Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (STATISTICS WITH PURE MATHEMATICS) (SHORT COURSE) **1347/01**

Paper 1 Pure Mathematics **May/June 2017**

MARK SCHEME

Maximum Mark: 65

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.

Cambridge will not enter into discussions about these mark schemes.

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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

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 marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be 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 in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation '**dep**' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

AEF	any equivalent form
art	answers rounding to
cao	correct answer only
dep	dependent
FT	follow through after error
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Part Marks
1	$y = x + 5$; $x^2 + x(x + 5) = 12$	**M1**	Make x or y subject of first equation and substitute
	$2x^2 + 5x - 12 = 0$ oe	**A1**	or $2y^2 - 15y + 13 = 0$
	$(2x - 3)(x + 4) = 0$	**M1**	Method to get both solutions
	$x = \frac{3}{2}$ or -4	**A1**	Two correct values, **FT** on their quad
	$(x, y) = \left(\frac{3}{2}, \frac{13}{2}\right)$ or $(-4, 1)$	**A1**	Both answers, properly paired, cao
2(i)	$2^4 + 4.2^3.x + 6.2^2.x^2 + 4.2.x^3 + x^4$	**M1**	Needs attempt at ${}^nC_r$ and powers of x
	$16 + 32x + 24x^2 + 8x^3 + x^4$	**A2**	**A1** for any 2 terms apart from first and last
2(ii)	$16 + 32\sqrt{k} + 24k + 8k\sqrt{k} + k^2$	**M1**	Substitute and use $\left(\sqrt{k}\right)^2 = k$ at least once
	$p = 16 + 24k + k^2$	**A1**	
	$q = 32 + 8k$	**A1**	
3(i)	$2(x^2 + 6x) + 13$	**M1**	Attempt to remove 2 and complete square
	$= 2(x + 3)^2 - 18 + 13$	**A1**	$a = 2$, $b = 3$
	$= 2(x + 3)^2 - 5$	**A1**	$c = -5$
3(ii)	Translation, x-direction, -3	**M1**	Mention one translation and one stretch, allow wrong terminology; all numbers and directions
	Stretch, y-direction, SF 2	**A1**	
	Translation, y-direction, -5	**A1**	All correct terminology
		A1	Correct order (these three A1s independent)
4	Attempt to differentiate	**M1**	
	$\frac{dy}{dx} = 6x - \frac{1}{2\sqrt{x}} - 20$	**A2**	**A1** for 2 of these terms correct
	$= 3\frac{3}{4}$ at $x = 4$	**M1**	Substitute numerical value
	Perp gradient $-\frac{4}{15}$	**M1**	Take reciprocal and change sign (numerical)
	$x = 4$, $y = 11$	**M1**	Find y when $x = 4$
	$y - 11 = -\frac{4}{15}(x - 4)$	**M1**	Method for finding equation of line
	$4x + 15y = 181$	**A1**	AEF, simplified, allow $4x + 15y - 181 = 0$

Question	Answer	Marks	Part Marks
5(i)	Treat as $u^2 - u - 6 = 0$	**M1**	Treat as quadratic in e^x
	$u = 3$ or -2	**A1**	Both solutions seen
	Attempt to take ln of one solution	**M1**	
	$x = \ln 3$ only	**A1**	Answer ln 3 or exact equivalent only, no others
5(ii)	"$b^2 - 4ac$" < 0	**M1**	Consider discriminant
	$1 - 4h < 0$	**A1**	**FT** This or $1 + 4h < 0$, RHS needed, allow $\leqslant$ here
	$h > ¼$	**A1**	This answer or exact equivalent only
6(i)	Differentiate	**M1**	
	$\frac{d\theta}{dt} = 2t - \frac{32}{t}$	**A1**	Fully correct
	$2t^2 = 32$	**M1**	Equate to 0 and solve
	$t = 4$ ($t > 0$ only)	**A1**	Obtain $t = 4$ (allow even if -4 seen)
	$\theta = 16 - 32 \ln 4$ (= –28.36)	**A1**	$16 - 32 \ln 4$, aef, or art –28.4, no other
6(ii)	Differentiate again	**M1**	or other method
	$\frac{d^2\theta}{dt^2} = 2 + \frac{32}{t^2}$ = 4 at $t = 4$	**A1**	Correct derivative, or substitution etc.
	Positive therefore minimum	**M1**	Correct conclusion, **FT** on *their* numerical y''
6(iii)	Continues to increase indefinitely	**B1**	Or equivalent
7(a)	Attempt to integrate	**M1**	
	$y = \frac{6}{4}x^4 - \frac{1}{x} + c$	**A1**	Both x-terms correct
	$+ c$	**A1**	
	$x = 2, y = 20$ so $20 = 24 - \frac{1}{2} + c$	**M1**	Substitute, needs $+ c$
	$c = -3\frac{1}{2}$	**A1**	Correct c or complete formula

Question	Answer	Marks	Part Marks
7(b)	$4x - x^2 = x$	**M1**	Attempt to find intersections
	$\Rightarrow x = 0$ and $x = 3$	**A1**	Both values stated or implied
	$\int_0^3 (4x - x^2 - x)\mathrm{d}x$	**M1**	Integrate, no limits needed
		A1	Correct indefinite integral
	$= \left[2x^2 - \frac{1}{3}x^3 - \frac{1}{2}x^2\right]_0^3$	**M1**	Subtract x and integrate, or subtract Δ (= 4½)
	$= 4\frac{1}{2}$	**A1**	Final answer 4.5 or exact equivalent
8(i)	$\sqrt{(12-3)^2 + (m-7)^2}$ [$m = 1$]	**M1**	Use distance formula on *their* numerical m
	$= \sqrt{117} = 3\sqrt{13}$ **AG**	**A1**	Need to see $\sqrt{117}$ or equivalent intermediate step
8(ii)	Gradient $-\frac{2}{3}$; perpendicular grad $\frac{3}{2}$	**M1**	Find m and $-1/m$, or use $3x - 2y = c$
	$y - 2 = \frac{3}{2}(x - 4)$	**M1**	Method for finding equation
	$y = \frac{3}{2}x - 4$	**A1**	aef, needn't be simplified [$3x - 2y = 8$]
8(iii)	$2x + 3(\frac{3}{2}x - 4) = 27$	**M1**	Solve simultaneously, e.g. elimination
	$x = 6$, $y = 5$	**A2**	**FT** *their*(ii) **A1** for each
8(iv)	Distance $AP = \sqrt{13}$	**M1A1**	Find dist from A to intersection; $\sqrt{13}$ √13 or 3.60…
	Area $= \frac{1}{2} \times 3\sqrt{13} \times \lvert AP \rvert$	**M1**	Use $\frac{1}{2} \times AB \times$ perp dist
	= 19.5	**A1**	19.5 or exact equivalent, *not* art 19.5