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Cambridge Assessment International Education
Cambridge Pre-U Certificate

MATHEMATICS **9794/03**

Paper 3 Applications of Mathematics **May/June 2019**

MARK SCHEME

Maximum Mark: 80

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 International will not enter into discussions about these mark schemes.

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

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks	Guidance
1(a)(i)	0.3	**B1**	AEF
1(a)(ii)	0.1	**B1**	AEF
1(a)(iii)	$^3/_7$	**B1**	Allow 0.429
1(b)	P(B). P(T) = $^{11}/_{30}.^7/_{30}$ [$=^{77}/_{900}$ = 0.0855(5555555….)]	**M1**	or P(B) = $^{11}/_{30}$
	(Compare with answer to 1(a)(ii) and) state NOT independent	**A1**	compare P(B) with P(B|T)
2(a)	Standardise 55 as $\frac{55-50}{15}$	**M1**	
	Use tables to get 0.63(0)	**A1**	Accept 0.631 Awrt 0.630 or 0.631
2(b)	P(X ⩽ 60) – P(X ⩽ 30)	**M1**	
	P(Z ⩽ 0.667) – P(Z ⩽ –1.333) = 0.7477 – (1 – 0.9087)	**M1**	
	0.656	**A1**	Awrt 0.656
2(c)	1.645	**B1**	
	$\frac{t-50}{15} = 1.645$	**M1**	Using *their* 1.645
	t = 74.7	**A1**	Awrt to 74.7
3(a)	Attempt to find b using S_{xy}/S_{xx}	**M1**	E.g. 2.911/8.98
	Clearly get 0.324	**A1**	0.324164811
	Clearly get a = 1.886 – 0.324164811 × 4.2 = 0.525	**B1**	
	Draw correct line on scatter graph	**B1**	
3(b)	Residuals shown	**B1ft**	**FT** *their* line
3(c)	State 0	**B1**	
3(d)	Attempt residuals and square	**M1**	
	Get 0.0812	**A1**	0.081211709 from a exact 0.081225138 from a as 0.324

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Question	Answer	Marks	Guidance
4(a)	The probability of John connecting with a customer adviser is constant	**B1**	Must be in context
	Independence of connecting on successive attempts Unlimited number of calls possible within a day	**B1**	
4(b)(i)	$0.6^2 \times 0.4$	**M1**	
	$\frac{18}{125}$ or 0.144	**A1**	
4(b)(ii)	0.6^3 or $1 - (0.4 + 0.6 \times 0.4 + 0.6^2 \times 0.4)$	**M1**	
	$\frac{27}{125}$ or 0.216	**A1**	
4(c)	B(6, 0.216)	**B1ft**	**FT** their 0.216, may be implied
	${}^6C_2 \times 0.216^2 \times (1 - 0.216)^4$	**M1**	Using their binomial distribution with $n = 6$
	0.264	**A1**	
5(a)	12! or 479 001 600	**B1**	
5(b)	7! or 5! seen	**B1**	
	$2 \times 7! \times 5! = 1\,209\,600$	**B1**	
5(c)	Consider arrangement to get 8!	**B1**	
	Total number of arrangements of statistics books is 5!	**B1**	
	Get $\frac{8! \times 5!}{\text{their}12!}$	**M1**	$8! \times 5! = 4\,838\,400$
	Get $\frac{1}{99}$	**A1**	0.0101

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Question	Answer	Marks	Guidance
5(d)	Get 6! × 4!	**B1**	
	Separated by 9 or 10 books and a reasonable attempt at probability	**M1**	$\frac{k\times 6!\times 4!}{7!\times 5!}=\frac{3}{35}$, $k>1$
	$\frac{3\times 6!\times 4!}{7!\times 5!}=\frac{3}{35}$	**A1**	0.0857(14285)
	OR		
	Consider A in 1st position and 2nd position	**B1**	
	Attempt at $\frac{1}{7}\times\frac{2}{5}+\frac{1}{7}\times\frac{1}{5}$	**M1**	
	Get $\frac{3}{35}$	**A1**	0.0857(14285)
6(a)	Use $v = u + at = 4 \times 3 = 12$	**B1**	
6(b)	Use area under graph is distance	**M1**	
	½ x 12 × (30 + 40)	**A1ft**	**FT** *their v*
	420 m	**A1ft**	35 × *v*
7(a)	Use of N2L on whole system with 5 terms	**M1**	Dimensionally correct, allow sign errors
	$2600 – 400 – 500 = 2700a$	**A1**	
	$a = 0.63(0)$ ms^{-2}	**A1**	Awrt 0.630
	OR		
	Use N2L on car (4 terms) OR caravan (3 terms)	**M1**	Dimensionally correct, allow sign errors
	$2600 – 500 – T = 1900a$ AND $T – 400 = 800a$	**A1**	
	Solve to get $a = 0.63(0)$ ms^{-2}	**A1**	Awrt 0.630

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Question	Answer	Marks	Guidance
7(b)	Use N2L with their a on car (4 terms) OR caravan (3 terms)	**M1**	Dimensionally correct, allow sign errors
	$2600 - 500 - T = 1900a$ OR $T - 400 = 800a$	**A1**	*Their* a substituted
	$T = 904$ N	**A1**	Awrt 904
	OR Use N2L on car (4 terms) OR caravan (3 terms)	**M1**	Dimensionally correct, allow sign errors
	$2600 - 500 - T = 1900a$ AND $T - 400 = 800a$	**A1**	
	Solve to get $T = 904$ N	**A1**	Awrt 904
8(a)	$x = 44\cos 7\,t$	**B1**	$x = 43.67203067t$; allow if x not the subject
	$y = 44\sin 7\,t - ½.10.t^2$	**B1**	$y = 5.36225111t - ½.10.t^2$
	Eliminate t	**M1**	
	Get $y = 0.123x - 0.00262x^2$	**A1**	
8(b)	Substitute $x = 12$ in trajectory equation	**M1**	Or find t (= 0.27477…) from horizontal motion using a component of 44 **and** use in $s = ut + \frac{1}{2}at^2$ with u = component of 44 and $a = -g$
	Get height = 1.09872 + 2.6 = 3.7(0)	**A1**	
	Substitute y = –2.6 into trajectory equation	**M1**	Or use $s = ut + \frac{1}{2}at^2$ with $s = -2.6$, u = component of 44 and $a = -g$
	Attempt to solve 3 term quadratic equation	**M1**	Or solve 3 term quadratic for t (= 1.4348…..) and use x = (component of 44) t
	Get 50.7 only	**A1**	Allow 50.8; discard the other solution

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Question	Answer	Marks	Guidance
9(a)	$R = 5g\cos 16$	**B1**	
	Use $F = 0.4 \times R$	**M1**	19.22523392; $R \neq 5g$
	Use N2L parallel to slope with 3 terms	**M1**	Dimensionally correct, allow sign errors
	$-5g\sin 16 - F = 5a$	**A1**	Allow $5g\sin 16 + F = 5a$; F need not be substituted, allow *their F*
	$a = \pm 6.6(01420342)$	**A1**	Allow $a = \pm\dfrac{(5g\sin 16 + 0.4 \times 5g\cos 16)}{5}$
	use $v = u + at$ with $v = 0$ and their a	**M1**	a must be –ve
	$t = 0.757$s	**A1**	Awrt 0.757
9(b)(i)	Compare weight component (5gsin16) down slope with Fmax (2gcos16)	**M1**	May be implied
	Get required friction to be 5gsin16 =13.8	**A1**	13.78186779
9(b)(ii)	50N, vertically upwards or 74° to slope and above	**B1**	**oe**
	Balances the weight	**B1**	
10(a)	$2v_A = 2 \times 5 - 6$ or $3v_B = 3 \times 1.5 + 6$	**M1**	Attempt at momentum-impulse equation
	$v_A = 2$	**A1**	
	$v_B = 3.5$	**A1**	
10(b)	Use conservation of momentum	**M1**	Allow sign errors
	$3 \times 3.5 = 3b + mc$	**A1**	**FT** *their* 3.5
	Use NEL	**M1**	Allow sign errors
	$b - c = -0.4 \times 3.5$	**A1**	**FT** Momentum and NEL must be consistent for both A1s
	Eliminate c to get an equation in b and m	**M1**	**Dep** on first two **M1** $b = (10.5 - 1.4m)/(m+3)$
	Set $b \geqslant 2$	**M1**	Allow > or =, FT their 2
	Get $m \leqslant 1.32$	**A1**	Allow 45/34

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