GCE

Mathematics A

H230/01: Pure Mathematics and Statistics

AS Level

Mark Scheme forJune 2026

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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

1. RM Assessor

- Access and complete the on-screen marking training packages: OCR Examiner Training (RMA3).
- Read the mark scheme and question paper for this component or unit.
- The mark scheme and question paper are available in RM Assessor or on your Component Page if you use the Training Platform for standardisation.
- Log in to RM Assessor and mark the **required number** of practice scripts and the **required number** of standardisation scripts.

Marking

2. General Guidance

- Mark strictly to the mark scheme.
- Marks awarded must relate directly to the marking criteria.
- If you are in any doubt about applying the mark scheme, consult your Team Leader by phone, email or via the RM Assessor messaging system.
- It is **essential** that you meet the RM Assessor 50% and 100% batch deadlines. For traditional marking this will be 40% and 100%. If you experience problems, contact your Team Leader without delay.
- 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 the annotation '**SEEN**' to confirm that the work has been seen and mark any responses using the annotations in Section 11.

- The RM Assessor **comments box** isusedbyyourTeamLeadertoexplainthemarkingof the practice responses. Use these comments when checking your practice responses. **Do not use the comments box for any other reason.**

- **Before the end of the marking period** senda briefreport ontheperformanceofcandidates to your Team Leader via email. The report should contain notesonstrengthsdisplayedaswellas common errorsor weaknesses.Constructivecriticism of the question paper/mark scheme is also appreciated.

3. No Response and Crossed-out Answers

Using the No Response (NR) option. Only mark as NR if:

- the answer space is blank
- there is only a comment not related to the question (e.g., 'can't do', 'don't know')
- there is only a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Enter 0 marks for an attempt that earns no credit (including copying out the question). Do **not** use NR.

Crossed-out answers

If acandidate has crossed out an answer and written a clear alternative, do **not** mark the crossed-out answer.

If acandidate has crossed out an answer and **not** written a clear alternative, mark the crossed-out answer if it is readable.

4. Annotations available in RM Assessor

Annotation	Meaning
√and	Benefit of doubt
BOD	Follow through
FT	Ignore subsequent working
ISW	Method mark awarded 0, 1
M0,M1	Accuracy mark awarded 0, 1
A0,A1	Independent mark awarded 0, 1
B0,B1	Special case
SC	Omission sign
^	Misread
MR	Blank Page
BP	
Seen	
Highlighting	

5. Abbreviations, annotations and conventions used in the mark scheme (including subject-specific conventions).

Abbreviation / Annotation	Meaning
dep*	Mark dependent on a previous mark, indicated by *. The * may be omitted if only one previous M mark
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working
AG	Answer given
awrt	Anything which rounds to
BC	By Calculator
DR	This question included the instruction: In this question you must show detailed reasoning.

6. Subject-specific Marking Instructions

Introduction

Yourfirsttaskistofamiliarise yourself with:

- thespecification,especially the assessment objectives
- thequestionpaperand any inserts or resource booklets
- themarkscheme,including annotation requirements
- theadministrativeprocedures related to the marking process.

Theadministrativeprocedures are set out in the OCR booklet **Instructions for Examiners**.

Ifyouareexaminingforthe first time, please read **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Allrelevanttrainingmaterials are accessed from the Training Platform.

Pleaseaskforhelporguidance whenever you need it. Your first point of contact is your Team Leader.

a.Annotationsmustbeused during your marking. For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0or^)issufficient,but not required.

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

Itisvitalthatyouannotate standardisation scripts fully to show how the marks have been awarded.

If a candidate uses the answer space for one question to answeranother, forexample using the space for 8(b) to answer 8(a), then give benefit of doubt unless it is ambiguous for which part it is intended.

b. An element of professional judgement is required in the marking ofany written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct solutions leading to correct answers are awarded full marks but work must not always be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly. Correct but unfamiliar or unexpected methods are often signalled by a correct result following an apparently incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, escalate the question to your Team Leader who will decide on a course of action with the Principal Examiner.

If you are in any doubt whatsoever you should contact your Team Leader.

c. The following types of marks are available.

M

A suitable method has been selected and applied in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

Amethod mark may usually be implied by a correct answer unless the question includes the DR statement, the command words “Determine” or “Show that”, or some other indication that the method must be given explicitly.

A

Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B

Mark for a correct result or statement independent of Method marks.

Unless otherwiseindicated,marksoncegainedcannotsubsequentlybelost,e.g.wrongworkingfollowingacorrectformofansweris ignored. Sometimesthisisreinforcedinthemarkschemebytheabbreviationisw.However,thiswouldnotapplytoacasewherea candidate passesthroughthecorrectanswerаspartofawrongargument.

d. When a part of aquestionhastwoormore‘method’steps,theMmarksareinprincipleindependentunlessttheschemespecificallysays otherwise; and similarlywheretheareseveralBmarksallocated.(Thenotation‘dep*’isusedtoindicatethataparticularmarkis dependent on anearlier,asterisked,markinthescheme.)Ofcourse,inpracticeitmayhappenthatwhenacandidatehasoncegone wrong in a part ofaquestion,theworkfromthereonisworthlesssothatnomoremarkscansensiblybegiven.Ontheotherhand,when two or more stepsaresuccessfullyruntogetherbythecandidate,theearliermarksareimpliedandfullcreditmustbegiven.

e. The abbreviationFTimpliesthattheAorBmarkindicatedisallowedforworkcorrectlyfollowingonfrompreviouslyincorrectresults. Otherwise, A andBmarksaregivenforcorrectworkonly–differencesinnotationareofcoursepermitted.A(accuracy)marksarenot given for answersobtainedfromincorrectworking.WhenAorBmarksareawardedforworkatanintermediatestageofasolution,there may be various alternativesthatareequallyacceptable.Insuchcases,whatisacceptablewillbedetailedinthemarkscheme.Ifthisis not the case please,escalatethequestiontoyourTeamLeaderwhowilldecideonacourseofactionwiththePrincipalExaminer.

Sometimes the answertoonepartofaquestionisusedinalaterpartofthesamequestion.Inthiscase,Amarkswilloftenbe‘follow through’. In such casesyoumustensurethatyoureferbacktotheanswerofthepreviouspartquestionevenifthisisnotshownwithin the image zone. Youmayfinditeasiertomarkfollowthroughquestionscandidate-by-candidateratherthanquestion-by-question.

f. We are usually quiteflexibleabouttheaccuracytowhichthefinalanswerisexpressed;over-specificationisusuallyonlypenalisedwhere the scheme explicitlysaysso.

- When a value is **given** inthepaperonlyacceptananswercorrecttoatleastasmanysignificantfiguresasthegivenvalue.
  When a value is **not given** inthepaperacceptanyanswerthatagreeswiththecorrectvalueto **3 s.f.** unlessadifferentlevelof accuracy has beenaskedforinthequestion,orthemarkschemespecifiesanacceptablerange.
  NB for SpecificationB(MEI)therubricisnotspecificaboutthelevelofaccuracyrequired,sothisstatementreads“2s.f”.

Candidates using avalueof9.81or10forgshouldusuallybepenalisedforanyfinalaccuracymarkswhichdonotagreetothevalue found with 9.8 whichisgivenintherubric.

g. Rules for replaced work and multiple attempts:

- If one attempt is clearly indicated as the one to mark, or onlyone is left uncrossed out, then mark that attempt and ignore the others.
- If more than one attempt is left not crossed out, then markthelast attempt unless it only repeats part of the first attempt or is substantially less complete.
- if a candidate crosses out all of their attempts, the assessorshould attempt to mark the crossed out answer(s) as above and award marks appropriately.

h. For a genuine misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A or B mark in the question. Marks designated as cao may be awarded as long as there are no other errors.
If a candidate corrects the misread in a later part, do not continue to follow through. Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

i. If a calculator is used, some answers may be obtained with little or no working visible. Allow full marks for correct answers, provided that there is nothing in the wording of the question specifying that analytical methods are required such as the bold "In this question you must show detailed reasoning", or the command words "Show" or "Determine". Where an answer is wrong but there is some evidence of method, allow appropriate method marks. Wrong answers with no supporting method score zero. If in doubt, consult your Team Leader.

j. Ifin any case the scheme operates with considerable unfairness consult your Team Leader.

Question			Answer	Mark	AO	Guidance
1	(a)		$\frac{x^2 \cdot x}{x6}$ or $\left(\frac{\sqrt{x}}{x2}\right)^2$ or $\frac{x^3}{x^6}$	M1	1.1	Anyfullycorrect first step; may be implied by A1. $\left(\frac{\sqrt[3]{x^2}}{x3}\right)^2$ alone isnotsufficient.Allowe.g.$(x^{\frac{3}{2}}2)^2$ but not just $x^{-\frac{3}{2}}$
			$= x^{-3}$	A1 [2]	1.1	May be given as $a=-3$
1	(b)		**DR** $\frac{\sqrt{20}-2}{\sqrt{5}+1} \times \frac{\sqrt{5}-1}{\sqrt{5}-1}$ $= \frac{10-\sqrt{20}-2\sqrt{5}+2}{5-1}$ or e.g. $\frac{(12-4\sqrt{5})}{4}$ $=3-\sqrt{5}$	B1* M1 dep* A1 [3]	2.1 1.1 1.1	Multiplying by an appropriate term to rationalise (or $\frac{-\sqrt{5}+1}{-\sqrt{5}+1}$) Multiplying out their fractions correctly – an intermediate step must be seen. Condone sign errors when multiplying out. **AG** following any correct intermediate step www

Question			Answer	Mark	AO	Guidance
2	(a)		$[x^5 3x^2+1=]x-1$	B1 [1]	1.1 1.1	Maybegiven as $a=1, b=-1$. Condone just $x-1$
2	(b)		$y = x - 1$ drawn or implied $[x=]-0.9, 0.7, 1.4$ ± 0.05	M1 A1 A1 [3]	1.1 1.1	FTtheirequation or their a and b from **(a)**, not $y=0$ Condonepoints (on line) but not just marking the roots. A1foranytwo correct A1forallthree values correct (NB:candidates who do not show evidence of using the graph willscore0/3)

Question			Answer	Mark	AO	Guidance
3	(a)		**Fig.1**	B1 [1]	1.2	cao
3	(b)		**Fig. 2**:'3roots' or 'negative coefficient of x^4' **Fig 3**:'negative coefficient of x^4' **Fig 4**:'3roots'	B1 B1 [2]	2.2a 2.2a	B1 for correct statement about any two curves B1 for a correct statement about all three curves Allow 'two equal roots' or 'repeated root' or 'two of *a, b, c, d* are equal' oe for '3 roots' (Condone 'solution' for 'root') Condone 'negative curve/graph' oe for 'negative coefficient' but not just 'negative' or 'negative gradient' (Condone 'x^4 term' is positive/negative as appropriate – candidates may argue in the affirmative or negative)

Question			Answer	Mark	AO	Guidance
4	(a)		$\vec{AM} = \begin{pmatrix}4\\1\end{pmatrix} - \begin{pmatrix}2\\-3\end{pmatrix} = \begin{pmatrix}2\\4\end{pmatrix}$	B1	1.1	soi, or for $\vec{OB} = \begin{pmatrix}6\\5\end{pmatrix}$ or for $\vec{AB} = \begin{pmatrix}4\\8\end{pmatrix}$
			$\vec{OC} = \vec{OA} + 4\vec{AM}$ or $\vec{OC} = \vec{OM} + 3\vec{AM}$ or $\vec{OC} = \vec{OB} + \vec{AB}$ or $\vec{OC} = \vec{OB} + 2\vec{AM}$	M1	1.1	Attemptatacomplete method for $\vec{OC}$ (may be implied by A1 in thiscase, following B1). This additionmay be implied by a clear diagram or appropriatesum (i.e. vector notation not needed).
			$= \begin{pmatrix}10\\13\end{pmatrix}$	A1 [3]	1.1	Allow 10**i**+13**j** **SCB1** for $\begin{pmatrix}10\\13\end{pmatrix}$ without working (max 1/3)
4	(b)	(i)	$\sqrt{20}$	B1 [1]	1.1	oe e.g. $2\sqrt{5}$ (must be exact)
4	(b)	(ii)	$\vec{OQ} = -2\mathbf{i} + 4\mathbf{j} + k(3\mathbf{i} - \mathbf{j})$	B1	1.1	oe e.g. $(-2+3k)\mathbf{i} + (4-k)\mathbf{j}$ Allow as column vector. ISW incorrect simplification following a correct answer
	(b)	(iii)		[1]		
4			$(-2+3k)^2 + (4-k)^2$	B1FT	2.1	FT their $\vec{OQ}$ in this expression (may be embedded)
			$(-2+3k)^2 + (4-k)^2 = 20$	M1*	1.1	Set =20 to form a quadratic equation in k (FT their 20 but must be their answer to **(b)(i)** squared or with √ both sides as appropriate). Do not allow with **i** and **j**.
			$10k^2 - 20k = 0$ or $10k^2 - 20k + 20 = 20$	M1 dep*	1.1	Rearrange their quadratic correctly to solvable form
			$k = 2$ **and** $k = 0$	A1 [4]	1.1	For both (AG for $k=0$)

Question			Answer	Mark	AO	Guidance
4	(b)	(iv)	Q is at P	B1 [1]	3.2a	oe - Allow: • "(Q is) exactly where P is" or "It is at P" B1 • "thevector (-2,4) is the same as $\vec{OP}$ " B1 (BOD) • $\vec{OQ}=\vec{OP}$ B1 Condone "$Q=P$" B1 BOD • "$Q$and P would be the same" (not spoilt if candidates go on to say 'which is not possible' oe) Do not allow: • "kcan't be 0" or "Q is at the origin" B0 • "kcan't be 0 because Q and P are different" • "Q is on the x-axis" (or "y-axis") B0

Question			Answer	Mark	AO	Guidance
5	(a)		$x^4+4x^3h+6x^2h^2+4xh^3+h^4$	B1 [1]	1.1	Allow $x^4+\binom{4}{1}x^3h+\binom{4}{2}x^2h^2+\binom{4}{3}xh^3+h^4$ oe or $[{}^4C_0]x^4+{}^4C_1x^3h+{}^4C_2x^2h^2+[{}^4C_3]h^3h^4$
5	(b)		$[\lim_{h\to 0}]\frac{(x+h)^4+2(x+h)-(x^4+2x)}{h}$ $[=\frac{4x^3h+6x^2h^2+4x^3+h^4\ h+2h}{h}]$ $=[lim]4x^3+6x^2\ h+4x^2h^3\ h+2$ $\lim_{h\to 0}(4x^3+6x^2\ h+4x^2h^3\ h+2)$ $=4x^3+2$	M1* A1 M1 dep* A1 [4]	2.1 1.1 1.1 2.2a	For setting up $\frac{f(x+h)-f(x)}{h}$ with the given form of $f(x)$ or their expansion from **(a)**. lim not required for first 2 marks. Allow other variables e.g. δx for h Correct expression simplified correctly Must have ***lim*** here (condone just $h\to 0$ for their h but not $h=0$). FT their $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ with their expansion from **(a)** (condone poor simplification) correctly obtained from 1st principles www

Question			Answer	Mark	AO	Guidance
6	(a)		Volume$=4=x^2h \Rightarrow h = \frac{4}{x^2}$ $[A=]x^2+4xh$ $\Rightarrow A = x^2 + 4x\cdot\frac{4}{x^2} = x^2 + \frac{16}{x}$ **AG**	**M1** **A1** **[2]**	**1.1** **1.1**	Usingthegiven information to find h in terms of x Substituting for h to obtain AG correctly (must see an intermediate step)
6	(b)	(i)	$[\frac{dA}{dx} =]2x - \frac{16}{x^2}$ $2x - \frac{16}{x^2} = 0$ $[x^3=8] \Rightarrow x=2$ $A=2^2 + \frac{16}{2} = 12$	**M1** **M1** **A1** **A1** **[4]**	**3.1a** **1.1** **1.1** **1.1**	Differentiating, condone sign errors for **M1** Set their $\frac{dA}{dx} = 0$, must be seen soi (but **A0** for any other incorrect values of x unless explicitly rejected) Must be correctly obtained from a correct derivative.
6	(b)	(ii)	$[\frac{d^2A}{dx^2} =]2 + \frac{32}{x^3}$ $\frac{d^2A}{dx^2} > 0$ when $x = 2$, hence minimum	**M1** **A1**	**1.1** **2.2a**	FT their $\frac{dA}{dx}$, condone sign errors for **M1** www dep $x=2$; no need to see actual value but must be obtained correctly i.e. $\frac{dA}{dx} = 2x + \frac{16}{x^2} \Rightarrow \frac{d^2A}{dx^2} = 2 + \frac{32}{x^3}$ (2x sign errors) is **A0** For reference if correct $[\frac{d^2A}{dx^2}]_{x=2} = 6$
			Alternative Method Attempt find $\frac{dA}{dx}$ or A either side of their $x=2$ Correct values of $\frac{dA}{dx}$ or A for $x=2\pm$ hence min	**M1** **A1** **[2]**		FT their value of x and their $\frac{dA}{dx}$ dep $x=2$ www

Question			Answer	Mark	AO	Guidance
7	(a)		$350\times(1.03)^2$	M1	3.3	oe(ifcorrect=371.315… - **M1** may be implied by this valuerotto1dp or better – NB 350×1.06=371)
			$\times1.015^{13}$	M1	1.1	Multiplyingtheir 371.315… by 1.015^{13}
			=450.61	A1	1.1	**M1** impliedby 450.610… rot awrt (£)451 DonotISW(mark final answer)
				[3]		**SCB1** forawrt (£)451 without working (max. 1/3)
7	(b)		**DR** $350\times1.03^2\times1.015^n>500$	M1*	3.1b	Setting upacorrect (in)equality. Allow withtheir 371.315…from **(a)** i.e. Their $371.315...\times1.015^n>500$ Allow '='throughout and condone < Allow anyvariable for n or $n\pm2$ in place of n.
			$n\ln1.015>\ln1.346566$	M1 dep*	1.1	Take logsofboth sides (may not be ln)and apply log laws correctlytoreach $n\ln1.015>\cdots$ $\log_{1.015}$ correctlytoreach an(in)equality in n: Or using $\frac{500}{their\ 371.315...}(=1.346...)<1.015^n$ $\Rightarrow n>\log_{1.015}1.346...$ Or using $n-2$: $\frac{500}{their\ 371.315...}(=1.346...)<1.015^{n-2}$ $\Rightarrow n-2>\log_{1.015}1.346...$
			$n>19.99$ After22years	A1 A1	1.1 3.2b	Or $n-2>19.99...$ (Donotallowthismark with $n+2$)

			Alternative Method $350 \times 1.03 \times 1.015^{13} \times 1.015^{n-15} > 500$	**M1***		Setting up a correct (in)equality. Allow with their 450.61… from part **(a)** Allow '=' throughout and condone < Allow any variable for n or $n \pm 15$ in place of $n-15$
			$(n-15)\ln 1.015 > \ln 1.109...$	**M1 dep***		Take logs of both sides (may notbe ln) Orusing $\log_{1.015}$ correctly to reach an (in)equality in n: $\frac{500}{their\ 450.61...} (= 1.109...) < 1.015^{n-15}$ $\Rightarrow n-15 > \log_{1.015} 1.109...$
			$n-15 > 6.9...$ After 22 years	**A1** **A1**		
				[4]		NB trial and improvement or non-logarithm methods score 0.

Question			Answer	Mark	AO	Guidance
8			**DR** $[y=]x+3x(+c)$	**M1***	**3.1a**	Attempttointegrate $\frac{dy}{dx}$ (allow without + c). Both powers must increase by 1 and the coefficient of x^2 must not be 2.
			$a=10+c$ **and** $2a=18+c$	**M1**	**1.1**	oe Substitute (2, a) **and** (3, $2a$) into their equation of curve to obtain two equations in a and c (must now have + c)
			$[a=8]\Rightarrow c=-2$	**A1**	**1.1**	
			Alternative method for 1st three marks (using the property of a parabola that the gradient of a chord between any two points equals the gradient at the pointwith mean -xcoordinate).			
			Gradient at $x=2.5$ is $\frac{2a-a}{3-2}=a=2\times2.5+3$ $[a=8]$, hence $[y=]x^2+3x(+c)$	**M1***		Using the gradient property to obtain a quadratic expression M1 for one term correct (allow without + c)
			$8=2^2+3\times2+c$	**M1**		Setting equal to their value of a
			$c=-2$	**A1**		Solving to obtain c
			$x2+3x-2=4x+4$	**M1** **dep***	**3.1a**	Setting their integrated expression for the curve = $4x$ + 4 with their value for c (must have a value for c here)
			$[\Rightarrow x^2-x-6=0]\Rightarrow(x+2)(x-3)=0$	**B1FT** **dep****	**1.1**	Correct method to solve their quadratic equation (FT their quadratic) – method e.g. factorising/formula/completing square must be seen for this mark.
			$x=-2$ **and** $x=3$	**A1**	**1.1**	For both values of x correct.
			$(-2,-4)$ **and** $(3,16)$	**A1**	**3.2a**	Must be written as coordinates or clearly in pairs
				[7]		

Question			Answer	Mark		Guidance
9	(a)		$[1-\frac{1}{3}=]\ \frac{2}{3}$	B1 [1]	1.1	oe – Accept $\frac{4}{6}$ 0.667, 66.7% etc.
9	(b)		$(\frac{1}{3}\times)+(\frac{1}{6}\times)$ $\frac{1}{6}$ $\frac{1}{3}$ or $2\times\frac{1}{3}\times\frac{1}{6}$ $=\frac{1}{9}$ **AG**	M1 A1 [2]	1.1 1.1	oe - Appropriate calculation (sum of two products) for (2,3) and(3,2) cao, mustfollow correct expression
9	(c)		$\frac{5}{18}\times\frac{1}{4}$ $\frac{1}{36}\times\frac{1}{3}$ $=\frac{17}{216}$ or 0.0787 (3 sf)	M1 A1 [2]	3.1a 1.1	Allow oneslipin the probabilities but must be an expressionofthe correct form (i.e. sum of two products) This stepoemust be seen May see $((2\times\frac{1}{6}\times\frac{1}{2}+\frac{2}{6}\times)\frac{2}{6}$ $\frac{1}{2}\times)\frac{1}{2}+(\times$ $\frac{1}{6}$ $\frac{1}{6}\times$ $(2\times\frac{1}{2}$ $\frac{1}{}$ $\times))$ **SCB1** for 0.0787 only without working. NBcandidateswho attemptto double valuesof X (i.e. 8 spins of the spinner or 4 'events' of X) will score 0/2

Question			Answer	Mark	AO	Guidance
10	(a)		Useofareaas frequency (allow any scale for frequencydensity) e.g. 30-50: 150× or 70-90: $150\times\frac{4}{6}$	M1	3.1a	Useofthegiveninformation to obtain an appropriate equatione.g.10×30× =150 (i.e. measuring the heightofeachsmall square is '1/2 a unit') or 6×25= 150(i.e.eachmedium square is '25' units) in their unitsoffrequency density. Maybeimpliedby any other frequency (125, 125, 100) correctlyobtained.
			Therefore frequencies are 125, (150), 125, 100	M1	1.1	Remainingfrequencies obtained (NB 150 is given) oe if otherunitsof'frequency' used e.g. 2x these values or finding'cumulative' frequency from 30-90 (500).
			Freq for 90-120: $545 - 500 = 45$ **AG**	A1	2.1	Correctlyobtained www (Must have 545-500 soi to obtain AG)
				[3]		
10	(b)		$\frac{40\times125+55\times150+65\times125+80\times100+105\times45}{545}$ $[=\frac{34100}{545}]$	M1	1.1	Attempt $\frac{\Sigma xf}{545}$ using midpts (must see frequencies x midpointsanddivided by 545); FT their frequencies Condoneomission of 90-120 class (45) or one slip only. Maybeimpliedby **A1**.
			=62.6	A1	1.1	Awrt 62.6
				[2]		
10	(c)		Exact values unknown oe	B1	2.4	Allow: • "because [we] used the midpoint to find the mean" **B1** • "distribution/spread of masses in each interval is unknown" **B1** Do not allow: • Just "grouped data" **B0** • "No scale on histogram" **B0**
				[1]		

Question		Answer	Mark		Guidance
11 (a)		0.128	B1 [1]	1.1	awrt0.128Accept e.g. 12.8%
11 (b)	(i)	H0:p=0.2 H1:p≠0.2 where p =P([random] car [in town] is **blue**)	B1 B1	1.1 2.5	Accept proportion, allow 'where p is the proportion of **blue** cars' (but not 'number'). Must say **blue**. Condone 20% for 0.2 Subtract B1 for each error e.g.: • 1-tail B1B0 • undefined p B1B0 • use of X,x and not defined B0B0 • sample proportion implied (i.e. referring specifically to the proportion in the 60 cars) – B1B0 (condone e.g. 'certain car park') B0B0 Missing value 0.2 B0B0 H_0=0.2 etc:
		$X \sim B(60,0.2)$ and x=6	M1	3.3	Stated or implied (e.g. by P(X < 6) = 0.0308)
		P($X \leq 6$)=0.0308	A1	3.4	**BC** Condone 2sf i.e. awrt 0.03$\dot{1}$ (but the full statement must be correct) Accept equivalents e.g. P(X<7)= 0.0308 or P(X>6)=1−0.0308=0.969
		0.0308>0.025	A1FT	1.1	For a correct comparison FT their probability and their hypotheses (i.e. one-tail: 0.05, two-tail with '1-P' 0.975) NB M1A0A1FT is possible
		Do not reject H_0	M1	1.1	FT their comparison with 0.025, 0.975, 0.05 or 0.95 (this conclusion must follow from their comparison but is not dep. on A1FT) Condone "Accept H_0" but not "Reject H_1"

Question			Answer	Mark		Guidance
			Insufficient evidence that proportion of blue cars ≠20%	A1 [7]	2.2b	www, dependent on all previous marks Must beincontext and not definite. Allow: • Probability, but not number • "insufficient evidence to suggest that Hiro's belief is not correct" • Condone "evidence suggests Hiro's belief is correct" • (But do not accept 'Show' or 'Prove' A0) Consistent 1-tail test: H1: $p < 0.2$, $0.0308 < 0.05$, RejectH_0 **B1B0M1A1A1FTM1A0** Two-tail test with incorrect significancelevel: H1: $p \neq 0.2$, $0.0308 < 0.05$, RejectH_0 **B1B1M1A1A0M1A0**

Question			Answer	Mark	AOs	Guidance
11	(b)	(ii)	Any of: • **Yes** because cars parked on Saturday may not be typical of other days [with respect to colour]. • **Yes** because on Saturday, more parked cars may belong to people doing shopping, whereas on weekdays more parked cars may belong to people working in the town [with respect to colour]. • **No** because there is no reason to suppose that the percentage of blue cars will be different on Saturday compared with any other day.	**B1** **[1]**	**3.5b**	oe Must be given in context (so must refer to people/cars/activity) Must say (or otherwise indicate e.g. 'it will/will not affect') **Yes/No** i.e. must be clearly arguing one way or the other. Accept e.g. • "Yes because Saturday is when people go out more [or less]" • "Yes because fewer/no people are at work" • "Yes because people go shopping at the weekend" • "No because (we would reasonably expect that) the day of the week is independent of car colour" • "Yes because Saturday is not a weekday [and the number of blue cars may vary on weekday vs weekend]" Do not accept e.g. • "Yes because it's Saturday"

Question			Answer	Mark	AO	Guidance
12	(a)	(i)	Similarproportions of age 85 and over	B1 [1]	2.2a	Must referto proportion and not number/amount (but if ambiguouse.g. 'similar' without reference to number then allowB1 BOD) Accept e.g. • "Similar proportions of 75-84 (or 75+)" • "(Approximately) similar proportions of 45-59" • Condone references 'older people' (for 85+) • "The smallest proportion of residences in both is in the category 85+"
12	(a)	(ii)	E.g. Bexley **higher** proportion in 45-59 or 60-74 or 75-84 Or Greenwich has **higher** proportion in 30-44 or younger people	B1 [1]	2.2a	Must refer to proportion and not number/amount (but if ambiguous e.g. '**greater'** without reference to number then allow B1 BOD) (Must be a comparison e.g. higher/lower not just 'different') Accept e.g. "Greenwich has **higher** proportion of 30-44" "Bexley has **higher** proportion of 45-59" "Bexley has **higher** proportion of 60-74" "Bexley has **higher** proportion of 75-84" • (Allow 'inverse' statements of the above oe) • (Allow combination of two or more categories) • Condone references to 'younger people' (for 30-44) or 'older people' (for 75-84)

Question			Answer	Mark	AO	Guidance
12	(b)		Bromley has largest number in range 60 to 74	B1 B1 [2]	2.2b 2.4	ChooseBromley State useofnumberinrange **60** to74(Must not be referring to proportion) Must say **60** butcondone'greatestnumber of age **60** and above'i.e.donotacceptjust'largest elderly population'
12	(c)		Few people move in or out of these LAs in next 5 years	B1 [1]	2.2b	oe - Accepte.g. • "Fewpeoplemovein"or"Fewpeople move out" • "Fewpeopledieintheseagegroups in the next 5 years" • "Theresidentscurrentlyaged60-74 will still live in Bromley in 15 years" Do notaccepte.g. • Irrelevantcommentsabout"other care homes" or "long-term health trends" • "Everyoneovertheageof___will require a care home" • Referencestotheresidentswhoare currently age80+(mustbereferringto60-74 if mentioned) • "Thenumberofpeopleaged60-74 remains constantoverthenext15/20years" • Just"thenumberofresidentsremains constant" (Must notbereferringtoproportion)

Question			Answer	Mark	AO	Guidance
12	(d)		No,(stillBromley), as total for ages 30 to 74 is greatest	B1 [1]	2.4	oe(Mustnotbereferring to proportion) Must mention **30** (and,if referring to a group, it must be 30-74 or30-59not30-44) Accept: • "No,hasthelargest population 30-74" Condone: • "NobecauseBromley still has the largest population30and above" B1 BOD Do notaccept: • Lewisham(because it has the largest number in theagerange30-44) B0 • "Bromleybecause it has the largest population ofage30-44"B0 (statement is incorrect)

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