

Cambridge International A Level

MATHEMATICS**9709/61**

Paper 6 Probability & Statistics 2

October/November 2025**MARK SCHEME**Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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This document consists of **15** printed pages.

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GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

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- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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Annotations

Annotation	Meaning
	More information required
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Independent accuracy mark awarded zero
	Independent accuracy mark awarded one
	Independent accuracy mark awarded two
	Benefit of the doubt
	Blank Page
	Incorrect
Dep	Used to indicate DM0 or DM1

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Annotation	Meaning
DM1	Dependent on the previous M1 mark(s)
	Follow through
	Indicate working that is right or wrong
Highlighter	Highlight a key point in the working
	Ignore subsequent work
	Judgement
	Judgement
	Method mark awarded zero
	Method mark awarded one
	Method mark awarded two
	Misread
	Omission or Other solution
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
	Judgment made by the PE
	Premature approximation
	Special case
	Indicates that work/page has been seen

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Annotation	Meaning
 SF	Error in number of significant figures
	Correct
 TE	Transcription error
 XP	Correct answer from incorrect working

PUBLISHED**Mark Scheme Notes**

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M** Method mark, awarded for a valid method applied to the problem. Method marks are not 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. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.
- 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).
- B** Mark for a correct result or statement independent of method marks.
- DM or DB** When a part of a question has two or more ‘method’ steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- FT** Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.
- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
 - For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
 - The total number of marks available for each question is shown at the bottom of the Marks column.
 - Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
 - Square brackets [] around text or numbers show extra information not needed for the mark to be awarded.

Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no ‘follow through’ from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1(a)	$e^{-3}(\frac{3^3}{3!} + \frac{3^4}{4!}) = e^{-3}(4.5 + 3.375) = 0.22404 + 0.16803$	M1	Allow one end error. Allow incorrect λ .
	$= 0.392$ (3 sf)	A1	
		2	
1(b)	$\lambda = 5$	B1	SOI. Need to be stating or using Poisson.
	$1 - e^{-5}(1 + 5 + \frac{5^2}{2!}) = 1 - e^{-5}(1+5+12.5)$ $= 1 - (0.0067379 + 0.0336897 + 0.0842243)$	M1	Allow one end error and any λ .
	$= 0.875$ (3 sf)	A1	Alternative combinations method. B1 for one correct product, M1 for correct structure (incl $1 - \dots$) and probs of full set of totals = 1 or probs of full set of totals = 2. A1 for 0.875.
		3	
1(c)	$T \sim N(600, 600)$	B1	SOI.
	$\frac{559.5-600}{\sqrt{600}} [= -1.653]$	M1	For standardising. Must have sqrt. Allow with no or incorrect continuity correction.
	$\Phi(-1.653) = 1 - \Phi(1.653)$	M1	For correct area consistent with their working.
	$= 0.0492$ (3 sf) or 0.0491	A1	
		4	

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Question	Answer	Marks	Guidance
2	est (μ) = 499.5 or 29970/60	B1	
	est (σ^2) = $\frac{60}{59} \left(\frac{14970300}{60} - '499.5'^2 \right)$ or $1/59(14970300 - (29970)^2/60)$	M1	Biased var = 4.75 M0 .
	= 4.83 or 285/59	A1	
	H ₀ : Pop mean (or μ) = 500 H ₁ : Pop mean (or μ) $\neq$ 500	B1	Both. Not just 'mean'.
	$\frac{'499.5'-500}{\frac{\sqrt{'4.83'}}{\sqrt{60}}}$	M1	For standardising with their values. Must have $\div\sqrt{60}$. Ignore cc s.
	= -1.762	A1	Allow -1.778 (from biased variance) accept 3 sf if nothing better.
	'1.762' < 1.96 or -'1.762' > -1.96 0.0390 > 0.025	M1	For valid comparison. Allow 1.778 < 1.96 0.0377 > 0.025.
	There is insufficient evidence that [mean] mass is not 500g	A1FT	In context. Not definite. No contradictions. FT from incorrect z. μ only accepted if defined. Accept CV method 499.5 > 499.44. Using biased var or using incorrect hypothesis can score a maximum of 6/8.
		8	

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Question	Answer	Marks	Guidance
3(a)	$\lambda = 1.45$	B1	Need indication of Poisson.
	$e^{-1.45} \left(1 + 1.45 + \frac{1.45^2}{2!} + \frac{1.45^3}{3!} \right) = e^{-1.45}(1+1.45+1.05125+0.5081041)$	M1	Allow one term extra or omitted or incorrect. Allow incorrect lambda.
	$= 0.94[0] \text{ or } 0.941$	A1	SC use of Binomial(14500, 0.0001) to find prob (< 4) = 0.940485 = 0.940 scores B2 . Unjustified 0.94[0] or 0.941 scores B1B1 .
		3	
3(b)	$e^{-14500p}$ seen or $2e^{-1.45} [= 0.46914]$ seen	B1FT	FT their λ from 3(a) .
	$e^{-14500p} = 2e^{-1.45} [\Rightarrow -14500p = \ln 2 + (-1.45)]$	M1	Forming an equation in p and attempting to solve. FT their $e^{-14500p}$. Factor of 2 on the wrong side of the equation can still score M1 .
	$p = 0.0000522$ (3 sf)	A1	OE. Use of binomial reaching 0.0000522 scores SCB2 .
		3	

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Question	Answer	Marks	Guidance
4(a)	$[2 \times] z \times \frac{\sigma}{\sqrt{n}} = 1.414 \times [2 \times] 1.645 \times \frac{\sigma}{\sqrt{n}} \quad [z = 2.326]$	M1	Form an equation in z (accept $z = 1.414 \times 1.645$ OE). Factor of 1.414 on the wrong side of the equation can still score M1 . Condone 1.282 instead of 1.645 for M1 .
	$2\Phi('2.326') - 1$	M1	OE.
	$\alpha = 98$ (3 sf)	A1	Allow 98%.
		3	
4(b)	$\frac{90}{'98'} = \frac{45}{49}$ or 0.918 (3 sf)	B1FT	FT their α . no ft if $\alpha < 90$ in 4(a) .
		1	

Question	Answer	Marks	Guidance
5(a)	$P(X \leq 2) = 0.8^{40} + 40 \times 0.8^{39} \times 0.2 + {}^{40}C_2 \times 0.8^{38} \times 0.2^2$ $= 0.0001329 + 0.0013292 + 0.0064799$	M1	Attempt $P(X \leq 2)$ or $P(X \leq 3)$ using $B(40, 0.2)$. Need to see expressions.
	$= 0.00794$ (< 0.025)	A1	SC unjustified $X \leq 2 = 0.00794$ scores M0B1 .
	$P(X \leq 3) = [0.00794 + {}^{40}C_3 \times 0.8^{37} \times 0.2^3]$ $= 0.0079421 + 0.0205199 = 0.0285 > 0.025$	B1FT	Correct term $P(X = 3)$ added to $P(X \leq 2)$ and one relevant comparison seen. Need to see expressions.
	$P(\text{Type I}) = 0.00794$ (3 sf) with both relevant comparisons seen	B1	Unjustified final answer 0.00794 scores SCB1B1 .
		4	

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Question	Answer	Marks	Guidance
5(b)	Rejection region is $X \leq 2$	B1	OE.
		1	
5(c)	H_0 will be rejected Or result lies in the rejection region	B1	
		1	

Question	Answer	Marks	Guidance
6(a)	$N(2.5 + 0.8, 0.05 + 0.02) = N(3.3, 0.07)$	B1B1	SOI B1 for $N(3.3, \dots)$ B1 for 0.07 give at early stage OE.
	$\frac{3.55 - '3.3'}{\sqrt{0.07}}$ [= 0.945]	M1	For standardising with their values.
	$1 - \Phi('0.945')$	M1	For area consistent with their values.
	= 0.172 (3 sf)	A1	
		5	

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Question	Answer	Marks	Guidance
6(b)	$E(D) = 2.5 - 3 \times 0.8 = 0.1$	B1	Give at early stage. OE.
	$\text{Var}(D) = 0.05 + 3^2 \times 0.02 = 0.23$	M1	Give at early stage.
	$\frac{0 - ('0.1')}{\sqrt{'0.23'}} [= -0.2085 \text{ or } 0.209 \text{ or } 0.208]$	M1	For standardising with their values. Must have used the vars for denom.
	$\Phi(' -0.2085') = 1 - \Phi('0.2085')$	M1	For area consistent with their values.
	$= 0.417 \text{ (3 sf) or } 0.418$	A1	
		5	

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Question	Answer	Marks	Guidance
7(a)	$[f(x) = -\frac{3}{4}(x^2 - 8x + 15)]$		
	$-\frac{3}{4} \int_{4.5}^5 (x^2 - 8x + 15) dx$	M1	Attempt to integrate their $f(x)$. Condone missing $-3/4$.
	$= -\frac{3}{4} \left[\frac{x^3}{3} - 4x^2 + 15x \right]_{4.5}^5$	A1	Correct integration and correct limits 4.5 and 5. OE e.g. 1– integration from 3 to 4.5 condone missing $-3/4$.
	$-\frac{3}{4} \left[\frac{125}{3} - 100 + 75 - \left(\frac{4.5^3}{3} - 4 \times 4.5^2 + 15 \times 4.5 \right) \right]$	M1	Attempt substitute correct limits in correct integral must have the $-3/4$. OE. May be implied by correct answer.
	$= \frac{5}{32}$ or 0.15625 or 0.156 (3 sf)	A1	
		4	
7(b)	Median = 4	B1	
		1	
7(c)	$1 - 2 \times \left(\frac{5}{32} \right)$, or $2(0.5 - \left(\frac{5}{32} \right))$	M1	Must see working. FT their $\frac{5}{32}$.
	$\frac{11}{16}$ or 0.6875 or 0.687 or 0.688 (3 sf)	A1FT	FT their $\frac{5}{32}$.
			SC not using 7(a) and integrating from 3.5 to 4.5 and getting 11/16 OE scores B1 only.
		2	

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	Transcription error
	Correct answer from incorrect working

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SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1(a)	Computers are donated independently or singly or randomly	B1	Context i.e. ‘computers’ or ‘donations’ must be mentioned. ‘Events/trials/X/It is independent’ B0 . ISW after a correct statement.
		1	
1(b)	$\lambda = 9.6$	B1	
	$e^{-9.6} \left(\frac{9.6^7}{7!} + \frac{9.6^8}{8!} \right) = e^{-9.6} (1490.97 + 1789.16) = 0.10098 + 0.12118$	M1	Allow one end error and incorrect λ . Accept fully correct sigma notation.
	$= 0.222$ (3 sf)	A1	As final answer. SC Unjustified 0.222 scores B1M0B1 .
		3	
1(c)	$N(48, 48)$	B1	SOI.
	$\frac{50.5-48}{\sqrt{48}} [= 0.361]$	M1	For standardising with their N (... , ...) Ignore missing or incorrect cc for M1 .
	$1 - \Phi(0.361)$	M1	For area consistent with their working.
	$= 0.359$ (3 sf)	A1	
		4	

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Question	Answer	Marks	Guidance
2(a)	$\text{Var}(Y) = 4$	B1	SOI. Accept $\text{sd} = 2$ for B1 if $\text{var} = 4$ not seen.
	$\text{Var}(X + Y) = 3^2 + '4'$	M1	SOI. FT their $\text{Var}(Y)$.
	$\text{sd of } X + Y = \sqrt{13} = 3.61$	A1	
		3	
2(b)	$\text{Var}(5X) = 5^2 \times 3^2$	B1	May be implied.
	$\text{Var}(5X - Y) = \text{Var}(5X) + \text{Var}(Y) = "5^2 \times 3^2" + "4"$	M1	fit their $\text{Var}(5X)$, and their $\text{Var}(Y)$ from 2(a) .
	$\text{sd of } 5X - Y = \sqrt{229} \text{ or } 15.1 \text{ (3 sf)}$	A1	
		3	

Question	Answer	Marks	Guidance
3(a)	Sample mean = 32.5 soi or Width = 2.96	B1	SOI. Could be implied.
	$32.5 + 1.96 \times \frac{\sigma}{\sqrt{100}} = 33.98 \text{ or } 2.96 = 2 \times 1.96 \times \frac{\sigma}{\sqrt{100}}$	M1	OE. Factor of 2 error can still score M1 . Accept $z=1.96$ or 1.645 for M1 .
	$\sigma = 7.55 \text{ (3 sf)}$	A1	(Final answer of 15.1 scores 2/3).
		3	

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Question	Answer	Marks	Guidance
3(b)	Because the sample size is large.	B1	Accept n is large. Accept $n > 30$ condone > 50 'Number of students is large' B0 need 'sample' or 100.
		1	
3(c)	$0.95^r > 0.5$ Allow '='	M1	OR 0.95^r evaluated for any positive integer r M1 .
	$r \ln 0.95 > \ln 0.5$ Allow '=' Correctly take logs and use log rule	A1	OE. $0.95^{13} = 0.51\dots$ A1 .
	$r < 13.5\dots$ Allow '='	A1	$0.95^{14} = 0.48\dots$ A1 .
	Largest value of r is 13	A1	(Condone incorrect inequality signs throughout).
		4	

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Question	Answer	Marks	Guidance
4(a)	Assume flaws in cups are independent OR prob of containing a flaw is the same for all cups	B1	OE in context (e.g. prob... is consistent) but $p = 0.18$ is B0 .
	$H_0: P(\text{contains flaw}) = 0.18$ $H_1: P(\text{contains flaw}) < 0.18$	B1	Both. Allow ' p '
	$[P(X \leq 3) =] 0.82^{40} + 40 \times 0.82^{39} \times 0.18 + {}^{40}C_2 \times 0.82^{38} \times 0.18^2 + {}^{40}C_3 \times 0.82^{37} \times 0.18^3$ $= 0.0003569 + 0.0031338 + 0.013414 + 0.037298$	M1	
	0.0542 (3 sf)	A1	Unsupported 0.0542 scores M0B1 .
	$0.0542 > 0.05$	M1	Valid comparison – must be a tail probability Or if CR found (≤ 2) then comparison with 3 M1 .
	[Accept H_0] Insufficient evidence to accept factory owners claim. [Insufficient evidence that percentage less than 18%]	A1FT	In context, not definite, no contradictions no use of ' p ' unless defined. e.g. not '%age is not less than 0.18' or '%age is 18%' 2TT scores max B1B0M1A1M1 (with 0.025) is A0 .
			<u>Normal approx'n</u> : (First B1B1 * if earned) then: $CV = \frac{3.5 - 40 \times 0.18}{\sqrt{40 \times 0.18 \times 0.82}} = \pm 1.523$ SCB1 (need cc). $1.523 < 1.645$ or $0.0639 > 0.05$ No evidence less than 18% SCB1 . *hypotheses $\mu = 7.2$ and $\mu < 7.2$ can score if Normal approx. used.
		6	

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Question	Answer	Marks	Guidance
4(b)	$np = 7.2$ which is too large, or > 5 . Or $n = 40$ which is not greater than 50. Or $p = 0.18$ which is not small or > 0.1 .	B1	Context required (7.2 or 40 or 0.18). One correct condition required ISW.
		1	

Question	Answer	Marks	Guidance
5(a)	$k \int_0^2 (2x^2 - x^3) dx = 1$	M1	Attempt to integrate $f(x)$ & $= 1$, ignore limits.
	$k \left[\frac{2x^3}{3} - \frac{x^4}{4} \right]_0^2 = 1$	A1	Correct integration and limits.
	$k \times \frac{4}{3} = 1 \quad k = \frac{3}{4}$	A1	AG. Correctly obtained, at least one step shown and no errors seen.
		3	
5(b)(i)	0.5	B1	Could be in a correct expression.
		1	

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Question	Answer	Marks	Guidance
5(b)(ii)	$E(X) = \frac{3}{4} \int_0^2 (2x^3 - x^4) \, dx$	M1	Attempt to integrate $xf(x)$, ignore limits condone k or missing k .
	$= \frac{3}{4} \left[\frac{2x^4}{4} - \frac{x^5}{5} \right]_0^2 = \frac{6}{5}$	A1	
	$P(X < E(X)) = \frac{3}{4} \int_0^{1.2} (2x^2 - x^3) \, dx$	M1	Attempt to integrate $f(x)$, limits from 0 to their $E(X)$ (OR integrate $f(x)$ limits from their $E(X)$ to 2).
	$= \frac{3}{4} \left[\frac{2x^3}{3} - \frac{x^4}{4} \right]_0^{1.2} = \frac{594}{1250} \text{ or } 297/625 \text{ or } 0.4752$	A1	OR 0.5248 or 656/1250 or 328/625.
	$P(E(X) \leq X \leq m) = 0.5 - '0.4752'$		OR 0.5248 – 0.5.
	$= 0.0248 \text{ or } 31/1250$	A1	CWO. SC solutions attempting to find the value of m (1.22854) 1.229 Must be correct. Can score M1A1 then B1 for integrate correctly from 1.2 to 1.229 (accept 3sf here for 1.229) and 0.0248 to 0.0252 obtained B1 . (Incorrect values of m could score first M1A1 only).
		5	

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Question	Answer	Marks	Guidance
6(a)	Assume sd is still 26 or is unchanged	B1	
	H ₀ : Population mean = 736 H ₁ : Population mean < 736	B1	Both. Allow 'μ', but not just 'mean'.
	$\pm \frac{725-736}{\frac{26}{\sqrt{35}}}$	M1	For standardising (ignore cc attempts).
	= -2.503	A1	(±) Accept 3sf if nothing better seen.
	-2.503 < -2.054(or 5 or 6) or 0.0062 < 0.02	M1	Valid comparison.
	[Reject H ₀] There is sufficient evidence that (mean) weekly profit has decreased	A1	In context, not definite, no contradictions. No use of μ unless defined. e.g. not 'Mean weekly profit has decreased.'. 2TT scores max B1B0M1A1M1 (comparison 2.326 or 0.01) A0 . CV method: 726.973=727 M1 A1 > 725 and concl M1A1 . Condone: 734.027 =734 M1 A1 < 736 and concl M1A1 .
		6	
6(b)	0.02	B1	
		1	

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Question	Answer	Marks	Guidance
6(c)	$\frac{a-736}{\frac{26}{\sqrt{35}}} = -2.054 \text{ or } -2.055$	M1	For standardising to find CV Must be – 2.054 OE. (2TT in part a accept –2.326 in expression for M1).
	$a = 726.973$	A1	CWO Accept 727 or better (working may be in 6(a)).
	$\frac{'726.973'-718}{\frac{26}{\sqrt{35}}} (= 2.042)$	M1	For standardising with their cv and 718.
	$= 1 - \phi('2.042')$	M1	For area consistent with their working.
	$= 0.0203 \text{ to } 0.0207$	A1	CWO. Note: $(736-718)/(26/\sqrt{35})$ or $(725-718)/(26/\sqrt{35})$ or similar scores M0A0M1 and possibly M1 . Max 2/5.
		5	

Cambridge International A Level

MATHEMATICS**9709/63**

Paper 6 Probability & Statistics 2

October/November 2025**MARK SCHEME**Maximum Mark: 50

Published

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This document consists of **15** printed pages.

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- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
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Annotations

Annotation	Meaning
	More information required
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Independent accuracy mark awarded zero
	Independent accuracy mark awarded one
	Independent accuracy mark awarded two
	Benefit of the doubt
	Blank Page
	Incorrect
Dep	Used to indicate DM0 or DM1

PUBLISHED

Annotation	Meaning
DM1	Dependent on the previous M1 mark(s)
	Follow through
	Indicate working that is right or wrong
Highlighter	Highlight a key point in the working
	Ignore subsequent work
	Judgement
	Judgement
	Method mark awarded zero
	Method mark awarded one
	Method mark awarded two
	Misread
	Omission or Other solution
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
	Judgment made by the PE
	Premature approximation
	Special case
	Indicates that work/page has been seen

PUBLISHED

Annotation	Meaning
 SF	Error in number of significant figures
	Correct
 TE	Transcription error
 XP	Correct answer from incorrect working

PUBLISHED**Mark Scheme Notes**

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M** Method mark, awarded for a valid method applied to the problem. Method marks are not 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. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.
- 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).
- B** Mark for a correct result or statement independent of method marks.
- DM or DB** When a part of a question has two or more ‘method’ steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- FT** Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.
- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
 - For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
 - The total number of marks available for each question is shown at the bottom of the Marks column.
 - Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
 - Square brackets [] around text or numbers show extra information not needed for the mark to be awarded.

Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no ‘follow through’ from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1(a)	$e^{-3}(\frac{3^3}{3!} + \frac{3^4}{4!}) = e^{-3}(4.5 + 3.375) = 0.22404 + 0.16803$	M1	Allow one end error. Allow incorrect λ .
	$= 0.392$ (3 sf)	A1	
		2	
1(b)	$\lambda = 5$	B1	SOI. Need to be stating or using Poisson.
	$1 - e^{-5}(1 + 5 + \frac{5^2}{2!}) = 1 - e^{-5}(1+5+12.5)$ $= 1 - (0.0067379 + 0.0336897 + 0.0842243)$	M1	Allow one end error and any λ .
	$= 0.875$ (3 sf)	A1	Alternative combinations method. B1 for one correct product, M1 for correct structure (incl $1 - \dots$) and probs of full set of totals = 1 or probs of full set of totals = 2. A1 for 0.875.
		3	
1(c)	$T \sim N(600, 600)$	B1	SOI.
	$\frac{559.5-600}{\sqrt{600}} [= -1.653]$	M1	For standardising. Must have sqrt. Allow with no or incorrect continuity correction.
	$\Phi(-1.653) = 1 - \Phi(1.653)$	M1	For correct area consistent with their working.
	$= 0.0492$ (3 sf) or 0.0491	A1	
		4	

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Question	Answer	Marks	Guidance
2	est (μ) = 499.5 or 29970/60	B1	
	est (σ^2) = $\frac{60}{59} \left(\frac{14970300}{60} - '499.5'^2 \right)$ or $1/59(14970300 - (29970)^2/60)$	M1	Biased var = 4.75 M0 .
	= 4.83 or 285/59	A1	
	H ₀ : Pop mean (or μ) = 500 H ₁ : Pop mean (or μ) $\neq$ 500	B1	Both. Not just 'mean'.
	$\frac{'499.5'-500}{\frac{\sqrt{'4.83'}}{\sqrt{60}}}$	M1	For standardising with their values. Must have $\div\sqrt{60}$. Ignore cc s.
	= -1.762	A1	Allow -1.778 (from biased variance) accept 3 sf if nothing better.
	'1.762' < 1.96 or -'1.762' > -1.96 0.0390 > 0.025	M1	For valid comparison. Allow 1.778 < 1.96 0.0377 > 0.025.
	There is insufficient evidence that [mean] mass is not 500g	A1FT	In context. Not definite. No contradictions. FT from incorrect z. μ only accepted if defined. Accept CV method 499.5 > 499.44. Using biased var or using incorrect hypothesis can score a maximum of 6/8.
		8	

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Question	Answer	Marks	Guidance
3(a)	$\lambda = 1.45$	B1	Need indication of Poisson.
	$e^{-1.45} \left(1 + 1.45 + \frac{1.45^2}{2!} + \frac{1.45^3}{3!} \right) = e^{-1.45}(1+1.45+1.05125+0.5081041)$	M1	Allow one term extra or omitted or incorrect. Allow incorrect lambda.
	$= 0.94[0] \text{ or } 0.941$	A1	SC use of Binomial(14500, 0.0001) to find prob (< 4) = 0.940485 = 0.940 scores B2 . Unjustified 0.94[0] or 0.941 scores B1B1 .
		3	
3(b)	$e^{-14500p}$ seen or $2e^{-1.45} [= 0.46914]$ seen	B1FT	FT their λ from 3(a) .
	$e^{-14500p} = 2e^{-1.45} [\Rightarrow -14500p = \ln 2 + (-1.45)]$	M1	Forming an equation in p and attempting to solve. FT their $e^{-14500p}$. Factor of 2 on the wrong side of the equation can still score M1 .
	$p = 0.0000522$ (3 sf)	A1	OE. Use of binomial reaching 0.0000522 scores SCB2 .
		3	

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Question	Answer	Marks	Guidance
4(a)	$[2 \times] z \times \frac{\sigma}{\sqrt{n}} = 1.414 \times [2 \times] 1.645 \times \frac{\sigma}{\sqrt{n}} \quad [z = 2.326]$	M1	Form an equation in z (accept $z = 1.414 \times 1.645$ OE). Factor of 1.414 on the wrong side of the equation can still score M1 . Condone 1.282 instead of 1.645 for M1 .
	$2\Phi('2.326') - 1$	M1	OE.
	$\alpha = 98$ (3 sf)	A1	Allow 98%.
		3	
4(b)	$\frac{90}{'98'} = \frac{45}{49}$ or 0.918 (3 sf)	B1FT	FT their α . no ft if $\alpha < 90$ in 4(a) .
		1	

Question	Answer	Marks	Guidance
5(a)	$P(X \leq 2) = 0.8^{40} + 40 \times 0.8^{39} \times 0.2 + {}^{40}C_2 \times 0.8^{38} \times 0.2^2$ $= 0.0001329 + 0.0013292 + 0.0064799$	M1	Attempt $P(X \leq 2)$ or $P(X \leq 3)$ using $B(40, 0.2)$. Need to see expressions.
	$= 0.00794$ (< 0.025)	A1	SC unjustified $X \leq 2 = 0.00794$ scores M0B1 .
	$P(X \leq 3) = [0.00794 + {}^{40}C_3 \times 0.8^{37} \times 0.2^3]$ $= 0.0079421 + 0.0205199 = 0.0285 > 0.025$	B1FT	Correct term $P(X = 3)$ added to $P(X \leq 2)$ and one relevant comparison seen. Need to see expressions.
	$P(\text{Type I}) = 0.00794$ (3 sf) with both relevant comparisons seen	B1	Unjustified final answer 0.00794 scores SCB1B1 .
		4	

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Question	Answer	Marks	Guidance
5(b)	Rejection region is $X \leq 2$	B1	OE.
		1	
5(c)	H_0 will be rejected Or result lies in the rejection region	B1	
		1	

Question	Answer	Marks	Guidance
6(a)	$N(2.5 + 0.8, 0.05 + 0.02) = N(3.3, 0.07)$	B1B1	SOI B1 for $N(3.3, \dots)$ B1 for 0.07 give at early stage OE.
	$\frac{3.55 - '3.3'}{\sqrt{0.07}}$ [= 0.945]	M1	For standardising with their values.
	$1 - \Phi('0.945')$	M1	For area consistent with their values.
	= 0.172 (3 sf)	A1	
		5	

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Question	Answer	Marks	Guidance
6(b)	$E(D) = 2.5 - 3 \times 0.8 = 0.1$	B1	Give at early stage. OE.
	$\text{Var}(D) = 0.05 + 3^2 \times 0.02 = 0.23$	M1	Give at early stage.
	$\frac{0 - ('0.1')}{\sqrt{'0.23'}} [= -0.2085 \text{ or } 0.209 \text{ or } 0.208]$	M1	For standardising with their values. Must have used the vars for denom.
	$\Phi(' -0.2085') = 1 - \Phi('0.2085')$	M1	For area consistent with their values.
	$= 0.417 \text{ (3 sf) or } 0.418$	A1	
		5	

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Question	Answer	Marks	Guidance
7(a)	$[f(x) = -\frac{3}{4}(x^2 - 8x + 15)]$		
	$-\frac{3}{4} \int_{4.5}^5 (x^2 - 8x + 15) dx$	M1	Attempt to integrate their $f(x)$. Condone missing $-3/4$.
	$= -\frac{3}{4} \left[\frac{x^3}{3} - 4x^2 + 15x \right]_{4.5}^5$	A1	Correct integration and correct limits 4.5 and 5. OE e.g. 1– integration from 3 to 4.5 condone missing $-3/4$.
	$-\frac{3}{4} \left[\frac{125}{3} - 100 + 75 - \left(\frac{4.5^3}{3} - 4 \times 4.5^2 + 15 \times 4.5 \right) \right]$	M1	Attempt substitute correct limits in correct integral must have the $-3/4$. OE. May be implied by correct answer.
	$= \frac{5}{32}$ or 0.15625 or 0.156 (3 sf)	A1	
		4	
7(b)	Median = 4	B1	
		1	
7(c)	$1 - 2 \times \left(\frac{5}{32} \right)$, or $2(0.5 - \left(\frac{5}{32} \right))$	M1	Must see working. FT their $\frac{5}{32}$.
	$\frac{11}{16}$ or 0.6875 or 0.687 or 0.688 (3 sf)	A1FT	FT their $\frac{5}{32}$.
			SC not using 7(a) and integrating from 3.5 to 4.5 and getting 11/16 OE scores B1 only.
		2	

Cambridge International A Level

MATHEMATICS**9709/65**

Paper 6 Probability & Statistics 2

October/November 2025**MARK SCHEME**Maximum Mark: 50

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	Incorrect
Dep	Used to indicate DM0 or DM1

PUBLISHED

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	Method mark awarded zero
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PUBLISHED

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- DM or DB** When a part of a question has two or more ‘method’ steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- FT** Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.
- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
 - For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
 - The total number of marks available for each question is shown at the bottom of the Marks column.
 - Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
 - Square brackets [] around text or numbers show extra information not needed for the mark to be awarded.

Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no ‘follow through’ from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1(a)	$\text{Est}(\mu) = \frac{6430}{80} \text{ or } \frac{643}{8} \text{ or } 80.375$	B1	Accept 80.4 if nothing better seen.
	$\text{Est}(\sigma^2) = \frac{80}{79} \left(\frac{519740}{80} - \left(\frac{6430}{80} \right)^2 \right) = \frac{1}{79} \left(519740 - \frac{6430^2}{80} \right)$	M1	Biased [36.61] scores M0A0 .
	$= 37.073 \text{ [37.1 3sf]} \text{ or } \frac{11715}{316}$	A1	
	$z = 2.054 \text{ or } 2.055$	B1	
	$\frac{6430}{80} \pm z \times \sqrt{\frac{37.073}{80}}$	M1	Use of correct formula, any z .
	$= 79.[0] \text{ to } 81.9 \text{ or } 81.8 \text{ [3 sf]}$	A1	Must be an interval. Use of biased [79.0 to 81.8] can score B1M0A0B1M1A1 .
		6	
1(b)	CLT would not apply	B1	Or distribution of the sample means is not [necessarily] normal.
		1	

Question	Answer	Marks	Guidance
2(a)	Researcher is looking for evidence of ‘different from’ or researcher is not looking for ‘less than’ or ‘more than’	B1	OE.
		1	

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Question	Answer	Marks	Guidance
2(b)	$H_0: p = 0.101$ $H_1: p \neq 0.101$ [where p is proportion [in his town] not owning a car]	B1	
		1	
2(c)	$1.82 < 1.96$	M1	Valid comparison, accept $0.034 > 0.025$ OE.
	[Do not reject H_0] Insufficient evidence that [town] proportion is different from 10.1%	A1	In context, not definite, no contradictions. If p is used, it must be defined. SC: if in 2(b) $H_1: p > 0.101$ [or $p < 0.101$], then $1.82 > 1.645$ or $0.0344 < 0.05$ scores M1A0 .
		2	

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Question	Answer	Marks	Guidance
3(a)	$H_0: \lambda = 2.4$ or $\mu = 14.4$ $H_1: \lambda > 2.4$ or $\mu > 14.4$	B1	OE.
	$[\lambda =] 2.4$ soi	B1	
	$1 - e^{-2.4} \left(1 + 2.4 + \frac{2.4^2}{2!} + \frac{2.4^3}{3!} + \frac{2.4^4}{4!} + \frac{2.4^5}{5!} \right) =$ $1 - e^{-2.4} (1 + 2.4 + 2.88 + 2.304 + 1.3824 + 0.6636) =$ $1 - (0.09072 + 0.2177 + 0.2613 + 0.2090 + 0.1254 + 0.060196)$	M1	Any λ . Allow one end error. This expression must be seen, accept fully correct sigma notation.
	$= 0.0357$ (3 sf)	A1	SC unjustified answer of 0.0357 scores B1M0B1 .
	'0.0357' > 0.025	M1	Valid comparison.
	[Do not reject H_0] Insufficient evidence that μ has increased	A1FT	In context, not definite, no contradictions. Condone sufficient evidence that μ has not increased OE.
		6	
3(b)	H_0 not rejected, so Type II error may have been made.	B1FT	OE.
	H_0 not rejected, so Type I error cannot have been made.	B1FT	OE. ' H_0 not rejected' is necessary, but only needs to be stated once
		2	

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Question	Answer	Marks	Guidance
4(a)(i)	$[\lambda =] \frac{2430}{540}$ or $[\lambda =] 4.5$	B1	SOI.
	$1 - e^{-4.5} \left(1 + 4.5 + \frac{4.5^2}{2!} + \frac{4.5^3}{3!} \right) =$ $1 - e^{-4.5} (1 + 4.5 + 10.125 + 15.1875) =$ $1 - (0.01111 + 0.04999 + 0.11248 + 0.16872)$	M1	Any λ . Allow one end error. This expression must be seen, accept fully correct sigma notation.
	= 0.658 (3sf)	A1	SC unjustified answer of 0.658 scores B1M0B1 . SC use of $B\left(2430, \frac{1}{540}\right)$ and probability = 0.658 scores B2 . Note: use of normal could score B1 only.
		3	
4(a)(ii)	$[n =] 2430 > 50$ and $[np =] 4.5 < 5$ or $[p =] 0.00185 < 0.01$	B1	Explicit, both needed. Note: n large and p small is insufficient.
		1	
4b(i)	Mean of X is constant Sales occur singly or randomly or independently of each other	B1	Any of these stated in context OE.
		1	

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Question	Answer	Marks	Guidance
4(b)(ii)	$N(123.4, 123.4)$	B1	SOI. B1 for $N(123.4, \dots)$
		B1	B1 for $\text{Var}(X) = 123.4$
	$\frac{130.5 - '123.4'}{\sqrt{'123.4'}} [= 0.639]$	M1	For standardising with <i>their</i> values Condone with no cc or incorrect cc.
	$1 - \Phi('0.639')$	M1	Correct area consistent with their working.
	$= 0.261$ (3 sf)	A1	
		5	

Question	Answer	Marks	Guidance
5(a)	$D \sim N(2.10 - 1.51, 0.12 + 0.09) [= N(0.59, 0.21)]$	B1	B1 for $N(2.10 - 1.51, \dots)$ OE.
		B1	B1 for $\text{Var}(D) = 0.12 + 0.09$ SOI.
	$\frac{0.5 - '0.59'}{\sqrt{'0.21'}} [= -0.196]$	M1	For standardising with <i>their</i> values.
	$1 - \Phi(' - 0.196') = \Phi('0.196')$	M1	Correct area consistent with their working.
	$= 0.578$ (3 sf)	A1	
		5	

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Question	Answer	Marks	Guidance
5(b)	$T \sim N(4.3 \times (2.10 + 1.51), 4.3^2 \times (0.12 + 0.09))$ $[= N(15.532, 3.8829)]$	B1	B1 for $N(4.3 \times (2.10 - 1.51), \dots)$.
		M1	M1 for $\text{Var}(T) = 4.3^2 \times (0.12 + 0.09)$ SOI.
	$\frac{16 - '15.523'}{\sqrt{3.8829'}} [= 0.242]$	M1	For standardising with <i>their</i> values.
	$\Phi('0.242')$	M1	Correct area consistent with their working.
	$= 0.596$ (3 sf)	A1	Accept alternative method: $\frac{16}{4.30} - '3.61'$ $\frac{16}{\sqrt{0.21'}}$.
		5	

Question	Answer	Marks	Guidance
6(a)	$\frac{1}{2}ab = 1$	M1	Attempt area of triangle = 1. $\int_0^b -\frac{a}{b}x + a \, dx = 1$ and attempt to integrate with correct limits to reach an equation in a and b .
	$b = \frac{2}{a}$	A1	
		2	

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Question	Answer	Marks	Guidance
6(b)	$f(x) = a - \frac{a^2}{2}x$ or $f(x) = a - \frac{a}{b}x$	B1FT	FT <i>their</i> b . SOI .
	$\int_0^{\frac{2}{a}} ax - \frac{a^2 x^2}{2} dx$ or $\int_0^b \frac{2}{b}x - \frac{2}{b^2}x^2 dx$	M1	Attempt to integrate $xf(x)$, ignore limits. FT <i>their</i> linear $f(x)$.
	$\left[\frac{ax^2}{2} - \frac{a^2 x^3}{6} \right]_0^{\frac{2}{a}} \left[= \frac{2}{3a} \right]$ or $\left[\frac{x^2}{b} - \frac{2x^3}{3b^2} \right]_0^b \left[= \frac{1}{3}b \right]$	A1FT	FT <i>their</i> b . Correct integration and limits. Could be in terms of a or a and b .
	$\frac{2}{3a} = \frac{4}{9}$ or $\frac{1}{3}b = \frac{4}{9}$ and $b = \frac{2}{a}$,	M1	Equate <i>their</i> integral to $\frac{4}{9}$ to obtain an equation in a .
	$a = \frac{3}{2}$	A1	
		5	

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Question	Answer	Marks	Guidance
6(c)	$\int_0^k \left(\frac{3}{2} - 0.5 \cdot \frac{9}{4} x \right) dx = \int_0^k \left(\frac{3}{2} - \frac{9}{8} x \right) dx$ $\left[\frac{3}{2} x - \frac{9}{16} x^2 \right]_0^k = \left[\frac{3}{4} \right]$	M1	Attempt to integrate $f(x)$, with limits 0 to k . FT <i>their</i> linear $f(x)$ and <i>their</i> a .
	$\frac{3}{2}k - \frac{9}{16}k^2 = \frac{3}{4} \quad \left[3k^2 - 8k + 4 = 0 \right]$	M1	Attempting to find a quadratic equation in k in any form.
	$(3k - 2)(k - 2) = 0 \quad k = 2, \quad k = \frac{2}{3}$	A1	
	$k = \frac{2}{3}$ only with explanation	A1	$k \leq b = \frac{4}{3}$ so reject $k = 2$.
		4	