



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2019

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.

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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 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, 5, 10	0, 4, 7, 10	0, 4, 6, 8, 10
15-mark scale			0, 5, 9, 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*. 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 (15)

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

Question 2 (15)

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

Question 3 (15)

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

Question 4 (35)

- (a) (i) 10C
- (a) (ii) 10D
- (b) 5C
- (c) 10B

Question 5 (15)

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

Question 6 (40)

- (a), (b) 15D
- (c) 5C
- (d), (e) 10D
- (f), (g) 10D

Question 7 (20)

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

Question 8 (10)

10C

Question 9 (25)

- (a) 5D
- (b) 5C
- (c), (d) 5D
- (e), (f) 10D

Question 10 (20)

- Graph 1 10C
- Graph 2 10C

Question 11 (10)

10D

Question 12 (30)

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

Question 13 (25)

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

Question 14 (25)

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

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.

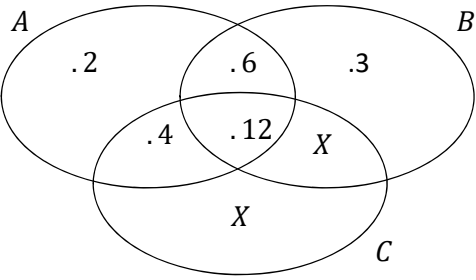
Q.1	Model Solution – 15 Marks	Marking Notes
<p>(a), (b)</p>	<p>(a) $\frac{3}{5} \times 85 = 51$</p> <p style="text-align: center;">OR</p> <p>$\frac{2}{5} \times 85 = 34$ $85 - 34 = 51$</p> <p>(b) $\frac{26}{85} \times 100 = 30.588$ $= 30.6[\%]$</p>	<p>Scale 5D (0, 2, 3, 4, 5)</p> <p>Accept correct answer in (a) and in (b) without supporting work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: one relevant calculation <p><i>Mid-Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part <p><i>Full Credit-1</i></p> <ul style="list-style-type: none"> • Apply a * if incorrect or no rounding
<p>(c)</p>	<p>Answer: $a < 15$</p> <p>Example:</p> <p>Original ratio = 15:1</p> <p>New ratio = 15:2 = 7.5:1</p> <p>$7.5 < 15$</p> <p><i>Or any other similar example</i></p>	<p>Scale 10C (0, 4, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Answer correct • Answer incorrect but work of merit in example; adds one to teacher number <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Answer correct and work of merit in example • Example fully correct but incorrect box ticked

Q.2	Model Solution – 15 Marks	Marking Notes
(a), (b)	(a) Answer: 3, 5, 9, 15 (b) <i>Prime</i> ticked	<p>Scale 5D (0, 2, 3, 4, 5)</p> <p>Accept correct answers without supporting work Note: Accept correct pairs of factors</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct factor in (a) • (b) correct <p><i>Mid partial Credit</i></p> <ul style="list-style-type: none"> • Two correct factors in (a) and (b) correct • Three correct factors in (a) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Three correct factors in (a) and (b) correct • (a) correct
(c), (d)	(c) $p = 49$ (d) Answer: 2, 4, $3k + 2$, $6k + 4$	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answers without supporting work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Multiple(s) of 7 listed in (c), one correct term factorised in (d), eg. $4(3k)$ indicated <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • (c) correct • Work of merit in both (c) and (d) • Two correct factors in (d), including one in terms of k <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (c) correct and two correct factors in (d), including one in terms of k • (d) correct

Q.3	Model Solution – 15 Marks	Marking Notes
(a), (b)	(a) $56\,000\,000 = 5.6 \times 10^7$ [km] (b) $0.0075 = 7.5 \times 10^{-3}$ [cm]	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answer without units</p> <p>Accept correct answers without supporting work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Correct value in standard form but $1 \geq a > 10$ and $n \in \mathbb{Z}$ eg 5600×10^4 • a or b correct or n correct 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 fully correct and work of merit in other part
(c)	$90 \text{ km/h} \times 1\,000 = 90\,000 \text{ m/hr}$ $90\,000 \text{ m/hr} \div 60 = 1500 \text{ m/min}$ $1500 \text{ m/min} \div 60 = 25 \text{ m/sec}$ $25 \div 2 = 12.5$ [m] in half a second	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answer without units</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: Indicates $\times 1000$ or $\div 60$. • Correct relevant formula. i.e. $S = \frac{D}{T}$ <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Correct conversion to m/min or km/sec or m/sec • Correct answer without supporting work

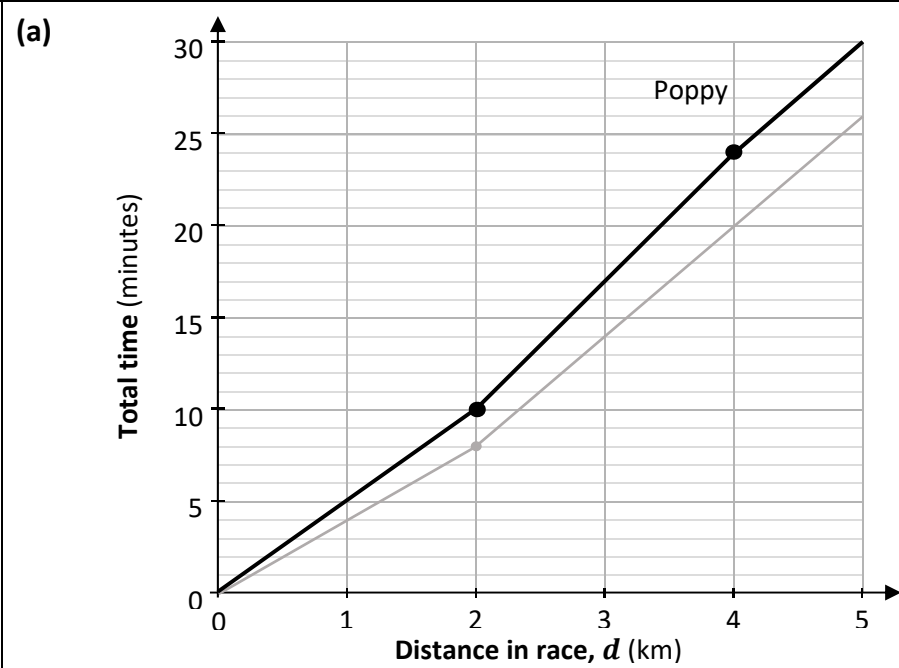
Q.4	Model Solution – 35 Marks	Marking Notes
(a) (i)	Pension contribution: $0.085 \times 52\,460 = 4\,459.10$ Taxable income = $52\,460 - 4\,459.10$ $= [\text{€}] 48\,000.90$ OR $1 - 0.085 = 0.915$ $0.915 \times 52\,460 = [\text{€}] 48\,000.90$ OR $1\% = \frac{52\,460}{100} = 524.60$ $8.5\% = 524.6 \times 8.5 = 4\,459.10$ Taxable income = $52\,460 - 4\,459.10$ $= [\text{€}] 48\,000.90$	Scale 10C (0, 4, 7, 10) Accept correct answer without supporting work Accept correct answer without unit <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Work of merit, for example: 8.5% written as a decimal or fraction; i.e. 0.085 or $\frac{8.5}{100}$ <i>High Partial Credit</i> <ul style="list-style-type: none"> • $4\,459.10$ • 0.915 • Uses 0.85 or 0.0085 (or equivalent) but continues correctly
(a) (ii)	Step 1: $0.2 \times 34\,000 = 6\,800$ Step 2: $(48\,000.90 - 34\,000) = 14\,000.90$ $0.4 \times 14\,000.90 = 5\,600.36$ Step 3: $6\,800 + 5\,600.36 = 12\,400.36$ $12\,400.36 - 4\,200 = 8\,200.36$ Step 4: $48\,000.90 - 8\,200.36$ $= [\text{€}] 39\,800.54$	Scale 10D (0, 4, 6, 8, 10) Note: Accept candidates answer from (i) Treat the solution as having four steps Step 1: Calculate tax at standard rate Step 2: Calculate tax at higher rate Step 3: Calculate net tax Step 4: Calculate net income <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Work of merit in one step, for example 0.2, or finds income to be taxed at higher rate <i>Mid Partial Credit</i> <ul style="list-style-type: none"> • Two steps correct • One step correct and work of merit in two other steps <i>High Partial Credit</i> <ul style="list-style-type: none"> • Three steps correct • Two steps correct and work of merit in other two steps • Correct answer without supporting work <i>Full Credit -1</i> <ul style="list-style-type: none"> • Apply a * if incorrect reduced gross income figure is used i.e. $\text{€}52\,460$ used

Q.4	(contd.) Model Solution – 35 Marks	Marking Notes
(b)	$420 \times 1.02^3 = \text{€ } 445.71$ <p style="text-align: center;">OR</p> $420 \times 0.02 = 8.40$ $428.40 \times 0.02 = 8.57$ $436.97 \times 0.02 = 8.74$ $\text{Bill now} = \text{€}445.71$	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answer without supporting work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> Writes 0.02 or $\frac{2}{100}$ or 1.02 or $\frac{420}{100}$ Correct relevant formula <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> Fully correct substitution into compound interest formula Correctly calculates bill for two months, not necessarily consecutive. €25.71 Uses 0.2 correctly An incorrect percentage consistently compounded in all 3 years <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> Apply a * for incorrect or early rounding
(c)	$12\,150 = 90\% \text{ of original value}$ $\frac{12\,150}{0.9} = \text{€}13\,500$	<p>Scale 10B (0, 5, 10)</p> <p>Accept correct answer without supporting work</p> <p><i>No Credit</i></p> <ul style="list-style-type: none"> 10% of 12 150 <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> Some work of merit, for example: Mentions 90% or 0.9 Correct relevant formula

Q.5	Model Solution – 15 Marks	Marking Notes
(a), (b)	<p>(a) Answer: Any multiple of 12</p> <p>(b) A is the set of even numbers. C is the set of multiples of 4. All multiples of 4 are even numbers so C is a subset of A.</p> <p style="text-align: center;"><i>or any other valid explanation</i></p>	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Lists more multiples of 2, 3 or 4 in (a) or shows some understanding of subsets in (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct
(c), (d)	<p>For example:</p> 	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Note: For part (d) there are an infinite number of possible solutions</p> <p>Note: Any incorrect element in a region negates that region in (d) (numbers only)</p> <p>Note: More than two 'X's in diagram cannot get (c) correct.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One region correct • Work of merit in (d) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Three regions correct • Part (c) correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Five regions correct including at least one region containing an X • Part (c) correct and work of merit in (d)

Q.6	Model Solution – 40 Marks	Marking Notes
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(a),
(b)



(b)

Distance (km)	Time (Ella)
1	4
2	8
3	14
4	20
5	26

Scale 15D (0, 5, 9, 12, 15)

Treat the graph in (a) as having 6 given points including (0,0).
 These points need to be joined as an increasing function of d .

Low Partial Credit

- Two of the given points correctly plotted in (a)
- One value correct in (b)

Mid Partial Credit

- One part correct
- Work of merit in both parts

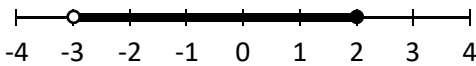
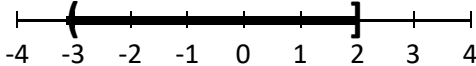
High Partial Credit

- One part correct and work of merit in the other part

Full Credit -1

- Apply a * if all 5 given points are plotted in (a) correctly but not joined appropriately

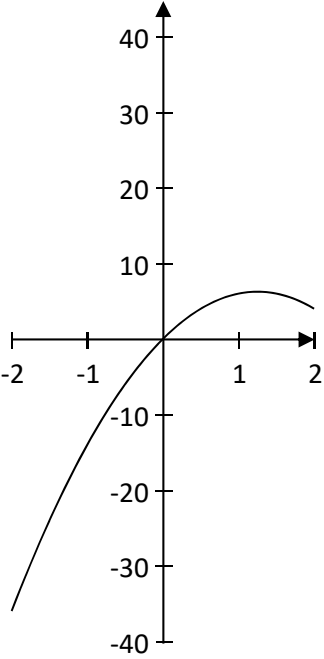
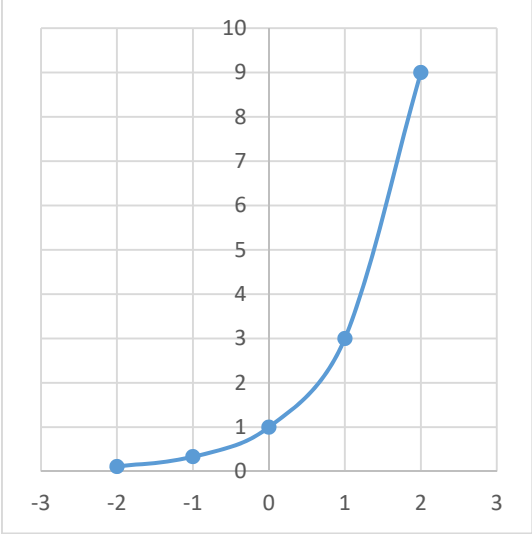
Q.6	Model Solution – 40 Marks	Marking Notes
(c)	$\begin{array}{cccccc} 5 & 10 & 17 & 24 & 30 & \\ & 5 & 7 & 7 & 6 & \\ & & 2 & 0 & -1 & \end{array}$ <p>Second differences are not constant</p>	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Relevant formula; i.e. $T_n = an^2 + bn + c$ • Mentions second differences • Calculates first difference(s) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Finds one second difference <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> • Apply a * if two or three correct second differences given but no conclusion • Apply a * if Ella's data used correctly
(d),(e)	<p>(d) Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{5}{26} \times 60 = 11.54$ [km/hr]</p> <p style="text-align: center;">OR</p> <p>5 km = 26 mins 1 km = 5 · 2 mins $60 \div 5 \cdot 2 = 11 \cdot 54$ [km/hr]</p> <p>(e) Answer: Ella's speed decreased Justification: The first two km took 8 minutes while the next two took 12 minutes. <i>or any other valid reason based on the graph or the table.</i></p>	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>Accept correct answer without supporting work in (d)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in either (d) or (e), for example: some correct relevant calculation or formula in (d) OR Correct box ticked in (e) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <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> <p>Apply a * for incorrect or no rounding in (d)</p> <p>NOTE: Work of merit in (e) if ticks box for 'speed increases' and justifies by reference to increase in slope</p>
(f), (g)	<p>(f) Ciarán stopped running for 5 minutes</p> <p>(g) An input can only have one output so a graph of a function can't be vertical</p> <p><i>or any other valid explanation based on section C of graph</i></p>	<p>Scale 10D (0, 4, 6, 8, 10)</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"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part

Q.7	Model Solution – 20 Marks	Marking Notes
(a)	(i) The (set of) positive whole numbers (ii) The (set of) positive and negative whole numbers and zero <i>or any other valid explanation</i>	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit</i> <ul style="list-style-type: none"> • Work of merit in one part, for example: Lists some element(s) of \mathbb{N} in (i) or \mathbb{Z} in (ii) <i>High Partial Credit</i> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <i>Full Credit -1</i> <ul style="list-style-type: none"> • Apply a * if zero omitted in (ii)
(b)	 <p>Note: strictness of inequality may be indicated in different ways</p> <p>For example:</p> 	Scale 5B (0, 3, 5) <i>Partial Credit</i> <ul style="list-style-type: none"> • One correct end-point indicated • Graphs given inequality for $x \in \mathbb{Z}$ <i>Full Credit -1</i> <ul style="list-style-type: none"> • Apply a * if -3 included or 2 omitted in otherwise correct solution
(c)	$-7 < 8 - 3g \leq 11$ $-15 < -3g \leq 3$ $15 > 3g \geq -3$ $\frac{15}{3} > g \geq \frac{-3}{3}$ $5 > g \geq -1$	Scale 10C (0, 4, 7, 10) Accept " $g < 5$ and $g \geq -1$ " or " $g < 5 \cap g \geq -1$ " for Full Credit Accept integers or real numbers shaded correctly on the number line with work <i>Low Partial Credit</i> <ul style="list-style-type: none"> • One correct relevant step completed, for example: Subtracts 8 from LHS or RHS <i>High Partial Credit</i> <ul style="list-style-type: none"> • Correctly solves both sides for $3g$ or $-g$ • Correctly solves one side of inequality • Solves to get both 5 and -1 but incorrect inequalities <i>Full Credit -1</i> $g < 5$ $g \geq -1$

Q.8	Model Solution – 10 Marks	Marking Notes
	$52 + 184 - n + 2n + 125$ Total people = $361 + n$ So make n as big as possible $M \cap S = 184 - n$ so max value of n is 184 Max number of people = $361 + 184 = 545$	Scale 10C (0, 4, 7, 10) Accept correct answer without supporting work <i>Low Partial Credit</i> <ul style="list-style-type: none"> Some work of merit, for example: Adds a number of terms States “make n as big as possible” or similar <i>High Partial Credit</i> <ul style="list-style-type: none"> Gets $361 + n$ OR $361 - n + 2n$ States $n = 184$ and stops

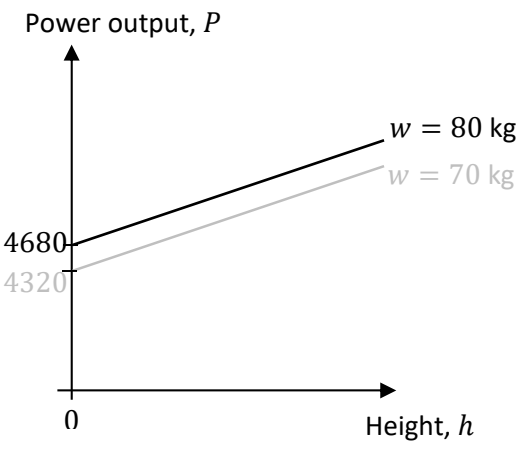
Q.9	Model Solution – 25 Marks	Marking Notes
(a)	(i) 12 th term = 4 (ii) $100 \div 3 = 33$ Rem 1 so 100 th term will be the same as Term 1 100 th term = 3	Scale 5D (0, 2, 3, 4, 5) Accept correct answers without supporting work <i>Low Partial Credit</i> <ul style="list-style-type: none"> Work of merit in one part, for example: Continues sequence of terms in (i) or (ii) OR divides by 3 in (ii); $\frac{12}{3} = 4$ written below box is work of merit in (i) if no answer in the box <i>Mid Partial Credit</i> <ul style="list-style-type: none"> One part 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
(b)	Divide n by 3. If remainder = 0 then $T_n = T_3$ If remainder = 1 then $T_n = T_1$ If remainder = 2 then $T_n = T_2$	Scale 5C (0, 2, 3, 5) <i>Low Partial Credit</i> <ul style="list-style-type: none"> Mentions dividing by 3 Reference to treatment of the remainder <i>High Partial Credit</i> <ul style="list-style-type: none"> Mentions dividing by 3 and links at least one remainder to correct appropriate term

Q.9	Model Solution – 25 Marks	Marking Notes
(c), (d)	<p>(c) 8, 5, 10, 6, 4</p> <p>(d) His sequence will remain constant at 2 <i>or equivalent</i></p>	<p>Scale 5D (0, 2, 3, 4, 5)</p> <p>Accept correct answers in (c) without supporting work</p> <p>Note: 2,2,2,... is Work of merit in (d) (not fully correct)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Gets one term correct in (c), finds a second term in (d) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in the other part
(e), (f)	<p>(e) $86 \div 2 = 43$ and $86 \times 2 - 2 = 170$</p> <p>(f) $k \times 2 = 2k$ even</p> <p>$\frac{1}{2}(2k + 2) = k + 1$ even</p> <p>$\frac{1}{2}(k + 1 + 2) = \frac{k+3}{2}$</p> <p>Answer: $k, 2k, k + 1, \frac{k+3}{2}$</p>	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Some relevant calculation in (e), one correct term in (f) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • (e) or (f) correct • Work of merit in both (e) and (f) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (e) or (f) correct and work of merit in other part <p>NOTE: If terms not in simplest form apply * once only</p>

Q.10	Model Solution – 20 Marks	Marking Notes
	<p>Graph 1</p> <p>Points: $(-2, -36), (-1, -14), (0,0), (1,6), (2,4)$</p> 	<p>Scale 10C (0, 4, 7, 10)</p> <p>NOTE: Linear graph merits LPC at most</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in calculating a point • One point plotted correctly on graph <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • All 5 points calculated correctly • Three correct points plotted correctly • Graph drawn correctly but all five points not listed <p><i>Full credit -1</i></p> <p>Apply a * if all points are plotted correctly but not joined or joined incorrectly with work once only</p>
	<p>Graph 2</p> <p>Points: $(-2, \frac{1}{9}), (-1, \frac{1}{3}), (0,1), (1,3), (2,9)$</p> 	<p>Scale 10C (0, 4, 7, 10)</p> <p>NOTE: Linear graph merits LPC at most</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in calculating a point • One point plotted correctly on graph <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • All 5 points calculated correctly • Three correct points plotted correctly • Graph drawn correctly but all five points not listed <p><i>Full credit -1</i></p> <p>Apply a * if all points are plotted correctly but not joined or joined incorrectly with work once only</p>

Q.11	Model Solution – 10 Marks	Marking Notes
	$\frac{3x + 5}{2} + \frac{x - 4}{3} = 16$ $\frac{3(3x + 5) + 2(x - 4)}{(2)(3)} = 16$ $9x + 15 + 2x - 8 = 96$ $11x = 89$ $x = \frac{89}{11}$	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Correct common denominator • Some work of merit in numerator <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • $3(3x + 5) + 2(x - 4) = 6(16)$ or equivalent • Two errors in numerator but finishes correctly <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • $11x = 89$ • Fully solved with at most one error • Correct answer without supporting work • Solves correctly: $3(3x + 5) + 2(x - 4) = 16$ <p><i>Full credit -1</i></p> <p>Apply a * if 8·0909 given with work without showing $\frac{89}{11}$</p>

Q.12	Model Solution – 30 Marks	Marking Notes												
(a)	$(a)^2 - (4n)^2$ $(a - 4n)(a + 4n)$	<p>Scale 5B (0, 3, 5)</p> <p>Accept correct answer without supporting work</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> • $(a)^2$ or $(4n)^2$ • Difference of two squares indicated eg. $(a - 16n)(a + 16n)$ • One correct factor 												
(b)	<p>(i) $(8x - 3)(x + 6)$</p> <p style="text-align: center;">OR</p> $45x = 48x - 3x$ $8x^2 + 48x - 3x - 18$ $8x(x + 6) - 3(x + 6)$ $= (8x - 3)(x + 6)$ <p>(ii) Eg. $(x + 6)(x + 1)$</p> <p>$= x^2 + 7x + 6$ or any other quadratic expression that has $(x + 6)$ as a factor</p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Accept correct answers without supporting work</p> <p>Note: $(x + 6)$ does not merit any credit as it is given in both parts</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: One correct term in factoring eg. $8x$ or -3 in (i) or sets up multiplication in (ii) • Finds root as $\frac{3}{8}$ or $0 \cdot 375$ <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part 												
(c)	$2y + 3\sqrt{2y^3 - 9y^2 - 28y - 15}$ $\begin{array}{r} 2y^3 + 3y^2 \\ -12y^2 - 28y \\ \hline -12y^2 - 18y \\ -10y - 15 \\ \hline -10y - 15 \\ 0 \end{array}$ <p style="text-align: center;">OR</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">y^2</td> <td style="text-align: center;">$-6y$</td> <td style="text-align: center;">-5</td> </tr> <tr> <td style="text-align: right;">$2y$</td> <td style="border: 1px solid black; padding: 5px;">$2y^3$</td> <td style="border: 1px solid black; padding: 5px;">$-12y^2$</td> <td style="border: 1px solid black; padding: 5px;">$-10y$</td> </tr> <tr> <td style="text-align: right;">$+3$</td> <td style="border: 1px solid black; padding: 5px;">$+3y^2$</td> <td style="border: 1px solid black; padding: 5px;">$-18y$</td> <td style="border: 1px solid black; padding: 5px;">-15</td> </tr> </table>		y^2	$-6y$	-5	$2y$	$2y^3$	$-12y^2$	$-10y$	$+3$	$+3y^2$	$-18y$	-15	<p>Scale 10C (0, 4, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct term in long division or array method <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One full step/cycle completed correctly including finding remainder in long division; e.g. $-12y^2$ • Gets y^2 and correctly splits up the $-9y^2$ or the $-28y$ in array method
	y^2	$-6y$	-5											
$2y$	$2y^3$	$-12y^2$	$-10y$											
$+3$	$+3y^2$	$-18y$	-15											

Q.13	Model Solution – 25 Marks	Marking Notes
(a), (b)	<p>(a) $P = 36(70) + 62(0 \cdot 65) + 1800$ $P = 2\,520 + 40 \cdot 3 + 1\,800$ $P = 4\,360 \cdot 3$ or $\frac{43603}{10}$</p> <p>(b) $P = 4360 \cdot 3 + 8 = 4368 \cdot 3$ $36(70) + 62h + 1800 = 4368 \cdot 3$ $2\,520 + 62h + 1\,800 = 4368 \cdot 3$ $62h + 4320 = 4368 \cdot 3$ $62h = 48 \cdot 3$ $h = 0 \cdot 779 = 0 \cdot 78$ [m]</p> <p style="text-align: center;">OR</p> $36w + 62h + 1800 + 8 = 36w + 62H + 1800$ $62h + 8 = 62H$ $\frac{62(0.65) + 8}{62} = H$ $H = 0 \cdot 779 = 0 \cdot 78$ [m] <p style="text-align: center;">OR</p> <p>Increase in h: $\frac{8}{62} = 0 \cdot 129 \dots = 0 \cdot 13$ [2D.P.] New $h = 0 \cdot 65 + 0 \cdot 13 = 0 \cdot 78$ m</p>	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p>NOTE: Correct answer with no supporting work is considered fully correct in (a), but work of merit in (b)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: Correct substitution or operation in (a) or (b), Adds 8 to answer from (a) in part (b) • Sets up equation in (b) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> • Apply a * for incorrect or no rounding
(c)	<p>$P = 36(80) + 62h + 1800$ $P = 62h + 4680$</p> <p>Power output, P</p>  <p style="text-align: right;">Height, h</p>	<p>Scale 5C (0, 2, 3, 5)</p> <p>Consider the solution as requiring three aspects:</p> <ol style="list-style-type: none"> 1: Correct figure (4680) 2: Parallel line 3: line above the given line <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • 1 aspect correct • Work of merit in calculating P <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 aspects correct • $P = 62h + 4680$

Q.13	Model Solution – 25 Marks	Marking Notes
(d)	$60w + 80h - 15f - 1300 = 36w + 62h + 1800$ $80h - 62h = 15f + 36w - 60w + 1800 + 1300$ $18h = 15f - 24w + 3100$ $h = \frac{15f}{18} - \frac{24w}{18} + \frac{3100}{18} \text{ or equivalent}$	<p>Scale 10C (0, 4, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: One correct transposition <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Isolates all h terms on one side and all non-h terms on other side i.e. $18h = 15f - 24w + 3100$

Q.14	Model Solution – 25 Marks	Marking Notes
(a)	$T_2 - T_1 = x^2 - 8x + 3$ $T_3 - T_2 = 4x^2 + 3x - (x^2 - 2x)$ $T_3 - T_2 = 3x^2 + 5x$	<p>Scale 10D (0, 4, 6, 8, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: One correct subtraction in $T_2 - T_1$, Writes in correct terms in $T_3 - T_2$ <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part
(b)	<p>If linear then: $x^2 - 8x + 3 = 3x^2 + 5x$</p> $2x^2 + 13x - 3 = 0$	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: States first differences are constant, sets $T_2 - T_1 = T_3 - T_2$ <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • At least one correct transposition in $x^2 - 8x + 3 = 3x^2 + 5x$ (i.e. in $T_2 - T_1 = T_3 - T_2$)

Q.14	Model Solution – 25 Marks	Marking Notes
(c)	$2x^2 + 13x - 3 = 0$ $a = 2, b = 13, c = -3$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-13 \pm \sqrt{13^2 - 4(2)(-3)}}{2(2)}$ $= \frac{-13 \pm \sqrt{193}}{4}$ $x = 0.223 \text{ or } x = -6.723$	<p>Scale 10C (0, 4, 7, 10)</p> <p>Consider the solution as having 3 steps:</p> <p>Step 1: Identifies a and b and c.</p> <p>Step 2: Full correct substitution into the quadratic formula.</p> <p>Step 3: Evaluates the quadratic formula.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Identifies a or b or c • 1 step • Correct formula • One correct answer without work <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 2 steps • Correct answers without work • Stops at $\frac{-13 \pm \sqrt{193}}{4}$ <p><i>Full Credit -1</i></p> <p>Apply a * for not rounded to three decimal places or incorrectly rounded</p>

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2019

Marking Scheme

Mathematics

Higher Level

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 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, 5, 10	0, 2, 7, 10	0, 2, 4, 8, 10
15-mark scale		0, 6, 10, 15	0, 5, 9, 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*. 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 (20)

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

Question 2 (35)

- (a), (b) 5B
- (c), (d) 5D
- (e), (f) 10D
- (g) 10D
- (h) 5C

Question 3 (10)

10C

Question 4 (15)

- (a), (b) 15C

Question 5 (45)

- (a), (b) 10D
- (c) 15C
- (d), (e) 5C
- (f), (h) 5C
- (g) 10C

Question 6 (30)

- (a), (b) 15D
- (c) 5B
- (d) 10D

Question 7 (30)

- (a), (b) 10D
- (c) 10D
- (d), (e) 10D

Question 8 (15)

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

Question 9 (20)

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

Question 10 (15)

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

Question 11 (15)

- (a), (b) 15D

Question 12 (15)

15D

Question 13 (20)

- (a) 10C
- (b) 10C

Question 14 (15)

15D

Model Solutions & Marking Notes

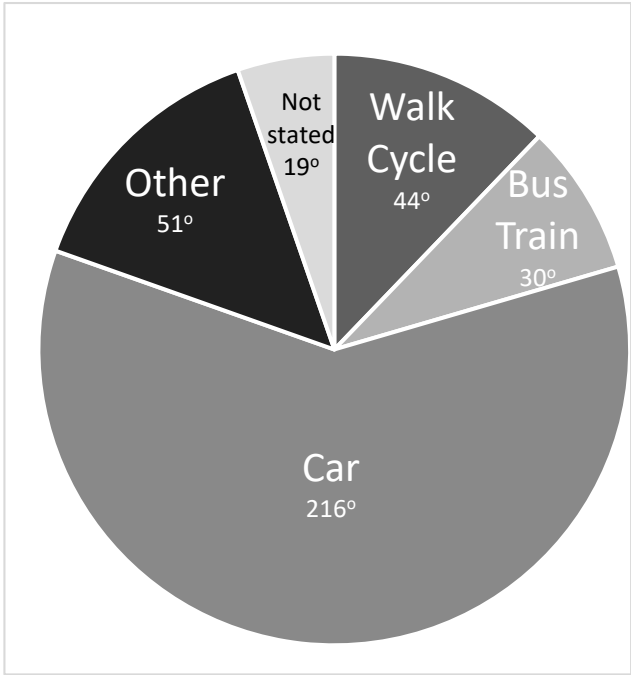
Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

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.

Q.1	Model Solution – 20 Marks	Marking Notes
(a), (b)	<p>(a) Range = $172 - 141 = 31$</p> <p>(b) Answer: 141 Reason: Rest of data has a range of 7</p> <p><i>or any other valid reason</i></p>	<p>Scale 10D (0, 2, 4, 8, 10)</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, for example: indicates subtraction in (a), answer correct or explains outlier in (b) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> One part correct Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> One part correct and work of merit in other part
(c)	<p>Mean = $\frac{141+165+\dots+172}{8}$</p> <p>$= \frac{1324}{8} = 165.5[\text{cm}]$</p>	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answer without work</p> <p>Accept correct answer without units</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> Work of merit, for example: some correct addition indicated, \div by 8 <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> $\frac{141+165+\dots+172}{8}$

Q.1	Model Solution – 20 Marks	Marking Notes
(d)	<p>Answer: The median height of the teachers is bigger than 175 cm</p> <p>Reason: If median is bigger than 175cm then more than 50% of teachers must be more than 175 cm</p> <p style="text-align: center;">OR</p> <p>Not mean as due to outliers the mean could be greater than 175cm while more than half of teachers could be less than or equal to 175cm <u>and</u> not mode as this is simply the most common height which could easily be less than 175 cm</p> <p style="text-align: center;"><i>or any other valid explanation</i></p>	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Answer correct or work of merit in reason, for example: explains mean, mode or median, discounts either mode or mean <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Answer correct and work of merit in reason • Reason correct but incorrect or no box ticked

Q.2	Model Solution – 35 Marks	Marking Notes																																								
(a), (b)	(a) Answer: Categorical Nominal (b) Answer = Car	Scale 5B (0, 3, 5) <i>Partial Credit</i> • One part correct																																								
(c), (d)	<p>(c)</p> <table border="1" data-bbox="256 461 890 1010"> <thead> <tr> <th></th> <th colspan="2">2006</th> <th colspan="2">2016</th> </tr> <tr> <th>Way</th> <th>Men</th> <th>Women</th> <th>Men</th> <th>Women</th> </tr> </thead> <tbody> <tr> <td>Walk or Bike</td> <td>12.1</td> <td>15.4</td> <td>12.2</td> <td>12.6</td> </tr> <tr> <td>Bus or Train</td> <td>8.0</td> <td>11.3</td> <td>8.3</td> <td>10.5</td> </tr> <tr> <td>Car</td> <td>62.6</td> <td>71.4</td> <td>60.0</td> <td>71.9</td> </tr> <tr> <td>Other</td> <td>15.3</td> <td>0.7</td> <td>14.2</td> <td>0.4</td> </tr> <tr> <td>Not stated</td> <td>2.0</td> <td>1.2</td> <td>5.3</td> <td>4.6</td> </tr> <tr> <td>Total</td> <td>100.0</td> <td>100.0</td> <td>100.0</td> <td>100</td> </tr> </tbody> </table> <p>(d) 15.4% of women walked or cycled compared with 12.1% of men.</p>		2006		2016		Way	Men	Women	Men	Women	Walk or Bike	12.1	15.4	12.2	12.6	Bus or Train	8.0	11.3	8.3	10.5	Car	62.6	71.4	60.0	71.9	Other	15.3	0.7	14.2	0.4	Not stated	2.0	1.2	5.3	4.6	Total	100.0	100.0	100.0	100	<p>Scale 5D (0, 2, 3, 4, 5) Accept correct answers in (c) without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct value in (c) • Work of merit in (d), for example: correct relevant percentage mentioned <p><i>Mid partial Credit</i></p> <ul style="list-style-type: none"> • (d) correct • Two correct values in (c) • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • (d) correct and two correct values in (c) • Three correct values in (c)
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(e), (f)	<p>(e) Answer: Alison is not correct Reason: 71.9% of a smaller population could be less than 71.4% of a larger population. <i>or any other valid reason</i></p> <p>(f) 8.3% of 990 000 = 82 170 men 10.5% of 880 000 = 92 400 women Total for bus or train = 174 570 people</p> <p>Total people 990 000 + 880 000 = 1 870 000 Percentage for bus or train = $\frac{174\,570}{1\,870\,000} \times 100$ = 9.3353 = 9.34 %</p>	<p>Scale 10D (0, 2, 4, 8, 10) Note: Correct answer in part (f) without supporting work cannot get full credit for this part.</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: answer correct in (e) or merit in reason, relevant percentage used in (f), 1 870 000 mentioned <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part fully correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part fully correct and work of merit in other part <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no rounding or incorrect rounding in (f) 																																								

Q.2	Model Solution – 35 Marks	Marking Notes															
(g)	<p>(i) $\frac{12.2}{100} \times 360 = 43.92$ $\frac{8.3}{100} \times 360 = 29.88$ $\frac{60}{100} \times 360 = 216$ $\frac{14.2}{100} \times 360 = 51.12$ $\frac{5.3}{100} \times 360 = 19.08$</p> <table border="1" data-bbox="280 517 919 703"> <thead> <tr> <th>Walk or cycle</th> <th>Bus or Train</th> <th>Car</th> <th>Other</th> <th>Not Stated</th> </tr> </thead> <tbody> <tr> <td>12.2</td> <td>8.3</td> <td>60.0</td> <td>14.2</td> <td>5.3</td> </tr> <tr> <td>44°</td> <td>30°</td> <td>216°</td> <td>51°</td> <td>19°</td> </tr> </tbody> </table> <p>(ii)</p> 	Walk or cycle	Bus or Train	Car	Other	Not Stated	12.2	8.3	60.0	14.2	5.3	44°	30°	216°	51°	19°	<p>Scale 10D (0, 2, 4, 8, 10)</p> <p>Accept correct angles but not transferred to table</p> <p>Allow tolerance of $\pm 2^\circ$ in (ii)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: use of 360, one angle correctly calculated or drawn <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Four angles correctly calculated • One angle correctly calculated and drawn in the pie-chart • Pie chart fully correct, size of the angles not marked on the chart or listed on the table and no work shown <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Part (i) fully correct and two correct angles in pie-chart • Four angles correct in (i) and three angles correct in (ii) • Fully correct but work not shown <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no rounding or incorrect rounding • Apply a * for diagram not labelled and/or angles not marked
Walk or cycle	Bus or Train	Car	Other	Not Stated													
12.2	8.3	60.0	14.2	5.3													
44°	30°	216°	51°	19°													

Q.2	Model Solution – 35 Marks	Marking Notes
(h)	<p><i>Answer must mention three ways/lines and reference the shapes/percentages or comparisons; for example:</i></p> <p>The percentage of students travelling by car doubled to 50% between 1986 and 2002 with the sharpest rise between 1996 and 2002. From 2002 to 2016 it increased more gradually to 60%</p> <p>The percentage of students walking or cycling halved to 25% between 1986 and 2002 when it then stabilised</p> <p>The percentage of students travelling by bus or train was relatively stable at 20% until 1996 and it then decreased gradually to around 10% by 2016.</p>	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Two correct

Q.3	Model Solution – 10 Marks		Marking Notes
	Transformation	Image	<p>Scale 10C (0, 2, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct entry <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Two correct entries
Axial symmetry in the x -axis	<i>S</i>		
Axial symmetry in the y -axis	<i>T</i>		
Translation	<i>P</i>		
Central symmetry in $(0, 0)$	<i>Q</i>		

Q.4	Model Solution – 15 Marks	Marking Notes
(a), (b)	<p>(a) Construction: Line drawn from Gary straight through centre point of circle to edge of circle. Point marked J</p> <p>(b) Each angle in a semi-circle is a right angle</p> <p style="text-align: center;">OR</p> <p>The angle at the centre of a circle is twice the angle at any point on the circle standing on the same arc</p>	<p>Scale 15C (0, 6, 10, 15)</p> <p>Note: Line drawn from Gary straight through centre point to edge of the circle must be shown in (a)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in either part, for example: draws right angled triangle where $\angle JRG \neq 90^\circ$ <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for point not labelled

Q.5	Model Solution – 45 Marks	Marking Notes
<p>(a), (b)</p>	<p>(a) Shop: $(-3, 1)$ Home: $(4, 2)$ School: $(4, 5)$</p> <p>(b) Mid-pt = $\left(\frac{4-3}{2}, \frac{2+1}{2}\right)$ = $\left(\frac{1}{2}, \frac{3}{2}\right)$</p>	<p>Scale 10D (0, 2, 4, 8, 10)</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, for example: one point correct in (a), correct relevant formula <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part fully correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part fully correct and work of merit in other part <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for answers in (a) in incorrect boxes, otherwise correct • Apply a * for coordinates in (a) reversed
<p>(c)</p>	<p>(c) Distance $\sqrt{(4 - (-3))^2 + (2 - 1)^2}$ = $\sqrt{(7)^2 + (1)^2}$ = $\sqrt{49 + 1} = \sqrt{50}$ = $7 \cdot 07$ [cm]</p> <p style="text-align: center;">OR</p> $x^2 = 7^2 + 1^2$ $x^2 = 49 + 1$ $x^2 = 50$ $x = \sqrt{50} = 7 \cdot 07$ [cm]	<p>Scale 15C (0, 6, 10, 15)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Correct relevant formula • Measures 7.1 cm from the diagram • Right-angled triangle drawn • Finds distance from Home to School • Use of $\sqrt{(x_2 - x_1)^2 - (y_2 - y_1)^2}$ or $\sqrt{(x_2 + x_1)^2 + (y_2 + y_1)^2}$ with some correct substitution <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Full correct substitution into formula • Answer given as $\sqrt{50}$ • Correct answer without supporting work • One error and finishes correctly <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no rounding or incorrect rounding • Apply a * for finding distance from School to Shop

<p>(d), (e)</p>	<p>(d) $8 \cdot 1 \times 2500 = 20250 \text{ cm}$ $= 202 \cdot 5 \text{ [m]}$</p> <p>(e) The answer in (d) is the shortest distance between the two points. It is unlikely that the path she takes goes in a straight line between two points due to buildings etc. <i>or any other valid reason</i></p>	<p>Scale 5C (0, 2, 3, 5)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in (d) • (e) correct <p><i>High Partial credit</i></p> <ul style="list-style-type: none"> • (d) correct • (e) correct and work of merit in (d) <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> • Apply a * for answer in (d) not in m
<p>(f), (h)</p>	<p>(f) Slope = $\frac{\text{Rise}}{\text{Run}} = \frac{4}{7}$</p> <p style="text-align: center;">OR</p> <p>Slope = $\frac{5-1}{4-(-3)} = \frac{4}{7}$</p> <p>(h) $\tan A = \frac{4}{7}$</p> <p>$A = \tan^{-1} \frac{4}{7}$</p> <p>$A = 29 \cdot 7^\circ$</p>	<p>Scale 5C (0, 2, 3, 5)</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, for example: indicates rise or run on graph, correct slope formula, correct trigonometric formula <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> • Apply a * for answer given as $\frac{-4}{-7}$ in (f) • Apply a * for no rounding or incorrect rounding in (h) • Apply a * for calculator in incorrect mode in (h)
<p>(g)</p>	<p>Eqn: $y - 5 = \frac{4}{7}(x - 4)$ $7(y - 5) = 4(x - 4)$ $7y - 35 = 4x - 16$ $4x - 7y + 19 = 0$</p> <p style="text-align: center;">OR</p> <p>Eqn: $y - 1 = \frac{4}{7}(x - (-3))$ $7(y - 1) = 4(x + 3)$ $7y - 7 = 4x + 12$ $4x - 7y + 19 = 0$</p>	<p>Scale 10C (0, 2, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Correct relevant formula <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Equation found, but not in correct form • One error and finishes correctly <p><i>Full Credit -1</i></p> <ul style="list-style-type: none"> • Apply a * for answer given as $4x - 7y + 19$

Q.6	Model Solution – 30 Marks	Marking Notes								
<p>(a), (b)</p>	<p>(a)</p> <table border="1" data-bbox="316 264 756 376"> <thead> <tr> <th>Type</th> <th>Acute</th> <th>Reflex</th> <th>Obtuse</th> </tr> </thead> <tbody> <tr> <td>Angle</td> <td><i>K</i></td> <td><i>N</i></td> <td><i>M</i></td> </tr> </tbody> </table> <p>(b)</p> $K = 60^\circ$ $M = 120^\circ$ $N = 240^\circ$	Type	Acute	Reflex	Obtuse	Angle	<i>K</i>	<i>N</i>	<i>M</i>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Accept correct answers in (b) without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One correct entry in (a) or (b) • Work of merit in (b), for example: some calculation involving given triangles or parallelograms <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • (a) correct • One correct entry in (a) and 2 correct in (b) <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 4 correct entries including at least 2 in (b) • (b) correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no units or incorrect units in (b)
Type	Acute	Reflex	Obtuse							
Angle	<i>K</i>	<i>N</i>	<i>M</i>							
<p>(c)</p>	<p>(i) Both triangles are equilateral and similar triangles have equal angles <i>or equivalent</i></p> <p>(ii) Congruent triangles are the same size and these two are not <i>or equivalent</i></p>	<p>Scale 5B (0, 3, 5)</p> <p><i>Partial Credit</i></p> <ul style="list-style-type: none"> • One part fully correct 								

Q.6	Model Solution – 30 Marks	Marking Notes
(d)	Construction	<p>Scale 10D (0, 2, 4, 8, 10)</p> <p>Note: Treat construction as having four shapes combined to make overall shape</p> <p>Allow a tolerance of ± 2 mm and $\pm 2^\circ$</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One element of construction correct, for example: one side of correct length or one angle of correct size • Correct overall shape drawn but incorrect size <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Two parallelograms constructed correctly • One parallelogram and one triangle constructed correctly • One triangle correct and work of merit in the other triangle <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Two parallelograms and one triangle constructed correctly • Two triangles constructed correctly • One parallelogram and one triangle constructed correctly and work of merit in the other two

Q.7	Model Solution – 30 Marks	Marking Notes
(a), (b)	<p>(a) Diagram A: Length = 12 [cm] Diagram B: Length = 7 [cm]</p> <p>(b) Answer: 10 [cm], 8 [cm], and 6 [cm].</p>	<p>Scale 10D (0, 2, 4, 8, 10)</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, for example: some relevant calculation involving perimeter and/or given sides, draws isosceles triangle with some relevant measurement <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part fully correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part fully correct and work of merit in other part

Q.7	Model Solution – 30 Marks	Marking Notes
(c)	<p>(i) Answer: $18 \cdot 7$ [cm²] Accept values between $18 \cdot 5$ and 19 inclusive</p> <p>(ii) Plot point on graph where $x = 9$ Approx. $(9, 30 \cdot 5)$. Point must be on $x = 9$ but allow a tolerance of $\pm 0 \cdot 5$ vertically.</p> <p>(iii) Draw vertical line at $x = 8$ and Equation: $x = 8$</p>	<p>Scale 10D (0, 2, 4, 8, 10)</p> <p>Note: There are four answers to check:</p> <ol style="list-style-type: none"> (1) Area in part (i) (2) Point B plotted and labelled in part (ii) (3) Axis of symmetry drawn in part (iii) (4) Equation of the axis of symmetry in part (iii) <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • One answer correct <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Two answers correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Three answers correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for point not labelled in (ii)
(d), (e)	<p>(d) $(11)^2 = (10)^2 + (5)^2$ $121 = 100 + 25$ $121 \neq 125$</p> <p>so by Theorem of Pythagoras triangle is not right-angled</p> <p>(e) Let h be perpendicular height $(8)^2 = (h)^2 + (5)^2$ $64 = h^2 + 25$ $h = \sqrt{39}$</p> <p>Area = $\frac{1}{2} \times 10 \times \sqrt{39} = 5\sqrt{39}$</p> <p style="text-align: center;">OR</p> <p>Area = $\sqrt{s(s-a)(s-b)(s-c)}$ = $\sqrt{13(13-8)(13-8)(13-10)}$ = $\sqrt{13(5)(5)(3)}$ = $\sqrt{975}$ = $5\sqrt{39}$</p>	<p>Scale 10D (0, 2, 4, 8, 10)</p> <p>Accept construction in (d). Allow a tolerance of ± 2 mm in construction in (d)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: correct formula, constructs triangle, correct answer in (e) with no supporting work <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in both parts • One part fully correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part fully correct and work of merit in other part <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for answer in (e) not in required surd form • Apply a * for $121 \neq 125$ not indicated in (e) • Apply a * for triangle constructed correctly, the two acute angles given but $\neq 90^\circ$ not indicated in (d)

Q.8	Model Solution – 15 Marks		Marking Notes								
(a), (b), (c)	(a) Answer: 1 (b) $P(X > 6) = \frac{1}{3}$ (c) $P(\text{odd}) = \frac{2}{3}$ $\frac{2}{3} \times 60 = 40$		Scale 10D (0, 2, 4, 8, 10) Accept correct answers without work <i>Low Partial Credit</i> <ul style="list-style-type: none"> (a) correct Work of merit in (b) or (c), for example $\frac{2}{3}$ mentioned in (c) <i>Mid Partial Credit</i> <ul style="list-style-type: none"> (a) and one of (b) or (c) correct (a) correct and work of merit in (b) and (c) <i>High Partial Credit</i> <ul style="list-style-type: none"> (b) and (c) correct (a) and one of (b) or (c) correct and work of merit in other part 								
(d)	<table border="1"> <thead> <tr> <th data-bbox="268 842 547 891">Description</th> <th data-bbox="547 842 770 891">Term</th> </tr> </thead> <tbody> <tr> <td data-bbox="268 891 547 940">The set of all...</td> <td data-bbox="547 891 770 940">Sample Space</td> </tr> <tr> <td data-bbox="268 940 547 990">One possible...</td> <td data-bbox="547 940 770 990">Outcome</td> </tr> <tr> <td data-bbox="268 990 547 1039">A subset of ...</td> <td data-bbox="547 990 770 1039">Event</td> </tr> </tbody> </table>	Description	Term	The set of all...	Sample Space	One possible...	Outcome	A subset of ...	Event		Scale 5B (0, 3, 5) <i>Partial Credit</i> <ul style="list-style-type: none"> One correct entry
Description	Term										
The set of all...	Sample Space										
One possible...	Outcome										
A subset of ...	Event										

(a)

Diagram	Outcome	Number of Heads (H)
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">1st flip</div> <div style="text-align: center;">2nd flip</div> <div style="text-align: center;">3rd flip</div> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">HHH</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">HHT</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">HTH</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">HTT</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">THH</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">THT</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">TTH</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;">TTT</div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">3</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">2</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">2</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">1</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">2</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">1</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">1</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; width: 30px; height: 30px; line-height: 30px;">0</div>

Scale 5D (0, 2, 3, 4, 5)

Low Partial Credit

- One correct entry in table

Mid Partial Credit

- Six correct entries in table

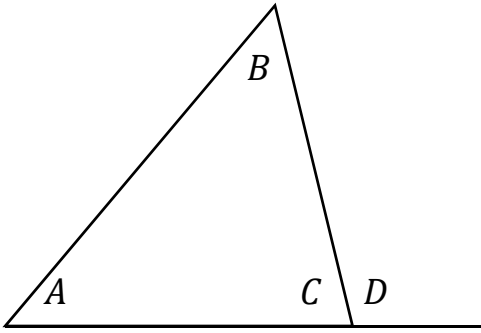
High Partial Credit

- Eleven correct entries in table

Q.9	Model Solution – 20 Marks					Marking Notes
(b)	Number of Heads	0	1	2	3	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answers without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> Two correct numerators or two correct denominators One correct entry <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> Two correct entries <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> Three correct entries Apply a * for no % sign, if probabilities given as percentages
	Probability	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$	
(c), (d)	<p>(c) (i) One outcome has no heads</p> <p>(ii) Eight outcomes have one head</p> <p>(d) $2^8 = 256$ outcomes</p>					<p>Scale 10D (0, 2, 4, 8, 10)</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, for example: lists some relevant outcomes, $\frac{1}{256}$ in (c)(i), $\frac{8}{256}$ in (c)(ii) <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> One part correct Work of merit in two parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> One part correct and work of merit in other two parts Two parts correct <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> Apply a * for correct outcomes listed Apply a * for answer given as 2^8 in (d)

Q.10	Model Solution – 15 Marks	Marking Notes
(a)	$r = 4 \text{ cm}$ $C = 2\pi r$ $C = 2\pi(4)$ $= 8\pi$ $= 25 \cdot 1 \text{ cm [1 D.P.]}$	<p>Scale 5C (0, 2, 3, 5)</p> <p>Accept correct answer without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Radius correct • Correct relevant formula <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Fully correct substitution into formula • Answer given as 8π • Finds area of the circle <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no rounding or incorrect rounding • Apply a * for no units or incorrect units
(b), (c)	<p>(b) Length = $6 \times \text{diameter} + C$ $= (6 \times 8) + 25 \cdot 1$ $= 48 + 25 \cdot 1$ $= 73 \cdot 1 \text{ cm}$</p> <p>(c) Total distance = $73 \cdot 1 \text{ cm}$ 1 turn = $25 \cdot 1 \text{ cm}$ Number of turns = $\frac{73 \cdot 1}{25 \cdot 1} = 2 \cdot 9 \text{ turns}$ 2 full turns</p>	<p>Scale 10D (0, 2, 4, 8, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: adds some relevant measurements <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for answer given as 2.9 or 3 turns • Apply a * for no units or incorrect units in (b)

Q.11	Model Solution – 15 Marks	Marking Notes
(a), (b)	<p>(a) Area = $(6)(10) - (s)(s)$ OR $= s(10 - s) + s(6 - s) + (10 - s)(6 - s)$ OR $= 6(10 - s) + s(6 - s)$ OR $= 10(6 - s) + s(10 - s)$ OR <i>any other correct version</i> $= 60 - s^2$</p> <p>(b) Perimeter $= 10 + 6 + (10 - s) + s + s + (6 - s)$ $= 32$ OR <i>Some valid explanation</i></p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Accept correct answer in (a) without work</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit in one part, for example: divides shape up into rectangles, calculates a measurement for two unknown sides, correct relevant formula <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct • Work of merit in both parts <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • One part correct and work of merit in other part

Q.12	Model Solution – 15 Marks	Marking Notes
	<p>Step 1: Diagram</p>  <p>Given: Triangle with angles labelled A, B, C and D To Prove: $\angle A + \angle B = \angle D$</p> <hr/> <p>Step 2: Proof: $\angle A + \angle B + \angle C = 180^\circ$ Reason: Angles in a triangle sum to 180°</p> <hr/> <p>Step 3: $\angle C + \angle D = 180^\circ$ Reason: Angle in a straight line is 180°</p> <hr/> <p>Step 4: $\angle A + \angle B + \angle C = \angle C + \angle D$ Subtracting $\angle C$ from both sides gives: $\angle A + \angle B = \angle D$</p>	<p>Scale 15D (0, 5, 9, 12, 15) Accept proof without reasons for up to High Partial Credit.</p> <p>Proof must have both reasons to achieve Full Credit.</p> <p>Steps must be in a logical order to be considered correct.</p> <p>Steps 2 & 3 can be in either order</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Diagram (including angle D) • Some correct relevant statement, for example: $\angle A + \angle B + \angle C = 180^\circ$ <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • 2 steps correct <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • 3 steps correct

Q.13	Model Solution – 20 Marks	Marking Notes
(a)	$\tan 20^\circ = \frac{6}{x}$ $x = \frac{6}{\tan 20^\circ}$ $x = 16.48 \text{ [2 D.P.]}$	<p>Scale 10C (0, 2, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: labels sides of triangle using 20° as reference angle, fills in 70° on diagram, correct trigonometric ratio, some correct substitution into tan ratio • Incorrect trigonometric ratio but finished correctly <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • $\tan 20^\circ = \frac{6}{x}$ or $\tan 70^\circ = \frac{x}{6}$ • Solves correctly using $\tan 20^\circ = \frac{x}{6}$ • Correct answer with no work shown <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for no rounding or incorrect rounding • Apply a * for calculator in incorrect mode
(b)	$a + b > c$ $\frac{a}{c} + \frac{b}{c} > \frac{c}{c} = 1$ $\cos Y = \frac{a}{c} \quad \text{and} \quad \sin Y = \frac{b}{c}$ <p>So, $\cos Y + \sin Y > 1$</p> <p style="text-align: center;">OR</p> $\cos Y + \sin Y > 1$ $\frac{a}{c} + \frac{b}{c} > 1$ $c \left(\frac{a}{c} + \frac{b}{c} \right) > c(1)$ $a + b > c \dots \text{ True}$ <p>So, $\cos Y + \sin Y > 1$</p> <p style="text-align: center;">OR</p> $\cos Y + \sin Y$ $= \frac{a}{c} + \frac{b}{c}$ $= \frac{a+b}{c}$ $> 1, \text{ as } a + b > c$	<p>Scale 10C (0, 2, 7, 10)</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: correct trigonometric ratio, use of specific angle • Expresses $\cos Y$ or $\sin Y$ in terms of c and a or b <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Expresses $\cos Y$ and $\sin Y$ in terms of c and a or b

Q.14	Model Solution – 15 Marks	Marking Notes
	$100\% - 10\% = 90\% = 0.9$ $0.9 \times \text{Vol of cylinder} = \text{Vol of cone}$ $0.9 \times \pi \times r^2 \times 10 = \frac{1}{3} \times \pi \times r^2 \times H$ $9 = \frac{1}{3}H$ $27 = H$ <p>Increase: $27 - 10 = 17\text{cm}$</p> <p>Percentage increase: $\frac{17}{10} \times 100 = 170\%$</p>	<p>Scale 15D (0, 5, 9, 12, 15)</p> <p>Note: Consider the solution as having four steps:</p> <p>Step 1: Work of merit</p> <p>Step 2: Sets up equation correctly</p> <p>Step 3: Finds the value of H</p> <p>Step 4: Finds the percentage increase</p> <p><i>Low Partial Credit</i></p> <ul style="list-style-type: none"> • Work of merit, for example: mentions 90% or 0.9, correct relevant formula <p><i>Mid Partial Credit</i></p> <ul style="list-style-type: none"> • Correctly equates two relevant formulae • Finds volume of either shape if using specific case • Finds 90% of $10\pi r^2$ <p><i>High Partial Credit</i></p> <ul style="list-style-type: none"> • Solves for H • Finds increase using specific case and finishes correctly • One error and finishes correctly • Correct answer without supporting work <p><i>Full Credit –1</i></p> <ul style="list-style-type: none"> • Apply a * for answer given as 2.7 or 1.7 or 270% • Apply a * for early rounding

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 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% 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