

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper

Introduction First variant Question Paper Second variant Question Paper

Mark Scheme

Introduction
First variant Mark Scheme
Second variant Mark Scheme

Principal Examiner's Report

Introduction	
First variant Principal Examiner's Report	
Second variant Principal Examiner's Report	

Who can I contact for further information on these changes?

Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2009 question paper for the guidance of teachers

9709 MATHEMATICS

9709/71

Paper 7, maximum raw mark 50

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 must be read in conjunction with the question papers and the report on the examination.

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	Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
Γ	GCE A/AS LEVEL – May/June 2009		9709	71

Mark Scheme Notes

Marks are of the following three types:

- 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.
- 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 (or dep*) 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.
- The symbol √ 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 and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.
- Note: B2 or A2 means that the candidate can earn 2 or 0.
 B2/1/0 means that the candidate can earn anything from 0 to 2.

The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.
- For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking g equal to 9.8 or 9.81 instead of 10.

Page 3 Mark Scheme: Teachers' version		Syllabus	Paper
GCE A/AS LEVEL – May/June 2009		9709	71

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AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
BOD	Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
CAO	Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
CWO	Correct Working Only – often written by a 'fortuitous' answer
ISW	Ignore Subsequent Working
MR	
IVIIX	Misread
PA	Misread Premature Approximation (resulting in basically correct work that is insufficiently accurate)
	Premature Approximation (resulting in basically correct work that is insufficiently

Penalties

- MR −1 A penalty of MR −1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through √" marks. MR is not applied when the candidate misreads his own figures this is regarded as an error in accuracy. An MR−2 penalty may be applied in particular cases if agreed at the coordination meeting.
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Page 4	Page 4 Mark Scheme: Teachers' version		Paper
	GCE A/AS LEVEL – May/June 2009	9709	71

1 $H_0: \mu = 18.5$	B1	Both hypotheses correct
$H_1: \mu < 18.5$	D1	Both hypotheses correct
· ·		
Test statistic $z = \frac{18.1 - 18.5}{(1.1/\sqrt{20})}$	M1	Standardising, must have $\sqrt{20}$
= -1.626	A1	For correct z
$CV z = \pm 1.96$	M1	Correct comparison with correct CV or
		finding area on LHS of –1.626 and comparing
		with 2.5 % (OR comparison with 2.241 oe if
		one-tail test set up)
Not enough evidence to support the claim	A1ft	Correct conclusion must ft their CV and their
that fingers are smaller.	7111	z. No contradictions
that migets are smaller.	[5]	
2 (i) $\hat{\mu} = 227.(1)$	B1	Correct mean
	B1	2.17 seen
$\hat{\sigma}^2$		
$5 = 2.17 \times \sqrt{\frac{\hat{\sigma}^2}{50}}$	M1	Solving an equation with 5 or 10 on the LHS
V 30		$\hat{\sigma}$
		and some z value $\times \frac{\hat{\sigma}}{\sqrt{n}}$ on the RHS
$\hat{\sigma}^2 = 265 \text{ or } 266$	A1	Correct answer
	[4]	
(ii) $4 = 2.17 \times \frac{16.3}{\sqrt{n}}$	B1ft	Comment associate ft their remains - if the same
(n) $4-2.17 \wedge \frac{1}{\sqrt{n}}$	DIII	Correct equation ft their wrong z if the same as in part (i) and their σ
	M1	Solving an equation with their z and σ , and
	1,11	width 4 or 8
n = 78	A1	Correct answer (whole number)
	[3]	
3 (i) $\lambda = 2$	B1	Correct mean (used)
P(X>3) = 1 - P(0, 1, 2, 3)		
$=1-e^{-2}\left(1+2+\frac{2^2}{2}+\frac{2^3}{2!}\right)$	M1	Poisson $1 - P(0,1,2,3)$ or $P(0,1,2)$ or $P(1,2,3)$
$\begin{bmatrix} 1 & 2 & 2 & 3! \end{bmatrix}$		(7,7,7)
= 1 - 0.857 = 0.143	A1	Correct answer
	[3]	
(ii) $\lambda = 16/3$	B1	Correct new mean
$p(7) = -\frac{16}{3} \left((16/3)^7 \right)$	M1	P(7) vaing a different researchism (5)
$P(7) = e^{-16/3} \left(\frac{(16/3)^7}{7!} \right)$	M1	P(7) using a different mean from (i)
= 0.118	A1	Correct final answer
- 0.116	[3]	
(iii) $X \sim N(160, 160)$	B1	Correct mean and variance
	M1	Standardising attempt with or without cc must
(136.5 – 160)		have sq rt
$P(X < 137) = P\left(z < \frac{136.5 - 160}{\sqrt{160}}\right)$	M1	Cc of 136.5 or 137.5 and area < 0.5
, , ,		
= P(z < -1.858) $= 1 - 0.9684 = 0.0316$	A1	Correct answer
1 0.7001 0.0310	[4]	
	<u>. </u>	

Page 5	Page 5 Mark Scheme: Teachers' version		Paper
	GCE A/AS LEVEL – May/June 2009	9709	71

1	(1)	$U \cdot n = 0.36$	B1		Roth hypotheses correct
4	(1)	$H_0: p = 0.36$ $H_1: p > 0.36$	DΙ		Both hypotheses correct
		•			
		$P(7) = {}^{8}C_{7} \times (0.36)^{7} (0.64)^{1} = 0.00401$ $P(8) = (0.36)^{8} = 0.000282$	M1		Evaluating P(7) or P(8)
			A1		Correct answer for both
		$\Sigma P = 0.00429 < 0.05$	M1		Comparing their prob sum to 0.05 oe
		A count duiving instructor? a stair-	B1		Correct conclusion ewo no contradictions
		Accept driving instructor's claim	DI	[5]	Correct concrusion two no contradictions
	(ii)	Type I error	B1	r~1	Correct answer
	()	$P(6) = {}^{8}C_{6} \times (0.36)^{6} (0.64)^{2} = 0.02496$	M1		Evaluating P(6)
		$P(5) = {}^{8}C_{5} \times (0.36)^{5} (0.64)^{3} = 0.08876,$	B1		Correct P(5) and showing this is not in the CR
		> 0.05			either by $\Sigma P > 0.05$ or $P(5) > 0.05$
		D/E I) 0.0000 0.0000			
		P(Type I error) = 0.0292 or 0.0293	A1		Correct answer
					NB Marks for part (ii) may be awarded in part
				[4]	(i) but not vice versa.
_	(*)	1 ⁶ 1(C) (2) 1 1) / 1	ι'n	Espanishing to 1 and a sec 21 at a sec
5	(1)	$\int_3^6 k(6t-t^2)dt = 1$	M1		For equating to 1 and a sensible attempt to integrate
		$k[3t^2-t^3/3]_3^6=1$			megrate
		k([108 - 216/3] - [27 - 9]) = 1	A1		Correct integration and correct limits
		k = 1/18 AG	A1		Given answer correctly obtained
				[3]	
	(ii)	mean = $\int_{3}^{6} k(6t^2 - t^3) dt$	M1		Attempt to evaluate the integral of $tf(t)$ (t or x)
	. /		1,11		The state of the s
		$=\left[k(2t^3-\frac{t^4}{4})\right]_{3}^{6}$			
		$-\left \frac{\kappa(2i - \frac{\pi}{4})}{4} \right _2$	A1		Correct integral and correct limits (condone
		= k(432 - 324) - k(54 - 81/4)			loss of k)
					Ź
		$=\frac{33}{8}$ (4.13)			
		o	A1	[2]	Correct answer
		c 6		[3]	
	(iii)	$\int_{5}^{6} k(6t-t^2)dt$	M1		Attempt to evaluate the integral between 5 and
		• •			6 oe
		$= k \left[3t^2 - \frac{t^3}{3} \right]_5^6 = k \left(36 - \frac{100}{3} \right)$			
		$\begin{vmatrix} 1 & 3 \end{vmatrix}_5 \begin{vmatrix} 1 & 3 \end{vmatrix}$			
		4			
		$=\frac{4}{27}$ (0.148)	A1		Correct answer
		21		[2]	
	(iv)	the area on the left is > 0.75	M1		sensible reason
		or (iii) is < 0.25 UQ is less than 5	A1ft		ft their (iii)
		OQ 15 1055 tilali 3	AIII		SR B1ft correct but 0.25/0.75 implied
				[2]	Six B11t confect out 0.25/0.75 implied
			l	[-]	

First variant Mark Scheme

Page 6	Page 6 Mark Scheme: Teachers' version		Paper
	GCE A/AS LEVEL – May/June 2009	9709	71

6	(i)	$T_1 + T_2 + T_4 - T_3 \sim N(-0.95, 4.345)$	M1	Attempt to find mean and var of $T_1 + T_2 + T_4 - T_3$
		,		oe
			B1	Correct mean $(3.75 + 3.1 + 3.2 - 11)$
			A1	Correct variance
		$P[(T_1 + T_2 + T_4 - T_3) > 0]$	M1	Finding P their $[(T_1 + T_2 + T_4 - T_3) > 0]$ oe
		$= P\left(z > \frac{00.95}{\sqrt{4.345}}\right) = P(z > 0.4557)$ $= 1 - 0.0.6758$	M1	Standardising (appropriate variance involving all 4) and area <0.5
		= 0.324	A1	Correct answer
		0.002	[6]	Correct and Wes
	(ii)	$\overline{X} \sim N(3.1, 0.785/6)$	M1	Normal distribution mean 3.1, var 0.785/6, can be
		$P(\overline{X} < 4) = P\left(z < \frac{4 - 3.1}{\sqrt{0.785/6}}\right)$ = $P(z < 2.488)$	M1	implied OR N(18.6, 4.71) if working with totals Standardising with sq rt OR $(24 - 18.6)/\sqrt{4.71}$ no mixed methods
		= 0.994	A1	Correct answer
			[3]	

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1	$H_0: \mu = 1.746$	B1		
1				Both hypotheses correct
	$H_1: \mu \neq 1.746$			
	Test statistic $z = \frac{1.765 - 1.746}{0.149 / \sqrt{230}}$	M1		Standardising, must have $\sqrt{230}$
	$\pm -1.93(4)$ CV $z = \pm 1.645$	A1 M1		For correct z Correct comparison with correct CV or finding area on RHS of their z and comparing with 0.05 (must be 0.05)
	Evidence of a difference	A1ft		OR if one tail test comparison with 1.282 oe Correct conclusion must ft their CV and their
	Evidence of a difference	7111	[5]	z. No contradictions
2	(i) $\hat{\mu} = 227.(1)$	B1 B1		Correct mean 2.17 seen
	$5 = 2.17 \times \sqrt{\frac{\hat{\sigma}^2}{50}}$	M1		Solving an equation with 5 or 10 on the LHS $\hat{\sigma}$
				and some z value $\times \frac{\hat{\sigma}}{\sqrt{n}}$ on the RHS
	$\hat{\sigma}^2 = 265 \text{ or } 266$	A1	[4]	Correct answer
	(ii) $4 = 2.17 \times \frac{16.3}{\sqrt{n}}$	B1ft		Correct equation ft their wrong z if the same as in part (i) and their σ
		M1		Solving an equation with their z and σ , and width 4 or 8
	n = 78	A1	[3]	Correct answer (whole number)
3	(i) $\lambda = 4.5$ P(at most 2) = P(0, 1, 2)	B1		Correct mean (used)
	$=e^{-4.5}\left(1+4.5+\frac{4.5^2}{2!}\right)$	M1		Poisson (0, 1, 2) or P(0, 1) or P(1, 2)
	= 0.174	A1	[3]	Correct answer
	(ii) $\lambda = 7.5$	B1		New mean (1.5 + 6) used
	$P(6) = e^{-7.5} \left(\frac{7.5^6}{6!} \right)$	M1		P(6) using a different mean from (i)
	= 0.137	A1	[3]	Correct answer
	(iii) X~N(90, 90)	B1 M1	- 5 - 3 - 3	Correct mean and variance Standardising attempt with or without cc must have sq rt
	$P(X > 100) = P\left(z > \frac{100.5 - 90}{\sqrt{90}}\right)$	M1		Cc of 100.5 or 99.5 and area < 0.5
	= P(z > 1.107) = 1 - 0.8657 = 0.134	A1	[4]	Correct answer

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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H ₁ : $p > 0.36$ $P(7) = {}^{8}C_{7} \times (0.36)^{7} (0.64)^{1} = 0.00401$ $P(8) = (0.36)^{8} = 0.000282$ $\Sigma P = 0.00429 < 0.05$ $Accept driving instructor's claim$ (ii) Type I error $P(6) = {}^{8}C_{6} \times (0.36)^{6} (0.64)^{2} = 0.02496$ $P(5) = {}^{8}C_{5} \times (0.36)^{6} (0.64)^{3} = 0.08876,$ > 0.05 $P(Type I error) = 0.0292 \text{ or } 0.0293$ A1 Solve I error $P(6) = {}^{8}C_{6} \times (0.36)^{6} (0.64)^{3} = 0.08876,$ > 0.05 $P(Type I error) = 0.0292 \text{ or } 0.0293$ A1 Solve I error expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ $P(Type I error) = 0.0292 \text{ or } 0.0293$ A1 Solve I error expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ 14 Solve I error expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ 14 Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. A1 Solve I error expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ $\Sigma = \frac{16k}{3} - \frac{16k}{4} = 1$ $E = $	4 (i)	$H_0: p = 0.36$	B1	Both hypotheses correct
$\Sigma P = 0.00429 < 0.05$ Accept driving instructor's claim A1 Comparing their prob sum to 0.05 oe Accept driving instructor's claim A1 Correct conclusion cwo. No contradictions [5] Correct answer P(6) = $^8C_6 \times (0.36)^6 (0.64)^2 = 0.02496$ P(5) = $^8C_5 \times (0.36)^5 (0.64)^3 = 0.08876$, > 0.05 P(Type I error) = 0.0292 or 0.0293 A1 Signature of the problem of the probl				
$\Sigma P = 0.00429 < 0.05$ Accept driving instructor's claim A1 Comparing their prob sum to 0.05 oe Accept driving instructor's claim A1 Correct conclusion cwo. No contradictions [5] Correct answer Evaluating P(6) Correct expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ Occrete tanswer NB Marks for part (ii) may be awarded in part (i) but not vice versa. [4] For equating to 1 and a sensible attempt to integrate Correct integration and correct limits $ \frac{16k}{3} - \frac{16k}{4} = 1 $ $ k = 3/4 \text{ AG} $ A1 Given answer correctly obtained [3] (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. A1 Correct integration and correct limits Correct integration and correct limits Correct integral and correct limits (condone loss of k)		$P(7) = {}^{8}C_{7} \times (0.36)^{7} (0.64)^{1} = 0.00401$	M1	Evaluating P(7) or P(8)
$\Sigma P = 0.00429 < 0.05$ Accept driving instructor's claim A1 Comparing their prob sum to 0.05 oe Accept driving instructor's claim A1 Correct conclusion cwo. No contradictions [5] Correct answer Evaluating P(6) Correct expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ Occrete tanswer NB Marks for part (ii) may be awarded in part (i) but not vice versa. [4] For equating to 1 and a sensible attempt to integrate Correct integration and correct limits $ \frac{16k}{3} - \frac{16k}{4} = 1 $ $ k = 3/4 \text{ AG} $ A1 Given answer correctly obtained [3] (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. A1 Correct integration and correct limits Correct integration and correct limits Correct integral and correct limits (condone loss of k)		$P(8) = (0.36)^8 = 0.000282$		
(ii) Type I error $P(6) = {}^8C_6 \times (0.36)^6 (0.64)^2 = 0.02496$ $P(5) = {}^8C_5 \times (0.36)^5 (0.64)^3 = 0.08876,$ $P(5) = {}^8C_5 \times (0.36)^5 (0.64)^3 = 0.08876,$ $P(7) = {}^8$			M1	
(ii) Type I error $P(6) = {}^8C_6 \times (0.36)^6 (0.64)^2 = 0.02496$ $P(5) = {}^8C_5 \times (0.36)^5 (0.64)^3 = 0.08876$, > 0.05 P(Type I error) = 0.0292 or 0.0293 5 (i) $\int_0^2 kx^2(2-x)dx = 1$ $\left[\frac{2kx^3}{3} - \frac{kx^4}{4}\right]_0^2 = 1$ $k = 3/4$ AG (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 m$ A1 B1 Correct answer Evaluating P(6) Correct expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ or $P(5) > 0.05$ Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. A1 For equating to 1 and a sensible attempt to integrate Correct integration and correct limits A1 A1 Attempt to evaluate the integral of $xf(x)$ Correct integral and correct limits (condone loss of k)		Accept driving instructor's claim	A1	Correct conclusion ewo. No contradictions
$P(6) = {}^{8}C_{6} \times (0.36)^{6} (0.64)^{2} = 0.02496$ $P(5) = {}^{8}C_{5} \times (0.36)^{5} (0.64)^{3} = 0.08876,$ > 0.05 $P(Type I error) = 0.0292 \text{ or } 0.0293$ $P(3) = {}^{2}C_{5} \times (0.36)^{5} (0.64)^{3} = 0.08876,$ > 0.05 $P(3) = {}^{2}C_{5} \times (0.36)^{5} (0.64)^{3} = 0.08876,$ > 0.05 $P(3) = {}^{2}C_{5} \times (0.36)^{5} (0.64)^{3} = 0.08876,$ $= {}^{2}C_{5} \times (0.56)^{5} \times (0.56)$				
P(5) = ${}^8C_5 \times (0.36)^5 (0.64)^3 = 0.08876$, > 0.05 P(Type I error) = 0.0292 or 0.0293 A1 Correct expression for P(5) and showing this is not in the CR either by $\Sigma P > 0.05$ or P(5) > 0.05 Or P(5	(ii)	Type I error		
$P(\text{Type I error}) = 0.0292 \text{ or } 0.0293$ A1 $I(\textbf{a})$ is not in the CR either by $\Sigma P > 0.05$ or $P(5) > 0.05$ Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. $I(\textbf{a})$ $I(\textbf{a})$ $I(\textbf{a})$ $I(\textbf{a})$ $I(\textbf{a})$ $I(\textbf{b})$ $I(\textbf{a})$ $I(\textbf$		$P(6) = {}^{\circ}C_6 \times (0.36)^{\circ} (0.64)^2 = 0.02496$		- · ·
P(Type I error) = 0.0292 or 0.0293 A1 Or $P(5) > 0.05$ Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. M1 For equating to 1 and a sensible attempt to integrate Correct integration and correct limits $ \frac{16k}{3} - \frac{16k}{4} = 1 $ $ k = 3/4 \text{ AG} $ A1 Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 A1 Correct integral and correct limits (condone loss of k) A1 Correct answer			BI	- · · · · · · · · · · · · · · · · · · ·
P(Type I error) = 0.0292 or 0.0293 A1 Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. 5 (i) $\int_0^2 kx^2(2-x)dx = 1$ M1 For equating to 1 and a sensible attempt to integrate Correct integration and correct limits $ \frac{16k}{3} - \frac{16k}{4} = 1 $ $ k = 3/4 \text{ AG} $ A1 Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $ = \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2 $ A1 Attempt to evaluate the integral of $xf(x)$ Correct integral and correct limits (condone loss of k) $ = \frac{32k}{4} - \frac{32k}{5} $ $ = 1.2 \text{ m} $ A1 A1 Correct answer NB Marks for part (ii) may be awarded in part (i) but not vice versa. A1 Correct integration and correct limits Correct integral and correct limits (condone loss of k)		~ 0.03		
NB Marks for part (ii) may be awarded in part (i) but not vice versa. Solution 1		P(Type I error) = 0.0292 or 0.0293	A1	` '
(i) but not vice versa. [4] (i) but not vice versa. [5] (i) $\int_0^2 kx^2(2-x)dx = 1$ $\left[\frac{2kx^3}{3} - \frac{kx^4}{4}\right]^2 = 1$ $k = 3/4 \text{ AG}$ A1 Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct integration and correct limits A1 Correct integral and correct limits (condone loss of k) A1 Correct integral and correct limits (condone loss of k)		,		
5 (i) $\int_0^2 kx^2(2-x)dx = 1$ M1 For equating to 1 and a sensible attempt to integrate $\left[\frac{2kx^3}{3} - \frac{kx^4}{4}\right]_0^2 = 1$ A1 Correct integration and correct limits $\frac{16k}{3} - \frac{16k}{4} = 1$ $k = 3/4 \text{ AG}$ A1 Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ M1 Attempt to evaluate the integral of $xf(x)$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer				(i) but not vice versa.
$\begin{bmatrix} \frac{2kx^3}{3} - \frac{kx^4}{4} \end{bmatrix}_0^2 = 1$ $\frac{16k}{3} - \frac{16k}{4} = 1$ $k = 3/4 \text{ AG}$ A1 Given answer correctly obtained [3] (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5} \right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct integration and correct limits A1 Correct integral and correct limits (condone loss of k) A1 Correct integral and correct limits (condone loss of k)		• 2	[4]
$\left[\frac{2kx^3}{3} - \frac{kx^4}{4}\right]_0^2 = 1$ Al Correct integration and correct limits $\frac{16k}{3} - \frac{16k}{4} = 1$ $k = 3/4 \text{ AG}$ Al Given answer correctly obtained $[3]$ (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ Al Correct integral of $xf(x)$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ Al Correct integral and correct limits (condone loss of k) A Correct answer	5 (i)	$\int_0^2 kx^2 (2-x) dx = 1$	M1	2 7
$\frac{16k}{3} - \frac{16k}{4} = 1$ $k = 3/4 \text{ AG}$ Al Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{m}$ Al Correct integral and correct limits (condone loss of k) Al Correct answer		$\begin{bmatrix} 21 & 3 & 1 & 4 \end{bmatrix}^2$		integrate
$\frac{16k}{3} - \frac{16k}{4} = 1$ $k = 3/4 \text{ AG}$ A1 Given answer correctly obtained (ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer		$\left \frac{2kx}{2} - \frac{kx}{4} \right = 1$	A1	Correct integration and correct limits
(ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ M1 Attempt to evaluate the integral of $xf(x)$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer		$\begin{bmatrix} 3 & 4 \end{bmatrix}_0$		
(ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ M1 Attempt to evaluate the integral of $xf(x)$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer		$\frac{16k}{1} - \frac{16k}{1} - 1$		
(ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ M1 Attempt to evaluate the integral of $xf(x)$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer		3 4 = 1		
(ii) mean = $\int_0^2 2kx^3 - kx^4 dx$ M1 Attempt to evaluate the integral of $xf(x)$ $= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ A1 Correct integral and correct limits (condone loss of k) $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{ m}$ A1 Correct answer		$k = 3/4 \Delta G$	A 1	Given answer correctly obtained
$= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{m}$ A1 Correct integral and correct limits (condone loss of k) A1 Correct answer		N = 5/4 AG		· ·
$= \left[\frac{2kx^4}{4} - \frac{kx^5}{5}\right]_0^2$ $= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \text{m}$ A1 Correct integral and correct limits (condone loss of k) A1 Correct answer	(ii)	$mean = \int_{0}^{2} 2kx^{3} - kx^{4} dx$	M1	Attempt to avaluate the integral of $xf(x)$
$= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \mathrm{m}$ A1 Correct answer	()	2	IVII	Attempt to evaluate the integral of $x_1(x)$
$= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \mathrm{m}$ A1 Correct answer		$= \left \frac{2kx^4}{x^4} - \frac{kx^5}{x^5} \right ^2$	Δ1	Correct integral and correct limits (condone
$= \frac{32k}{4} - \frac{32k}{5}$ $= 1.2 \mathrm{m}$ A1 Correct answer		4 5 0	711	-
$= \frac{4}{5}$ $= 1.2 \mathrm{m}$ A1 Correct answer		32k $32k$,
[3]		$=\frac{1}{4}-\frac{1}{5}$		
		$= 1.2 \mathrm{m}$	A1	Correct answer
$\lim_{x \to \infty} \int_{-\infty}^{\infty} kx^2(2-x)dx$			[3].
M Attempt to evaluate the integral between 1.3	(iii)	$\int_{13}^{2} kx^2(2-x)dx$	M1	Attempt to evaluate the integral between 1.3
and 2 or aguizalant		• 1.5		
$= \left[\frac{2kx^3}{3} - \frac{kx^4}{4}\right]_{12}^2$		$= \left \frac{2kx^3}{kx^4} - \frac{kx^4}{kx^4} \right $		
		$\begin{bmatrix} 3 & 4 \end{bmatrix}_{1.3}$		
= 1 - 0.563				
= 0.437 A1 Correct answer		= 0.437		
[2]	(iv)	the area on the right is < 0.5 as	,	
(iv) the gray on the right is < 0.5 og M1 Sangible reason	(17)			
(iv) the area on the right is < 0.5 oe M1 Sensible reason median is less than 1.3 m A1ft ft their (iii)				SR B1ft if correct but 0.5 implied
median is less than 1.3 m A1ft ft their (iii)			[2	_

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE A/AS LEVEL – May/June 2009	9709	72

	(D) T + T + T T N/	0.05 4.245) 3.41	
6	(i) $T_1 + T_2 + T_4 - T_3 \sim N(-$	0.95, 4.345) M1	Correct method to find mean and var of
			$T_1 + T_2 + T_4 - T_3$ oe
		B1	Correct mean $(3.75 + 3.1 + 3.2 - 11)$
		A1	Correct variance
	$P[(T_1 + T_2 + T_4 - T_3) >$	_	Finding P their $[(T_1 + T_2 + T_4 - T_3) > 0]$ oe
	(0-0.95)		
	$= P\left(z > \frac{00.95}{\sqrt{4.345}}\right) = 1$	P(z > 0.4557) M1	Standardising (appropriate variance involving all
	(\(\square 4.345 \)		4) and area < 0.5
	= 1 - 0.0.6758		
	= 0.324	A1	Correct answer
		[6	
	(ii) $\overline{X} \sim N(3.1, 0.785/6)$	M1	Normal distribution mean 3.1, var 0.785/6, can be
	(=) == = (===, ==, ==, =)		implied
	(2.1	OR N(18.6, 4.71) if working with totals
	$P(\overline{X} < 4) = P\left(z < \frac{4}{\sqrt{0}}\right)$	-3.1 M1	Standardising with sq rt
	$\sqrt{0}$.	785/6	OR $(24 - 18.6)/\sqrt{4.71}$
	= P(z < 2.488)		` ,
	-1(2 \ 2.400)		no mixed methods
	= 0.994	A1	Correct answer
	3.55.	[3	
		ĮS,	1