Higher

GCSE

Mathematics - Paper 4

J560/04: Paper 4 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris 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 posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

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 scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) 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 by telephone or the scoris messaging system, or by email.

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. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:

   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The scoris **comments box** is used by 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 phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The 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.

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	**Award mark**
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. Annotations available in RM Assessor. These **must** be used whenever appropriate during your marking.

Annotation	**Meaning**
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	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
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

12. **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.

13. 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.

14. 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.

15. 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.

16. 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 × (*their* '37' + 16), or FT 300 – √(*their* '52 + 72'). Answers to part questions which are being followed through are indicated by
e.g. FT 3 × *their* (a).

17. 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'.

18. 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.

19. 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.

20. 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.

21. 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.

22. 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.

23. Ranges of answers given in the mark scheme are always inclusive.

24. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

25. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Marks	Part marks and guidance	
1			46.34	3	**B2** for 46.33[7…] or **B1** for 99 493[.836…] or 144 266[.0625] If **0** scored **SC1** for *their* answer to more than 4 figures correctly rounded to 4 s.f.	for **B1** accept these numbers rot to at least integers
2			$\frac{1}{2} \times 18 \times 6.4$ $\frac{9+15}{2} \times 4.8$ oe [both answers =] 57.6 or $\frac{288}{5}$ oe	**M1** **M1** **A1**	**A1 dep** on **M1 M1**	Allow equivalents for both **M1**s but it must be full and correct working and allow any correct method e.g. **M1** for $\frac{9+15}{2} \times 4.8 = 57.6$ **M1** for 57.6 ÷ 9 = 6.4 = height **A1** for 6.4 Condone 24 for 9 + 15 and 9 for $\frac{1}{2} \times 18$. e.g. $\frac{115.2}{2}$

3			[a =] 15.6 [b =] 7.2 with correct working	**5**	**B4** for one correct answer <u>with correct working</u> OR **M1** for $\frac{a + a + b + a + 2b + 3a - b}{4} = 27$ oe **M1** for $3a - b - a = 24$ oe **M1** for equating coefficients of one variable for *their* linear equations **M1** for correct method to eliminate one variable for *their* original linear equations If **0, M1** or **M2** scored, instead award **SC3** for answers 15.6 and 7.2 with no working or insufficient working If **0** or **M1** scored, instead award **SC2** for a = 7.2 and b = 15.6 with no working or insufficient working If **0** scored, instead award **SC1** for two answers which satisfy one of the original conditions	"Correct working" requires evidence of at least **M1M1** for the two equations and **M1** for some evidence of solving them e.g. $6a + 2b = 108$ e.g. $2a - b = 24$ dependant on two linear equations e.g. $6a - 3b = 72$ or $4a - 2b = 48$ or $3a + b = 54$ dependant on two linear equations e.g. $5b = 36$ Allow one numerical error in each step of solving *their* equations A sign error is not an arithmetic error Substitution method: **M1** and **M1** for the two equations **M1** dependant on two linear equations and for rearranging one equation to make one variable the subject e.g. $a = \frac{24+b}{2}$ **M1** for substituting it into *their* other equation Trials (need to see the mean or total, and the range evaluated for each): **M1** for each correct trial up to a maximum of 3 After three correct trials, correct final answers score 5

Question			Answer	Marks	Part marks and guidance	
4	(a)	(i)	(360 – 52) ÷ (1 + 2 + 4) or better [= 44]	2	**M1** for 360 – 52 or 308 or *their*(360 – 52) ÷ (1 + 2 + 4) Alternative method 1 : **M2** for 7*x* = 360 – 52 or 7*x* = 308 then *x* = 44 or **M1** for *x*, 2*x* and 4*x* or 360 – 52 or 308 Alternative method 2 : **M2** for 52 + 44 + 2 × 44 + 4 × 44 = 360 oe or **M1** for 52 + 44 + 2 × 44 + 4 × 44 oe	better includes 308 ÷ 7 Mark the work in the answer space and if blank, mark any work round the diagram allow any letter For **M2** and **M1** accept 88 for 2 × 44 and 176 for 88 × 2
	(a)	(ii)	Correct labelled pie chart with ruled lines and sector angles 44, 88 and 176	3	**B2** for two additional correct sectors within tolerance or a correct unlabelled/incorrectly labelled pie chart with ruled lines or correct labelled pie chart with unruled lines or **B1** for one correct sector within tolerance, ignore label	Use online protractor and apply an angle tolerance of ± 2°. For **3** marks we need only four sectors and condone one sector unlabelled. Labels must be letters not angles
	(b)		270	2	**M1** for any correct method e.g. $\frac{39}{52} \times 360$ oe or 39 + $\frac{176}{\frac{52}{39}} + \frac{88}{\frac{52}{39}} + \frac{44}{\frac{52}{39}}$	e.g. $\frac{360}{\frac{52}{39}}$ or $\frac{39}{52 \div 360}$ condone $\frac{52}{39}$ = 1.3
	(c)	(i)	Accept any correct advantage e.g. Information is immediately displayed as part of a whole	1		See appendix and mark best response as long as it is not contradictory or has an incorrect statement
	(c)	(ii)	Accept any correct disadvantage e.g. you cannot read the exact frequencies from it	1		See appendix and mark best response as long as it is not contradictory or has an incorrect statement

Question			Answer	Marks	Part marks and guidance	
5			Any unambiguous indication of correct pack (5 kg) with three accurate comparable figures	3	Allow any correct comparison e.g.(converting all to 1 kg) **B2** for three accurate comparable figures or **B1** for two accurate comparable figures OR **M1** for one correct appropriate calculation e.g. 7.70 ÷ 0.7 oe or 32.40 ÷ 3 oe	See appendix for other calculations and values Mark *their* figures at the most accurate

Question			Answer	Marks	Part marks and guidance	
6			32 nfww	4	**B2** for 11.25 **M1** for 360 ÷ *their* 11.25 seen OR **B1** for 15*a* and *a* or 16*a* **M1** for 15*a* + *a* = 180 oe **M1** for 360 ÷ *their* 11.25 seen Alternative method 1: **M2** for 15 × 360 = 180(n — 2) or better or **M1** for $\frac{180(n-2)}{n} = 15 \times \frac{360}{n}$ and **M1** for 180n = 5400 + 360 oe Alternative method 2: Use of trials by choosing a value for n. **M1** for each correct trial up to a maximum of **M3** for using <u>two</u> of these [exterior angle] = $\frac{360}{n}$ (formula A) [interior angle] = $\frac{180(n-2)}{n}$ (formula B) interior + exterior = 180 and for checking that interior = 15 × exterior if **0** scored **SC1** for one of formula A or B seen or used	*a* = exterior angle and allow any consistent single letter **B1 M1** implied by 16*a* = 180 or $\frac{180}{15+1}$ oe Alternative for number of sides: e.g. **M1** for $\frac{180(n-2)}{n}$ = 180 – *their*11.25 If they get 32 from any number of trials they score **4** marks. Trials can be seen from a calculation or a list. see appendix for likely results

Question			Answer	Marks	Part marks and guidance	
7			$[2^{-2} =]$ [0].25 $[2 \times 10^{-2} =]$ [0].02 2×10^{-2} , 0.2 , 2^{-2}	**M2** **B1**	**M1** for each accept answer in alternate form e.g fractions or decimals	Alternative methods: eg **M2** for finding $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{50}$ or 20[%], 25[%], 2[%] or other comparable forms or **M1** for two of these
8			14 with correct working	**5**	**B4** for answer 0.14 with correct working or for answer 86 with correct working OR **B3** for answer 0.86 with correct working OR **M4** for any correct calculation that would lead to 0.14 or 86 e.g. $1 - \frac{1.161}{1.35}$ or $\frac{135-116.1}{135}$ oe OR **M3** for any correct calculation that would lead to 0.86 e.g $\frac{1.161}{1.35}$ or $\frac{1161}{1350}$ oe OR **M2** for 1.35 and 1.161 or 135 and 116.1 OR **B1** for 1.35 or 135 or 1350 If **0** or **1** scored, instead award **SC3** for answer 14 with no working or insufficient working If **0** or **1** scored, instead award **SC2** for answer 0.14 or 86 with no working or insufficient working If **0** scored, instead award **SC1** for answer 0.86 with no working or insufficient working	"Correct working" requires evidence of at least **M2** Ignore % written on answer line and ignore × 100 and units when awarding **M** marks. Allow any correct method. **M4** includes $1 - \frac{1161}{1350}$ or $\frac{1161}{1350} \times 100$ or $\frac{1.35-1.161}{1.35}$ or $\frac{1.161}{1.35} \times 100$ **M3** includes $\frac{116.1}{135}$ **M2** includes 1350 and 1161 or 1.35 – 1.161 or 1.161 – 1.35 or ±0.189 or [1]35 – [1]16.1 or 1.161 – 1.35 or ±18.9 **B1** includes 1.161 or 116.1 or 1161 Alternative method : e.g. trials needs **M2** to award **5** marks, evidence of at least 2 trials seen or **M1** for each correct trial up to **M3**, see appendix for figures

Question			Answer	Marks	Part marks and guidance	
9			Correct statement with supporting working yes/correct oe and e.g. 1533 with 1532 or 0.667[1]… oe with 0.666… oe or $\frac{511}{766} - \frac{2}{3} > 0$ or $\frac{511}{766}$ and 510.6	5	**B4** for 1533 and 1532 OR **M1** for $\frac{1638}{9+3+2}$ [× 9] or better **M1** for $\frac{660}{8+1+2}$ [× 8] or better **M1** for *their*1053 + *their*480 or 1638 + 660 **M1** for $\frac{their\,1533}{their\,2298}$ or for *their* 2298 × $\frac{2}{3}$ or 1532 for those that sum the columns (i.e 17 : 4 : 4); **M1** for $\frac{1638+660}{their(17+4+4)}$ [× 17] or better or $\frac{their\,17}{their(17+4+4)}$ **M1** for $\frac{their\,1562.64}{their\,2298}$ or for *their* 2298 × $\frac{2}{3}$ or 1532 or $\frac{2}{3}$ [× 25] **M1** for 0.68 and 0.66… or 1562[.64]/1563 and 1532	 implied by 117 or 1053 implied by 60 or 480 implied by 1533 or 2298 implied by 0.667[1]… oe or $\frac{511}{766}$ implied by 91.92 or1562.64 or $\frac{17}{25}$ or 0.68 implied by 0.68 oe or 1532 or 16.6.. or 0.66… or $0.\dot{6}$ allow 17 and 16.6 to 16.7
10			The formula should be $y = kx$ [not the one they use] $y = 4.5x$ or $y = \frac{9}{2}x$ oe	1 2	 **M1** for y = *kx* or better e.g. 9 = *k* × 2	See appendix Allow any letter for *k* can be awarded in the first statement

Question			Answer	Marks	Part marks and guidance	
11	(a)		Correct tree diagram	2	**B1** for 0.4 on missing branch in task 1 **B1** for $1 - x$ on both missing branches in task 2	If there is more than one answer on any branch, choose the one on the dotted line first
	(b)		They are independent oe	1		Pick the best comment, see appendix
	(c)		0.36	4	**M2** for $0.6(1 - x) + 0.4x = 0.528$ or better or **M1** for $0.6(1 - x) + 0.4x$ or better **M1** for rearranging *their* linear equation, $kx + a = b$, to make kx the subject ($0< k$) OR **M2** for $1 - 0.6x - 0.4(1 - x) = 0.528$ or better or **M1** for $1 - 0.6x - 0.4(1 - x)$ or better **M1** for rearranging *their* linear equation, $kx + a = b$, to make kx the subject ($0< k$) OR **FT** *their* **(a)** if not correct for up to **3** marks e.g. if in **(a)** $1 - x$ is replaced with e.g. 0.4 then **M2** for $0.6 \times 0.4 + 0.4x = 0.528$ or better or **M1** for $0.6 \times 0.4 + 0.4x$ or better **M1** for rearranging *their* linear equation, $kx + a = b$, to make kx the subject ($0< k$) If **0** scored **SC1** for any 2 branches correctly written down and added e.g. $0.6(1 - x) + 0.4(1 - x)$	e.g. **M2** for $0.6 - 0.2x = 0.528$ e.g. **M1** for $0.6 - 0.2x$ e.g. $0.6 - 0.528 = 0.2x$ or better allow similar equations involving 1–0.528 e.g $0.6x + 0.4(1 - x) = 0.472$ e.g. $0.6 - 0.528 = 0.2x$ or better e.g. $0.4x = 0.528 - 0.6 \times 0.4$ or better alternative method using trials **M1** for each correct trial up to **M3** and the correct answer from trials scores **4** marks, see appendix exactly two branches

Question			Answer	Marks	Part marks and guidance	
12	(a)		96	3	**B1** for angle SRQ = 180 – 62 or SRQ = 118 **B1** for angle RSQ = 48 **B1** for angle ROQ = 2 × *their* 48 to maximum of **B2**	could be marked on the diagram, see appendix for alternative methods
	(b)		Method 1 using **angle EFH** : *angle* DEF = *angle* EFH *because* alternate [angle] *angle* EDF = *angle* EFH *because* alternate segment [thm.] *therefore angle* DEF = *angle* EDF or "they have two angles equal" oe	 **B1** **B1** **B1dep**	Method 2 using **angle DFG** : *angle* EDF = *angle* DFG *because* alternate [angle] *angle* DEF = *angle* DFG *because* alternate segment [theorem] **dep** on **B2** awarded If **0** scored **SC1** for two sets of angles linked with incorrect/missing reasons e.g. DEF = EFH and EDF = EFH or EDF = DFG and DEF = DFG	If extra statements mark the best two BOD 'alternating' but not 'Z-angles' BOD 'alt. seg.' Note : Angles may be written the other way round e.g. EDF is the same as FDE and they can say *angle* DFG = *angle* EDF and in marking you must use either method 1 or method 2 not both
13	(a)		$\frac{x+3}{5}$ or $\frac{x}{5}+\frac{3}{5}$ oe	2	**B1** for $x + 3$ written in the correct place on the diagram or in the working space or **B1** for answer $\frac{x}{5}+3$ oe or $\frac{x-3}{5}$ oe or 5(x + 3) oe or correct answer using a different variable	(x + 3) ÷ 5 scores **2** marks x + 3 ÷ 5 scores **1** marks
	(b)		×15 + 27	4	**B3** for 15x and +27 or **B2** for ×15 or +27 in the correct place or **M2** for 5 × (3(x + 2)) [– 3] or better or **M1** for 3(x + 2) or better	**B3** may be seen on the diagram or as an expression Note: the variable x can be any letter for the **B** and **M** marks

Question			Answer	Marks	Part marks and guidance	
14			2219.9… or 2220 with correct working	**6**		"Correct working" requires evidence of at least **M2** or **M1 M1** Accept answers in the range 2217 to 2226. Accept any correct method.
					M2 for cos […] = $\frac{72-52}{52}$ oe or **M1** for 72 – 52 or 20	**M2** implied by 67.38… or 134.76… rot to at least an integer e.g. 67, 67.3, 67.4, 67.38, 134, equivalent method includes $\cos[\ldots] = \frac{52^2+52^2-96^2}{2\times52\times52}$ condone with 72 instead of 96
					and	
					M2 for $\frac{1}{2} \times 52 \times 52 \times \sin$ *their* 134.76… oe or **M1** for $\sqrt{52^2 - (their 20)^2}$ oe or 48 and **M1** for $\frac{1}{2} \times$*their*96 × *their*20 oe	**M2** for finding the area of the triangle OAB implied by 960 *their* 134.76… must come from a correct attempt to find angle AOB and condone using AB = 72 for **M2** and **M1** including $\sqrt{52^2 - 36^2}$ for **M1**
					and **M1** for $\frac{their\ angle\ AOB}{360} \times \pi \times 52^2$ or **B1** for $\pi \times 52^2$	**M1** implied by 3176 to 3186 or **B1** implied by 2704π, 8490 to 8496
						alternative method using major sector: **M2** for angle as before implied by 225, 225.2, 225.23 or 225.24 **M2** for area of triangle as before or **M1** for the third side e.g. 48 **M1** for $[\frac{their\ reflex\ angle\ AOB}{360}] \times \pi \times 52^2$ or 5314.718..
					If **0**, **1** or **2** scored award **SC3** for the correct answer with insufficient working If **0** or **1** scored award **SC2** for 3179.918… or 5314.718.. rot to at least an integer with insufficient working	

Question			Answer	Marks	Part marks and guidance	
15	(a)		(3x – 2)(x + 4) oe	M2	**M1** for (3x + *a*)(x + *b*) with *a* + 3*b* = 10 or *ab* = – 8 or 3*x*(*x* + 4) – 2(*x* + 4) or *x*(3*x* – 2) + 4(3*x* – 2)	For **M2** and **M1** condone the omission of the final bracket. $\frac{(3x-2)(3x+12)}{3}$ followed by 3*x* – 2 [= 0] and *x* + 4 [= 0] scores **M2**. If no products of factors shown then 3*x* – 2 = 0 and *x* + 4 = 0 scores **M1**. After 3*x*(*x* + 4) – 2(*x* + 4) or *x*(3*x* – 2) + 4(3*x* – 2) followed by correct answers award **M2B1 BOD**
			– 4 and $\frac{2}{3}$	B1FT	correct or **FT** *their* linear factors	Condone $0.\dot{6}$ or 0.666… or 0.67 for $\frac{2}{3}$
	(b)		$(x + 4)^2 – 5$	3	**B1** for $(x + 4)^2$ **B2FT** *their* $(x + a)^2$ for *their* – 5 If **0** scored **SC2** for 'correct' answer with missing power or power written in the wrong place	e.g. $(x + 11)^2 – 110$ scores **B2FT** e.g. **SC2** for $(x + 4) – 5$ or $(x + 4^2) – 5$
	(c)	(i)	3 8	2	**B1** for either 3 or 8 in the correct place	
	(c)	(ii)	Translation $\begin{pmatrix}3\\8\end{pmatrix}$	2	**B1** for each correct or **FT** the vector from *their* answer from **(c)(i)**	If more than one transformation score **0**
16	(a)		17.6[4…] with correct working	4	**B2** for 173.5 and 9.835 or 9.8349[9..] selected or **B1** for one of these or **M1** for 173.5 to 174.5/174.49[9..] and 9.825 to 9.835/9.8349[9..] **M1** for (173.5 to 174.5) ÷ (9.825 to 9.835) If **0** or **1** scored, instead award **SC2** for answer 17.6[4…] with no working or insufficient working	"Correct working" requires evidence of the selection of 173.5 and 9.835 or 9.8349[9..]
	(b)		Any viable reason e.g. lift has to speed up and slow down	1		see appendix

Question			Answer	Marks	Part marks and guidance	
17	(a)		40	1		
	(b)		25	1		
	(c)		$\frac{1}{3}$ oe	1		e.g. $\frac{25}{75}$ or 0.33[3…] or 33[.3…]%
18	(a)		162	3	**M2** for $\frac{1}{2}$×(*their*7 + 20) × *their*12 oe or **M1** for one relevant area e.g. $\frac{1}{2}$ × *their*8 × *their*12 or *their*7 × *their*12 or $\frac{1}{2}$ × *their5* × *their*12 alternative method : **M2** for *their*12 × 20 – $\frac{1}{2}$ × *their*8 × *their*12 – $\frac{1}{2}$ × *their5* × *their*12 or **M1** for one relevant area e.g. *their*12 × 20 or $\frac{1}{2}$ × *their*8 × *their*12 or $\frac{1}{2}$ × *their5* × *their*12	e.g. **M2** for $\frac{1}{2}$ × *their*8 × *their*12 + *their*7 × *their*12 + $\frac{1}{2}$ × *their5* × *their*12 implied by 48 + 84 + 30 implied by 240 – 48 – 30
	(b)	(i)	14	2	**M1** for $\frac{their32-their4}{4-2}$ oe	Allow any two points on the line joining (2,4) and (4,32)
	(b)	(ii)	Ruled tangent drawn at 3 seconds 14.0 – 16.0	**B1** **B2dep**	 **B2 dep** on **B1** correct or **FT** or **M1** for rise ÷ run with values substituted	Tangent – mark intention to touch the curve at 3 seconds(condone thin daylight at 3), ignore other lines, condone dotty/dashed and condone line on one side only. If tangent is ruled and *their* value is outside the range apply **FT** to *their* tangent use accuracy of 2 sf
	(b)	(iii)	[the speed] increases oe [because] the gradient is steeper/greater oe	1		Accept any correct response, accept accelerates for increase, see appendix

Question			Answer	Marks	Part marks and guidance	
19			$\frac{\sqrt{3}+2}{\sqrt{48}-6} \times \frac{\sqrt{48}+6}{\sqrt{48}+6}$	M1		multiply by conjugate of denominator
			$\frac{\sqrt{3}\times\sqrt{48}+6\sqrt{3}+2\sqrt{48}+2\times6}{\sqrt{48}\times\sqrt{48}+6\sqrt{48}-6\sqrt{48}-6\times6}$	M1	may be in a separate table **FT** $\sqrt{48}-6$ in both numerator and denominator	multiply out numerator giving at least three terms and denominator accept equivalents e.g. denominator as 48 – 36 or 12
			$\sqrt{48} = 4\sqrt{3}$ soi	M1		implied by $[2\sqrt{48} =]\ 8\sqrt{3}$ or $14\sqrt{3}$
			Simplifying *their* fraction e.g $\frac{24+14\sqrt{3}}{48-36}$ or better	M1dep	**Dep** on at least three terms in the numerator **FT** *their* fraction with surds	e.g. collecting like terms in numerator and in the denominator
			$\frac{12+7\sqrt{3}}{6}$	A1	**A1** dep on **M4**	

Appendix

Exemplar responses for Q4(c)(i)

Response	Mark
Information is immediately displayed as part of a whole	**1**
You can see the proportions easily	**1**
It shows proportions	**1**
Visual representation of proportions	**1**
Pie chart visually shows more than half the students voted G	**1**
It shows as a percentage of a whole	**1(BOD)**
Easier to tell the percentage of people who chose a design	**1(BOD)**
Easier to see percentage	**1(BOD)**
Easier to compare/ see results/ can see which one is most popular (or least popular)	**0**
Shows difference based on size of each part	**0**
Can easily compare size of sectors	**0**
Clear to see	**0**
Easier to read / understand	**0**
You can see the amounts compared to other amounts / can see biggest and smallest with a glance	**0**
It gives a better view on results	**0**
You can work out the percentage better	**0**
They give you a percentage whilst a bar chart doesn't	**0**
It's more accurate	**0**
Identify results quicker	**0**
Shows largest one without giving numbers	**0**

Exemplar responses for Q4(c)(ii)

Response	Mark
you cannot read the [exact] frequencies from it	1
It does not show frequencies/ the amount of people/ the number of students who chose which one	1
More difficult to work out how many students chose each logo	1
Harder to read frequencies	1
You can't see exactly how many people voted	1
You can clearly see the numbers on the bar chart	1
Can't see exact values	1
More steps to get the frequency	1 BOD
Bar chart shows the actual numbers(figures)	1(BOD)
Hard to read exact values	1(BOD)
It doesn't give any numbers	1(BOD)
The results aren't as clear, no numbers	1(BOD)
very difficult to add more data to it	1(BOD)
Does not show how many it is out of	1(BOD)
Harder to find the total amount	1(BOD)
Bar chart gives you more information	0
Not as in depth as pie chart / specific	0
Don't know what each section is and what it's of	0
Have to use/ have a protractor	0
People may not be able to read pie charts	0
Harder to compare than bar chart	0
Can be difficult to read	0

Question 5

Figures below show minimal values required, units are not required, accept some figures which may be rounded up. The figures given must be accurate enough to differentiate between the three sizes.

	Cost of 1 kg	Cost of 1g	Amount for £1	Amount for 1p	Amount for £7.70	Amount for £32.4	Amount for £53.9
700g	£11	£0.011	90[.9…] to 91 g	0.90[9] to 0.91 g	700 g	2945… g	4.9 kg
3 kg	£10.8[0]	£0.0108	92.5 to 92.6 g	0.925 to 0.926 g	712… g	3000 g	4.99… kg
5 kg	£10.7[8]	£0.0107[8]	92.7… g	0.927…g	714… g	3005… g	5 kg

	Cost of 700 g	Cost of 3 kg	Cost of 5 kg	Cost of 15 kg			
700g	£7.7[0]	£33	£55	£165			
3 kg	£7.56	£32.4[0]	£54	£162			
5 kg	£7.54[6] or £7.55	£32.3[4]	£53[.90]	£161[.70]			

Alternative method 2
Allow comparison in pairs e.g.
Compare 3 kg and 5 kg by working out the cost of 15 kg
3 kg is £162 and 5 kg is £161.70 so 5 kg is cheaper

Now compare 700 g and 5 kg by working out the cost of 7 kg
700 g is £77 and 5 kg is £75.46

Question 6

sides	interior	exterior			
5.00	108.00	72.00	35.00	169.71	10.29
6.00	120.00	60.00			
7.00	128.57	51.43			
8.00	135.00	45.00			
9.00	140.00	40.00			
10.00	144.00	36.00			
11.00	147.27	32.73			
12.00	150.00	30.00			
13.00	152.31	27.69			
14.00	154.29	25.71			
15.00	156.00	24.00			
16.00	157.50	22.50			
17.00	158.82	21.18			
18.00	160.00	20.00			
19.00	161.05	18.95			
20.00	162.00	18.00			
21.00	162.86	17.14			
22.00	163.64	16.36			
23.00	164.35	15.65			
24.00	165.00	15.00			
25.00	165.60	14.40			
26.00	166.15	13.85			
27.00	166.67	13.33			
28.00	167.14	12.86			
29.00	167.59	12.41			
30.00	168.00	12.00			
31.00	168.39	11.61			
32.00	168.75	11.25			
33.00	169.09	10.91			
34.00	169.41	10.59			

Question 8

Price	increase	decrease		answer
100	135.00	1	133.65	116.10
	135.00	2	132.30	116.10
	135.00	3	130.95	116.10
	135.00	4	129.60	116.10
	135.00	5	128.25	116.10
	135.00	6	126.90	116.10
	135.00	7	125.55	116.10
	135.00	8	124.20	116.10
	135.00	9	122.85	116.10
	135.00	10	121.50	116.10
	135.00	11	120.15	116.10
	135.00	12	118.80	116.10
	135.00	13	117.45	116.10
	135.00	14	116.10	116.10
	135.00	15	114.75	116.10
	135.00	16	113.40	116.10
	135.00	17	112.05	116.10
	135.00	18	110.70	116.10
	135.00	19	109.35	116.10
	135.00	20	108.00	116.10
	135.00	21	106.65	116.10
	135.00	22	105.30	116.10
	135.00	23	103.95	116.10

Exemplar responses for Q10

The error is……	**Mark**
The formula should be $y = kx$ [not the one they use]	**1**
the formula they use is not direct proportion	**1**
He should have multiplied x and c not added	**1**
They have added the constant [instead of multiplying]	**1**
They have used the wrong equation	**1**
It should not be + [c]	**1**
They should not add	**1**
$y = x + c$	**1**
They are directly proportional	**0**

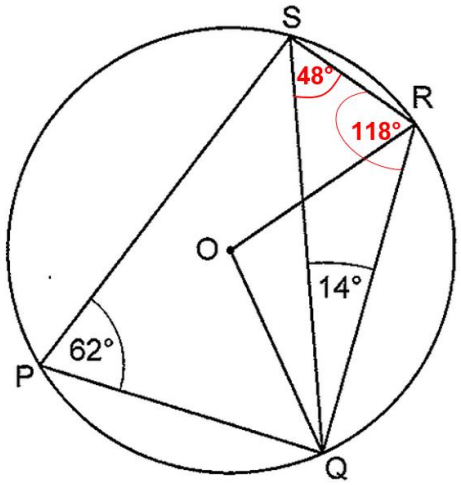
Exemplar responses for Q11(b)

	Mark
The pass before does not affect the results after	**1**
They are independent	**1**
The first task results do not affect the second	**1**
Passing first task does not affect the second task	**1**
Passing the second does not rely on passing the first	**1**
They are not linked	**1**
Same probability to pass second on both times	**0**
The probabilities of the tests do not change	**0**
The probability of passing will always stay the same	**0**
Both second tests are the same	**0**

Question 11(c)

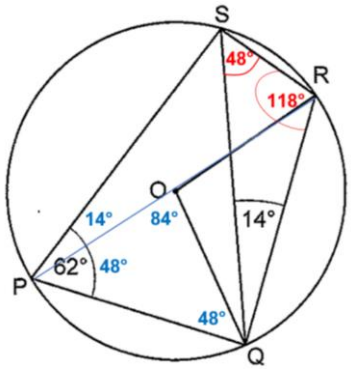
Value(x)	probability
0.2	0.56
0.21	0.558
0.22	0.556
0.23	0.554
0.24	0.552
0.25	0.55
0.26	0.548
0.27	0.546
0.28	0.544
0.29	0.542
0.3	0.54
0.31	0.538
0.32	0.536
0.33	0.534
0.34	0.532
0.35	0.53
0.36	0.528
0.37	0.526
0.38	0.524
0.39	0.522
0.4	0.52
0.41	0.518
0.42	0.516
0.43	0.514
0.44	0.512
0.45	0.51

Working for Q12(a)



Hence angle ROQ = 96° from which ORQ=OQR=42°, SRO=76°, OQS=28°.

Alternative method 1
Some candidates are joining OP, however ROP are not co-linear but point P can be moved so that ROP is a straight line and maintaining angle SPQ as 62°.
Mark this;
B1 for angle SPO = 14°
B1 for angle OPQ and angle OQP = 48°
B1 for angle QOP = 84° or OQR and ORQ = 42°
to maximum of **B2**



Alternative method 2

They can draw a tangent at Q. T is the end of the tangent.

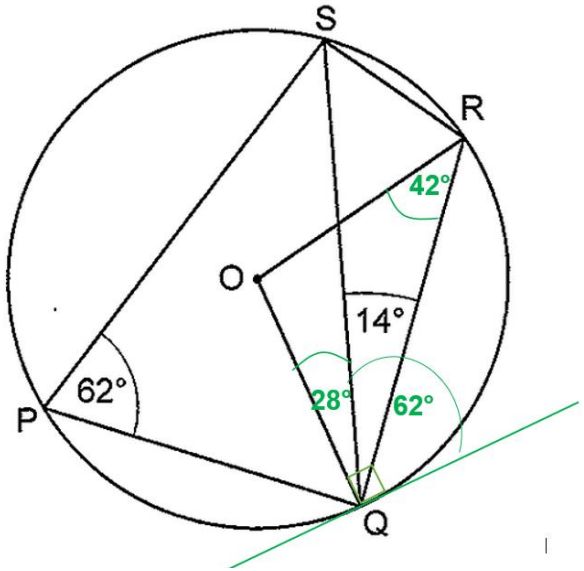
B1 for SQT = 62° (alternate segment theorem),

B1 for (angle OQT = 90°) so angle OQS = 28°,

B1 for making angle OQR = 42° = angle ORQ.

to maximum of **B2**

Hence angle ROQ = 180° – 42° – 42° = 96°



Exemplar responses for Q16(b)

	Mark
lift has to speed up and slow down	1
it will take time to reach this speed	1
It will not travel at the maximum speed all the way	1
the distance could be greater than 173.5 (e.g. 174.3) and the speed may be less than 9.835 (e.g. 9.826) therefore the time will be greater than the shortest time oe	1
We are using the bounds so it may not be accurate/achievable	1
The figure for the height has been rounded down which may not be the height of the building	1
The figure for the speed has been rounded up which may not be the actual speed	1
It makes other stops on the way	1
Extra weight may slow it down	1
Technical fault may occur	1
May not be a constant speed	1
Lift gets stuck	1
Lift may not be able to reach that speed	1
Weight on the lift is a factor [so may slow it down]	1(BOD)
It does not make any other stops	0

Exemplar responses for Q18(b)(iii)

	Mark
Increases and gradient is steeper/greater	1
Accelerates as curve is getting steeper	1
Increases as the distance per second increases	1
Increases as the distance travelled in the same time increases	1
Increases and curve goes upwards	0

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