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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.
 - When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
 - The symbol $\checkmark$ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.
 - Note: B2 or A2 means that the candidate can earn 2 or 0.
B2/1/0 means that the candidate can earn anything from 0 to 2.
- The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.
- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.
 - For a numerical answer, allow the A or B mark if a value is obtained which is correct to 3 s.f., or which would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers which arise from taking g equal to 9.8 or 9.81 instead of 10.

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- The following abbreviations may be used in a mark scheme or used on the scripts:

AEF	Any Equivalent Form (of answer is equally acceptable)
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
BOD	Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
CAO	Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
CWO	Correct Working Only – often written by a 'fortuitous' answer
ISW	Ignore Subsequent Working
MR	Misread
PA	Premature Approximation (resulting in basically correct work that is insufficiently accurate)
SOS	See Other Solution (the candidate makes a better attempt at the same question)
SR	Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

- MR -1 A penalty of MR -1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through $\sqrt{}$ " marks. MR is not applied when the candidate misreads his own figures – this is regarded as an error in accuracy. An MR-2 penalty may be applied in particular cases if agreed at the coordination meeting.
- PA -1 This is deducted from A or B marks in the case of premature approximation. The PA -1 penalty is usually discussed at the meeting.

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 75

SYLLABUS/COMPONENT: 9709/01

MATHEMATICS
Paper 1 (Pure 1)



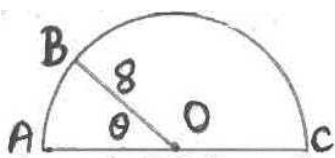
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1.	$(2x - 1/x)^5$. 4 th term needed. $\rightarrow {}_5C_3 = 5.4/2$ $\rightarrow x 2^2 x (-1)^3$ $\rightarrow -40$	M1 DM1 A1 [3]	Must be 4 th term – needs $(2x)^2 (1/x)^3$ Includes and converts ${}_5C_2$ or ${}_5C_3$ Co Whole series given and correct term not quoted, allow 2/3
2.	$\sin 3x + 2\cos 3x = 0$ $\tan 3x = -2$ $x = 38.9 (8)$ and $x = 98.9 (8)$ and $x = 158.9 (8)$ NB. $\sin^2 3x + \cos^2 3x = 0$ etc. M0 But $\sin^2 3x = (-2\cos 3x)^2$ plus use of $s^2 + c^2 = 1$ is OK Alt. $\sqrt{5}\sin(3x + \alpha)$ or $\sqrt{5}\cos(3x - \alpha)$ both OK	M1 A1 A1✓ A1✓ [4]	Use of $\tan = \sin \div \cos$ with $3x$ Co For $60 + "his"$ For $120 + "his"$ and no others in range (ignore excess ans. outside range) Loses last A mark if excess answers in the range
3.	(a) $dy/dx = 4 - 12x^{-3}$ (b) $\int = 2x^2 - 6x^{-1} + c$ (a) (quotient OK M1 correct formula, A1 co)	B2, 1 [2] 3 x B1 [3]	One off for each error (4, -, 12, -3) One for each term – only give +c if obvious attempt at integration
4.	$a = -10 \quad a + 14d = 11 \quad d = \frac{3}{2}$ $a + (n - 1)d = 41 \quad n = 35$ Either $S_n = n/2(2a + (n - 1)d)$ or $n/2(a + l)$ $= 542.5$	M1 M1 A1 M1 A1 [5]	Using $a = (n - 1)d$ Correct method – not for $a + nd$ Co Either of these used correctly For his d and any n
5.	(i) $2a + b = 1$ and $5a + b = 7$ $\rightarrow a = 2$ and $b = -3$ (ii) $f(x) = 2x - 3$ $ff(x) = 2(2x - 3) - 3$ $\rightarrow 4x - 9$ $= 0$ when $x = 2.25$	M1 A1 [2] M1 DM1 A1 [3]	Realising how one of these is formed Co Replacing "x" by "his $ax + b$ " and "+b" For his a and b and solved = 0 Co

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6. (i) (ii) $x = \pi/2, y = 3$ (allow if 90°) $\rightarrow k = 6/\pi$ co. (iii) $(-\pi/2, -3)$ – must be radians	B2, 1 [2] M1 A1 [2] B1 [1]	For complete cycle, shape including curves, not lines, -3 to +3 shown or implied, for $-\pi$ to π. Degrees ok Realising maximum is $(\pi/2, 3)$ + sub Co (even if no graph) Co (could come from incorrect graph)
7. (i) Gradient of $L_1 = -2$ Gradient of $L_2 = \frac{1}{2}$ Eqn of L_2 $y - 4 = \frac{1}{2}(x - 7)$ (ii) Sim Eqns $\rightarrow x = 3, y = 2$ $AB = \sqrt{(2^2 + 4^2)} = \sqrt{20}$ or 4.47	B1 M1 M1A1 [4] M1 A1 M1A1 [4]	Co – anywhere Use of $m_1 m_2 = -1$ Use of line eqn – or $y = mx + c$. Line must be through $(7, 4)$ and non-parallel Solution of 2 linear eqns Co Correct use of distance formula. Co
8. (i) $\overrightarrow{BA} = \mathbf{a} - \mathbf{b} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$ $\overrightarrow{BC} = \mathbf{c} - \mathbf{b} = -2\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$ Dot product $= -2 + 8 - 6 = 0$ $\rightarrow$ Perpendicular (ii) $\overrightarrow{BC} = \mathbf{c} - \mathbf{b} = -2\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$ $\overrightarrow{AD} = \mathbf{d} - \mathbf{a} = -5\mathbf{i} + 10\mathbf{j} + 5\mathbf{k}$ These are in the same ratio \ parallel Ratio $= 2:5$ (or $\sqrt{24} : \sqrt{150}$)	M1 M1A1 A1 [4] M1 M1 M1A1 [4]	Knowing how to use position vector for $\overrightarrow{BA}$ or $\overrightarrow{BC}$ – not for $\overrightarrow{AB}$ or $\overrightarrow{CB}$ Knowing how to use $x_1 y_1 + x_2 y_2 + x_3 y_3$. Co Correct deduction. Beware fortuitous (uses $\overrightarrow{AB}$ or $\overrightarrow{CB}$ – can get 3 out of 4) Knowing how to get one of these Both correct + conclusion. Could be dot product $= 60 \rightarrow$ angle $= 0^\circ$ Knowing what to do. Co. Allow 5:2

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9.  (i) $\theta = 1$ angle $BOC = \pi - \theta$ Area = $\frac{1}{2}r^2\theta = 68.5$ or $32(\pi - 1)$ (or $\frac{1}{2}$circle-sector) (ii) $8 + 8 + 8\theta = \frac{1}{2}(8 + 8 + 8(\pi - \theta))$ Solution of this eqn $\rightarrow 0.381$ or $\frac{1}{3}(\pi - 2)$ (iii) $\theta = \pi/3$ AB = 8cm BC = $2 \times 8 \sin \pi/3 = 8\sqrt{3}$ Perimeter = $24 + 8\sqrt{3}$	B1 M1 A1 [3] M1 M1 A1 [3] B1 M1 A1 [3]	For $\pi - \theta$ or for $\frac{1}{2}\pi r^2$ – sector Use of $\frac{1}{2}r^2\theta$ Co NB. 32 gets M1 only Relevant use of $s = r\theta$ twice Needs θ – collected – needs perimeters Co. [3] Co. Valid method for BC – cos rule, Pyth allow decimals here Everything OK. Answer given NB. Decimal check loses this mark
10. $y = \sqrt{(5x + 4)}$ (i) $dy/dx = \frac{1}{2}(5x + 4)^{-1/2} \times 5$ $x = 1$, $dy/dx = 5/6$ (ii) $dy/dt = dy/dx \times dx/dt$ $= 5/6 \times 0.03$ $\rightarrow 0.025$ (iii) realises that area $\rightarrow$ integration $\int = (5x + 4)^{3/2} \div \frac{3}{2} \div 5$ Use of limits $\rightarrow 54/15 - 16/15$ $= 38/15 = 2.53$	B1B1 B1 [3] M1 A1√ [2] M1 A1A1 DM1 A1 [5]	$\frac{1}{2}(5x + 4)^{-1/2} \times 5$ B1 for each part Co Chain rule correctly used For (i) $\times 0.03$ Realisation + attempt – must be $(5x + 4)^k$ For $(5x + 4)^{3/2} \div \frac{3}{2}$. For $\div 5$ Must use “0” to “1” Co

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11.	(i) $8x - x^2 = a - x^2 - b^2 - 2bx$ + equating $\rightarrow b = -4$ $a = b^2 = 16$ (i.e. $16 - (x - 4)^2$) (ii) $dy/dx = 8 - 2x = 0$ when $\rightarrow (4, 16)$ (or from $-b$ and a) (iii) $8x - x^2 \geq -20$ $x^2 - 8x - 20 = (x - 10)(x + 2)$ End values -2 and 10 Interval $-2 \leq x \leq 10$ $g: x \rightarrow 8x - x^2$ for $x \geq 4$ (iv) domain of g^{-1} is $x \leq 16$ range of g^{-1} is $g^{-1} \geq 4$ (v) $y = 8x - x^2 \rightarrow x^2 - 8x + y = 0$ $x = 8 \pm \sqrt{(64 - 4y)} \div 2$ $g^{-1}(x) = 4 + \sqrt{(16 - x)}$ or $(x - 4)^2 = 16 - y \rightarrow x = 4 + \sqrt{(16 - y)}$ $\rightarrow y = 16 - (x - 4)^2$	M1 B1 A1 [3] M1 A1 [2] M1 A1 A1 [3] B1✓ B1 [2] M1 DM1 A1 [3]	Knows what to do – some equating Anywhere – may be independent For $16 - ()^2$ Any valid complete method Needs both values Sets to 0 + correct method of solution Co – independent of $<$ or $>$ or $=$ Co – including $\leq$ ($<$ gets A0) From answer to (i) or (ii). Accept <16 Not f.t since domain of g given Use of quadratic or completed square expression to make x subject Replaces y by x Co (inc. omission of $-$)
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