GCE MARKING SCHEME

SUMMER 2016

Mathematics – S1
0983/01

INTRODUCTION

This marking scheme was used by WJEC for the Summer 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE Mathematics - S1
Summer 2016 Mark Scheme

Ques	Solution	Mark	Notes
1(a)	$P(A\cup B) = P(A) + P(B)$ $= 0.7$	M1 A1	Award M1 for the **use** of the formulae in all three parts
(b)	$P(A\cap B) = 0.12$ $P(A\cup B) = P(A) + P(B) - P(A\cap B)$ $= 0.58$	B1 M1 A1	
(c)	$P(A\cap B) = P(A\mid B)P(B)$ $= 0.1$ $P(A\cup B) = P(A) + P(B) - P(A\cap B)$ $= 0.6$	M1 A1 m1 A1	
2(a)	$P(\text{red}) = 0.45\times 0.03 + 0.55\times 0.05$ $= 0.041$	M1A1 A1	
(b)	$P(\text{female}\mid\text{red}) = \dfrac{0.55\times 0.05}{0.041}$ $= 0.671$ cao (55/82)	B1B1 B1	B1 num, B1 denom FT denominator from (a)
3(a)	$E(Y) = 2a + b = 8$ $Var(Y) = 2a^2 = 8$ $a = 2$; $b = 4$	M1A1 M1A1 A1A1	Award SC2 for correct answer unsupported
(b)	Any statement which mentions that certain values, eg 0, cannot be taken by Y.	B1	
4(a)(i)	$P(\text{no Welsh}) = \dfrac{4}{8}\times\dfrac{3}{7}\times\dfrac{2}{6}$ or $\dfrac{\binom{4}{3}}{\binom{8}{3}}$ $= \dfrac{1}{14}$ (0.071)	M1 A1	
(ii)	$P(\text{1 of each}) = \dfrac{4}{8}\times\dfrac{2}{7}\times\dfrac{2}{6}\times 6$ or $\dfrac{\binom{4}{1}\times\binom{2}{1}\times\binom{2}{1}}{\binom{8}{3}}$ $= \dfrac{2}{7}$ (0.286)	M1A1 A1	M1A0 if 6 omitted
(b)	$P(\text{Jack selected}) = \dfrac{1}{8}+\dfrac{7}{8}\times\dfrac{1}{7}+\dfrac{7}{8}\times\dfrac{6}{7}\times\dfrac{1}{6}$ or $\dfrac{\binom{7}{2}}{\binom{8}{3}}$ $=\dfrac{3}{8}$ (0.375)	M1 A1	Accept answer with no working

Ques	Solution	Mark	Notes
5(a)(i)	*X* is Poi(6) si	**B1**	
	$P(X = 5) = \frac{e^{-6} \times 6^5}{5!}$	**M1**	Award M0 if no working seen or if tables used
	= 0.161	**A1**	
(ii)	$P(X > 3) = 1 - e^{-6}\left(1 + 6 + \frac{36}{2} + \frac{216}{6}\right)$	**M1A1**	Award M1A0A0 if one of the four terms is missing
	= 0.849	**A1**	
(b)	Looking at the appropriate section of the table, Mean = 2.4	**M1A1**	Award M1 for evidence of sensible use of table
	$t = \frac{2.4}{0.2} = 12$	**A1**	Accept 12 with no working
6(a)(i)	*X* is B(8,0.12) si	**B1**	
	$P(X < 2) = 0.88^8 + 8 \times 0.88^7 \times 0.12$	**M1**	Award the first M1 in (iii) if not awarded in (i) for adding the six probabilities
	= 0.752	**A1**	
(ii)	$P(X = 2) = 28 \times 0.88^6 \times 0.12^2$ = 0.187	**B1**	
(iii)	P(X > 2) = 1 – 0.752 – 0.187 = 0.061	**B1**	FT from two other calculated probabilities
(b)	E(Profit) = 0.187 × 10 + 0.061 × 25 – 5	**M1**	M1A0 if – 5 omitted
	= –£1.61 (Accept 1.6)	**A1**	FT from (a) Allow 0.187 × 5 + 0.061 ×20 – 0.752 × 5
7(a)(i)	0.3 + 0.2 + 0.1 + *a* + *b* = 1 *a* + *b* = 0.4	**B1**	
(ii)	E(*X*) = 0.3 × 1 + 0.2 × 2 + 0.1 × 3 + 4*a* + 5*b*= 2.85	**M1**	.
	4*a* + 5*b* = 1.85	**A1**	
	Solving,	**m1**	
	a = 0.15, *b* = 0.25	**A1**	
(b)	The possible pairs are (1,1), (1,2), (1,3),(2,2)	**B1**	
	$P = 0.3 \times 0.3 + 2 \times 0.3 \times 0.2 + 2 \times 0.3 \times 0.1 + 0.2 \times 0.2$	**M1A1**	Award M1A0A0 if one of the terms is missing or if (1,1) or (2,2) is double counted
	= 0.31	**A1**	Award SC1 for Prob < 4 (0.21) or Prob = 4 (0.1)

Ques	Solution	Mark	Notes
8(a)	$np = 3$ giving $p = 0.06$	M1A1	
(b)	P(X = 2) = $\binom{50}{2}\times 0.06^2 \times 0.94^{48}$	M1	
	= 0.2262	A1	
(c)	Using the Poisson table,		
	P(X = 2) = 0.4232 – 0.1991 or 0.8009 – 0.5768	M1	Award M0A0 for 0.2240 from formula
	= 0.2241	A1	
	Percentage error = $\frac{0.0021}{0.2241}\times 100 < 1\%$	B1	Allow 0.2240 for this B1
9(a)(i)	$F(x) = k\int_1^x (2u-1)\mathrm{d}u$	M1	M1 for the integral of $f(x)$ limits may be left until 2nd line.
	$= k\left[u^2 - u\right]_1^x$	A1	
	$= kx(x-1)$	A1	
(ii)	F(2) = 1		
	$2k = 1$	M1	Allow integration of $f(x)$ from 1 to 2.
	$k = \frac{1}{2}$	A1	
(b)(i)	E(X) = $\int_1^2 \frac{1}{2}x(2x-1)\mathrm{d}x$	M1	M1 for the integral of $xf(x)$, limits may be left until 2nd line.
	$= \frac{1}{2}\left[\frac{2x^3}{3} - \frac{x^2}{2}\right]_1^2$	A1	
	= 1.58 (19/12)	A1	
(ii)	The median m satisfies		
	$F(m) = \frac{m(m-1)}{2} = \frac{1}{2}$	M1	Accept a geometrical argument FT $F(m)$ from (a) if it gives a quadratic equation and an answer in [1,2]
	$m^2 - m - 1 = 0$	A1	
	$m = \frac{1 \pm \sqrt{1+4}}{2}$	M1	Condone the absence of ±
	$m = 1.62$	A1	
(iii)	P(X > 1.5) = 1 – F(1.5)	M1	FT F from (a) if possible
	= 0.625	A1	