

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS Pre-U Certificate

## MARK SCHEME for the May/June 2011 question paper

## for the guidance of teachers

## 9794 MATHEMATICS

9794/01

Paper 1 (Pure Mathematics and Probability), maximum raw mark 120

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.

• Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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	Page 2		Mark Scheme: Teachers	Syllabus	Paper				
			Pre-U – May/June	9794	01				
				1					
1	(i)	Gradient =	= - 2	B1		Accept aef or method			
						e.g si	m eqns $5 = -2m$	+ c and itution for a	
		Attempt e	an of line	M1			-7 - 4m + c and substitution for c		
		y = -2x +	1	A1	[3]	Acce	pt any simplified	form	
-									
2	(i)	State $2r +$	$r\theta = 18$	B1		Acce	Accept work in degrees. Formula must		
		Obtain co	rrectly $\theta = \frac{18 - 2r}{r}$ AG	A1		be correct			
	(::)	Substituto	$s = \frac{1}{r^2} (18 - 2r)$	M1		Acce	nt work in degree	c	
	(11)	Substitute	$S = \frac{1}{2}r \left(\frac{1}{r}\right)$	1011		Accept work in degrees. Award for substituting for $\theta$ in correct expression for S.			
		Obtain 9r	$-r^2$	A1	[4]				
3		Method fo	or modulus ean, maybe implied	M1		e g graphical or if algebraic must			
C		1.10010010				consi	der $3 + 2x = 7 - 4$	x and	
						3 + 2.	x = 4x - 7		
		State $x = 5$		B1		Ignor	e y co-ordinates		
		State $x =$	$\frac{2}{3}$	B1	[3]	Accept unsimplified			
			2						
4	(i)	$\ln x^{-1} - \ln(1)$	$3x-2)-\ln x^2$	M1 M1		Use p	bower law at least	once	
		$r^2$		1011		least	once	incation law at	
		$\ln \frac{x}{2\pi}$		A1		AG so NIS			
		5x-2							
	<b>(1)</b>	$x^2$		D1		Ugo	$x^0 = 1$ or state $x^2 =$	2. 2 from	
	(11)	$\frac{1}{3x-2} =$	1	DI		$\ln x^2$	$= \ln(3x - 2)$	3x - 2 mom	
		$r^2 - 3r + 7$	2 - 0	M1		Atton	$\frac{1}{2}$	quadratia	
		x = 3x + 2 x = 2  or  x	+2 = 0 r x = 1		[6]	Obtai	in 2 and 1	quadratic	
5		Attempt u	se of $(\pi) \int (16 - x^2) dx$	B1					
		Attempt in	ntegration	M1			At least one power must rise in their		
		_				single	e variable integra	1	
		Obtain (π)	$\left[16x - \frac{1}{3}x^3\right]$	A1					
		Use of con	rrect limits in correct order	M1					
		Obtain $\frac{4}{4}$	$\frac{1\pi}{2}$ or 42.9 or better	A 1	[#]				
			3	AI	[ວ]				

	Pa	age 3	Mark Scheme: Teachers	s' versior	า	Syllabus	Paper	
			Pre-U – May/June	2011		9794	01	
					<u> </u>			
6	(i)	1 5		B1	A	positive exponentia	l graph	
		t		B1	Str	Straight line with positive slope		
				B1*	Sh	ow or state two inte	prsections or roots	
	(ii)	$x_{n+1} = x_n -$	$\frac{e^{0.2x} - x}{0.2e^{0.2x} - 1}$	M1 B1	Us Co	e correct NR formu rrect derivative	la	
				M1*	Sta ite Sta	arts at 0 and states a rates ntes 1.296	t least two	
		0, 1.25, 1.	2958, 1.2959	A1	[7]			
7	(i)	$2 - 3\lambda = 2$ $-3 + \lambda =$	$-\mu$ $4-2\mu$	B1	Ot	tain correct eqns		
		Obtain $\lambda$	$= 1  \mu = 3$	B1				
		Obtain <i>a</i> =	= 3  and  b = 1	B1				
	(ii)	$\begin{pmatrix} -1\\ -2\\ 1 \end{pmatrix}$ and	$d \begin{pmatrix} -3 \\ 1 \\ 1 \end{pmatrix}$	M1	Us	e correct vectors ae	f	
		$\frac{(-3)(-1)}{\sqrt{1}}$	$\frac{-1(-2) + 1(1)}{\overline{1}(\sqrt{6})}$	M1	Us	e correct dot produ	et formula	
		$=\frac{2}{\sqrt{66}}(=$	0.246)	B1	Fir	nd the length of any	vector	
		Obtain 75	.7 °	A1	[7] Ob	otain acute answer o	nly cao	

	Pa	age 4	Mark Scheme: Teacher	Syllabus	Paper				
			Pre-U – May/June	2011		9794	01		
				1	n				
			$\begin{pmatrix} 1 \end{pmatrix} \begin{pmatrix} -1 \end{pmatrix}$	M1	Atter	npt first two terms	5		
8	(i)	$(1 - 4a)^{\frac{1}{2}} =$	$=1+\frac{1}{2}(-4a)+\frac{(\overline{2})(\overline{2})}{(-4a)^2}$	A1 M1	State	a 1 - 2a			
Ŭ	(1)	(1-+u) -	$\frac{1}{2}(-4a) + \frac{1}{2}(-4a)$	INI I	Aller				
		= 1 - 2	$a-2a^2$	Al	Obta	$1n - 2a^2$			
	<i>(</i> ••)	$1\pm\sqrt{1-4a}$		DI	State	$1 \pm \sqrt{1-4a}$			
	(11)	x 2	BI	State	2				
		$x = \frac{1\pm (x)}{2}$	M1	Subs	Substitute answer to (i) for discriminar				
		x = 1 - a	$-a^2$	A1	Obta	Obtain $x = 1 - a - a^2 AG$			
		$x = a + a^2$		A1 [8	] Obta	Obtain $x = a + a^2$ AG			
0	(i)	$\sin 3\theta - s$	$in(2\theta + \theta)$	M1	Atto	mpt sin $(2A + A)$ N	Jeeds two terms		
,	(1)	$\sin 30 = s$	1111	but n	nav be incorrect	iccus two terms			
		-	$+\cos 2\theta\sin\theta$			, ,			
		$= 2 \sin \theta c$	$\cos^2 \theta + (1 - 2\sin^2 \theta)\sin \theta$	M1	Use	any cos 2 <i>A</i> or sin 2	9 <i>A</i> identity		
		2 511 00		1011	0.50				
		$= 2 \sin \theta$ (	$(1-\sin^2\theta)+(1-2\sin^2\theta)\sin\theta$	M1	Use	Use $\cos^2 \theta = 1 - \sin^2 \theta$ anywhere			
		$= 3 \sin \theta$ -	$-4\sin^3\theta$	A1	Obta	in the AG NIS			
		· 0 · ·	20	D1	<b>F</b> (	Factorica Asin A or sin A and correct			
		$\sin \theta + \sin \theta = 4\sin \theta - \theta$	$4 \sin^3 \theta$	BI	obtai	and correctly			
		$=4\sin\theta$ (	$1 - \sin^2 \theta$		0014				
		$=4\sin\theta$ c	$\cos^2  heta$						
		$\cos^2 \theta$				$\cos^2 \theta$			
	(ii)	$\frac{\cos^2\theta}{\sin^2\theta} =$	$4\sin\theta\cos^2\theta$	M1	Ident	tify $\frac{\cos^2 \theta}{\sin^2 \theta} = \cos^2 \theta$	$\operatorname{pt}^2 \theta$		
		$1 - \sin^3 6$			Atter	nnt to solve for A			
		$\frac{-}{4}$ - sin c	,	M1	11101				
		$\theta = 39.0 \text{ o}$	r 141.0	A1	Obta	in 39.0 and 141.0	l i i i i i i i i i i i i i i i i i i i		
				B1 [0	1 Reco	ognise $\cos^2\theta = 0$ ar	nd state 90°		
					]	6			
10	(a)	Re $z = -1$	$\operatorname{Im} z = -\sqrt{3}$	B1	State	z - 1			
				B1	State	with or without i,	$-\sqrt{3}$		
	(b)	$uv = (1 + 1)^{-1}$	ia)(b-i)	B1	State	: uv			
		a+b=7		M1	Atter	npt to equate real	and imaginary		
		ab = 1 - 0		A 1	parts	Allow aef			
		ab - 1 = 9		AI	Solv	e simultaneous equ	ns to obtain a		
		$a^2 - 7a +$	10 = 0	M1	quad	ratic			
		(a-2)(a-1)	- 5)	A1 M1	Obta	$a^2 - 7a + 10$	tic		
		a = 2b = 3	5		Allei 1 Obta	input solid of quadra in $a = 2$ and $b = 5$	uic		
1		~ .		<b>1</b> 11 <b>1</b> 9		$111 \alpha = 2 \text{ and } 0 = 3$			

	Page 5		Mark Scheme: Teachers	Syllabus	Paper				
			Pre-U – May/June	Pre-U – May/June 2011					
11	(i)	a, a + 8d a	and $a + 13d$	M1		State term.	State <i>n</i> th term of an A.P for at least one term. Must be correct formula		
		a + 8d = a	17	A1		Equa	te to $ar$ and $ar^2$		
		a + 13d =	$ar^2$			Ŷ			
		$r = \frac{a+12}{a+8}$	$\frac{3d}{d}$ or $\frac{a+8d}{a}$	B1		State	an expression for	$r, d \text{ or } r^2$	
		a(a+13d)	$(a+8d)^2$	M1		Equa one s	te 2 expressions a tep to solve	nd make at least	
	$(a = \frac{-6^2}{3})$		)	A1		Obtai	in an expression f	or $d$ or $a$	
		$d = \frac{-3a}{64}$		M1	M1		Substitute their value for <i>d</i> or <i>a</i> to find		
		$r = \frac{5}{8}$		A1		Obtai	$\frac{5}{8}$		
	(ii)	$S = \frac{8a}{3}$		M1		Subst	titute any $r$ into $-1$	$\frac{a}{-r}$	
		3		A1	[9]	Obtai	in S		
12		Attempt to	o separate variables	M1*					
		Attempt to	o use partial fractions of the form	M1*					
		$\frac{A}{x} + \frac{Bx}{1+1}$	$\frac{c}{x^2}$						
		A = 1		A1					
		B = -1		A1					
		C = 0		A1					
		Obtain ln	<i>y</i>	B1					
		Obtain ln	$x - \frac{1}{2} \ln(1 + x^2)$	B1					
		Attempt to	o combine logs	M1*		Atten logs	npt to find an eqn	not including	
		Attempt to	b deal with $+c$	M1*		Must	be valid use of lo	g or its inverse	
		Obtain <i>y</i> =	$=\frac{Cx}{\sqrt{1+x^2}}$	A1	[10]				

	Page 6		6	Mark Scheme: Teachers' version				Syllabus	Paper	
				Pre-U – May/June 2	2011			9794	01	
r										
13	(a)	(i) Boys mean = $14.8$ Girls mean = $14.7$			B1		Allow better 14.8013 and 14.699 rounding to 14.8 and 14.7			
			Boys Girls	sd = 1.21 sd = 2.29	B1 B1		Allow answers in range [ 1.21, 1.23] or 2.29			•
		(ii) Almost the same mean but ages more spread for girls.			B1		Award only for correct mean and sd. Comment must be made on mean and sd.			
	(b)	Per	mutatio	ons of DFATD = $\frac{5!}{2!} = 60$	B1		Sight of 60 or $\frac{5!}{2!}$			
		E's can be inserted in 3 of 6 positions								
		${}^{6}C_{3} = 20$			B1		20 se	en or ${}^{6}C_{3}$		
		No	of peri	$mutations = 20 \times 60 = 1200$	B1	[7]	Accept 1200 or 20 × 60			
14	(a)	(i)	$\begin{array}{c} A(A - A) \\ A^2 + A \end{array}$	A - 1) + A(A + 3) + 50 + 2 = 92 A - 20 = 0 or equiv	2 M1 Attem A1 Obtain			npt xy products in $A^2 + A - 20 = 0$	or equiv 3	
			<i>A</i> = 4		A1		State			
		(ii)	The p	points exactly lie on a straight line	B1		The l	ine is $3y - x = 5$		
	<b>(b)</b>	(i)	240 -	-x + x + 100 - x = 250	M1		Valid	method seen		
		X  or  P(A		$P(A \ \cap B) = 90$	A1		Awar	d if 90 seen in the	e diagram	
		$\frac{150}{300}$			A1		State	$\frac{150}{300}$ aef		
		(ii) $\frac{90}{100}$			M1		Use c $\frac{their}{200}$	conditional probab	bility	
					B1	[9]	Obtai	in 0.9 or equiv		

	Page 7 Mark Scheme: Teache			s' versio	on		Syllabus	Paper	
			Pre-U – May/June	2011			9794	01	
				1					
15	(i)	$z = \frac{114 - 6}{6}$	$\frac{120}{2} = -1$	B1		State	or imply $z = \pm 1$		
		P(X > 114)	P = P(Z > -1)	M1		Atten	npts $P(Z > \pm 1)$		
		= 0.8413	, , ,	A1		Conc	ludes 0.8413		
		Expected j	$profit = 15 \times 0.8413$	M1		Uses	Profit = Number	× Prob anywhei	re
		= 12.6195	$p = \pounds 12.62$	A1		£12.62 or equiv 84.13 (= 100* 0.8413) seen. No units seen A0			)
	(ii)	$20P(X > x) + 3P(X \le x) = 19.17$ $20(1 - P(X \le x) + 3P(X \le x) = 19.17$				State probabilities (may be wrong round) and make one further step			ý
		$P(X \le x) = 0.04882$				Obtai	in 0.04882 or 0.95	512	
		(1 - 0.048)	82) = 0.9512						
		$\Phi^{-1}(0.95)$	(12) = 1.657	M1		Use (	$\Phi^{-1}(0.9512)$		
		so $z = -1.657$ .				Allow	$w \pm [1.655, 1.660]$		
		$\frac{x-120}{6} =$	= – 1.657 or equiv negative version	M1 B1		Awaı z valı	d for sight of $\frac{x}{x}$	$\frac{-120}{6} = \pm \text{ (their)}$	r)
		<i>x</i> = 110		A1	[12]	Obtai	in 110 (= 110.058	)	
16	(i)	P(X=0) = chips	$p^8$ where X is the number of faulty	B1		State	$p^8$ or $(1-q)^8$		
		P(accept v	when $X=1$ ) = $8qp^7 \times p^4$	M1		Atten of cor	npt product of two rrect form	binomial term	IS
		$= 8qp^{11}$		A1		Corre	ect simplified forn	n seen	
		P(accept)	$=p^8+8p^{11}-8p^{12}$	M1		Use q	q = 1 - p to write t	heir expression	ì
		8 ( 1 )				in ter	ms of $p$ .	1.D(11 1)	
		$= p^{\circ} (1 +$	$8p^{3} - 8p^{3}$ )			Sum	their $P(X = 0)$ and	d P(X = 1)	
				AI		Obtai	in given answer		
	(ii)	+8 seen in	their $E(X)$	B1		Acce	pt P(selecting 8) =	= 1	
		P(selecting 12) involving $qp^7$ or equiv		M1		Reco	gnize that $P(12)$ r	equired.	
		$= 8qp^7$ or	$(8p^7 - 8p^8)$	A1		Obtai	in correct expressi	on	
		E(X) = 8P	(8) + 4P(12)	M1		Atten	npt sum of their ty	vo <i>np</i> 's	
		E(X) = 8 - E(X) = 0.2	+32qp'	Al	[14]	014		7)	
		E(X) = 9.0	)/	AI	[12]	Obtai	(= 9.06/8)	/)	