Cambridge Pre-U

Cambridge Assessment International Education
Cambridge Pre-U Certificate

MATHEMATICS **9794/03**

Paper 3 Application of Mathematics **May/June 2018**

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

Cambridge Assessment International Education

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.

Question	Answer	Marks	Guidance
1	P($A \cap B$) = 0.36 + 0.24 – 0.4 = 0.2	**B1**	
	Use P($A \cap B$) = P(B) × P($A \vert B$)	**M1**	
	$\frac{0.2}{0.24}=\frac{5}{6}$	**A1**	Allow 0.833
2(i)	$\dfrac{1350.2-\frac{24.6\times 404}{8}}{105.56-\frac{24.6^2}{8}}$	**M1**	
	$=3.60(6886178)$	**A1**	
	$y-\frac{404}{8}=3.61\left(x-\frac{24.6}{8}\right)$ or $a=\frac{404}{8}-3.61\times\frac{24.6}{8}$	**M1**	Using their 3.61, allow sign errors
	$y=39.4+3.61x$	**A1**	
2(ii)	Attempt at use of correct formula	**M1**	
	Get 0.965	**A1**	0.964914428
2(iii)(a)	44.8	**B1**	Accept 45; **FT** *their y* on *x*
2(iii)(b)	Reliable as within range of used values (interpolation)	**B1**	
	Close to linearity	**B1**	Accept strong correlation
3(i)	<table><tr><td>x</td><td>0</td><td>20</td><td>100</td></tr><tr><td>P($X=x$)</td><td>0.5</td><td>0.25</td><td>0.25</td></tr></table>One correct pair	**B1**	
	All correct	**B1**	
3(ii)	Attempt at use of E(X) formula	**M1**	
	0 × 0.5 + 20 × 0.25 + 100 × 0.25 = 30	**A1**	Allow if £0.3(0); allow if tell us working in £
3(iii)	$s > 30$	**B1**	**FT** *their* **(ii)**
4(i)	16 × 0.75 = 12	**B1**	
4(ii)	B(16, 0.75) seen or implied	**B1**	May be seen in **(i)**
	Use tables to get 0.803	**B1**	0.8029

Question	Answer	Marks	Guidance
4(iii)	$P(X < k) \leqslant 0.1$	**M1**	May be implied; allow $P(X \leqslant k) \leqslant 0.1$
	Any probability in list (8, 0.0075), (9, 0.0271), (10, 0.0796), (11,0.1897) seen	**A1**	
	(Pick p = 0.0796, hence) $k = 10$	**A1**	
5(i)	1.645 or 1.96(0) seen	**B1**	
	Standardise 500 or 495	**M1**	
	$\frac{500-\mu}{\sigma} = 1.645$	**A1**	
	$\frac{495-\mu}{\sigma} = -1.96(0)$	**A1**	
	Solve for μ or σ	**M1**	Using equations not involving probabilities, must be z values
	$\mu = 497.7$, $\sigma = 1.387$	**A1**	[Exact values are $\mu = \frac{51265}{103}$ and $\sigma = \frac{1000}{721}$]
5(ii)	Use $\mu' = 500.7$ and $\sigma = 1.387$	**B1**	**FT** on *their* μ and σ
	Standardise 500 using their μ' and σ	**M1**	Allow with $\mu' = \mu \pm 3$
	Get 0.693(2)	**A1**	From exact values 0.6977; cao
6(i)	$({}^{11}C_6) = 462$	**B1**	
6(ii)	Consider all possibilities (3W, 3M), (4W,2M), (5W,1M)	**M1**	
	${}^5C_3 \times {}^6C_3$, ${}^5C_4 \times {}^6C_2$, ${}^5C_5 \times {}^6C_1$	**B2**	**B1** for one correct
	281	**A1**	
6(iii)	Number of teams with 3 women is ${}^5C_3 \times {}^6C_3 = 200$	**B1**	Need not be evaluated
	Number of teams with married couple is ${}^4C_2 \times {}^5C_2 = 60$	**B1**	Need not be evaluated
	$\frac{60}{200}$ oe	**B1**	

Question	Answer	Marks	Guidance
6(iii)	OR		
	$\frac{{}^4C_2}{{}^5C_3}$ (= 0.6)	**B1**	Or other method to give 0.6
	$\frac{{}^5C_4}{{}^6C_3}$ (= 0.5)	**B1**	Or other method to give 0.5
	$\frac{60}{200}$ oe	**B1**	
7	Horizontal component is 8cos40	**B1**	6.128355545
	Vertical component = 8sin40 – 10×0.4	**B1**	1.142300877
	Use Pythagoras or trigonometry	**M1**	Using *their* horizontal and vertical components
	Speed = 6.23 ms^{-1}	**A1**	
	Direction = 10.6° above the horizontal	**A1**	May be clarified on a diagram, need either direction arrows on components or direction arrow on resultant
8(i)	Attempt to use $v^2 = u^2 + 2as$ with $v = 0$ and $a = -g$ to find height	**M1**	
	Get 12.2 m	**A1**	7.2 gets M1A0
8(ii)	Set up quadratic equation in t [$-5 = 12t - 5t^2$]	**M1**	May be done in 2 parts. M1 for one part and M1 for the second and added to first
	Attempt to solve their 3 term quadratic	**M1**	
	Get $t = 2.76$ s	**A1**	
9(i)	Attempt to use conservation of linear momentum	**M1**	Allow sign errors, all terms present.
	$2m = -0.5m + 0.4 \times 0.5$	**A1**	
	Get $m = 0.08$	**A1**	
9(ii)	Attempt to use formula for e	**M1**	e = separation/approach; allow sign errors
	Get $e = 0.45$	**A1**	

Question	Answer	Marks	Guidance
10(i)	Attempt to integrate v	**M1**	
	Use correct limits	**M1**	**dep** on first **M1** Allow $\pm\left[f(4)-f(1)\right]$
	18.3 m	**A1**	18.28125
10(ii)	Attempt to differentiate v	**M1**	
	Equate differential to 0 and solve to get $t = 2$ s	**A1**	
	Test for a maximum	**B1**	Show a sketch, at least $t = 2$ marked.
11(i)	Attempt to resolve in x or y direction	**M1**	
	$P\cos\theta + 4\cos 30 = 8$	**A1**	$P\cos\theta = 8 - 2\sqrt{3} = 4.535898385$
	$P\sin\theta = 4\sin 30$	**A1**	$P\sin\theta = 2$
	Attempt to solve for P or θ	**M1**	
	$P = 4.96$	**A1**	
	$\theta = 23.8$	**A1**	
	OR		
	Use cosine rule	**M1**	
	Get $P^2 = 8^2 + 4^2 - 2\times 8\times 4\times\cos 30$ oe	**A1**	
	$P = 4.96$	**A1**	
	Use sine or cosine rule	**M1**	
	Get $\dfrac{\sin\theta}{4} = \dfrac{\sin 30}{P}$ or $4^2 = 8^2 + P^2 - 2\times 8\times P\times\cos\theta$ oe	**A1**	
	$\theta = 23.8$	**A1**	
11(ii)	Right	**B1**	Allow east, positive x-direction, 090°

Question	Answer	Marks	Guidance
12(i)	$Fr = 0.4 \times 2g\cos 20$	**B1**	7.517540966
	Attempt to use Newton's second law on either mass or the system	**M1**	
	$3g - T = 3a$	**A1**	System equation $3g - 2g\sin 20 - Fr = 5a$
	$T - 2g\sin 20 - Fr = 2a$	**A1**	
	Solve for a or T	**M1**	
	$a = 3.13\ \text{ms}^{-1}$	**A1**	
	$T = 20.6$ N	**B1**	
12(ii)	Use $v^2 = 2 \times 3.13 \times 1.2$ to find v	**M1**	Using *their* 3.13
	$(2)a = (2)g\sin 20 + 0.4 \times (2)g\cos 20$	**M1**	Using *their* Fr; $a = 7.178971916$
	Use $v = u + at$ to find either time	**M1**	or use $s = ut + \frac{1}{2}at^2$ on A
	Get either 0.876 or 0.382	**A1**	
	Get $(0.876 + 0.382) = 1.26$ s	**A1**	