

Higher

GCSE

Mathematics - Paper 4

J560/04: Paper 4 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS**PREPARATION FOR MARKING
RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor then mark and annotate the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader via the RM Assessor messaging system.
5. **Crossed-Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. (*The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.*)

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. On each blank page the annotation **BP** must be inserted to confirm that the page has been checked. For additional objects (if present), a tick must be inserted on each page to confirm that it has been checked.
7. There is a NR (**No Response**) option. Award NR (No Response):
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')

- OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks - for an attempt that earns no credit (including copying out the question).

- The RM Assessor **comments box** is used by the Principal Examiner or your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the RM Assessor messaging system.

- Assistant Examiners should send a brief report on the performance of candidates to their Team Leader (Supervisor) by the end of the marking period. Please follow the direction of your Team Leader about which questions you should report on and how to submit your report. Your report should contain notes on particular strengths displayed as well as common errors or weaknesses. *Constructive criticism of the question paper/mark scheme is also appreciated.*
- Annotations available in RM Assessor. These **must** be used whenever appropriate during your marking.

Annotation	Meaning
	Correct
	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2

Annotation	Meaning
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
^	Omission sign
BP	Blank page
SEEN	Seen

For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.

For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.
2. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point e.g. 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
 - **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
 - **nfww** means **not from wrong working**.
 - **oe** means **or equivalent**.
 - **rot** means **rounded or truncated**.
 - **soi** means **seen or implied**.
 - **dep** means that the marks are **dependent** on the marks indicated. You must check that the candidate has met all the criteria specified for the mark to be awarded.
 - **with correct working** means that full marks **must not** be awarded without some working. The required minimum amount of working will be defined in the guidance column and **SC** marks given for unsupported answers.
3. Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.
4. Unless the command word requires that working is shown and the working required is stated in the mark scheme, then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, i.e. incorrect working is seen and the correct answer clearly follows from it.
5. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct. For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, e.g. FT $180 \times (\text{their } '37' + 16)$, or FT $300 - \sqrt{(\text{their } '52' + 72')}$. Answers to part questions which are being followed through are indicated by e.g. FT $3 \times \text{their } (a)$.
6. In questions **with no final answer line**, make no deductions for wrong work after an acceptable answer (i.e., **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.

7. In questions **with a final answer line and incorrect answer given**:
- (i) If the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
 - (ii) If the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) If the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded if there is no other method leading to the incorrect answer. Use the **M0**, **M1**, **M2** annotations as appropriate and place the annotation ✕ next to the wrong answer.
8. In questions **with a final answer line**:
- (i) If one answer is provided on the answer line, mark the method that leads to that answer. A correct step, value or statement that is not part of the method that leads to the given answer should be awarded **M0** and/or **B0**.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award marks for the poorer response unless the candidate has clearly indicated which method is to be marked.
9. In questions with **no final answer line**:
- (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award marks for the poorer response unless the candidate has clearly indicated which response is to be marked.
10. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the **MR** annotation. **M** marks are not deducted for misreads. If a candidate corrects the misread in a later part, do not continue to follow through, but award **A** and **B** marks for the correct answer only.
11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

12. Ranges of answers given in the mark scheme are always inclusive.
13. For methods not described in the mark scheme, such as visual representations like bar models, ratio tables, give equivalent marks for equivalent work.
If in doubt, consult your Team Leader.
14. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Mark	Part Marks and Guidance	
1			51.3	2	B1 for 51.2[5] or $\frac{205}{4}$ or $51\frac{1}{4}$ If 0 scored SC1 for <i>their</i> answer to more than 3 figures correctly rounded to 3 s.f.	
2			25	2	B1 for 40 : 1000 oe or $\frac{1000}{40}$ oe or 0.025 as the answer or answer with units e.g. 25 with any unit, 1 : 25 with consistent units	oe e.g 0.04 : 1 condone as answer 1 : 25 for 1 mark B1 for e.g. 25g, 25kg or 1kg : 25kg
3			55.7 to 55.71 or $40 + 5\pi$	4	B1 for diameter = 10 cm or radius = 5 cm M1 for $[\frac{1}{2}] 2 \times \pi \times \text{their} 5$ oe M1 for $8 + 17 + 8 + 3 + 4 + \text{their} 15.7$ or better	B1 might be seen on diagram and can be implied by 5 or 10 with π e.g. 5π , 31.4 to 31.42, $5^2 \times \pi$ M1 implied by 10π , 5π , 31.4 to 31.42 or 15.7 to 15.71 Award M marks even if not used to find final answer as long as it is not contradicted. Note : <i>their</i> 5 in the M1 should be <i>their</i> radius of the circle <i>their</i> 15.7 should involve π and be an attempt at the circumference of the semicircle, not the area or whole circle
4	(a)		negative no correlation positive	2	B1 for 2 correct	accept none, neutral, zero or uncorrelated for no correlation ignore embellishments

Question			Answer	Mark	Part Marks and Guidance	
	(b)		acceptable ruled line of best fit FT <i>their</i> straight line, reading from 250	B1 B1FT		See overlay between (170, 10) and (170, 50) and between (380, 160) and (380, 200) and must reach the vertical lines, ignore beyond overlay No line drawn 0 marks Line must have positive gradient. Correct reading ± 2 and <i>their</i> reading should be within the same grid square where <i>their</i> line(lobf) crosses 250
5	(a)		Equation Identity Equation	1		
	(b)		$y = 3x + 5$ as final answer	3	B2 for final answer $3x + 5$ or for a correct equation but not in required form isw OR M2 for using (2, 11) correctly in $y = 3x + c$ oe or M1 for " $y = 3x + c$ " or for $y = 3x + k$ oe where k is any numerical value except 0 or 5 or for correctly substituting (2, 11) in $y = mx + c$ oe ($m \neq 3$)	B2 for e.g. $(y - 11) = 3(x - 2)$ or $y - 3x = 5$ or $3x - y + 5 = 0$ as the answer B2 for $y = 3x + 5$ seen in working and subsequently spoilt (excluding changing to a perpendicular gradient) e.g. $11 = 3 \times 2 + c$ e.g. $11 = \frac{1}{3} \times 2 + c$

Question			Answer	Mark	Part Marks and Guidance	
6			$\frac{210}{150}$ oe or 1.4	M1	A1 dep. on M4	implied by 1 [h] 24 [m] or 84 [m]
			$\frac{210}{100}$ oe or 2.1	M1		implied by 2 [h] 6 [m] or 126 [m]
			<i>their</i> 1.4 + <i>their</i> 2.1 or 3.5	M1		<i>their</i> 3.5 could be 3½, 3 [h] 30[m] or 210 [m]
			$\frac{210+210}{\text{their } 3.5}$ oe or $125 \times \text{their } 3.5$ oe or $420 \div 125$	M1		use of $\frac{\text{total distance}}{\text{total time}}$ and allow total time=3.30 or in mins
			120 or $420 < 437.5$ oe or $3.36 < 3.5$ oe	A1		see appendix e.g. 420 is less distance than 437.5 e.g. 3.36 is faster than 3.5
7	(a)		$360 \div 5 [= 72]$ oe $180 - 72 [= 108]$	M1 M1	allow to split into 3 triangles or into a quadrilateral and a triangle so $360 + 180 [= 540]$ condone $540 \div 108 = 5$ with 5 is the number of sides [of a pentagon]	Accept any correct method but they must not start with 108 e.g $108 \times 5 = 540$ scores M0
			OR	OR		condone missing brackets
			$(5 - 2) \times 180 [= 540]$ oe	M1		Note : $\frac{(5 - 2) \times 180}{5}$ scores M1 M1
			$540 \div 5 [= 108]$	M1		

Question			Answer	Mark	Part Marks and Guidance	
	(b)		18	4	M1 for $360 - 108 - 92$ or 160 oe M2 for $\frac{360}{180 - \text{their}160}$ oe or M1 for $180 - \text{their}160$ may be implied by 20	Angles may be on diagram Alternative method 1: M1 for 160 as before M2 for $180n - \text{their}160n = 360$ or M1 for $\frac{(n-2)180}{n} = \text{their}160$ oe Alternative method 2: M2 for $92 - 72$ or 20 M1dep for $\frac{360}{\text{their}20}$ dep. on M2 Trials: M1 for $360 - 108 - 92$ or 160 M1 for each different value for the number of sides and the correct internal angle calculated to a maximum of M2 see appendix for values
8			Three correct and different criticisms or suggestions for improvement	3	We need three statements, only one from each category (in guidance) for 3 marks. B2 for two correct or B1 for one correct Different means different category Note : the same criticism and suggestion e.g. standing by station will only get people using trains and they should stand in the middle of town is only 1 mark	Categories: • Larger sample size • Vary the time (hour or day) • Vary the location e.g biased towards railway users • No control over numbers of genders • No control over numbers in age groups see appendix for exemplars and treat stratified sample as one category (usually age or gender)

Question			Answer	Mark	Part Marks and Guidance	
9	(a)		3.7×10^{-3}	1		Condone trailing zeros
	(b)		20 or 2×10^1 or 2×10 nfw	4	M1 for $1.2 \times 10^6 + 4[.0] \times 10^6$ or 5.2×10^6 oe M1 for $1.5 \times 10^5 + 1.1 \times 10^5$ or 2.6×10^5 oe M1 for $\frac{a \text{ population value}}{an \text{ area value}}$	may be implied by figs 52 may be implied by figs 26 Award M marks even if not used to find final answer as long as it is not contradicted. Population and area values must be consistent eg both south island, both north island or <i>their</i> summed population and area e.g. M1 implied by 8 or 36.36 to 36.4 or 44.36 or 44.4
10			7	3	M2 for $3k + 2 - 4 = 19$ oe or 5^{21} or M1 for 5^2 or 5^{3k} or 5^{-2} or 5^{23} or forming equation in k with one error or omission e.g. $3k - 4 = 19$	e.g. $3k + 2 = 23$ condone $5^{3 \times k}$ for M1

Question			Answer	Mark	Part Marks and Guidance	
11			$[a =] 9$ $[b =] 7$	5	B2 for $a(11 - 5) = 3(11 + b)$ oe and $a(29 - 5) = 2 \times 3(29 + b)$ oe or B1 for any two of the expressions below $a(11 - 5)$, $3(11 + b)$, $a(29 - 5)$, $3(29 + b)$ oe M1 for equating coefficients of one variable in <i>their</i> original linear equations or making a or b the subject of one of <i>their</i> original equations e.g. $24a = 12(11 + b)$ and $24a = 6(29 + b)$ or $b = 2a - 11$ M1 for correctly eliminating one variable in <i>their</i> linear equations with one coefficient of one variable equal e.g. $6(29 + b) = 12(11 + b)$ oe or $24a = 6(29 + 2a - 11)$ If 0 scored SC1 for $a(x - 5)$ or $3(x + b)$ allowing any letter for x	e.g. $6a = 3(11 + b)$ or better e.g. $24a = 6(29 + b)$ or better e.g. $6a$, $24a$, $33 + 3b$, $87 + 3b$ Note : if they write two correct equations and manipulate them incorrectly e.g. expanding brackets incorrectly then they can score B2 M0 M1 B2 M2 for a correct linear equation in a or b e.g. $2a - 11 = 4a - 29$ oe or better Allow one arithmetical error in one of the processes For substitution award second M1 at the point of substitution Trials : M1 for each attempt using values for a and b and checking both functions with 11 and 29 to a maximum of M2

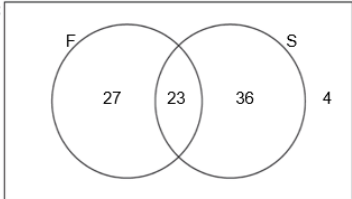
Question			Answer	Mark	Part Marks and Guidance	
12			119.8[4] with correct working	5	M1 for $\frac{25.6-17.2}{2}$ oe or 4.2 M2 for $\sqrt{7^2 - (their4.2)^2}$ or better or 5.6 or M1 for $[h]^2 + (their4.2)^2 = 7^2$ or 31.36 M1 for $\frac{25.6+17.2}{2} \times their\ height$ oe If 0 or 1 scored, instead SC3 for answer 119.8[4] with no or insufficient working	Correct working requires evidence of at least M2 or M1M1 <i>their</i> 4.2 must be an attempt at $\frac{25.6-17.2}{2}$ and must be less than 7 for <i>their</i> height do not allow 7 but condone e.g. 31.36 Longer methods must be complete and correct : e.g. M1 for 4.2 as before M1 for e.g. $\cos^{-1}(4.2 \div 7) = 53.13\dots$ M1 for e.g. $7\sin(53.13) = 5.59\dots$ or 5.6 M1 for area as before
13	(a)		O is not on the circumference oe	1		see appendix
	(b)		140	2	M1 for reflex angle AOC = 220 or for $360 - 2 \times 110$	May be on diagram Award M1 for other valid method reaching the equivalent of a correct equation in x e.g. Point D added on major arc, ADC indicated as $\frac{x}{2}$ and then $110 + \frac{x}{2} = 180$ oe or marking angle ADC as 70

Question			Answer	Mark	Part Marks and Guidance	
14	(a)		any evidence of reading (median) from cf = 60 or reading cf for score 34	M1		For M1 we need to see a line or mark on the graph or a figure allowing an error of $\pm \frac{1}{2}$ small square so for 60 allow reading from 59 – 61 giving 35 – 37 for 34 allow reading from 33 – 35 gives a reading of 51 – 57 figures may be in working, see appendix for some A1 statements
			No and a correct statement with [34 and] 35 – 37 or with 51 – 57 and 60	A1		
	(b)		58	3	M2 for $\frac{100-10}{100} \times 120$ oe or 108 or M1 for $\frac{10}{100} \times 120$ oe or 12	may be on the diagram
15			$y = \frac{180}{x^2}$ oe	3	M1 for $y = \frac{k}{x^2}$ oe B1 for $[k =] 180$ If 0 or 1 scored instead SC2 for answer $y \propto \frac{180}{x^2}$ or if 0 scored instead SC1 for $y \propto \frac{1}{x^2}$	equivalents include $5 = \frac{k}{6^2}$ and $yx^2 = k$
16	(a)		640	1		
	(b)		2.5	1		
	(c)	(i)	998 to 999 and 1023 to 1024	3	M2 for one of these correct or M1 for substitution of any number between 18 and 19 into the formula	e.g. 640×1.025^{18} and 640×1.025^{19} or <i>their</i> 998×1.025 If they use other values, one value must be 18 and instead of 19 they can use : $18.08 \leq \text{other value} \leq 19$ and ignore extras

Question			Answer	Mark	Part Marks and Guidance	
	(c)	(ii)	Any reason suggesting that the rate will not continue	1		see appendix, if more than one statement mark the best unless one is contradictory
17	(a)		$x^2 + y^2 = 4^2$ oe final answer	2	B1 for $x^2 + y^2 = k$ ($k \neq 0$ or 16) or answer $a^2 + b^2 = 4^2$ oe	k could be r^2
	(b)		$2.3^2 + 3.3^2$ 16.18 or 16.2 or 4.02[...] a correct decision e.g. outside and (16.18 or 16.2) and 16 or 4.02[...] and 4	M1 B1 A1FT	A1 is dependent on awarding M1 and is a correct decision based on <i>their</i> figure	If they have the correct working, produce an incorrect figure they can earn M1 B0 A1FT providing <i>their</i> decision is correct for <i>their</i> figure allow the reasoning to be in the working and condone 'above' for 'outside' see appendix for some comments
18	(a)		4.5 or $4\frac{1}{2}$ or $\frac{9}{2}$ oe nfw	3	M2 for $\frac{29.5+2}{7}$ or M1 for $29.5 = k \times 7 - 2$ oe Trials : M1 for each correct trial with value of k in $k \times 7 - 2$ with the result to a maximum of 2 marks	
	(b)	(i)	1.75 or $1\frac{3}{4}$ or $\frac{7}{4}$ oe	2	M1 for $2u_1 = 6u_1 - 7$ oe or better Trials : M1 for one correct trial with input and output for u_1	accept any letter for u_1
	(b)	(ii)	Always get 1.4 oe	1		see appendix

Question			Answer	Mark	Part Marks and Guidance										
19			$\sqrt{75} [-\sqrt{15} + \sqrt{15}] - \sqrt{3}$ or $\sqrt{5} \sqrt{15} [-\sqrt{5}\sqrt{3} + \sqrt{15}] - \sqrt{3}$ or $5\sqrt{3} [-\sqrt{15} + \sqrt{15}] - \sqrt{3}$ $5\sqrt{3} - \sqrt{3} = 4\sqrt{3}$	M2 A1	M1 for correct expansion with one error or omission or $\sqrt{75} = 5\sqrt{3}$ Alternative 1 M2 for $\sqrt{3} (\sqrt{5} - 1)(\sqrt{5} + 1)$ or better or M1 for $\sqrt{15} - \sqrt{3} = \sqrt{3} (\sqrt{5} - 1)$ for A1 allow $5\sqrt{3} - \sqrt{3}$ to be seen in the M2 expression	Working must be in surds, working can be in tables e.g M2 for <table><tr><td></td><td>$\sqrt{15}$</td><td>$-\sqrt{3}$</td></tr><tr><td>$\sqrt{5}$</td><td>$\sqrt{75}$</td><td>$-\sqrt{15}$</td></tr><tr><td>+1</td><td>$\sqrt{15}$</td><td>$-\sqrt{3}$</td></tr></table>		$\sqrt{15}$	$-\sqrt{3}$	$\sqrt{5}$	$\sqrt{75}$	$-\sqrt{15}$	+1	$\sqrt{15}$	$-\sqrt{3}$
	$\sqrt{15}$	$-\sqrt{3}$													
$\sqrt{5}$	$\sqrt{75}$	$-\sqrt{15}$													
+1	$\sqrt{15}$	$-\sqrt{3}$													
20			9.09 to 9.1	3	M2 for $[BC =] \frac{12 \times \sin 40}{\sin 58}$ oe or M1 for $\frac{12}{\sin 58} = \frac{BC}{\sin 40}$ oe	Allow any complete and correct alternative method									
21	(a)		3.8 – 4.2 nfww	2	M1 for $\frac{their15 - their7}{3 - 1}$ oe	condone $6.8 \leq their7 \leq 7.2$ and $14.8 \leq their15 \leq 15.2$ e.g $\frac{14.8 - 7.2}{3 - 1} = 3.8$ This part cannot be answered with a tangent at $x = 2$.									

Question			Answer	Mark	Part Marks and Guidance	
	(b)		Ruled tangent drawn at $x = 2.5$ using two points on <i>their</i> tangent at $x = 2.5$ use of $\frac{\text{difference in } y}{\text{difference in } x}$ accurate calculation from <i>their</i> tangent	B1 M1 M1 A1FT	this might be in the form of a triangle or two points clearly identified or in a calculation	Tangent should not cross the curve, should touch at $x = 2.5$ (condone slight daylight between tangent and curve) and condone running along the curve slightly. Ignore any tangent at $x = 2$ for this part. The remaining 3 marks depend on a reasonable ruled attempt at a tangent clearly at $x = 2.5$ so B0 M1 M1 A1FT is possible. M1 for attempting to divide vertical distance by horizontal distance on <i>their</i> tangent at $x = 2.5$ even if the readings are inaccurate The final mark (A1) is easily checked for accuracy by using the 'ruler' which is lined up on the tangent and extended as far as possible, calculate the gradient, or translate the ruler to put one end on the origin, and use a tolerance of ± 0.2 and if <i>their</i> figure is within range award A1

Question			Answer	Mark	Part Marks and Guidance																	
22			$\frac{23}{59}$	5	B4 for answer $\frac{23}{n}$ where $24 \leq n \leq 90$ or B3 for (F and S) = 23 or M3 for a correct Venn diagram or correct table showing these figures in black or B2 for (S and not F) = 36 or for (F and not S) = 27 or for answer $\frac{k}{59}$ where $1 \leq k \leq 58$ or M2 for a Venn diagram or table with two of $n(F)=50$, $n(S)=59$ and $n(\xi)=90$ correct or B1 for (not F) = 40 or (not S) = 31 or M1 for a Venn diagram or table with one of $n(F)=50$, $n(S)=59$ and $n(\xi)=90$ correct	If $\frac{23}{59}$ in working isw conversion to another form and accept 0.3898... or 0.39[0] or 38.98% or 39[.0]% for 5 marks Award B marks if correctly shown on a labelled grid or implied on a Venn diagram <table><tr><td></td><td>S</td><td>S'</td><td></td></tr><tr><td>F</td><td>23</td><td>27</td><td>50</td></tr><tr><td>F'</td><td>36</td><td>4</td><td>40</td></tr><tr><td></td><td>59</td><td>31</td><td>90</td></tr></table> 		S	S'		F	23	27	50	F'	36	4	40		59	31	90
	S	S'																				
F	23	27	50																			
F'	36	4	40																			
	59	31	90																			

Question			Answer	Mark	Part Marks and Guidance	
23	(a)		$(x - 8)^2$ or $(x - 8)(x - 8)$ final answer with correct working	6	B5 for answer $x^2 - 16x + 64$ with correct working OR B4 for answer $-9x^2 - 16x + 64$ with correct working OR M3 for correctly expanding the triple bracket e.g. $x^3 - 4x^2 - 16x + 64$ oe or M2 for correctly expanding any two brackets from the triple bracket e.g. $x^2 [-4x + 4x] - 16$ or $x^2 - 4x - 4x + 16$ oe or $(x^2 - 8x + 16)(x + 4)$ or M1 for attempting to expand any two brackets e.g. $x^2 + 4x - 4x - 16$ oe with at most one error AND M1 for correctly expanding final bracket e.g. $-x^3 + 5x^2$ oe AND M1 for correctly simplifying <i>their</i> final expression by collecting like terms e.g. $x^2 - 16x + 64$ If 0,1 or 2 scored instead SC3 for answer $(x - 8)^2$ or $(x - 8)(x - 8)$	correct working requires at least M3 or M1 M1 M1 or M2 M1 If you award B marks do not award any extra M marks e.g. $x^3 - 8x^2 + 16x + 4x^2 - 32x + 64$ oe e.g. $x^2 - 16$ or $x^2 - 8x + 16$ condone one error in the previous step e.g. $(x^2 - 8x + 8)(x + 4) = x^3 + 4x^2 - 8x^2 - 32x + 8x + 32$ or better scores M2 e.g. $x^2 - 8$ Note : brackets must be removed and $(-x^3 + 5x^2)$ must not be used for multiplication Note : once mark(s) are awarded they are not lost for subsequent incorrect working

Question			Answer	Mark	Part Marks and Guidance	
	(b)		8	1FT	Note : correct answer 8 scores 1 FT <i>their</i> $(ax^2 + bx + c)$ where $a > 0$ and <i>their</i> answer should be $-\frac{b}{2a}$.	If the quadratic expression is factorised, expand the brackets first.

APPENDIX

Exemplar responses for Q6

Response	Mark
120 and no comment	A1
It takes 3 and a half hours and to be below 125 it has to be above 3 hours 21 minutes	A1
If the ave. speed is 125, it must be 3.36 h but it is 3.5 h so the ave. speed is less than 125	A1
$120 > 125$	A0
(3.5 and 3.36 shown) it is slower than if it travelled at 125	A0

Exemplars for Q7(b)

Formula = $180 - \frac{360}{n}$ where n is the number of sides

sides	angle
6	120.00
7	128.57
8	135.00
9	140.00
10	144.00
11	147.27
12	150.00
13	152.31
14	154.29
15	156.00
16	157.50
17	158.82
18	160.00
19	161.05
20	162.00
21	162.86
22	163.64
23	164.35
24	165.00
25	165.60
26	166.15
27	166.67
28	167.14
29	167.59
30	168.00

Exemplar responses for Q8

1. Larger sample size
2. Vary the time (hour or day)
3. Vary the location e.g biased towards railway users
4. No control over numbers of genders
5. No control over numbers in age groups

	Response	Mark
1	The sample size is too small (1)	1
2	20 people is not enough (1)	1
3	Too few people (1)	1
4	Ask a wider group of people (1)	1(BOD)
5	He only got a sample for one day (2)	1
6	Do School and work on different days(2)	1
7	Do this more than once because schools might be closed (2)	1
8	Only on one day(2)	1
9	Only in one place (3)	1
10	They assume they all travel by train (3)	1
11	Go to bus stop and other places(3)	1
12	Look at different modes of transport (3)	1
13	There may not be school students if school isn't near a railway station(3)	1
14	It excludes other methods of transport (3)	1
15	Some people may not take the train to work or school (3)	1
16	Go to more than 1 location / area (3)	1

17	Ask random people in town centre(3)	1
18	Consider different factors such as gender (4)	1
19	Ask a variety of people (4 or 5)	1
20	They should select only workers or schoolchildren (5)	1
21	Use different aged people (5)	1
22	Use a stratified sample(4 or 5)	1
23	Survey the same amount of old people and young people (5)	1
24	He does not know who goes to work or school	0
25	They are going to different destinations	0
26	Use more interviewers	0
27	Go to the bus station	0
28	They can go nearer the workplace or school	0
29	They could do it online	0
30	They could fill in a questionnaire	0
31	Repeat the survey more than once	0
32	They only interview people who live in the town	0
33	Some people could be elderly	0
34	Do school and work on different surveys	0
35	Let people go to council and choose	0

Exemplar responses for Q13(a)

Response	Mark
O is not on the circumference	1
Not all the ends of the quadrilateral touch the sides of the circle	1(BOD)
Not all 4 points of the quadrilateral touch the circumference of the circle	1
Each point/angle/corners is not touching the circle	1
Point AOC does not touch the circumference	1
It should touch the circle 4 times	1
Not all corners touch the perimeter of the circle	1
It does not cover the whole of the diameter only the radius	0
Opposite angles are not supplementary	0
It does not touch the circle	0
All the points do not touch the arcs	0
All corners do not touch the edge	0
The point where A and C meet does not touch the perimeter (needs AO and CO and perimeter of the circle)	0
It meets at the centre of the circle	0
One point connects at the centre	0

Exemplar responses for Q14(a)

Response	Mark
35 – 37 is half way and 34 is not high enough	1
34 is less than 35 – 37	1
34 is at [c.f.] 51 – 57 which is less than 60	1
34 is at [c.f.] 51 – 57 which is 42.5% - 47.5% [percentile] and is less than 50% [percentile]	1
It is 1 – 3 marks short of halfway (implies 35 – 37)	1
51 – 57 is under half of 120	0

Exemplar responses for Q16(c)(ii)

Response	Mark
The [percentage] rate does not continue	1
It will not increase by 2.5% each year	1
Size of pond is restricted e.g. the more fish means less space so the rate will slow down	1
Pond cannot support so many fish	1
There might not be enough food	1
Catching fish [people, birds, other predators] will reduce the stock	1
There may be [more] predators	1
They could get hunted	1
There may be a [new] disease e.g. cause infertility	1
Pollution may kill more fish than predicted	1
Conditions in the pond may get worse	1(BOD)
Reproduction rate may decrease	1
Environmental factors may change such as temperature	1
Some years may differ	1(BOD)
They might ban fishing so that the rate will increase and it will happen earlier	1
Other factors might affect breeding	1(BOD)
They might not reproduce [at the same rate]	1
They may die in large amounts	1
Population will reach maximum	1
Population increase may fluctuate	1
Not all fish will fit [in the pond]	1

The fish will need to reproduce to keep it going	0
Some fish might die	0
It is only a prediction [it may not be accurate]	0
Population will decrease one year	0
They might not reproduce at a constant rate	0
The population might decrease	0
There are other factors	0

Exemplar responses for Q17(b)

Allow the reason to be in the working.

Decision must be **outside** and

Response	Mark
16.18 is greater than 16	1
$16.18 > 16$	1
16.18 and 16	1(BOD)
$16.18 \neq 16$ and is bigger	1
$\sqrt{16.18} = 4.02[\dots]$ which is bigger than 4	1
Radius is $4.02 > 4$	1
above and 16.18 and 16	1
$4 < 4.02[\dots]$	1
$2.3^2 > 4^2 - 3.3^2$	1
$3.3 > \sqrt{4^2 - 2.3^2}$	1
Exception : $2.3^2 + 3.3^2 = 15.73$ and inside because $15.73 < 16$	M1 B0 A1FT

Note :

To be outside the circle $2.3^2 + 3.3^2 > 4^2$ which can be rearranged to $2.3^2 > 4^2 - 3.3^2$ or $3.3^2 > 4^2 - 2.3^2$ all these are valid methods.

Exemplar responses for Q18(b)(ii)

Response	Mark
All the terms in the sequence will stay the same	1
Every term stays the same	1
The value never changes	1
The sequence repeats 1.4	1
It has a period/order of 1	1
$u_n = 1.4$	1
The sequence's value stays the same	1 (BOD)
It stays the same	1 (BOD)
stays the same	1
$u_2 = 1.4$ (needs u_n)	0

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