Cambridge Assessment International Education

Cambridge Pre-U

MATHEMATICS **9794/03**

Paper 3 Applications of Mathematics **For examination from 2020**

MARK SCHEME

Maximum Mark: 80

Specimen

This specimen paper has been updated for assessments from 2020. The specimen questions and mark schemes remain the same. The layout and wording of the front covers have been updated to reflect the new Cambridge International branding and to make instructions clearer for candidates.

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

This document has **8** pages. Blank pages are indicated.

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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.

Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

The following abbreviations may be used in a mark scheme:

AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
aef Any equivalent form
art Answers rounding to
cwo Correct working only (emphasising that there must be no incorrect working in the solution)
ft Follow through from previous error is allowed
o.e. Or equivalent
D Dependent mark (dependent on an earlier mark in the scheme)

Question	Answer	Marks	Notes
1(a)	$z = \frac{27-24}{4} = 0.75$	B1	
	P(X > 27) = P(Z > 0.75)	M1	
	= 0.2266	A1	
		3	
1(b)	P($X \leqslant 25$) – P($X \leqslant 20$) = P($Z \leqslant 0.25$) – P($Z \leqslant -1$)	M1	
	0.5987 – (1 – 0.8413)	M1	
	0.44	A1	
		3	

Question	Answer	Marks	Notes
2(a)(i)	$75 - x + x + 130 - x = 170$ $x = 35$ (Finding the intersection)	M1	
	State 75 – 35 o.e.	A1	
	$\frac{40}{200}$ o.e.	A1	
		3	
2(a)(ii)	Use conditional probability $\frac{\text{their } 35}{\text{their } 130}$	M1	
	$\frac{35}{130}$ o.e.	A1	
		2	
2(b)(i)	Recognise combination problem	M1	
	${}^{15}C_7 = \frac{15!}{8!7!}$ = 6435	A1	
		2	
2(b)(ii)	${}^6C_2 \times {}^9C_5$ correct method	M1	
	=1890	A1	
		2	
2(b)(iii)	(6M 1C) + (5M 2C) + (4M 3C) correct method	M1	
	${}^6C_6 \times {}^9C_1 + {}^6C_5 \times {}^9C_2 + {}^6C_4 \times {}^9C_3$	M1	
	1485	A1	
		3	

Question	Answer	Marks	Notes
3(a)	Median = 30 mpg	B1	
	Quartiles = 34 mpg and 23 mpg	B1	
		2	
3(b)	IQR = 11 mpg	M1	
	Outliers have mpg < 6.5 or > 50.5	A1	
	Car A	B1	
		3	

Question	Answer	Marks	Notes
4(a)	Independence between children	B1	
	Class is typical of population in respect of left-handedness	B1	
		2	
4(b)	13% of 20 = 2.6, so want P($X \leqslant 2$)	B1	
	$(0.87)^{20} + 20(0.13)(0.87)^{19} + 190(0.13)^2(0.87)^{18}$ At least one probability in B(20, 0.13)	M1	
	= 0.061714 + 0.18443 + 0.26181	A1	
	= 0.50795… = 0.508 to 3sf	A1	
		4	

Question	Answer	Marks	Notes
5(a)	Table shows (–1, 0.7)	B1	
	(0, 0.25) and (9, 0.05)	B1	
		2	
5(b)	Use E(X) formula	M1	
	Obtain –0.25 **AG**	A1	
	Use E(X^2) formula	M1	
	Obtain 4.6875 (or 4.69) o.e.	A1	
		4	
5(c)	Use 10 + 10E(X)	M1	
	Obtain 10 + 10(–0.25) = 7.5	A1	
		2	
5(d)	P(Must win at least one game)	M1	
	States $(0.25)^{10}$	B1	
	Obtain $1 – (0.95)^{10} + (0.25)^{10} = 0.401$	A1	
		3	

Question	Answer	Marks	Notes
6(a)	$x = 7$	B1	
	$y = 24$ (award both B1s only if x and y identified)	B1	
		2	
6(b)	$r^2 = 7^2 + 24^2$	M1	
	Magnitude is 25 N	A1	
	$\tan\theta = \frac{24}{7}$	M1	
	Angle is 73.7°	A1	
		4	

Question	Answer	Marks	Notes
7(a)	$v = t(t-4)(t-5)$	M1	
	$t = 4$ and 5	A1	
		2	
7(b)	$x = \frac{t^4}{4} - 3t^3 + 10t^2 + c$	M1	
	All terms correct including "+ c"	A1	
	When $x = 0$, $t = 0$ therefore $c = 0$	A1	
	When $t = 2$, $x = 4 - 24 + 40 = 20$	A1	
		4	

Question	Answer	Marks	Notes
8(a)	$P - 1050 = 18\,000 \times 0.3$	M1	
	$P = 6450$	A1	
		2	
8(b)	New acceleration $6450 - 2850 = 18\,000a$	M1	
	$a = 0.2$	A1	
		2	
8(c)	$6450 - 450 - T = 8000\ (0.2)$	M1	
	$T = 4400$ N	A1	
		2	

Question	Answer	Marks	Notes
9(a)	Conservation of linear momentum: $1 \times 14 + 2 \times 0 = U + 2V$	B1	
	Newton's experimental law: $V - U = 0.5(14 - 0)$	B1	
	$U = 0\,\text{m s}^{-1}$	B1	
	$V = 7\,\text{m s}^{-1}$	B1	
		4	
9(b)	Conservation of linear momentum: $2 \times 7 + 5 \times 0 = 2U + 5V$	B1	
	Newton's experimental law: $V - U = 0.5(7 - 0)$	B1	
	$U = -0.5\,\text{m s}^{-1}$	B1	
		3	
9(c)	$V = 3\,\text{m s}^{-1}$	B1	
	B reaches A in 2 seconds	B1	
	Distance between A and C is $1 + 2 \times 3 = 7$ metres	B1	
		3	

Question	Answer	Marks	Notes
10(a)	As system is in equilibrium, tension in string is $T = mg$	B1	
	Resolving at right angles to the plane: $R + T\sin\alpha = 2mg\cos\alpha$	M1	
	giving $R = mg\,(2\cos\alpha - \sin\alpha)$ **AG**	A1	
		3	
10(b)	By implication $\alpha \leqslant 45°$	M1	
	$\cos\alpha \geqslant \frac{1}{\sqrt{2}}$; $\sin\alpha \leqslant \frac{1}{\sqrt{2}}$	A1	
	$R \geqslant mg\left(\frac{2}{\sqrt{2}} - \frac{1}{\sqrt{2}}\right)$ **AG**	A1	
		3	
10(c)	Resolving up the slope $F = 2mg\sin\alpha - T\cos\alpha = mg(2\sin\alpha - \cos\alpha)$	M1	
	For this to be non-negative	A1	
	and combined with first line of solution to **(b)** $0.5 \leqslant \tan\alpha \leqslant 1$ **AG**	A1	
		3	
10(d)	Using $F = \mu R$	M1	
	$\mu = \frac{2\sin\alpha - \cos\alpha}{2\cos\alpha - \sin\varepsilon} = \frac{2t-1}{2-t}$	A1	
	Max value of μ is 1 when $t = 1$	A1	
		3	

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