GCE MARKING SCHEME

SUMMER 2018

MATHEMATICS – S1 (LEGACY)
0983-01

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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

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Ques	Solution	Mark	Notes
1(a)	$E(X^2) = \text{Var}(X) + [E(X)]^2$	M1	
	$= 153$	A1	
(b)	$E(Y) = 4E(X) - 3$	M1	
	$= 45$	A1	
	SD(Y) = 4SD(X) (or Var(Y) = 16Var(X))	M1	M1A0 for variance M0 for Var(Y) = 4Var(X)
	$= 12$	A1	
2(a)	We are given that		
	$p_a \times p_b = 0.4$	B1	
	$p_a + p_b =$ P($A \cup B$) + P($A \cap B$)	M1	
	$= 1.3$	A1	
	$p_a + \frac{0.4}{p_a} = 1.3$	M1	
	$p_a^2 - 1.3p_a + 0.4 = 0$	m1	
	$(p_a - 0.5)(p_a - 0.8) = 0$		Or by inspection
	$p_a = 0.8$, $p_b = 0.5$	A1A1	Lose A1 if wrong way round
(b)	$P(A \mid A \cup B) = \frac{P(A \cap (A \cup B))}{P(A \cup B)}$	M1	FT from (a)
	$= \frac{P(A)}{P(A \cup B)}$	A1	
	$= \frac{8}{9}$	A1	
3	P(Beti selects red first time) = $\frac{1}{6}$	B1	Special case – award an extra B1if after this first line you see P(Gwyn selects red 1st time) $= \frac{5}{6} \times \frac{1}{5} = \frac{1}{6}$ and no further relevant probabilities evaluated.
	P(Beti selects red second time) = $\frac{5}{6} \times \frac{4}{5} \times \frac{1}{4} = \frac{1}{6}$	M1A1	
	P(Beti selects red third time) $= \frac{5}{6} \times \frac{4}{5} \times \frac{3}{4} \times \frac{2}{3} \times \frac{1}{2} = \frac{1}{6}$	M1A1	Accept a solution which gives the probabilities of Gwyn winning each time.
	P(Beti selects red) = $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{1}{2}$	A1	
	(So equal probabilities for Beti and Gwyn)		

4	$E(X) = 10p$ si $SD(X) = \sqrt{10p(1-p)}$ si We require $\sqrt{10p(1-p)} > 10p$ $10p - 10p^2 > 100p^2$ $(10p(11p-1) < 0)$ $110p < 10$ $(0 <)\ p < \frac{1}{11}$	**B1** **B1** **M1** **A1** **A1**	
5(a) **(b)**	$P(>20) = \frac{1}{6} \times 0.6 + \frac{5}{6} \times 0.24$ $= 0.3$ $P(\text{cycled} \mid > 20) = \frac{0.2}{0.3}$ $= \frac{2}{3}$ cao	**M1A1** **A1** **B1B1** **B1**	 FT denominator from (a)
6(a)(i) **(ii)** **(b)**	Number X arriving between 9 am and 9.15 am is Poi(3.75) si $P(X = 4) = e^{-3.75} \times \frac{3.75^4}{4!}$ $= 0.194$ Number Y arriving between 10 am and 10:20 am is Poi(5) si $P(Y > 6) = 0.2378$ Evidence of using the table in the appropriate vicinity. Mean = 8 $t = 32$	**B1** **M1** **A1** **B1** **M1A1** **M1** **A1** **A1**	Award M0 if tables used with mean rounded to 3.8 Award M0 if no working shown. M1A0 if reading adjacent row or column

7(a)	$\alpha+\beta+0.5=1$ $\alpha+\beta=0.5$ $E(X)=0.3+2\alpha+3\beta+0.8=2.2$ $2\alpha+3\beta=1.1$ $\alpha=0.4, \beta=0.1$	**M1** **A1** **M1** **A1** **A1**	 Special case – award B1 if correct answer given with no working Only award if both M1s given
(b)	The possible values are 1,1,1 ; 2,2,2 ; 3,3,3 ; 4,4,4 si Required prob $=0.3^3+0.4^3+0.1^3+0.2^3$ $=0.1$	 **B1** **M1** **A1**	FT from (a) Accept α,β here
8(a)(i)	X is binomially distributed with parameters 20, 0.6.	**B1** **B1**	
(ii)	$P(X=15)=\binom{20}{15}\times 0.6^{15}\times 0.4^{5}$ $=0.0746$	**M1** **A1**	Award M0 if no working
(iii)	Let N denote the number not germinating so that N is B(20, 0.4). si We require $P(X\ge 15)=P(N\le 5)$ $=0.1256$	**M1** **A1** **m1** **A1**	
(b)	Y is B(200,0.05) which is approx Poi(10) si	**B1**	
(i)	$P(Y=8)=e^{-10}\times\frac{10^8}{8!}$ $=0.113$	**M1** **A1**	Award M0 if no working seen Accept 0.3328 – 0.2202 or 0.7798 – 0.6672
(ii)	$P(Y>12)=0.2084$	**M1A1**	M1A0 if reading adjacent row or column

9(a)(i)	$P(2 < X < 2.5) = F(2.5) - F(2)$ $= 0.275$	**M1** **A1**	
(ii)	Use of $F(q) = 0.75$ $q^2 + q - 9.5 = 0$ $q = \dfrac{-1 \pm \sqrt{1+38}}{2}$ $= 2.62$	**M1** **A1** **m1** **A1**	
(b)(i)	$f(x) = F'(x)$ $= \dfrac{1}{10}(2x+1)$	**M1** **A1**	
(ii)	Use of $E(X) = \int xf(x)\mathrm{d}x$ $= \dfrac{1}{10}\int_1^3 (2x^2 + x)\mathrm{d}x$ $= \dfrac{1}{10}\left[\dfrac{2x^3}{3} + \dfrac{x^2}{2}\right]_1^3$ $= 2.13 \quad (32/15)$	**M1** **A1** **A1** **A1**	FT from (b)(i) if M1 awarded Limits need not be seen here