Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2018

Marking Scheme

Mathematics

Higher 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.

Contents Page

Paper 1

Paper 2

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 on this examination paper are summarised in this table:

Scale label	B	C	D
No of categories	3	4	5
5-mark scale	0, 3, 5	0, 2, 3, 5	0, 2, 3, 4, 5
10-mark scale		0, 3, 7, 10	0, 2, 6, 9, 10
15-mark scale		0, 4, 12, 15	0, 3, 9, 13, 15

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

Marking scales – level descriptors

B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)

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

D-scales (five categories)

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

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work, or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may 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 (20)

(a)	5B
(b)	15C

Question 2 (30)

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

Question 3 (10)

(a),(b)	10D

Question 4 (15)

(a)	5C
(b)	10C

Question 5 (25)

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

Question 6 (40)

(a),(b)	10C
(c),(d)	10D
(e),(f)	10D
(g),(h)	10C

Question 7 (15)

(a)	5C
(b)	10C

Question 8 (25)

(a)	15C
(b)	10C

Question 9 (25)

(a)	5B
(b),(c)	5D
(d)	5B
(e)	10D

Question 10 (30)

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

Question 11 (10)

10D

Question 12 (15)

(a)	10D
(b)	5C

Question 13 (15)

(a),(b)	15D

Question 14 (25)

(a)	15C
(b)	10C

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.

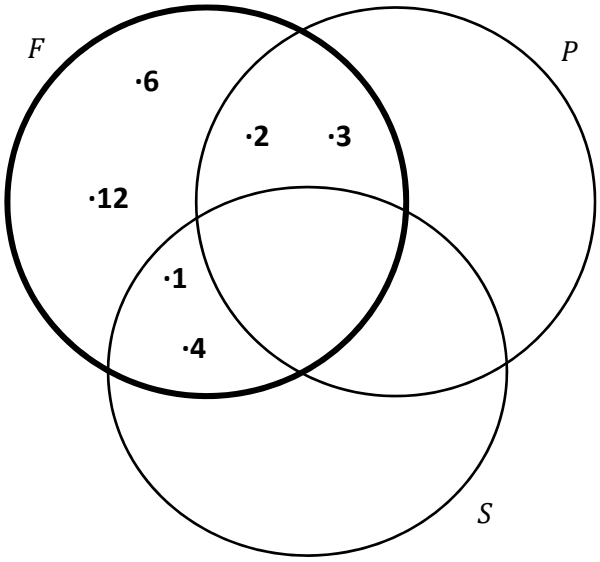
In general, accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

Q1	Model Solution – 20 Marks	Marking Notes
(a)	1st Difference $= 7 - 1 = 6$ Answer: 13, 19, 25	**Scale 5B (0, 3, 5)** Accept correct answer without supporting work. *Partial Credit* • Shows understanding of linear patterns, for example: explains linear properly; correct first difference found • Three consecutive terms in linear sequence (possibly including 1 and 7) • Correct relevant formula, for example: $T_n = a + (n-1)d$ or $y = mx + c$ *Full Credit –1* • Apply a * if two of the new first differences are 6, for example: 13, 19, 26 or 12, 18, 24.
(b)	*Any pattern continuing on from 1, 7 with a (non-zero) constant second difference.* *For example*: 14, 22, 31 *or any other quadratic sequence continuing on from 1, 7*	**Scale 15C (0, 4, 12, 15)** Accept correct answer without supporting work. *No Credit* • Answer of 13, 19, 25, or finds first difference *Low Partial Credit* • Shows understanding of quadratic patterns, for example: indicates or refers to second differences • Correct relevant formula, for example: $an^2 + bn + c$ *High Partial Credit* • Writes sequence with at least 2 equal non-zero second differences (not necessarily consecutive)

Q2	Model Solution – 30 Marks	Marking Notes
(a)	(i) 750 [kcal] (ii) 300 kcal in 30 mins means 600 kcal in 1 hour $\therefore 155$ [beats per minute]	**Scale 10C (0, 3, 7, 10)** Accept correct answer without supporting work Tolerance: $\pm\mathbf{10}$ on y-axis and $\pm\mathbf{1}$ on x-axis. *Low Partial Credit:* • Work of merit in (i) **or** (ii), for example: relevant indication on graph for either part (including indication of 300 kcal); or 125 given as answer in (ii) *High Partial Credit* • (i) **or** (ii) correct • Work of merit in both parts
(b)	Stage / Slow / Sprint / Total 1 / 60 / 50 / 110 2 / 60 / 100 / 160 3 / 60 / 150 / 210 4 / 60 / 200 / 260 5 / 60 / 250 / 310 n / 60 / $50n$ / $60+50n$	**Scale 10D (0, 2, 6, 9, 10)** Accept correct answer without supporting work *Note*: Accept Total as correct if it is either equal to the sum of Slow and Sprint, **or** (for stages 3, 4, and 5) if it is 50 greater than the Total from the previous row. *Note*: If final Sprint entry not in terms of *n*, award *MPC* at most. *Low Partial Credit* • One entry correct *Mid Partial Credit* • Five entries correct *High Partial Credit* • Seven entries correct, including at least one of the entries in terms of n *Full Credit –1* • Nine entries correct (i.e. all but one), including both of the entries in terms of n

Q2	Model Solution – 30 Marks	Marking Notes
(c)	Total distance $= 60 + 150 = 210$ [m] Slow run: Time $= \frac{D}{S} = \frac{60}{2} = 30$ [seconds] Sprint: Time $= \frac{D}{S} = \frac{150}{7 \cdot 5} = 20$ [seconds] Total time $= 30 + 20 = 50$ [seconds] Average Speed $= \frac{D}{T} = \frac{210}{50} = 4 \cdot 2$ [m/s]	**Scale 10D (0, 2, 6, 9, 10)** *Low Partial Credit* • Work of merit, for example: relevant formula; finds total distance *Mid Partial Credit* • One correct time calculated *High Partial Credit* • Total stage time calculated • One correct time calculated and 210 divided by some incorrect figure derived from some work of merit • Correct answer with no supporting work

Q3	Model Solution – 10 Marks	Marking Notes
(a), (b)	(a) $\frac{14}{35} \times 100 = \frac{2}{5} \times 100 = 40$ [%] (b) $\frac{200}{0 \cdot 88} = €227 \cdot 27 \ldots$ $227 \cdot 27 \ldots \times 1 \cdot 18 = 268 \cdot 181 \ldots$ $=$ [\$] $268 \cdot 18$ [2 D.P.] **OR** $\frac{1 \cdot 18}{0 \cdot 88} = 1 \cdot 3409 \ldots$ So $£1 = \$1 \cdot 3409 \ldots$ $£200 \times 1 \cdot 3409 \ldots = 268 \cdot 18 \ldots$ $=$ [\$] $268 \cdot 18$ [2 D.P.] **OR** $\frac{0 \cdot 88}{1 \cdot 18} = 0 \cdot 7457 \ldots$ So $\$1 = £0 \cdot 7457 \ldots$ $£200 \div 0 \cdot 7457 \ldots = 268 \cdot 18 \ldots$ $=$ [\$] $268 \cdot 18$ [2 D.P.]	**Scale 10D (0, 2, 6, 9, 10)** Accept correct answer without supporting work *Low Partial Credit* • Work of merit in (a) **or** (b), that is: a relevant product or relevant quotient (including reciprocals) *Mid Partial Credit* • (a) correct • Work of merit in (a) **and** (b) *High Partial Credit* • (a) correct, **and** work of merit in (b) • (b) correct *Full Credit –1* • Incorrect or no rounding

Q4	Model Solution – 15 Marks	Marking Notes
(a)	$\{1, 2, 3, 4, 6, 12\}$	**Scale 5C (0, 2, 3, 5)** Accept correct answer without supporting work *Note*: If incorrect excess factors are given, award at most *High Partial Credit* *Low Partial Credit* • One correct factor. *High Partial Credit* • Four correct factors.
(b)		**Scale 10C (0, 3, 7, 10)** Accept correct answer without supporting work. Ignore any elements in Venn diagram placed outside set F If a region contains an incorrect element, award at most *HPC.* If an element is written twice in F then that element is not correctly placed If answer from (a) has elements in 3 regions, *FC* may be awarded for (b); if answer from (a) only has elements in 2 regions, award at most *HPC* for (b); if answer from (a) only has elements in 1 region, award at most *LPC* for (b). *Low Partial Credit* • 1 region with all relevant elements (with or without excess elements) • 3 elements correctly placed *High Partial Credit* • 2 regions with all relevant elements and no excess • 5 elements correctly placed

Q5	Model Solution – 25 Marks	Marking Notes
(a)	$3(6) - 4(5^2)$ $= \quad 18 - 4(25)$ $= \quad 18 - 100$ $= \quad -82$	**Scale 5B (0, 3, 5)** Accept correct answer without supporting work *Partial Credit* • Some correct substitution or relevant calculation.
(b)	$2x(4 - 5x + x^2) - 3(4 - 5x + x^2)$ $= \quad 8x - 10x^2 + 2x^3 - 12 + 15x - 3x^2$ $= \quad 2x^3 - 13x^2 + 23x - 12$	**Scale 10D (0, 2, 6, 9, 10)** *Low Partial Credit* • One term correctly multiplied *Mid Partial Credit* • Three terms correctly multiplied *High Partial Credit* • 2nd line fully correct • 4 terms correct in 2nd line, finished correctly • Correct answer without supporting work
(c)	$10de - df - 5ef + 2d^2$ $= \quad 10de - 5ef + 2d^2 - df$ $= \quad 5e(2d - f) + d(2d - f)$ $= \quad (2d - f)(5e + d)$ **OR** $10de - df - 5ef + 2d^2$ $= \quad 10de + 2d^2 - 5ef - df$ $= \quad 2d(5e + d) - f(5e + d)$ $= \quad (5e + d)(2d - f)$	**Scale 10C (0, 3, 7, 10)** *Low Partial Credit* • Work of merit, for example: a common factor identified from given expression *High Partial Credit* • $5e(2d - f) + d(2d - f)$ or equivalent • Correct answer without supporting work • $5e(2d - f) - d(2d - f)$ or similar, and finishes correctly.

Q6	Model Solution – 40 Marks	Marking Notes
(a), (b)	(a) 16, 32, 64 (b) Domain: $\{1, 2, 3, 4, 5, 6\}$ Range: $\{2, 4, 8, 16, 32, 64\}$	**Scale 10C (0, 3, 7, 10)** Accept correct answers without supporting work. Accept answers in index form ($\mathbf{2^4}$, $\mathbf{2^5}$, $\mathbf{2^6}$) *Low Partial Credit* • Work of merit in (a) **or** (b), for example: in (a), one correct entry; indicates doubling; indication of 2^1, 2^2, or 2^3; in (b), three correct entries in either domain or range; or full domain in place of range; or full range in place of domain (but see note below regarding *FC-1*) *High Partial Credit* • (b) correct • (a) correct **and** work of merit in (b) *Full Credit –1* • Apply a * for domain **and** range correct but swapped
(c), (d)	(c) $2, 4, 8, 16, 32, 64, 128, 256, 512$ i.e. 9 [folds] (d) $512, 1024, 2048, 4096$ i.e. $4{\cdot}096 \times 10^3$ [layers] **OR** $2^{12} = 4096$ $= 4{\cdot}096 \times 10^3$ [layers]	**Scale 10D (0, 2, 6, 9, 10)** Accept correct answers without supporting work. Consider solution as requiring 3 steps: Step 1: solves part (c) Step 2: finds 4096 in part (d) Step 3: writes answer for (d) in correct form. *Low Partial Credit* • Work of merit in (c) **or** (d), for example: some correct continuation of candidate's pattern from (a); divides 500 by 2 (in (c)); some relevant use of 2^x *Mid Partial Credit* • 1 step correct (including expressing any number relevant to their solution in the form $a \times 10^n$) *High Partial Credit* • 2 steps correct

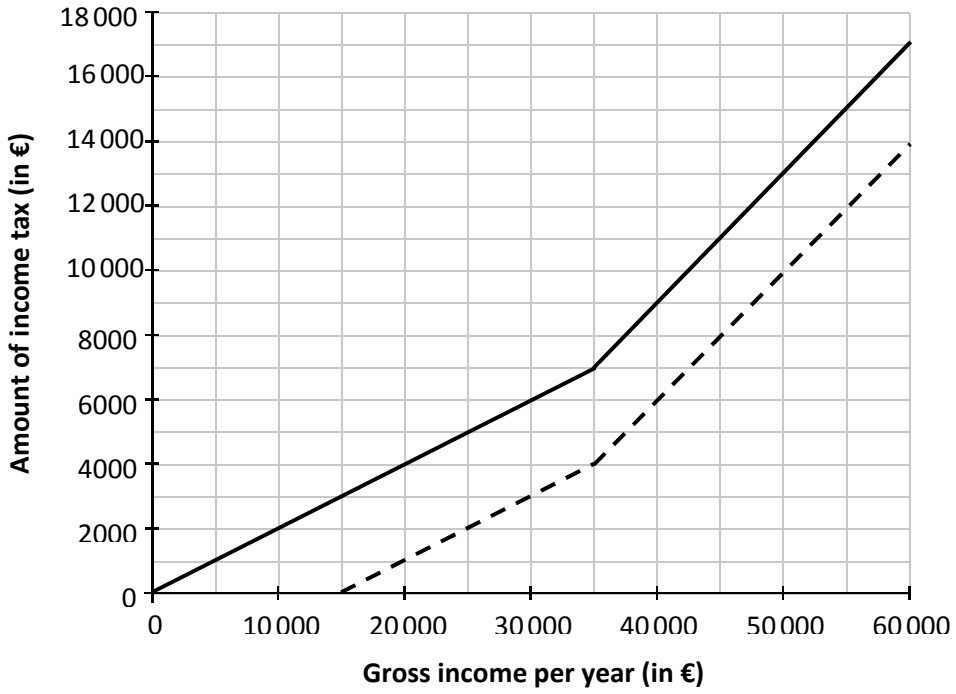
Q6	Model Solution – 40 Marks	Marking Notes
(e), (f)	(e) There will be more than $10\,000$ layers after 14 folds *or any other valid explanation* (f) *Answer*: Exponential *Reason*: It doubles each time **OR** The first differences are the same as the original sequence **OR** The variable is a power *or any other valid reason*	**Scale 10D (0, 2, 6, 9, 10)** *Low Partial Credit* • Work of merit in (e) **or** (f), for example: in (e), mentions 14 folds or $10\,000$ layers; in (f), correct box ticked; or shows understanding of linear / quadratic / exponential pattern. *Mid Partial Credit* • (e) **or** (f) correct • Work of merit in (e) **and** (f) *High Partial Credit* • One part correct **and** work of merit in the other part
(g), (h)	(g) $k \times 2 \times 2 \times 2 = 8k$ (h) $2^p \times 2 \times 2 \times 2$ $= 2^p \times 2^3 = 2^{p+3}$	**Scale 10C (0, 3, 7, 10)** Accept correct answers without supporting work. If a particular value is used for k or 2^p or p, award *LPC* at most, even if relevant work is presented in both (g) and (h) *Low Partial Credit:* • Work of merit in (g) **or** (h), for example: indicates multiplication by 2; indicates 8 in (g) *High Partial Credit* • (g) **or** (h) correct. • Work of merit in both (g) **and** (h)

Q7	Model Solution – 15 Marks	Marking Notes
(a)	Number of €5 notes: 3, 5 Number of €2 coins: 6, 1 *or with Way 2 = (5, 1) and Way 3 = (3, 6)*	**Scale 5C (0, 2, 3, 5)** Accept correct answers without supporting work. *Low Partial Credit* • Some work of merit, for example: attempt at trial and improvement *High Partial Credit* • One way correct
(b)	All even numbers can be made using €2 coins. €5 is the smallest odd number which can be made. All remaining odd numbers can be made using a €5 note and the required number of €2 coins. **OR** No €2: 5, 10, 15, ... = all no's ending in 0 or 5 One €2: 7, 12, 17, ... = all no's ending in 2 or 7 Two €2: 4, 9, 14, ... = all no's ending in 4 or 9 Three €2: 6, 11, 16, ... = all no's ending in 6 or 1 Four €2: 8, 13, 18, ... = all no's ending in 8 or 3 **OR** $2k$ gives all even $5 + 2k$ gives all odd **OR** *or any other valid explanation*	**Scale 10C (0, 3, 7, 10)** Accept indication of how to make all possible values, without full explanation. *Low Partial Credit* • Some work of merit, for example: gives one way of making an amount other than €2 or €5 *High Partial Credit* • Shows how to make all values in one infinite subset of the natural numbers that are greater than 3, for example: all even numbers; or all (relevant) odd numbers; or all multiples of five

Q8	Model Solution – 25 Marks	Marking Notes
(a)	$x = \frac{-(-4)\pm\sqrt{(-4)^2-4(1)(-7)}}{2(1)}$ $= \frac{4\pm\sqrt{16+28}}{2}$ $= \frac{4\pm\sqrt{44}}{2}$ $= 5\cdot316\ldots$ or $-1\cdot316\ldots$ $= 5\cdot32$ or $-1\cdot32$ [2 D.P.]	**Scale 15C (0, 4, 12, 15)** Note*:* If one root is given, award *HPC* at most Consider the solution as having 3 steps: Step 1: Correct formula Step 2: Full correct substitution into the quadratic formula. Step 3: Evaluates the quadratic formula. *Low Partial Credit* • 1 step correct • Identifies a, or b, or c • Correctly factorised and stops • 1 correct answer without work *High Partial Credit* • 2 steps correct • 2 correct answers without work *Full Credit –1* • Apply a * for incorrect rounding, or for answers in surd form: $2+\sqrt{11}$, $2-\sqrt{11}$
(b)	*Answer*: **A** *Justification*: It is the only one that crosses the y-axis at -2 [and $f(0)=-2$] **OR** Not **C** because the roots are wrong, and not **B** because the y-intercept is wrong.	**Scale 10C (0, 3, 7, 10)** If multiple boxes are ticked, ignore all ticks (unless answer is clearly identified) Award *FC* if candidate inputs an x value into $f(x)$ and generates the corresponding y value that uniquely defines graph A. *Low Partial Credit* • Correct graph identified • Work of merit in justification, for example: explains why it is not B **or** C; shows understanding that graph crosses x-axis at roots *High Partial Credit* • Correct graph identified **and** work of merit in justification

Q9	Model Solution – 25 Marks	Marking Notes
(a)	$\frac{45}{15} \times 10\,000 = 30\,000$ [views]	**Scale 5B (0, 3, 5)** Accept correct answer without supporting work. *Partial Credit* • Work of merit, for example, some correct multiplication or division indicated including reciprocals
(b), (c)	(b) $\frac{80\,000}{10\,000} \times 15 = [€]120$ (c) $\frac{15}{10\,000} = [€]0{\cdot}0015$ **OR** $[€]1 \cdot 5 \times 10^{-3}$ **OR** $[€]\frac{3}{2000}$	**Scale 5D (0, 2, 3, 4, 5)** Accept correct answers without supporting work. Accept correct answers in euro, without unit. *Low Partial Credit* • Work of merit in (b) **or** (c), for example, some correct multiplication or division indicated, including reciprocals *Mid Partial Credit* • (b) **or** (c) correct • Work of merit in both (b) **and** (c) *High Partial Credit* • (b) **or** (c) correct **and** work of merit in the other part *Full Credit –1* • Correct answer(s) given in cent (with unit)
(d)	Profit = Revenue - Cost $[€]\ 0{\cdot}0015x - 70$	**Scale 5B (0, 3, 5)** Accept correct answer without supporting work. *Partial Credit* • One correct term in expression, for example: -70 • Correct relevant formula: Profit = Revenue – Cost

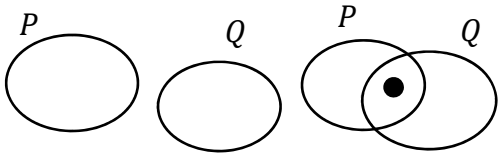
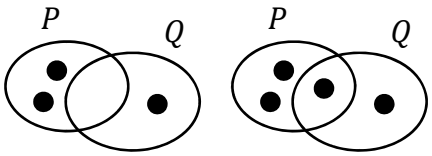
Q9	Model Solution – 25 Marks	Marking Notes
(e)	(i) $\frac{0\cdot0015x-70}{7}=200$ **OR** $0\cdot0015x-70=1400$ (ii) $0\cdot0015x=1470$ $x=980\,000$	**Scale 10D (0, 2, 6, 9, 10)** In (ii), correct answer without work is considered work of merit (rather than correct) *Note*: in (ii), candidate must deal adequately with the 15 and the 10 000, otherwise it is considered at most work of merit in (ii). *Low Partial Credit* • Work of merit in (i) **or** (ii), for example: (i) 7×200 ; (ii) 1470, or $\div15$, or $\times10\,000$ *Mid Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii) *High Partial Credit* • One part correct **and** work of merit in the other part *Full Credit –1* • Apply a * for the -70 missing or misused in (e)

Q10	Model Solution – 30 Marks	Marking Notes
(a)	Balance $= 50\,000 - 35\,000 = 15\,000$ 20% of €35000 + 40% of €15000 $= \quad 0 \cdot 2 \times 35000 + 0 \cdot 4 \times 15000$ $= \quad 7000 + 6000$ $= \quad €13\,000$	**Scale 15C (0, 4, 12, 15)** Accept correct answer without supporting work. *Low Partial Credit* • Work of merit, for example finds $15\,000$ *High Partial Credit* • 7000 **or** 6000 calculated
(b)		
	Marking Notes for Q10(b) are on the next page.	

Q10	Model Solution – 30 Marks	Marking Notes
(b)	When $x = 35\,000$, $y = 0 \cdot 2 \times 35000 = 7000$ When $x = 60\,000$, Balance $= 60\,000 - 35\,000 = 25\,000$, so $y \quad = 7000 + (0 \cdot 4 \times 25000)$ $= 7000 + 10\,000 = 17\,000$	**Scale 10C (0, 3, 7, 10)** Accept correct answer without supporting work. Tolerance: 1,000 on x-axis and 500 on y-axis Note: Graph must have a change of slope at $x = 35\,000$ for Full Credit *Low Partial Credit* • Some correct relevant calculation • Given line continued correctly for one box • Plots $(50\,000, 13\,000)$ or $(35\,000, 7\,000)$ *High Partial Credit* • One section of graph correct, that is: given line continues until $x = 35\,000$ and stops; or correct line drawn from $x = 35\,000$ to $x = 60\,000$ • Graph correct below $x = 30\,000$ **and** from $x = 40\,000$ up to $x = 60\,000$
(c)	*See dotted line graph above*.	**Scale 5B (0, 3, 5)** Note: if incorrect graph is given in (b) in the domain $[\mathbf{15\,000}, \mathbf{60\,000}]$, award FC in (c) if it is shifted correctly. *Partial Credit* • Graph in (b) (over a domain of width at least $10\,000$) shifted vertically or horizontally • Some relevant calculation • Two points plotted correctly

Q11	Model Solution – 10 Marks	Marking Notes
	$-3 \leq x \leq 1, \quad x \in \mathbb{Z}$ *or any other valid inequality*	**Scale 10D (0, 2, 6, 9, 10)** *Low Partial Credit* • Work of merit, for example: One correct box ticked; one inequality partially correct. *Mid Partial Credit* • One part fully correct (inequality and matching domain) • Two inequalities correct, but incorrect or no box(es) ticked *High Partial Credit* • Two parts fully correct (inequality and matching domain) • Three inequalities correct, but incorrect or no box(es) ticked *Full Credit –1* • Apply a * the first time the strictness of an inequality is incorrect; ignore any subsequent such errors
	$x \leq 3, \quad x \in \mathbb{N}$ **OR** $0 \cdot 5 < x < 4, \quad x \in \mathbb{Z}$ or $x \in \mathbb{N}$ *or any other valid inequality*	
	$-2 < x < 4, \quad x \in \mathbb{R}$	

Q12	Model Solution – 15 Marks	Marking Notes
(a)	$\frac{2}{n-3}-\frac{5}{2n+5}$ $=\frac{2(2n+5)-5(n-3)}{(n-3)(2n+5)}$ $=\frac{4n+10-5n+15}{(n-3)(2n+5)}$ $=\frac{-n+25}{(n-3)(2n+5)}$ **OR** $=\frac{-n+25}{2n^2-n-15}$	**Scale 10D (0, 2, 6, 9, 10)** *Low Partial Credit* • Work of merit , for example: Correct common denominator; some correct multiplication implied in numerator • $\frac{2(n-3)-5(2n+5)}{(n-3)(2n+5)}$ and continues *Mid Partial Credit* • Numerator set up correctly and denominator correct • Two terms correct out of $4n+10-5n+15$ in numerator and finishes correctly • No or incorrect common denominator but numerator correct as per solution *High Partial Credit* • $\frac{4n+10-5n+15}{(n-3)(2n+5)}$ • 3 terms correct in numerator and finishes correctly • Correct answer without supporting work *Full Credit –1* • Shows common denominator as denominator in calculations but then drops it subsequently
(b)	$(4x-3)^2+24x$ $=16x^2-12x-12x+9+24x$ $=\quad 16x^2-24x+9+24x$ $=\quad 16x^2+9,$ and $\quad x^2\geq 0 \quad$ so $\quad 16x^2+9>0$	**Scale 5C (0, 2, 3, 5)** *Low Partial Credit* • Correctly evaluates the expression for one real value of x • $(4x-3)(4x-3)$ *High Partial Credit* • One correct term in multiplication of given expression • Indication that $(\ )^2\geq 0$ *Full Credit –1* • $16x^2+9$, but with no conclusion

Q13	Model Solution – 15 Marks	Marking Notes
(a), (b)	(a) 1 Sometimes true 2 Never true 3 Always true 4 Always true (b) *Gives two examples: one where statement is true and one where statement is not true.* *For example:* True for {1, 2} and {3, 4}; False for {1, 2} and {1, 3}. **OR** True if $P =$ 7 days of the week and $Q =$ months of year; False if $P =$ 7 days of the week and $Q =$ days of the weekend **OR** True for: False for:  **OR** True for: False for:  **OR** States "True if $P \cap Q = \emptyset$, otherwise false." *or any other valid justification*	**Scale 15D (0, 3, 9, 13, 15)** *Low Partial Credit* • One statement correct in (a) • No statements correct in (a) but work of merit in (b), for example: answers "Always True" for Statement 1 and gives example where it is true *Mid Partial Credit* • Two statements correct in (a) • One statement correct in (a) **and** work of merit in (b), for example: Statement 1 correct and gives example where it is true (or where it is false) *High Partial Credit* • All four statements correct in (a) • Three statements correct in (a) **and** work of merit in (b) • One statement correct in (a) **and** (b) correct as per solution

Q14	Model Solution – 25 Marks	Marking Notes
(a)	$\frac{(2n-5)(n+3)}{(n+3)(n-3)}$ $= \frac{2n-5}{n-3}$	**Scale 15C (0, 4, 12, 15)** *Low Partial Credit* • Work of merit in numerator or denominator, for example: guide number correctly identified in top line (-30 or 30) *High Partial Credit* • Numerator **or** denominator factorised correctly • Correct answer without work
(b)	(i) $(x+a)(x+b)=0$ $x+a=0$ or $x+b=0$ $x=-a$ or $x=-b$ (ii) $(x+a)(x+b) \div (x+a)$ $= x+b$	**Scale 10C (0, 3, 7, 10)** Accept correct answer without supporting work. *Low Partial Credit* • Work of merit in (i) **or** (ii), for example: replaces $x^2+(a+b)\,x+ab$ with $(x+a)(x+b)$ • One correct term in answer if using long division in (ii) *High Partial Credit* • (i) **or** (ii) correct • Work of merit in (i) **and** (ii)