Cambridge Pre-U

Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (PRINCIPAL) **9794/02**

Paper 2 Pure Mathematics 2 **For examination from 2019**

MARK SCHEME

Maximum Mark: 80

Specimen

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

This document consists of **7** printed pages and **1** blank page.

CAMBRIDGE International Examinations

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)(i)	$\log_a 15$	B1	
		1	
1(a)(ii)	Use $b\log a = \log a^b$ at least once	M1	
	Use $\log a - \log b = \log\frac{a}{b}$	M1	
	Obtain $\log_b \frac{1}{2}$	A1	
		3	
1(b)	$\frac{1}{3}$	B1	
	$\frac{1}{3a^2}$ o.e.	B1	
		2	
1(c)	Attempt to multiply numerator and denominator by $2\sqrt{3}+3$	M1	
	Obtain $\frac{18+7\sqrt{3}-3}{12-9}$	A1	
	Obtain given answer	A1	
		3	

Question	Answer	Marks	Notes
2	$\frac{1}{2}x(x+2)\sin 30° = 12$ or simplified expression	B1	
	Rearrange to get a quadratic equation including putting $\sin 30° = \frac{1}{2}$	M1	
	Obtain $x^2 + 2x - 48 = 0$	A1	
	Solve their quadratic equation	M1	
	Obtain $x = 6$ only	A1	
		5	

Question	Answer	Marks	Notes
3(a)	Attempt to find gradient	M1	
	Get gradient $-\frac{1}{4}$	A1	
	Find c to be 3 $\left(y = -\frac{1}{4}x + 3\right)$	A1	
		3	
3(b)	$-\frac{1}{4} \times -4 = 1$	B1	
	No, gradients multiplied together $\neq -1$	B1	
		2	

Question	Answer	Marks	Notes
4(a)	Compare coefficients	M1	
	Obtain $a = 2$ and $b = \frac{-5}{2}$	A1	
	Obtain $c = \frac{-31}{2}$	A1	
	State $\left(\frac{5}{2}, \frac{-31}{2}\right)$	A1	
		4	
4(b)	Use quadratic formula in x^2	M1	
	Obtain $x^2 = \frac{9}{4}$ and $x^2 = 1$	A1	
	Obtain $x = \pm\frac{3}{2}$ and $x = \pm 1$	A1	
		3	

Question	Answer	Marks	Notes
5(a)	$P = 2r + 2rx$	B1	
	$A = r^2x$	B1	
		2	
5(b)	$P = 20$ implies $r = \frac{10}{1+x}$	M1	
	so $A = \left(\frac{10}{1+x}\right)^2 x = \frac{100x}{(1+x)^2}$ **AG**	A1	
		2	
5(c)	Use quotient rule	M1	
	$\frac{\mathrm{d}A}{\mathrm{d}x} = \frac{100(1+x)^2 - 200x(1+x)}{(1+x)^4} = \frac{100(1-x)}{(1+x)^3}$	A1	
	Set equal to zero and find $x = 1$	A1	
	Show with first differential test that it is maximum. o.e.	M1 A1	
		5	

Question	Answer	Marks	Notes
6(a)	Attempt to solve $c = 1$ for at least one drug, and obtain a solution	M1	
	Obtain 54.9 (hours) for Antiflu	A1	
	Obtain 23.0 (hours) for Coldcure	A1	
		3	
6(b)	Two *decaying* exponentials in the first quadrant	B1	
	Correct intercepts on the c-axis	B1	
	Crossing over at a value of $t < 23$	B1	
		3	
6(c)	Assume additive nature of the concentrations	M1	
	$5e^{-0.07\times 30} + 5e^{-0.07\times 10} = 3.10$	A1	
		2	

Question	Answer	Marks	Notes
7	Separate variable prior to integration	M1	
	$\int \frac{1}{\sec y}\,dy = \int \frac{1}{x^2}\,dx$	A1	
	$\sin y = -\frac{1}{x} \quad (+c)$	A1	
	Substitute in $y = \frac{\neq}{6}$ and $x = 4$ to get $c = \frac{3}{4}$	M1 A1	
	$y = \sin^{-1}\left(\frac{3}{4} - \frac{1}{x}\right)$ o.e.	A1	
		6	

Question	Answer	Marks	Notes
8(a)	Either $\frac{dy}{dt} = 2e^{2t} - 3$ or $\frac{dx}{dt} = 2e^{2t} - 5$	B1	
	$\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$ used	M1	
	$= \frac{2e^{2t} - 3}{2e^{2t} - 5}$	A1	
		3	
8(b)	Substitute $t = 0$ to obtain gradient $= \frac{-1}{-3}$ or equivalent	B1	
	Obtain $x = 1$	B1	
	Obtain $y = 1$	B1	
	Form equation of a straight line	M1	
	Obtain $3y - x = 2$	A1	
		5	

Question	Answer	Marks	Notes
9(a)	Find **a** – **b** or **b** – **a**	M1	
	Use correct method to find the magnitude of any vector	M1	
	$\sqrt{154}$ or equivalent	A1	
		3	
9(b)	Attempt $\cos\theta = \dfrac{\overrightarrow{AO}.\overrightarrow{AB}}{\lvert\overrightarrow{AO}\rvert\lvert\overrightarrow{AB}\rvert}$	M1	
	Obtain 70 anywhere	B1	
	Obtain $\dfrac{70}{\sqrt{45}\sqrt{154}}$	A1	
	Obtain 32.8°	A1	
		4	

Question	Answer	Marks	Notes
10(a)	Attempt to use product rule	M1	
	$y' = ae^{ax}\cos bx - be^{ax}\sin bx$	A1	
	Set $y' = 0$ and rearrange	M1	
	$\tan bx = \dfrac{a}{b}$ validly obtained	A1	
		4	
10(b)	<u>Model 1</u> Correct method to solve $\tan 15x = -\dfrac{1}{15} \Rightarrow x = -0.00444.....$	M1	
	Obtain $y = 1.0022$	A1	
	Correct method to solve $x + \dfrac{\neq}{15} = 0.20499$	M1	
	Obtain $y = -0.81284$	A1	
	State when $x = 0.3$ $y = -0.156$	B1	
	<u>Model 2</u> Obtain $f + g = 1$	B1	
	Obtain $-f + g = -0.8$	B1	
	Attempt to solve their equations simultaneously	M1	
	Obtain $f = 0.9$, $g = 0.1$	A1	
	Obtain $\lambda = 5\pi$	B1	
	State when $x = 0.3$, $y = 0.1$	B1	
	Relevant comment that model 2 matches experimental data more closely	B1	
		12	

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