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 $\surd$ 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.

Notes	Mark Scheme	Syllabus	
	A Level Examinations – June 2002	9709	

- 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✓" 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 2002

GCE Advanced Subsidiary Level

MARK SCHEME

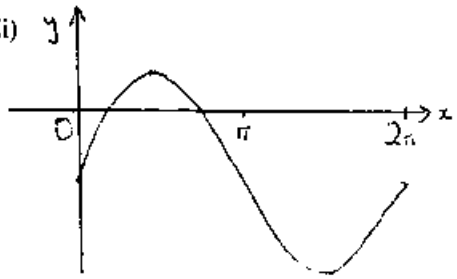
MAXIMUM MARK : 75

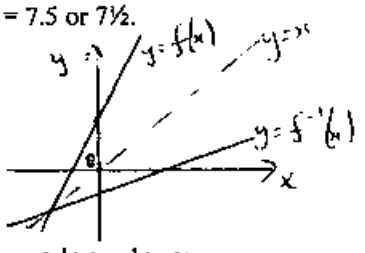
SYLLABUS/COMPONENT :9709 /1

MATHEMATICS
(Pure 1)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1. $x+2y=9$ solved with $xy+18=0$ $2y^2-9y-18=0$ or $x^2-9x-36=0$ $x= 12, y=-1.5$ and $x=-3, y= 6$.	M1 A1 DM1 A1 4	Complete elimination of x or y Correct 3-term equation (not = 0) Correct method of solving quadratic=0 Everything ok. Condone simple algebraic errors in first M1 Guesswork B2 B2
2. (i) $\sin x \tan x = \sin x \sin x \div \cos x$ $\sin x \tan x = (1-\cos^2 x) \div \cos x$ (ii) $2\sin x \tan x = 3 \rightarrow 2c^2+3c-2=0$ $\cos x=0.5 \quad x=60^\circ$ or $x=300^\circ$.	B1 1 M1 DM1 A1 A1√ 4	Uses t=s/c and uses $s^2+c^2=1$ correctly . Forms a 3 term quadratic in cosine Solves = 0 Correct only For 360 – (his answer) – loses this if other answers in range 0 to 360. Needs M1 and DM1 Guesswork B2 B2
3 (i) P is (9,9) (ii) Area under curve = $\int y dx$ $= 3x^{(3/2)} \div (3/2)$ Use of limits in either part Area = 54 Area under line = $\frac{1}{2}x^2$ or uses $\frac{1}{2}bh$ = 40.5 Subtract the areas → 13.5	B1 1 M1 A1 DM1 M1 A1 5	Correct only – needs both coordinates. used once to find area under a curve or line correct only use of his limits correctly Anywhere – correct attempt at area of triangle Correct only.
4 (i) $a=12 \quad a+4d = 18 \quad \therefore d=1.5$ $S_{25} = 25/2(24 + 24\times1.5)$ $= 750$ (ii) $a=12 \quad ar^4 = 18 \quad r^4=1.5$ 13 th term = ar^{12} $= 12 \times (1.5)^3$ = 40.5 or 40.6	B1 M1 A1 3 M1 A1 M1 A1 4	Correct only Use of S_n formula. Correct only. Correct method for r or r^4 (needs ar^4) Needs ar^{12} and method for subbing r (or r^4) Correct only.

5	(i) MO = 4i-6k MC = 4i+4j+6k	B1 B2,1 3	Correct only One off for each error in i, j and k.
	(ii) MO.MC = 16+0-36 = -20 $= \sqrt{(4^2+6^2)}\sqrt{(4^2+4^2+6^2)}\cos\theta$	M1 M1 M1	Use of $a_1b_1+a_2b_2+a_3b_3$ Use of $\|a\|\|b\|\cos\theta$ Use of Modulus.
	Angle = 109.7°. (allow 109.6)	A1 4	Correct only. No penalty for use of column vectors.
6	f(x) = asinx +b		
	(i) f(π÷2) = 2 a+b=2 f(3π÷2) = -8 -a+b=-8 Solution a=5, b=-3	B1 B1 B1 3	Correct only Correct only Correct only
	(ii) 5sinx-3=0 sinx=3/5 x = 0.64 or x = 2.50	B1√ B1√ 2	For $\sin^{-1}(-b/a)$ For π - his answer
	(iii) 	B2,1 2	Just one cycle Starts on negative y-axis Max about correct Min about correct.
7	(i) sin(½ angle) = 16/20 Required angle = 1.855 radians	M1 A1 2	Sine in 90° triangle – or cosine rule Correct only (answer was given)
	(ii) Area of sector = ½r²θ = 371 cm².	M1 A1 2	Correct formula used. Correct only.
	(iii) Area = Circle – rectangle – sector + triangle	M1	Correct logic – independent of method
	$= \pi r^2$ - l×b - ½r²θ + ½bh (or ½absinC) = 502 cm² (accept 501)	DM1 A1 3	Correct attempt at all parts. Correct only

8 (i) $192\pi=\pi r^2+2\pi rh$ leads to $h=(192\pi-\pi r^2)\div 2\pi r$ $V=\pi r^2h$ $V=\frac{1}{2}\pi(192r-r^3)$	M1 A1 M1 A1 4	Tries to relate surface area and (1 or 2) circles. Correct only. Subs for h into a correct volume formula. Answer was given. (beware fortuitous ans)
(ii) $dV/dr=\frac{1}{2}\pi(192-3r^2)$ $=0$ when $r=8$	M1 DM1 A1 3	Attempt to differentiate. Attempt to set to 0. Correct only.
(iii) value of $V=1610$ (or 512π)	A1	Correct only – could be in (ii)
$d^2V/dr^2=\frac{1}{2}\pi(-6r)$ Negative maximum.	M1 A1√ 3	Any correct method for max/min, Correct conclusion (must have second differential correct, but for his "r")
9 (i) At P(1,5), x=1 m=4/3 Gradient of normal $=-\frac{3}{4}$ Eqn of normal $y-5=-\frac{3}{4}(x-1)$ Puts y=0, x=23/3	B1 M1 M1 A1 4	Correct only Use of $m_1m_2=-1$ Correct form – though may put y=0 at start Correct only
(ii) $y=12(2x+1)^{-1}\div -1\ \div 2$ $y=-6/(2x+1)+c$ $c=7$	M1 A1 M1A1 4	For $12(2x+1)^k\div k$ – no other "x" anywhere. For k=-1 and ÷ 2. Needs an attempt at integration, plus use of C
(ii) $dx/dt=0.3$ $dy/dt=dy/dx\times dx/dt$ $=4/3\times 0.3=0.4$	B1 M1 A1 3	Fact only Correct relation between rates of change used Correct only. (condone use of δx, δy) Nb could get M1 A1 for (ii) if in (i) .
10 f:x→3x+2 g:x→6÷(2x+3) (i) fg(x) =3 18÷(2x+3) + 2 = 3 solution of this x = 7.5 or 7½.	M1 DM1 A1 3	Puts g into f – order correct (or $f=3\rightarrow x=\frac{1}{3}$) Correct method of solution (or $f=\frac{1}{3}\rightarrow x=7\frac{1}{2}$) Correct only
(ii)  	B1 B1 B1 3	Graph of f(x) – needs m>1, +ve y intercept Graph of $f^{-1}(x)$ – needs m<1. +ve x-intercept Some idea of reflection in y=x – stated ok.
(iii) $f^{-1}(x)=\frac{1}{3}(x-2)$ $y=6\div(3x+2)$ makes x the subject and swops x and y → $\frac{1}{2}(6/x-3)$ $\frac{1}{3}(x-2)=\frac{1}{2}(6/x-3)$ → $2x^2+5x=18$ x =2 or x= -4.5	B1 M1 A1 M1 A1 5	Correct only Any valid method Correct only – any form. Complete method of solution Correct only