UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the June 2005 question paper

9709 MATHEMATICS
8719 HIGHER MATHEMATICS

9709/05, 8719/05   Paper 5, maximum raw mark 50

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY *of* CAMBRIDGE
International Examinations

Grade thresholds taken for Syllabus 8719/9709 (Higher Mathematics/Mathematics) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 5	50	33	29	16

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

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 √ 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.

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.

UNIVERSITY *of* CAMBRIDGE
International Examinations

June 2005

GCE AS/A LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/05, 8719/05

**MATHEMATICS AND HIGHER MATHEMATICS
PAPER 5 (Mechanics 2)**

UNIVERSITY *of* CAMBRIDGE
International Examinations

1 $T_A = 8 \times 0.7 \div 0.4$ or
$T_B = 8 \times 0.5 \div 0.4$ B1
     M1   For resolving forces on *P* vertically (3 terms needed)

$8 \times 0.7 \div 0.4 = 8 \times 0.5 \div 0.4 + 10m$ A1   (correct unsimplified equation)
$m = 0.4$ A1   4

2 **(i)** $0.15\,g = T\cos\theta$ B1
$(T\sin\theta = 0.15 \times 7)$ M1   For using Newton's second law horizontally

$\theta = 35$ A1   3

(ii) The tension is 1.83 N   B1 ft   1

(iii)   M1   For using $a = v^2 \div r$ and $r = 2\sin\theta$

Speed is 2.83 ms^{-1} A1 ft   2   ft $v = \sqrt{14\sin\theta}$

3 **(i)**   M1   For obtaining an equation in $\overline{x}$ by taking moments (equation to contain all relevant terms)

$(300 + 100)\overline{x} = 300 \times 5 + 100 \times 15$ A1   Any correct equation in $\overline{x}$
Distance is 7.5 m   A1   3

(ii)   For obtaining an equation in *P* and *W* by taking moments about *F* and using the idea that the normal component of the contact force has no moment about *F* (almost
   M1   certainly implied in most cases).
$30P = 7.5W$ (moment about *A*) is M0

$(20 - 7.5)W = 30P$ A1 ft

$P = \dfrac{5}{12}W \;\; (= 0.417W)$ A1   3

4 **(i)** Initial EE = $6 \times 2^2 \div (2 \times 1.5)$ B1
Final KE = $\frac{1}{2}\,0.4 \times 6^2$ B1
   M1   For using WD against friction = initial EPE – final KE

WD = $6 \times 4 \div (2 \times 1.5) - \frac{1}{2}\,0.4 \times 6^2$ A1 ft   Any correct form
WD against friction is 0.8 J   A1   5

(ii) $(0.8 = \mu\,0.4g \times 2)$ M1   For using WD = $F \times d$ and $F = \mu R$
Coefficient is 0.1   A1 ft   2   ft $\mu =$ WD $\div 8$

5 **(i)**   M1   For using $\alpha = v\dfrac{dv}{dx}$ and attempting to separate the variables

$\int v\,dv = \int(x - 2.4)\,dx$ A1

$\frac{1}{2}v^2 = \frac{1}{2}x^2 - 2.4\,x\ (+\ C)$ A1   Only allow second M1 if $v = f(x)$

Page 2		Mark Scheme	Syllabus	Paper
		GCE AS/A LEVEL – JUNE 2005	9709/8719	5

$\frac{1}{2} 2.5^2 = 0 - 0 + C$ M1   For using $v = 2.5$ when $x = 0$ to find C (or equivalent using limits)

$v = \sqrt{x^2 - 4.8x + 6.25}$ A1   5   Allow $v^2 = x^2 - 4.8x + 6.25$

(ii) $\frac{dv}{dx} = 0 \to x = 2.4 \to v_{min} = v(2.4)$ M1   For any complete method for finding v_{min}

$(= \sqrt{2.4^2 - 4.8(2.4) + 6.25})$ or

$v = \sqrt{(x - 2.4)^2 + 0.7^2} \quad \to$

$v^{min} = v(2.4)$

Minimum value of v is 0.7   A1   2

6   **(i)** $OG = 2\sin(\pi/8) \div (\pi/8)$ B1   (=1.94899)

Distance from G go $OC =$

$[2\sin(\pi/8) \div (\pi/8)] \times \sin(\pi/8)$ B1 ft   (= 0.74585) ie. horiz cpt of candidates OG

$(\sqrt{8} - 16\sin^2(\pi/8) \div \pi =$ M1   For attempting to find OA – distance from G to OC (subtract two horizontal distances)

2.82843 – 0.74585

Distance is 2.083 m   A1   4   (from figures which give required accuracy)

(ii)   M1   For taking moments about A (3 terms required)

$4 \times 1\sin 45° + 3 \times 2.083 = T \times 2$ A1

$T = 4.54$ A1   3

(iii)   Horizontal component is 4.54 N and vertical component is 7 N   B1 ft   1

7   **(i)**   Height of A is $7 - \frac{1}{2} gr^2$ B1   1

(ii)   **(a)**   Horizontal distance is $Vt\cos\theta$ B1   1

(b)   Height is $Vt\sin\theta - \frac{1}{2}gr^2$ B1   1

(iii)   For using $t = T$ and equating heights

$7 - \frac{1}{2} gT^2 = VT\sin\theta - \frac{1}{2}gT^2$ M1

$VT\cos\theta = 24$ B1

$VT\sin\theta \div VT\cos\theta = 7 \div 24$ or   M1   For eliminating VT or θ

$(VT\sin\theta)^2 + (VT\cos\theta)^2 = 7^2 + 24^2$

$\tan\theta = 7/24$ or $VT = 25$ A1

$(VT\cos[\tan^{-1}(7/24)] = 24$ or   M1   For substituting for θ or VT

$25\cos\theta = 24)$

$VT = 25$ or $\tan\theta = 7/24$ A1   6

SR If first result never (or wrongly) obtained then for a correct substitution into a correct equation to get the second result can get B1/2 max (e.g. use $\tan\theta = 7/24$ in $24 = VT\cos\theta \to VT = 25$)

Page 3	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – JUNE 2005	9709/8719	5

(iv) $[H = 7 - \frac{1}{2}g(25^2/V^2)]$ M1* For obtaining H in terms of V

$7 - 5 \times 625 \div V^2 > 0$ M1 (dep) For using $H(V) > 0$ (or $H(V) = 0$)

Alternatively:
For using $H(T) \geq 0$ ($T^2 < 7/5$) M1*
For obtaining an inequality in V^2
only ($625/V^2 < 7/5$) M1 (dep)
Alternatively:
For expressing the range in terms of
V^2 only M1*
$[2V^2/10 \times (7/25) \times 24/25]$
For using 'range ≥ 24' to obtain an
inequality in V^2 only M1(dep)
$[2V^2/10) \times (7/25) \times (24/25) > 24]$

$7V^2 > 3125$ A1 3