GCE AS MARKING SCHEME

SUMMER 2018

AS (NEW)
MATHEMATICS – UNIT 2 APPLIED MATHEMATICS A
2300U20-1

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.

AS Mathematics Unit 2: Applied Mathematics A

Solutions and Mark Scheme Summer 2018

SECTION A – Statistics

Qu. No.	Solution	Mark	Notes
1.	$P(X=7)=\binom{16}{7}\times 0.3^7\times 0.7^9$	M1	M0 if no calculation shown.
	$P(X=7)=0.1009(6\ldots)$	A1	Accept 0.101.
		[2]	
2(a)	(The set of) students who study Mathematics and not Drama.	E1	Do not accept reference to 'number of students' or 'probability'
(b) (i)	$\frac{6}{40}$ OR $\frac{3}{20}$ OR 0.15	B1	
(ii)	$P(M\cup F)=\frac{13+2+10+4}{40}$ oe	M1	
	$=\frac{29}{40}$ OR 0.725	A1	
(c)	$P(M)=\frac{16}{40}\quad P(D)=\frac{10}{40}\quad P(M\cap D)=\frac{4}{40}$	B1	All 3 correct (0.4, 0.25, 0.1)
	$P(M)\times P(D)=\frac{16}{40}\times\frac{10}{40}=\frac{1}{10}\left(=P(M\cap D)\right)$	B1	Correctly evaluating 'their P(M)' x 'their P(D)' provided at least one correct.
	Since $P(M)\times P(D)=P(M\cap D)$ they are statistically independent.	E1	Accept alternative method FT candidate's probabilities provided B1 awarded. Convincing.
		[7]	

Qu. No.	Solution	Mark	Notes
3(a)	Let the random variable X be the number of defects per tabletop.		
	$X \sim \text{Po}(k)$ si	B1	
	$X \sim \text{Po}(1.2)$ si i.e. $k = 1.2$	M1	
	$P(X \leq 2) = 0.879(48\ldots)$ or 0.8795	A1	
(b)	Let the random variable Y be the number of 4.8m^2 tabletops containing at most 2 defects.		
	$Y \sim \text{B}(n, p)$ si	B1	
	$Y \sim \text{B}(7, 0.8795)$ si	B1	FT 'their p' in (a)
	$P(Y = 4) = 0.0366(5\ldots)$ awrt 0.0366 or 0.0367	B1	cao
		[6]	
4(a)(i)	(p (or θ) denotes the probability of Edward correctly identifying types of wild flower.) $H_0: p = 0.2$ $H_1: p > 0.2$ OR $H_0: \theta = 0.2$ $H_1: \theta > 0.2$	B1	
(ii)	The number/amount of times he correctly identifies a type of wild flower from the 10 types of wild flower.	B1	Accept 'proportion'.
(b)	Under H_0, $X \sim \text{B}(10,0.2)$ si	B1	
	$P(X \geq 4) = 0.1209$ $P(X \geq 5) = 0.0328$	M1	M1 for either $P(X \geq 4) = 0.1209$ or $P(X \geq 5) = 0.0328$ or $P(X \leq 4) = 0.9672$ or $P(X \leq 3) = 0.8791$
	CR: $X \geq 5$	A1	A0 for $P(X \geq 5)$ M0 for evaluating $P(X = 5)$ or $P(X = 4)$
(c)	0.0328	B1	FT their CR provided M1 awarded in (b)
	It is the probability of concluding that Edward has improved his ability to correctly identify wild flowers when in fact he has not.	E1	Or equivalent explanation
(d)	4 is not in the CR, therefore do not reject H_0 OR $P(X \geq 4) = 0.1209 > 0.05$, do not reject H_0.	B1	FT their CR provided M1 awarded in (b). Do not allow 'accept H_0'.
	There is insufficient evidence to conclude that Edward has improved his ability to correctly identify wild flowers.	E1 **[9]**	Do not allow an explanation suggesting the proportion is 0.2.

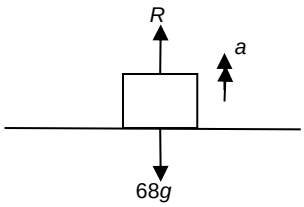
Qu. No.	Solution	Mark	Notes
5(a)	Strong linear relationship	E1	
	The higher the hydration the lower the pH.	E1	
(b)(i)	Each additional ml of water per 100g of flour decreases the pH by 0.02 on average.	E1	Or equivalent
	The intercept would imply that at zero hydration the pH would be 5.4.	E1	
(ii)	$y = 5.4 - 0.02 \times 20$		
	$y = 5$	B1	From use of regression line.
	Any correct comment. e.g. Outside the data set Extrapolation, etc.	E1 **[6]**	
6(a)(i)	$1.5(21 - 16)$ $= 7.5$	B1	B1: 7.5 May be implied by sight of 8.5 or 28.5.
	$16 - 7.5 = 8.5$ (therefore no outliers below 8.5)	M1	M1: Correct method for either using "their 7.5"
	$21 + 7.5 = 28.5$ (therefore outliers above 28.5)	A1	A1: 8.5 and 28.5 both correct.
	40 is an outlier but there may be others.	E1	E1: stating that 40 is an outlier but must also state or imply that the summary stats don't show if there are any others.
(b)	Positive skew.	B1	Accept skewed to the right.
	Appropriate comment. e.g. A few tutors are very expensive. The bulk of the tutors are relatively cheap.	E1	
(c) (i)	Mean will decrease.	E1	
(ii)	Median may stay the same or it may decrease.	E1	Must imply that we don't know unless we know the individual values.
(d)	Two appropriate comments. e.g. Dafydd's lessons are cheaper on average than Basel's. Dafydd's lessons are more variable in cost than Basel's Both are positively skewed.	E2 **[10]**	E1 for one appropriate comment. E0 if omission of "on average" ISW unless contradicts a previous correct statement. Do not allow "data is more variable" without reference to cost somewhere in the answer.

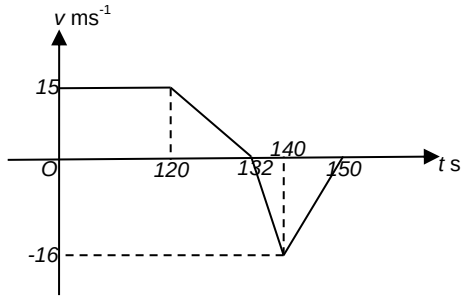
Section B – Mechanics

Q	Solution	Mark	Notes
7	$x = \int 6t^2 - 8t - 5 \, dt$	M1	at least 1 term with increased power
	$x = \frac{6}{3}t^3 - \frac{8}{2}t^2 - 5t + (C)$	A1	
	$x = 2t^3 - 4t^2 - 5t + (C)$		
	when $t = 1$, $x = -4$		
	$C = -4 - 2 + 4 + 5 = 3$	A1	cao
	$x = 2t^3 - 4t^2 - 5t + 3$		

Q	Solution	Mark	Notes
8(a)	Apply N2L to both particles.	M1	dim correct for at least 1 Allow T±3g=3a, T and 5g opposing.
	$T = 3a$	B1	first correct equation
	$5g - T = 5a$	A1	second correct equation
	$5g = 8a$	m1	
	$a = 6.125$ (ms^{-2})	A1	cao
	$T = 18.375$ (N)	A1	cao
8(b)	If the pulley is rough, the tension in the string on either side of the pulley would not be the same.	E1	

Q	Solution	Mark	Notes
9.	$\boldsymbol{R} = (2 + 3 + 4)\mathbf{i} + (5 - 22 - 23)\mathbf{j}$	M1	
	$\boldsymbol{R} = 9\mathbf{i} - 40\mathbf{j}$	A1	cao si
	$\lvert R \rvert = \sqrt{9^2 + 40^2}$	M1	ft $\boldsymbol{R}$
	$\lvert R \rvert = 41$ (N)	A1	ft $\boldsymbol{R}$ only if 2 non-zero components
	$\theta = \tan^{-1}\left(-\frac{40}{9}\right)$	M1	
	$\theta = -77.32^\circ$ or 282.68°	A1	cao direction clearly indicated eg angle in fourth quadrant, diagram with resultant marked.

Q	Solution	Mark	Notes
10(a)	Apply N2L to lift and man	M1	Dim correct equation. Tension and wt opposing.
	$8000 - (770 + 68)g = (770 + 68)a$	A1	correct equation.
	$a = -0.25$ (ms^{-2}) (correct to 2 d.p.)	A1	cao
	SC		
	(a) Apply N2L to lift only	M1	Dim correct equation. Tension and wt opposing.
	$8000 - 770g = 770a$		
	$a = 0.59$ (ms^{-2}) (correct to 2 d.p.)	A1	cao
10(b)	As the acceleration is negative, the lift is slowing down. B0 if SC in (a)	B1	depends on M1 in (a)
10(c)			
	Apply N2L to man	M1	Dim correct equation. Reaction and weight opposing.
	$R - 68g = 68a$	A1	
	$R - 68g = 68\times(-0.25)$		
	$R = 649(.16)$(N)	A1	cao Accept answers rounding to 649.

Q	Solution	Mark	Notes
11(a)	Distance moved during constant speed		
	$= 15\times120 = 1800$	B1	
	Distance moved during deceleration		
	$= 0.5(u+v)\times t$, $u=15, v=0, t=12$	M1	oe
	$= 0.5(15+0)\times12 = 90$		
	$AB = 1890$ (m)	A1	cao
11(b)	During acceleration		
	Use $v=u+at$ with $u=0$, $a=(\pm)2$, $t=8$	M1	
	$v = (\pm)16$	A1	
	During deceleration		
	Use $v=u+at$ with $u=16$, $v=0$, $a=(\pm)1.6$	M1	
	$0 = 16 -1.6t$, $t = 10$		
	Time from B to C = 18 s	A1	
11(c)		B1	v-t graph +ve portion with 15, 120, 132 Labelled
		B1	negative portion
		B1	all correct, units, labels
11(d)	Distance AB = 1890		
	Distance = area under graph		
	Distance $BC = 0.5\times18\times16$	M1	used. oe
	Distance CB = 144		
	Distance AC = 1890 – 144		
	Distance AC = 1746 (m)	A1	ft answer from (a)