Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Cycle 2024

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.

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 on this examination paper 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, 3, 5	0, 2, 3, 4, 5
10-mark scale		0, 6, 10	0, 3 , 8 , 10	0, 3, 6, 9, 10
15-mark scale		0, 10, 15	0, 3, 10, 15	0, 3 , 9, 13 , 15
20 – mark scale			0 , 7 , 13 , 20	0,5,10,15,20

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)	20D
(b)	10C

Question 2 (35)

(a)	15D
(b)	10D
(c)	10D

Question 3 (25)

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

Question 4 (20)

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

Question 5 (5)

5C

Question 6 (15)

15D

Question 7 (5)

5C

Question 8 (60)

(a)	20C
(b)(i)(ii)(iii)	10D
(b)(iv)	5B
(c)(i)(ii)(iii)	15D
(c)(iv)	10B

Question 9 (20)

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

Question 10 (20)

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

Question 11 (30)

(a)	15C
(b)	10C
(c)	5C

Question 12 (5)

(a)(b)(c) 5D

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.

Where "work of merit" is referred to in the marking notes, example(s) are given to demonstrate the standard of work to be considered work of merit in that particular question.

<table>
<tr><th>Q1</th><th>Model Solution – 30 Marks</th><th>Marking Notes</th></tr>
<tr><td>(a)
(i)(ii)
&(iii)</td><td>(i) 931

(ii) $\frac{144}{5}$ or $28{\cdot}8$

(iii) $32 \div (2)^2 = 32 \div 4 = 8$</td><td>Scale 20D (0, 5 , 10, 15 , 20)
Accept correct answer without work
Low Partial Credit:
• Work of merit in any one part e.g. 7-5=2 in part (iii)

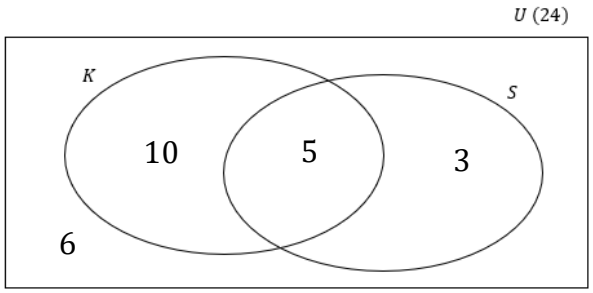
Mid Partial Credit:
• One part correct and work of merit in another part.

High Partial Credit:
• Part (i) and (ii) correct OR Part (iii) correct</td></tr>
<tr><td>(b)
(i)(ii)</td><td>(i)
<table><tr><td>12</td><td>1, 2, 3, 4, 6, 12</td></tr><tr><td>16</td><td>1, 2, 4, 8, 16</td></tr></table>(ii) 4 ticked as HCF</td><td>Scale 10C (0, 3 , 8 , 10)
Low Partial Credit:
• Any one correct factor.

High Partial Credit:
• Part (i) or (ii) correct.</td></tr>
</table>

Q2	Model Solution – 35 Marks	Marking Notes
(a) **(i)(ii)**	(i) Total sum $= €2{\cdot}49 + €1{\cdot}19 + €0{\cdot}99 + €1{\cdot}15 + €2{\cdot}55 = €8{\cdot}37$ (ii) $€50 + €20 + €20 = €90$ Change $= €90 - €72{\cdot}63 = €17{\cdot}37$	**Scale 15D (0, 3 , 9 , 13 , 15)** **Accept correct answers without work** *Low Partial Credit:* • Work of merit in either (i) or (ii) e.g. in (i) 2.49 + 1.19 or similar or 50 + 20 in (ii) *Mid Partial Credit :* Work of merit in both parts *High Partial Credit:* • One part correct. *Full Credit (-1)* 837÷100 or 837 in (i) or 173700÷100 or1737 in (ii)
(b)	(b) (i) Hours worked $= 7 + 8 = 15$ Basic pay $= €18 \times 15 = €270$ (ii) Pay per hour $= €18 \times 1{\cdot}5 = €27$ Total pay $= €27 \times 6 = €162$	**Scale 10D (0, 3, 6, 9, 10)** **Accept correct answers without work** *Low Partial Credit:* • Work of merit in one part , e.g. 7+8 or 7 × 18 or 8 × 18 in (i) or 18 × 0.5 or 18 × 1.5 or equivalent in (ii) or 9 without work in (ii) *Mid Partial Credit:* • One part correct. • Work of merit in both parts *High Partial Credit:* • One part correct and work of merit in the other part

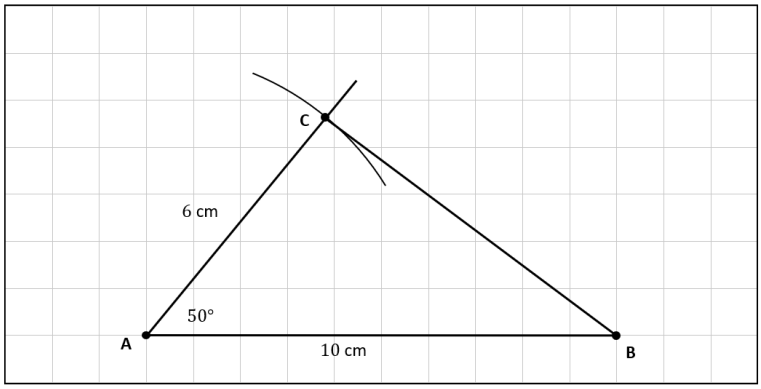
	(c) (i) Gross tax $= \frac{20}{100} \times €1900 = €380$ (ii) Net tax $= €380 - €312{\cdot}50 = €67{\cdot}50$ Net Income $= €1900 - €67{\cdot}50 = €1832{\cdot}50$	**Scale 10D (0, 3, 6, 9 , 10)** **Accept correct answers without work** *Low Partial Credit:* • Work of merit in one part , e.g. any multiplication or division by 20 or 100 in (i) or 380 – 312 in (ii) or 0.2 in (ii) • Gross – x • X – 312.50 • Answer from part (i) brought down to part (ii) *Mid Partial Credit:* • Part (i) correct. • Work of merit in both parts *High Partial Credit:* • Part (i) correct and work of merit in part (ii) • Part (ii) correct

Q3	Model Solution – 25 Marks	Marking Notes
(a)	(i) Any one of the following: $S_1 = \{4, 5, 9, 10\}$ $S_2 = \{4, 5, 9, 11\}$ $S_3 = \{4, 5, 10, 11\}$ $S_4 = \{4, 9, 10, 11\}$ $S_5 = \{5, 9, 10, 11\}$ (ii) Any one of the following: $S_6 = \{5\}$ $S_7 = \{11\}$ $S_6 = \{5, 11\}$	**Scale 10C (0, 3, 8 , 10)** *Low Partial Credit:* • Work of merit in either part , e.g. any correct subset of A that does not contain 4 elements in (i) or any set containing prime numbers in (ii) or a subset of A in (ii) *High Partial Credit:* • (i) or (ii) correct. • Work of merit in both parts
(b) (i)(ii) &(iii)	(i) Fries only (ii) $R \cap F$ (iii) {Evan, Aileen}	**Scale 10C (0, 3 , 8 , 10)** Accept Fries without only *Low Partial Credit:* • One correct. • Evan only or Aileen only *High Partial Credit:* • Two correct. *Misreading (-1)* Answer of Lillian in part (iii)
(c) (i)(ii)	(i)  (ii) $\frac{6}{24}$ *or* $\frac{1}{4}$	**Scale 5C (0, 2 , 3 , 5)** *Low Partial Credit:* • Work of merit in any one part e.g. Any one correct entry in (i) or numerator of 6 or denominator of 24 in (ii) *High Partial Credit:* • (i) or (ii) correct. • Work of merit in both parts

Q4	Model Solution – 20 Marks	Marking Notes
(a) (i)(ii) & (b)	(a) (i) 2 minutes (ii) D (b) It has the steepest slope or similar	**Scale 5D (0, 2 , 3 , 4 , 5)** *Low Partial Credit:* • Work of merit in (a) or (b). e.g. reference to slope in (b). *Mid Partial Credit :* • Work of merit in (a) and (b) • Part (a) or (b) correct *High Partial Credit:* • One part correct and work of merit in the other part
(c)(i)(ii)	(i) $\frac{15}{60}$ *or* $\frac{1}{4}$ (ii) $\frac{5}{\frac{1}{4}} = 20$	**Scale 10C (0, 3 , 8 , 10)** **Accept correct answer without work** *Low Partial Credit:* • Work of merit e.g. numerator of 15 or denominator of 60 in (i) or S = D÷T in (ii) • Answer from part (i) brought down to part (ii) *High Partial Credit:* • (i) or (ii) correct. *Full Credit (-1)* • Answer of 0.25 in (i)

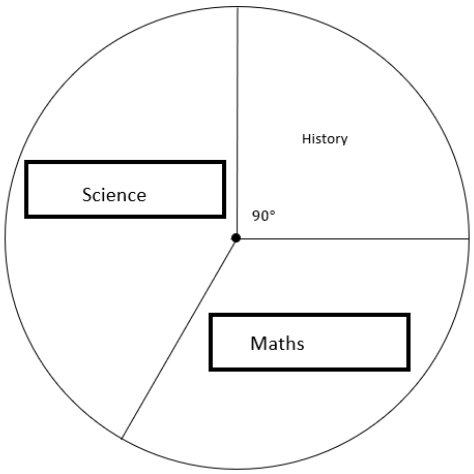
(d) **(i)(ii)**	(i) $€0{\cdot}50$ (ii) $\frac{0{\cdot}5}{1{\cdot}50} \times 100 = 33[\%]$	**Scale 5C (0, 2 , 3 , 5)** **Accept correct answer without work** *Low Partial Credit:* • (i) correct. • Work of merit in (ii) , e.g. multiplication or division by 100 • Answer from part (i) brought down to part (ii) *High Partial Credit:* • (i) correct and work of merit in (ii). • (ii) correct

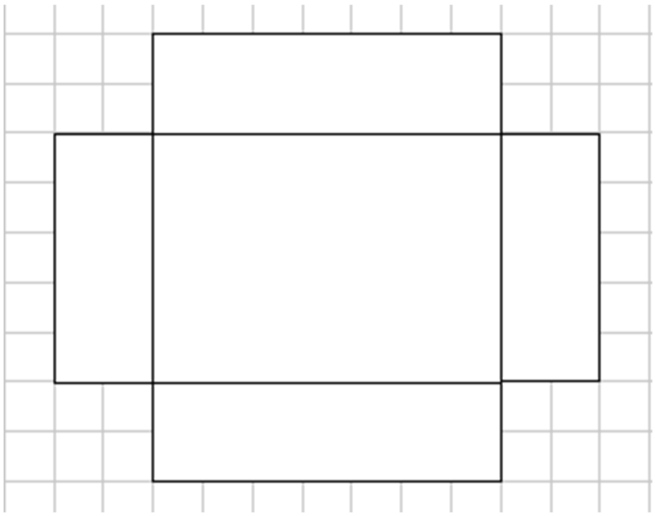
Q5	Model Solution – 5 Marks	Marking Notes
	$\lvert\angle a\rvert = 85°$ $\lvert\angle b\rvert = 140°$ $\lvert\angle c\rvert = 55°$	**Scale 5C (0, 2, 3 , 5)** *Low Partial Credit:* • Work of merit. e.g. One angle correct, or work of merit on diagram e.g. any correct vertically opposite , alternate or corresponding pair of angles in diagram identified . *High Partial Credit:* • Two angles correct.

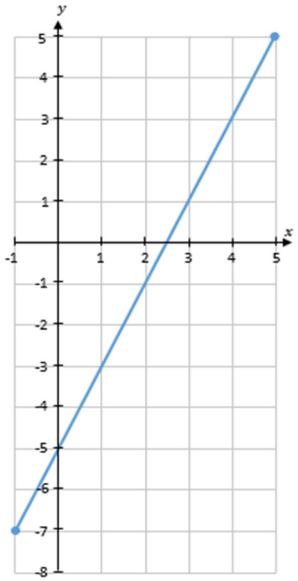
Q6	Model Solution – 15 Marks	Marking Notes
		**Scale 15D (0, 3 , 9, 13 , 15)** **Step 1:** $\mathbf{10}$ cm measured **Step 2:** $\mathbf{6}$ cm measured **Step 3:** $\mathbf{50}°$ measured **Step 4:** Triangle completed *Low Partial Credit:* • Work of merit e.g. any horizontal line segment drawn from A *Mid Partial Credit:* • Two correct steps. *High Partial Credit:* • Three correct steps.

Q7	Model Solution – 5 Marks	Marking Notes
	No $x + y = 5$ $\underline{x - 2y = -4}$ $3y = 9$ $y = 3$ $x + 3 = 5$ $x = 2$	**Scale 5 C (0, 2 , 3 , 5)** *Low Partial Credit:* • Correct box ticked. • Work of merit to solve or substitute and wrong or no box ticked or any trial and error *High Partial Credit:* • Correct box ticked and work of merit to solve or substitute. • Fully correct justification with no box ticked

Q8	Model Solution – 60 Marks	Marking Notes
(a)	<table><tr><td>17</td><td>9</td><td></td><td></td><td></td><td></td></tr><tr><td>18</td><td>5</td><td>6</td><td>7</td><td>7</td><td>9</td></tr><tr><td>19</td><td>0</td><td>1</td><td>2</td><td>6</td><td>7</td></tr><tr><td>20</td><td>0</td><td></td><td></td><td></td><td></td></tr></table> $\boxed{19}\ \boxed{1} = \boxed{191}$	**Scale 20C (0, 7 , 13 , 20)** *Low Partial Credit:* • Any correct entry. *High Partial Credit:* • 6 correct entries. *Full Credit (-1)* • One incorrect entry or one omitted entry
(b)(i) **(ii)(iii)**	(i) $\frac{2279}{12} = 189.9$ Accept rounding to 190 (ii) $\frac{189+190}{2} = 189{\cdot}5$ (iii) $200 - 179 = 21$	**Scale 10D (0, 3, 6, 9 , 10)** **Accept correct answers without work** *Low Partial Credit:* • Work of merit, for example: relevant addition or numbers identified. *Mid Partial Credit:* • One part correct. • Work of merit in two parts *High Partial Credit:* • Two parts correct • Work of merit in all three parts
(b)(iv)	(iv) Range All ages will have increased by 6 months so the range will not change or equivalent	**Scale 5B (0, 2, 5)** *Partial Credit:* • Correct box ticked with no justification.

(c)(i) **(ii)(iii)**	(i) 3 (ii) $\frac{5}{12}$ $\frac{3}{12}$ (iii) 120° 150°	**Scale 15D (0, 3, 9, 13 , 15)** **Accept correct answers without work** *Low Partial Credit:* • Work of merit, for example: relevant addition or subtraction. *Mid Partial Credit:* • One part correct. • Work of merit in any two parts *High Partial Credit:* • Two parts correct. • One part correct and work of merit in the other two parts
(c)(iv)		**Scale 10B (0, 6 , 10)** *Partial Credit :* • One sector correctly labelled *Full Credit (-1)* • Incorrect or no labelling

Q9	Model Solution – 20 Marks	Marking Notes
(a), (b)	(a)  (b) $7 \times 5 = 35$ $7 \times 2 = 14 \times 2 = 28$ $5 \times 2 = 10 \times 2 = 20$ $35 + 28 + 20 = 83 \text{ cm}^2$	**Scale 5D (0, 2, 3, 4, 5)** **Accept correct answer without work i.e. 83 cm^2** *Low Partial Credit* • Correct area of one face in (b). • Any horizontal or vertical line measuring 2 , 5 or 7 cm. *Mid Partial Credit*: • One part correct. • Work of merit in both parts. *High Partial Credit:* • One part correct and work of merit in the other part. *Full Credit (-1)* • Incorrect or no units • Net of closed rectangular box
(c)	15 [cm] 6 [cm]	**Scale 10B (0, 6 , 10)** *Partial Credit:* • One measurement correct.
(d)	$25 + 25 + 20 + 20 = 90$ OR 1 g = 0·05 minutes 1400 g = 70 $70 + 20 = 90$	**Scale 5C (0, 2, 3 , 5)** *Low Partial Credit:* • Work of merit, for example: relevant addition or conversion , e.g. 500g = 0.5 kg *High Partial Credit:* • 70 worked.

Q10	Model Solution – 20 Marks	Marking Notes
(a)(i)(ii)	(i) $\boldsymbol{A}\ (1, 2)$ $\boldsymbol{B}\ (4, 1)$ (ii) $\sqrt{(4-1)^2 + (1-2)^2}$ $= \sqrt{10}$ = 3.1622 = 3.2 Type equation here. or I AB I^2 = 3^2 + 1^2 = 9 + 1 = 10 I AB I = $\sqrt{10}$ = 3.1622 = 3.2	**Scale 10C (0, 3 , 8 , 10)** *Low Partial Credit:* • Work of merit, for example: one coordinate correct in (i) or some correct substitution in (ii) or extracting a correct formula from the tables *High Partial Credit:* • (i) or (ii) correct. *Misreading (-1) :* • Coordinates of A and B reversed *Full Credit (-1) :* • Answer not rounded to one decimal place i.e. 3.1622 or $\sqrt{10}$
(b)	 	**Scale 5B (0, 2 ,5)** *Partial Credit:* • Any relevant point identified e.g. (0 , -5)

(c)(i)(ii)	(i) $y = 3x + k$, k ≠-2 (ii) $y = x - 2$ Or any other value for m	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit:* • Work of merit, for example: the equation of a line written in the form y = mx + c *High Partial Credit:* • (i) or (ii) correct • Work of merit in both parts e.g. writes an equation of a line in the form y = mx + c in both parts

Q11	Model Solution – 30 Marks	Marking Notes
(a)(i)(ii)	(i) 5 [m] (ii) $\pi(5)$ $= 15{\cdot}7$ [m] ≈ 16 [m]	**Scale 15C (0, 3, 10 , 15)** **Accept correct answer without work** *Low Partial Credit:* • (i) correct or work of merit in (ii). *High Partial Credit:* • (i) correct and work of merit in (ii) i.e. 5π • (ii) correct *Full credit (-1)* • Incorrect or no rounding off
(b)	$10^2 = x^2 + 5^2$ $x^2 = 75$ X = √75 $x = 8{\cdot}7$ [m]	**Scale 10C (0, 3, 8, 10)** **Accept correct answer without work** *Low Partial Credit:* • Some correct substitution into correct formula. • Work of merit e.g. correct substitution into incorrect formula • $C^2 = a^2 + b^2$ or similar • Any correct trigonometric step *High Partial Credit:* • Fully correct substitution into formula. • Correct substitution into incorrect formula and finishing correctly *Full credit (-1)* • Incorrect or no rounding off or answer of $5\sqrt{3}$

Q11	Model Solution – 30 Marks	Marking Notes
(c)(i)(ii)	(i) $\frac{5}{10}$ or equivalent fraction (ii) $\sin^{-1}\left(\frac{5}{10}\right)$ $= 30°$	**Scale 5C (0, 2, 3, 5)** **Accept correct answers without work** *Low Partial Credit:* • Numerator or denominator correct in (i). • Some work of merit in (ii) , e.g. mention of $\sin^{-1}$ • Answer in (i) brought down to (ii) *High Partial Credit:* • (i) or (ii) correct. *Full Credit(-1} ;* • Calculator in incorrect mode , otherwise correct

Q12	Model Solution – 5 Marks	Marking Notes
(a)	(a) $5\ (\ 4 + 3(\ -3))$ $= 5\ (\ 4 - 9\ )$ $= 5\ (\ -\ 5\ )$ $= -\ 25$ (b) $(x + 8)(x - 3)$ (c) $2x(x - 4) + 3(x - 4)$ $2x^2 - 8x + 3x - 12$ $2x^2 - 5x - 12$	**Scale 5D (0, 2 , 3 , 4 , 5)** **Accept correct answer in (a) without work** *Low Partial Credit:* • Some correct substitution in (a). • One term correctly multiplied in (a) or (c). • Work of merit e.g. identifying x or 3 in (b) *Mid Partial Credit:* • One part correct • Work of merit in (a) **and** (b) **and** (c). *High Partial Credit:* • Two parts correct. • One part correct and work of merit in the other 2 parts