Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2018

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	B	C	D
No of categories	3	4	5
5-mark scale	0, 2, 5	0, 2, 3, 5	0, 2, 3, 4, 5
10-mark scale	0, 5, 10	0, 4, 7, 10	0, 3, 5, 8, 10
15-mark scale		0, 6, 11, 15	0, 4, 8, 12, 15
20-mark scale			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

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*, and these types of errors are identified with an asterisk (*). 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*.

Summary of mark allocations and scales to be applied

Question 1 (15)
(a) 10D
(b) 5B

Question 2 (20)
(a) 10C
(b) 10B

Question 3 (15)
(a) 10C
(b) 5C

Question 4 (25)
(a) 10C
(b) 5C
(c), (d) 10C

Question 5 (30)
(a) 15D
(b) 15C

Question 6 (25)
(a) 15C
(b) 10C

Question 7 (25)
(a), (b) 15D
(c) 10C

Question 8 (20)
(a) 15D
(b) 5C

Question 9 (20)
(a) 15D
(b) 5B

Question 10 (20)
(a) 10C
(b) 10C

Question 11 (15)
(a) 10C
(b) 5B

Question 12 (20)
(a) 15D
(b), (c) 5C

Question 13 (10)
(a) 5C
(b) 5C

Question 14 (20)
(a), (b) 20D

Question 15 (20)
(a) 5B
(b) 5D
(c) 10D

Model Solutions & Marking Notes

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 the scheme refers to "work of merit", examples are given of the standard acceptable as work of merit in that particular part.

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.

Q1	Model Solution – 15 Marks	Marking Notes
(a)	(i) $100 + (20 \times 4) = [€]180$ **OR** $100 + 20 + 20 + 20 + 20 = [€]180$ (ii) 240 – 100 =140 140 ÷ 20 = 7 [months] **OR** 240 – 180 = 60 60 ÷ 20 = 3 3 + 4 = [7 months]	**Scale 10D (0, 3, 5, 8, 10)** Accept correct answers without work Accept correct answers without units *Low Partial Credit* • Work of merit, for example: a relevant operation in (i) or (ii) *Mid Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii) *High Partial Credit* • (i) **or** (ii) correct, **and** work of merit in other part *Full Credit -1* • Apply a * for answer given as 3 in (ii)
(b)	$\frac{320-50}{18} = \frac{270}{18} = [€]15$	**Scale 5B (0, 2, 5)** Accept correct answer without work Accept correct answer without units *Partial Credit* • Work of merit, for example: a relevant operation; or evidence of trial and improvement.

Q2	Model Solution – 20 Marks	Marking Notes
(a)	(a)(i) *Any 4-digit password using the given digits without repetition, and ending in 1, 5, or 9* (a)(ii) *Any 4-digit password using the given digits without repetition, and ending in 0 or 5*	**Scale 10C (0, 4, 7, 10)** *Low Partial Credit* • Work of merit in one part, for example: answer is a possible password (uses only given digits, without repetition); or answer uses only given digits with repetition, and is either odd in (i) or a multiple of 5 in (ii). *High Partial Credit* • (i) **or** (ii) correct
(b)	9852	**Scale 10B (0, 5, 10)** Accept 9999 for Full Credit in (b), if there was repetition of digits in (a) *Partial Credit* • 9999, with no repetition of digits in (a) • Answer is a possible password (uses given digits without repetition) starting with 9.

Q3	Model Solution – 15 Marks	Marking Notes
(a)	6 10 14 18 22 *1st D:* *4* *4* *4* *4*	**Scale 10C (0, 4, 7, 10)** Accept correct answers without work. *Low Partial Credit* • Shows understanding of linear pattern, for example: explains linear properly; correct first difference found • Three consecutive terms in linear sequence (including 10 and/or 14) • Relevant formula (for example, $T_n = a + (n-1)d$ or $y = mx + c$) *High Partial Credit* • Four consecutive terms in linear sequence (including 10 and 14)

Q3	Model Solution – 15 Marks	Marking Notes
(b)	2 4 7 11 16 *1st D:* *2* *3* *4* *5* *2nd D:* *1* *1* *1*	**Scale 5C (0, 2, 3, 5)** Accept correct answers without work. *Low Partial Credit* • Shows understanding of quadratic patterns, for example: indicates or refers to second differences • Relevant formula (for example $T_n = an^2 + bn + c$) *High Partial Credit* • 2 equal second differences (not necessarily consecutive)

Q4	Model Solution – 25 Marks	Marking Notes
(a)	16, 32, 64	**Scale 10C (0, 4, 7, 10)** Accept correct answers without work. *Low Partial Credit* • Work of merit, for example: 1 correct entry; indicates doubling; effort at continuing as quadratic sequence *High Partial Credit* • 2 correct entries • Continues as quadratic sequence
(b)	$2, 4, 8, 16, 32, 64, 128, 256, 512$ i.e. 9 [folds]	**Scale 5C (0, 2, 3, 5)** Accept correct answer without work. *Low Partial Credit* • Work of merit, for example: some correct continuation of candidate's pattern from (a) *High Partial Credit* • Continues pattern to at least 512 *Full credit -1* • Answer given as 3

Q4	Model Solution – 25 Marks	Marking Notes
(c), (d)	(c) *Answer:* Exponential *Reason:* It doubles each time **OR** The first differences are the same as the original sequence **OR** The 1st and 2nd differences both change *or any other valid reason* (d) 1 million × 2 × 2 × 2 = 8 million	**Scale 10C (0, 4, 7, 10)** *Low Partial Credit* • Work of merit in (c), for example: correct box ticked; shows understanding of linear or quadratic pattern • Work of merit in (d), for example: indicates 2×2 or 8; some correct continuation of their pattern from (a) *High Partial Credit* • (c) **or** (d) correct • Work of merit in (c) and (d)

Q5	Model Solution – 30 Marks	Marking Notes
(a)	(i) 07:28 (ii) 09:25 - 07:28 = 1 hour 57 minutes	**Scale 15D (0, 4, 8, 12, 15)** If candidate's answer in (a)(i) leads to oversimplification of the work in (a)(ii), award at most *Mid Partial Credit*; for example, 09:25 - 07:20 = 2 hrs 5 mins *Low Partial Credit* • Work of merit, for example: in (i), indicates the correct bus; in (ii), work of merit in subtraction; or identifies bus from Oranmore to Limerick (06:48 to 08:45; 07:28 to 09:25; or 07:57 to 09:44) *Mid Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii) *High Partial Credit* • (i) **or** (ii) correct, **and** work of merit in the other part

Q5	Model Solution – 30 Marks	Marking Notes
(b)	(i) $\frac{1}{4}$ (ii) $\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{90}{1{\cdot}25} = 72$ [km/hr]	**Scale 15C (0, 6, 11, 15)** Accept correct answers without work Accept correct answer in (ii) without units *Low Partial Credit* • (i) correct • Work of merit in (ii), for example: correct formula; writes down $1 \cdot 25$ or $\frac{5}{4}$ *High Partial Credit* • (i) correct **and** work of merit in (ii) • (ii) correct *Full credit -1* • (i) correct **and** answer 1.2 [km/min] given with work for (ii)

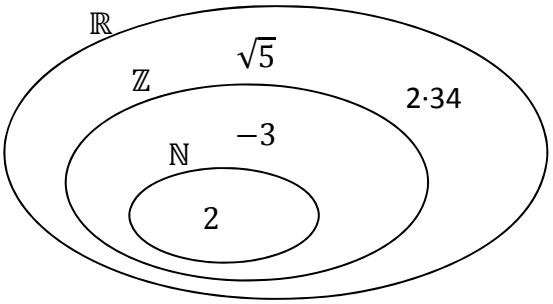
Q6	Model Solution – 25 Marks	Marking Notes
(a)	(i) 30 000 × 20% = [€] 6000 (ii) 6000 – 3300 = 2700 30 000 – 2700 = [€] 27 300 **OR** $30\,000 + 3300 - 6000$ $= \quad 33\,300 - 6000$ $= \quad$ [€] $27\,300$	**Scale 15C (0, 6, 11, 15)** Accept correct answers without work Accept correct answers without units *Low Partial Credit* • Work of merit in one part, for example: some relevant use of 100; relevant operation (including $\frac{100}{20}$) *High Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii)
(b)	$800 \times 0 \cdot 05 = 40$ $800 + 40 = [€]840$ **OR** $800 \times 1 \cdot 05 = [€]840$	**Scale 10C (0, 4, 7, 10)** Accept correct answer without work Accept correct answer without units *Low Partial Credit* • Work of merit, for example: some relevant use of 100; relevant operation (including $\frac{100}{5}$) • 40 without work *High Partial Credit* • Substantial work of merit, that is: uses 0.5, 0.005, or similar, and otherwise correct

Q7	Model Solution – 25 Marks	Marking Notes
(a), (b)	(a) $51 \cdot 24 \div 0 \cdot 9 = 56{\cdot}933\ldots$ $= [€]56{\cdot}93$ [2 D.P.] (b) $65 \times 0 \cdot 15 = 9 \cdot 75$ $65 - 9 \cdot 75 = [€]55 \cdot 25$ **OR** $100 - 15 = 85\%$ $65 \times 0 \cdot 85 = [€]55 \cdot 25$	**Scale 15D (0, 4, 8, 12, 15)** Accept correct answers without work. Accept correct answers without units *Low Partial Credit* • Work of merit, for example: in (a), multiplication or division involving $0{\cdot}9$; in (b), a relevant operation with 2 relevant numbers *Mid Partial Credit* • (a) correct • Work of merit in (a) **and** (b) • Substantial work of merit in (b), that is: finds 15% correctly; or uses 1.5, 0.015, or similar, and otherwise correct *High Partial Credit* • (b) correct • (a) correct **and** work of merit in (b) • Work of merit in (a) **and** substantial work of merit in (b)
(c)	(i) $28 - 20 = [€]8$ (ii) $\frac{8}{20} \times 100 = 40[\%]$	**Scale 10C (0, 4, 7, 10)** Accept correct answers without work Accept correct answers without units *Low Partial Credit* • (i) correct • Work of merit in (ii), for example: a relevant operation with 2 relevant numbers *High Partial Credit* • (ii) correct • (i) correct **and** work of merit in (ii)

Q8	Model Solution – 20 Marks	Marking Notes
(a)	(i) 50 (ii) 4 (iii) B	**Scale 15D (0, 4, 8, 12, 15)** *Low Partial Credit* • Work of merit, for example: relevant work on the graph *Mid Partial Credit* • 1 part correct *High Partial Credit* • 2 parts correct
(b)	Gym **B** costs **€20** per month plus **€5** for each class.	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • Work of merit, for example: relevant work on the graph; or 7 in second box *High Partial Credit* • 1 value correct • values correct but reversed • Correct answer given for Gym A

Q9	Model Solution – 20 Marks	Marking Notes
(a)	(i) $\{t, a, s, e\}$ (ii) $\{a, s, e\}$ (iii) $\{x, m\}$	**Scale 15D (0, 4, 8, 12, 15)** If an element is listed more than once in a set, ignore the repetition *Low Partial Credit* • 1 correct element in one part *Mid Partial Credit* • 1 part correct • 1 correct element in **each** part *High Partial Credit* • 2 parts correct
(b)	Answer: Always true Justification: If elements are in both P and Q they must be in P **OR** The elements in the part in the middle must be in the whole set P. *or any other valid justification, including a diagram*	**Scale 5B (0, 2, 5)** *Partial Credit* • Correct answer with no valid justification • Incorrect answer, but work of merit in justification, for example: gives an example where it is true, including using sets from (a) • Takes $P \cap Q$ to mean $P \cup Q$, but has work of merit in response, for example: gives an example where it is false.

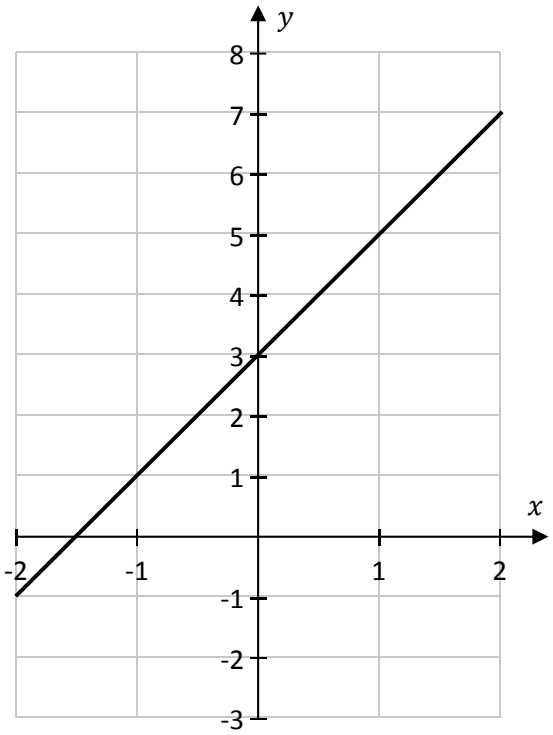
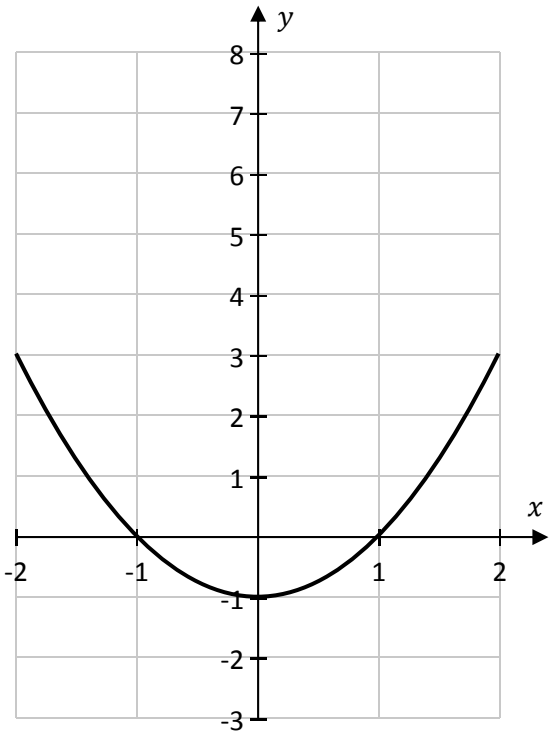
Q10	Model Solution – 20 Marks	Marking Notes
(a)	-3, 2, $\sqrt{5}$, 2·34	**Scale 10C (0, 4, 7, 10)** Accept $2{\cdot}2$ or more accurate approximation in place of $\sqrt{5}$ in answer. *Low Partial Credit* • 2 consecutive numbers with the second greater than the first (other than "$-3, \sqrt{5}$") • $\sqrt{5}$ written as $2{\cdot}2$, or more accurate *High Partial Credit* • 3 of the 4 numbers (not necessarily consecutive) in increasing order *Full Credit –1* • 2·34, $\sqrt{5}$, 2, – 3 (i.e. order from biggest to smallest)

Q10	Model Solution – 20 Marks	Marking Notes
(b)		**Scale 10C (0, 4, 7, 10)** *Low Partial Credit* • 1 number correctly positioned *High Partial Credit* • 2 numbers correctly positioned

Q11	Model Solution – 15 Marks	Marking Notes
(a)	Grace: $E - 7$ Evan: $2E$ Aoibhe: $E + 3$	**Scale 10C (0, 4, 7, 10)** *Low Partial Credit* • 1 correct • Work of merit in one part, for example: shows operations described (– 7, × 2, + 3) *High Partial Credit* • 2 correct • Actual values (7, 28, 17) written in • Work of merit in three parts, for example: shows **all** operations described
(b)	$\frac{1}{2}E = E - 7$ $7 = \frac{1}{2}E$ $E = 14$ [years]	**Scale 5B (0, 2, 5)** Accept correct answer without work Accept correct answer without units *Partial Credit* • Work of merit, for example: $\frac{1}{2}E$; $E - 7$; attempt at trial and improvement

Q12	Model Solution – 20 Marks	Marking Notes
(a)	5 → 25 3 → **9** –6 → **36** 0 → **0** **7 or –7** → 49	**Scale 15D (0, 4, 8, 12, 15)** *Low Partial Credit* • 1 correct • Some work of merit, for example: multiplies an input by 5; doubles an input *Mid Partial Credit* • 2 correct *High Partial Credit* • 3 correct
(b), (c)	(b) $\{25, 9, 36, 0, 49\}$ (c) $3^{7+7} = 3^{14}$	**Scale 5C (0, 2, 3, 5)** Accept 14 as answer in (c) *No Credit* • Evaluates 3^7 (2187) or 3^{14} (4 782 969) *Low Partial Credit* • Work of merit, for example: in (b), 1 correct element; gives full domain instead of range; in (c): correct relevant formula; indicates expansion: $3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$ *High Partial Credit* • (b) **or** (c) correct • Work of merit in (b) **and** (c)

Q13	Model Solution – 10 Marks	Marking Notes
(a)	$4(5) - 3(2)$ $= \quad 20 - 6 = 14$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • Any correct substitution *High Partial Credit* • Fully correct substitution with some multiplication
(b)	$3(x + 5) + 2(2x + 3) = 0$ $3x + 15 + 4x + 6 = 0$ $7x + 21 = 0$ $7x = -21$ $x = -3$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • Two correct multiplications *High Partial Credit* • Fully correct multiplication • One error and finished correctly

Q14	Model Solution – 20 Marks	Marking Notes
(a), (b)	(a)  (b)  	**Scale 20D (0, 5, 10, 15, 20)** Accept correct graphs without supporting work *Low Partial Credit* • Work of merit for one graph, for example: work towards finding a point; or correct co-ordinates of one point written; or y-intercept correctly plotted for (a) or (b); or slope correct for (a); or 2 points correctly plotted in (a) or in (b) *Mid Partial Credit* • (a) **or** (b) correct • Work of merit for (a) **and** (b) *High Partial Credit* • (a) **or** (b) correct, **and** work of merit in the other part • All points plotted in (a) and (b) but not joined or joined incorrectly *Full Credit –1* • Apply a * for one point incorrectly found or plotted in (b) • Apply a * for one point incorrectly plotted in (a)

Q15	Model Solution – 20 Marks	Marking Notes
(a)	$3(x+2y)$	**Scale 5B (0, 2, 5)** Accept correct answer without work *Partial Credit* • Any term in solution correct, for example: $3(\quad)$ or $5(x+y)$
(b)	$2x(x-4)+7(x-4)$ $=\quad 2x^2-8x+7x-28$ $=\quad 2x^2-x-28$	**Scale 5D (0, 2, 3, 4, 5)** *Low Partial Credit* • Indicates distribution *Mid Partial Credit* • One term correct from second line, including sign *High Partial Credit* • Two terms correct from solution, including signs • Correct answer without work

Q15	Model Solution – 20 Marks	Marking Notes
(c)(i), (ii)	(i) $x-2=0$ or $x+8=0$ $x=2$ or $x=-8$ **OR** $x=\frac{-6\pm\sqrt{6^2-4(1)(-16)}}{2(1)}$ $x=\frac{-6\pm10}{2}$ $x=2$ or $x=-8$ (ii) $\frac{(x-2)(x+8)}{(x-2)}=x+8$ **OR** $x+8$ $x-2\ \overline{)\ x^2+6x-16}$ x^2-2x $8x-16$ $8x-16$ 0 Answer: $x+8$ **OR** x | -2 x | x^2 | $-2x$ 8 | $8x$ | -16 Answer: $x+8$	**Scale 10D (0, 3, 5, 8, 10)** (c) (ii) Accept $x+8$ without work *Low Partial Credit* • Work of merit in (i) or (ii), for example: in (i), sets $(x-2)(x+8)=0$; or sets one factor equal to 0;or writes down relevant formula correctly; in (ii), finds one term (x or 8) in solution • Any indication of correct use of relevant formula *Mid Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii) *High Partial Credit* • (i) **or** (ii) correct, **and** work of merit in other part

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:

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, 5, 10	0, 3, 7, 10	0, 3, 5, 8, 10
15-mark scale			0, 3, 10, 15	0, 3, 6, 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, 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*, and these types of errors are identified with an asterisk (*). 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*.

Summary of mark allocations and scales to be applied

Question 1 (30)

(a), (b)	15D
(c)	15D

Question 2 (20)

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

Question 3 (55)

(a)	5A
(b)	15C
(c)	15C
(d)	5A
(e)	15C

Question 4 (25)

(a)	15D
(b)	5B
(c)	5B

Question 5 (10)

(a)&(b)	10B

Question 6 (20)

(a)	10C
(b)	10B

Question 7 (55)

(a)	10D
(b)	15C
(c), (e)	15D
(d)	15D

Question 8 (20)

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

Question 9 (45)

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

Question 10 (20)

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

Model Solutions & Marking Notes

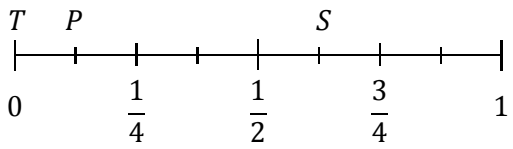
The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

Where the scheme refers to "work of merit", examples are given of the standard acceptable as work of merit in that particular part.

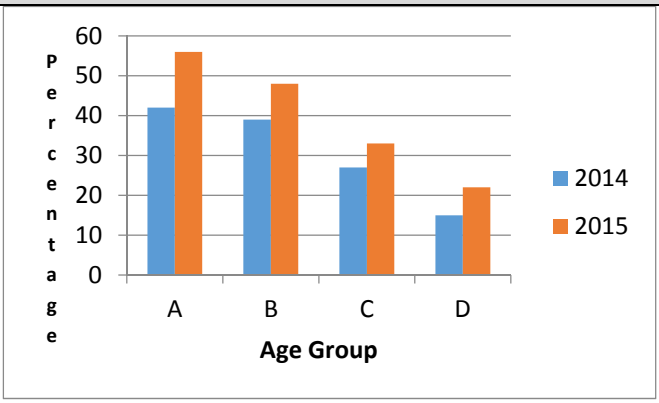
In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved

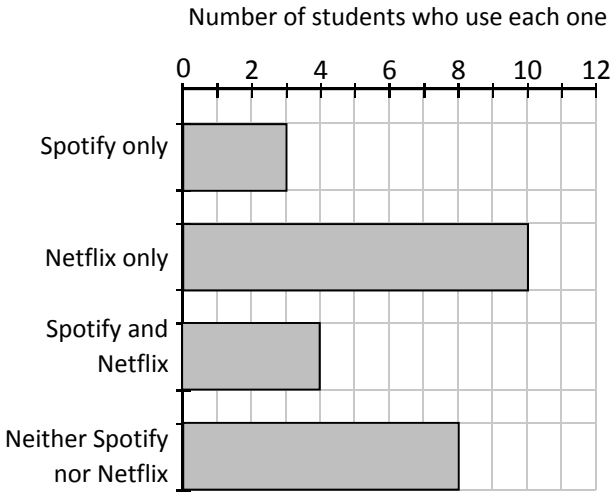
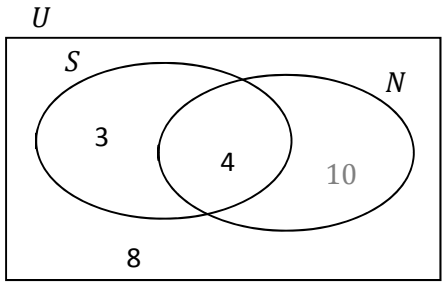
Q1	Model Solution – 30 Marks	Marking Notes
(a), (b)	(a) A = 3 [cm] B = 11 [cm] (b) Width = $5 \times 3 = 15$ m Vertical height = $5 \times 11 = 55$ m	**Scale 15D (0, 3, 6, 12, 15)** Consider answer as needing four answers: 3 [cm], 11 [cm], 15 m, and 55 m. Accept correct answers without work Accept correct answers in (a) with no or incorrect units *Low Partial Credit* • Work of merit, for example: in (a), A = 2 or 4; or B = 10 or 12 in (b), some use of ratio $1:5$; or indicates $\frac{1}{5}$ • 1 answer correct *Mid Partial Credit* • Work of merit in (a) and (b) • 2 answers correct *High Partial Credit* • 3 answers correct • (b) correct and work of merit in (a) *Full Credit –1* • Apply a * for answer in (a) not given correct to the nearest cm (only the first time it occurs), with a tolerance of ± 3 mm • Apply a * for incorrect or no units in (b) (only the first time it occurs)

Q1	Model Solution – 30 Marks	Marking Notes
(c)	$V = \pi r^2 h$ $= \pi(7)^2(60)$ $= 2940\pi$ $= 9236{\cdot}28 \ldots$ $= 9236{\cdot}3$ [m^3] [1 D.P.]	**Scale 15D (0, 3, 6, 12, 15)** Accept correct answer with no units If candidate's answer is taken from (a) or (b) and used in (c) correctly, apply a *. Award *Low Partial Credit* at most if *r* and/or *h* are unconnected to the figures presented or those in the previous parts. Consider solution as requiring 4 steps: Step 1: Correct formula Step 2: Substitution of r and h into formula Step 3: Calculates r^2 Step 4: Evaluates answer *Low Partial Credit* • 1 step correct • Product of 2 relevant numbers • Uses $2\pi rh$ formula and substitutes for r and h • Uses $A = \pi r^2$ and substitutes correctly for r *Mid Partial Credit* • 2 steps correct • Uses $2\pi rh$ formula and finishes correctly • 9236 with no supporting work and stops *High Partial Credit* • Correct answer with no supporting work • 3 steps correct • Uses $A = \pi r^2$ and finishes correctly. *Full Credit –1* • Apply a * for incorrect or no rounding • Apply a * for $9236{\cdot}2$, even if rounding is not explicitly shown

Q2	Model Solution – 20 Marks	Marking Notes
(a)	$P(P) = \frac{1}{8}$ **or** $0 \cdot 125$ $P(S) = \frac{5}{8}$ **or** $0 \cdot 625$ $P(T) = \frac{0}{8}$ **or** 0	**Scale 5D (0, 2, 3, 4, 5)** *Low Partial Credit* • Correct numerator or denominator for any event *Mid Partial Credit* • 1 correct *High Partial Credit* • 2 correct
(b)		**Scale 10C (0, 3, 7, 10)** Tolerance: Letters P and S need to be in close proximity to the correct positions. Accept T correct only if it is clearly at 0. *Low Partial Credit* • 1 correct *High Partial Credit* • 2 correct • Points marked correctly but not labelled
(c), (d)	(c) $€1 + 50c + 20c + 5c$ (d) $3 \cdot 88 - 1 \cdot 75 = €2 \cdot 13$ **OR** $0{\cdot}01 + 0{\cdot}02 + 0{\cdot}10 + 2{\cdot}00 = €2{\cdot}13$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • 2 relevant coins identified in (c) • Some relevant addition or subtraction *High Partial Credit* • (c) **or** (d) correct • Work of merit in both parts

Q3	Model Solution – 55 Marks	Marking Notes
(a)	39 [%]	**Scale 5A (0, 5)** Accept correct answer without units
(b)	42 – 15 = 27 [%]	**Scale 15C (0, 3, 10, 15)** Accept correct answer without work *Low Partial Credit* • Work of merit, for example: highlights max **or** min values *High Partial Credit* • Highlights max **and** min values • Answer = "15 to 42", or similar
(c)	$\frac{42+39+27+15}{4} = \frac{123}{4}$ **or** $30{\cdot}75\%$	**Scale 15C (0, 3, 10, 15)** *Low Partial Credit* • Shows understanding of the mean, for example: some relevant addition; division by 4 *High Partial Credit* • Correct sum (123) *Full Credit –1* • Apply a * if unit [%] not given anywhere in (a) , (b) or (c)
(d)	Younger internet users use the internet for storing files more than older users do *or any other valid answer*	**Scale 5A (0, 5)**

Q3	Model Solution – 55 Marks	Marking Notes
(e)	 *or any other valid graph(s)*	**Scale 15C (0, 3, 10, 15)** *Low Partial Credit* • Work of merit, for example: scaled axes drawn; or one angle correctly calculated; or one data element displayed correctly *High Partial Credit* • Data displayed correctly for one year • Two substantial graphs drawn *Full Credit –1* • Apply a * if a label is missing or incorrect (only the first time it occurs) • Apply a * if one of the values graphed is incorrect, and the rest are correct

Q4	Model Solution – 25 Marks	Marking Notes
(a)	3 + 4 + 10 = 17 25 – 17 = 8   	**Scale 15D (0, 3, 6, 12, 15)** Correct answer requires 5 correct entries: 2 in bar chart and 3 in Venn diagram *Low Partial Credit* • Work of merit, for example: 1 correct entry in bar chart or Venn diagram calculated or displayed (includes reading 3 or 4 from bar chart) *Mid Partial Credit* • 2 correct entries displayed in bar chart or Venn diagram • All correct entries calculated (3, 4, and 8) *High Partial Credit* • 3 correct entries displayed in bar chart or Venn diagram
(b)	$3 + 4 = 7$	**Scale 5B (0, 2, 5)** *Partial Credit* • Work of merit, for example: some relevant operation; or 3 or 4 identified
(c)	10 students use Netflix but don't use Spotify **OR** 10 of the students use Netflix only *or any other valid explanation*	**Scale 5B (0, 2, 5)** *Partial Credit* • Explains the meaning of part of the statement in context, for example: "The people in Netflix only"; or "10 students"

Q5	Model Solution – 10 Marks	Marking Notes
(a), (b)	(a) Mode (b) Grey	**Scale 10B (0, 5, 10)** Accept for *Full Credit*: mean selected and then worked out correctly as $\frac{15}{4}$ or $3 \cdot 75$ (i.e. the mean number of cars per colour). *Partial Credit* • Some work towards finding an average • (a) **or** (b) correct

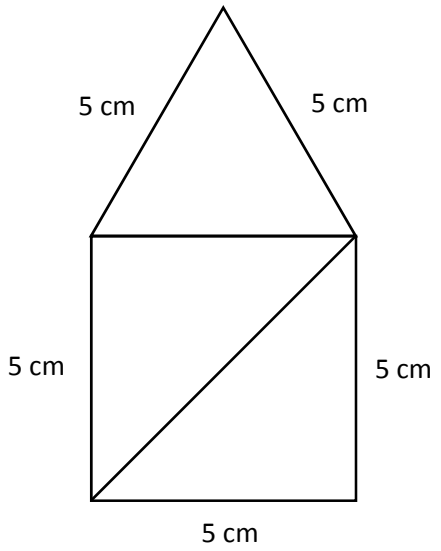
Q6	Model Solution – 20 Marks	Marking Notes
(a)	<table><tr><td colspan="2"></td><td colspan="3">Game 2</td></tr><tr><td colspan="2"></td><td>W</td><td>D</td><td>L</td></tr><tr><td rowspan="3">Game 1</td><td>W</td><td>WW</td><td>WD</td><td>WL</td></tr><tr><td>D</td><td>DW</td><td>DD</td><td>DL</td></tr><tr><td>L</td><td>L W</td><td>LD</td><td>LL</td></tr></table>	**Scale 10C (0, 3, 7, 10)** *Low Partial Credit* • 1 correct entry (other than LW and DD) • 3 correct outcomes listed (other than LW and DD), not necessarily in correct location *High Partial Credit* • 4 correct entries (other than LW and DD) • All 7 correct outcomes listed (other than LW and DD), not necessarily in correct location.
(b)	$3^3 = 27$ **OR** $9 \times 3 = 27$ **OR** Lists all 27 and counts them	**Scale 10B (0, 5, 10)** Accept correct answer without work *Partial Credit* • Work of merit, for example: Attempt at listing outcomes; or shows some understanding of the fundamental principle of counting *Full Credit –1* • Apply a * if all outcomes are listed correctly but not counted

Q7	Model Solution – 55 Marks	Marking Notes
(a)	$(2,2)\ (5,2)\ (5,4)$	**Scale 10D (0, 3, 5, 8, 10)** *Low Partial Credit* • 1 ordinate correct (including if co-ordinates reversed) *Mid Partial Credit* • 1 point correct • 2 points correct with co-ordinates reversed *High Partial Credit* • 2 points correct • All points correct with co-ordinates reversed
(b)	Area of Shape C: $l \times b = 2^2 = 2 \times 2 = 4$ [units^2] Area of Shape D: $\frac{1}{2}(b \times h) = \frac{1}{2}(3 \times 2) = 3$ [units^2]	**Scale 15C (0, 3, 10, 15)** Accept correct answers without work *Low Partial Credit* • Work of merit, for example: formula for area of rectangle or triangle; or one correct operation; or splits either shape up into unit squares (or parts thereof) *High Partial Credit* • One area correct • Work of merit towards area of rectangle **and** triangle
(c), (e)	(c) 12 [units] (e) $\frac{\text{rise}}{\text{run}} = \frac{2}{3}$ or $0 \cdot \dot{6}$	**Scale 15D (0, 3, 6, 12, 15)** *Low Partial Credit* • Work of merit, for example: in (c), work relevant to perimeter on diagram or on grid for working out; in (e), correct formula, or rise or run identified *Mid Partial Credit* • (c) **or** (e) correct • Work of merit in (c) **and** (e) *High Partial Credit* • (c) **or** (e) correct, **and** work of merit in other part

Q7	Model Solution – 55 Marks	Marking Notes
(d)	(i) **4** axes of symmetry (ii) Shape **F** (iii) Shape **D**	**Scale 15D (0, 3, 6, 12, 15)** Accept "A" for Full Credit in (iii) *Low Partial Credit* • Work of merit, for example: a correct axis of symmetry drawn on the diagram; or answer to (i) = 2; or answer to (iii) = B *Mid Partial Credit* • 1 correct *High Partial Credit* • 2 correct

Q8	Model Solution – 20 Marks	Marking Notes
(a)	k: 2 r: $(0, 8)$ t: $y = 7x - 6$	**Scale 5D (0, 2, 3, 4, 5)** *Low Partial Credit* • Work of merit in one part, for example: relevant formula (for example, slope or $y = mx + c$); or attempts to find a point on any of the lines; or $7x$ or -6 for t; or (0,) or (8,0) for *r*. *Mid Partial Credit* • 1 correct *High Partial Credit* • 2 correct *Full Credit –1* • Apply a * for answer of 8 for r
(b)	Answer: t Reason: Because it has the biggest slope *or any other valid reason*	**Scale 10B (0, 5, 10)** *Partial Credit* • Correct line identified • Shows understanding of relationship between slope and steepness
(c)	Answer: **is** on l Justification: $10 = 3(2) + 4$ $10 = 10$ *or any other valid justification*	**Scale 5B (0, 2, 5)** *Partial Credit* • Correct box ticked • Work of merit in justification, for example: effort at substitution; or effort to graph point or line

Q9	Model Solution – 45 Marks	Marking Notes
(a)(i)	$\lvert\angle W\rvert = 60°$ $\lvert\angle X\rvert = 90°$ $\lvert\angle Y\rvert = 45°$	**Scale 10D (0, 3, 5, 8, 10)** *Low Partial Credit* • Work of merit, for example: Indicates 180°, or indicates right angle • Measured angle(s) ±3° *Mid Partial Credit* • 1 angle correct *High Partial Credit* • 2 angles correct
(a)(ii)	$60 + 45 = 105°$	**Scale 5B (0, 2, 5)** *Partial Credit* • Some work of merit, for example: 60 or 45 written • Measured angle ±3°
(b)(i)	$x^2 = 5^2 + 5^2$ $x^2 = 50$ $x = \sqrt{50} = 7{\cdot}071 \ldots = 7{\cdot}07$ [2 D.P.]	**Scale 15C (0, 3,10, 15)** *Low Partial Credit* • Work of merit, for example: Theorem of Pythagoras stated correctly; or indicates 5^2 or 25 *High Partial Credit* • Correct answer without work • Formula fully substituted correctly *Full Credit –1* • Apply a * if no or incorrect rounding, or if answer left as $\sqrt{50}$

Q9	Model Solution – 45 Marks	Marking Notes
(b)(ii)		**Scale 15C (0, 3, 10, 15)** Tolerance: At least 3 angles in the square and 2 angles in the triangle correct within $3°$, and at least 3 of the 5 cm-sides correct within 3 mm. *Low Partial Credit* • Any line segment or angle within tolerance • Sketch of entire shape drawn *High Partial Credit* • Square or equilateral triangle within tolerance • Uses measured lengths (3.5 cm) *Full Credit –1* • Apply a * if the diagonal is omitted

Q10	Model Solution – 20 Marks	Marking Notes
(a)	$3^2 + y^2 = 5^2$ $y^2 = 25 - 9 = 16$ $y = \sqrt{16} = 4$ m	**Scale 10D (0, 3, 5, 8, 10)** Consider solution as requiring 4 steps: Step 1: Correct formula Step 2: Substitution into formula Step 3: Finds value of y^2 Step 4: Finds value of $\sqrt{y^2}$ *Low Partial Credit* • Work of merit, for example: Theorem of Pythagoras stated correctly; or indicates 3^2 or 5^2; or indicates 34 *Mid Partial Credit* • 2 steps correct *High Partial Credit* • 3 steps correct • Correct answer without work *Full Credit –1* • Apply a * if no or incorrect units

Q10	Model Solution – 20 Marks	Marking Notes
(b)	(i) $\cos B = \frac{3}{5}$ (ii) $\cos^{-1}\left(\frac{3}{5}\right) = 53 \cdot 13 \ldots °$ $B = 53°$ [nearest degree]	**Scale 5B (0, 2, 5)** Accept correct answer in (ii) without unit Accept correct answers without work Accept the answer in (ii) correct to one decimal place for Full Credit *Partial Credit* • (i) **or** (ii) correct • 2 or 3 correct labels in diagram in (i) • Any correct trigonometric ratio *Full Credit –1* • Apply a * if calculator is in incorrect mode • Incorrect or no rounding
(c)	$\frac{x}{9} = \frac{5 \cdot 8}{6}$ $x = 8 \cdot 7$ m **OR** $\frac{x}{5 \cdot 8} = \frac{9}{6}$ $x = 8 \cdot 7$ m	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • One correct relevant operation, for example: $6 \div 9$ or $9 \times 5 \cdot 8$ • Some knowledge of similar triangles *High Partial Credit* • Sets up equation correctly • Two correct relevant operations indicated • Correct answer without work *Full Credit –1* • Apply a * for no or incorrect units, if a * has not already been applied for this in (a)

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 ghnáthráta a bhronnadh ar iarrthóirí nach ngnóthaíonn níos mó ná 75% d'iomlán na marcanna don scrúdú. Ba chóir freisin an marc bónais 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% gnáthráta an bhónais.

Bain úsáid as an ngnáthráta 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