest degree] (iv) <i>Answer:</i> Yes <i>Reason:</i> The angle is less than 5°	Scale 5C (0, 2, 3, 5) Accept correct answer in (iii) without unit <i>Low Partial Credit</i> <ul style="list-style-type: none"> Part (iv) correct with supporting work, e.g. some angle found for (iii), or angle in diagram measured to 13°, 14° or 15° Work of merit in part (iii) <i>High Partial Credit</i> <ul style="list-style-type: none"> Part (iii) correct <i>Full Credit –1</i> <ul style="list-style-type: none"> Calculator in incorrect mode, otherwise fully correct Answer in (iii) not rounded correct to the nearest degree, otherwise correct
(b)	$x^2 + 224^2 = 226^2$ $\Rightarrow x^2 + 50\,176 = 51\,076$ $\Rightarrow x^2 = 51\,076 - 50\,176 = 900$ $\Rightarrow x = \sqrt{900}$ $= 30$	Scale 10C (0, 4, 7, 10) <i>Low Partial Credit</i> <ul style="list-style-type: none"> Indicates squaring of any relevant term Theorem of Pythagoras correctly stated Finds 101 252 <i>High Partial Credit</i> <ul style="list-style-type: none"> Terms squared correctly in correct theorem Solves $x^2 = 224^2 + 226^2$, i.e. $x = \sqrt{101252} = 318.2 \dots$ Correct answer without work <i>Full Credit –1</i> <ul style="list-style-type: none"> Leaves answer as $\sqrt{900}$

Marcanna breise as ucht freagairt trí Ghaeilge

Léiríonn an tábla thíos an méid marcanna breise ba chóir a bhronnadh ar iarrthóirí a ghnóthaíonn níos mó ná 75% d'iomlán na marcanna.

N.B. Ba chóir marcanna de réir an ghnáthrata a bhronnadh ar iarrthóirí nach ghnóthaíonn níos mó ná 75% d'iomlán na marcanna don scrúdú. Ba chóir freisin an marc bóonais sin **a shlánú síos**.

Tábla 300 @ 5%

Bain úsáid as an tábla seo i gcás na n-ábhar a bhfuil 300 marc san iomlán ag gabháil leo agus inarb é 5% gnáthrata an bhónais.

Bain úsáid as an ngnáthrata i gcás 225 marc agus faoina bhun sin. Os cionn an mharc sin, féach an tábla thíos.

Bunmharc	Marc Bónais
226	11
227 - 233	10
234 - 240	9
241 - 246	8
247 - 253	7
254 - 260	6

Bunmharc	Marc Bónais
261 - 266	5
267 - 273	4
274 - 280	3
281 - 286	2
287 - 293	1
294 - 300	0