TAYLOR'S COLLEGE

Wisdom • Integrity • Excellence

CAMBRIDGE 'A' LEVEL PROGRAMME

A2 TRIAL EXAMINATION AUGUST/SEPTEMBER 2005

(July 2004 Intake)

Monday 29 August 2005 1.00 pm – 2.15 pm

MATHEMATICS 9709/4

PAPER 4 Mechanics 1 (M1) 1 hour 15 minutes

Additional materials: Answer Booklet/Paper
List of formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
Where a numerical value for the acceleration due to gravity is needed, use 10 ms^{-2}.
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total marks for this paper is 50.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of 3 printed pages.

[Turn over

5 A particle P moves in a straight line in such a way that, at time t seconds, its acceleration a ms^{-2} is given by

$$a = 6t - 3t^2, \text{ where } t \geq 0.$$

When $t = 0$, P is at rest at O.

(i) Calculate the velocity of P when $t = 2$ s. [3]

(ii) Find the time when P is next at rest. [2]

(iii) Find the distance from O to the point where P is next at rest. [3]

6 A particle of mass 7 kg is placed on a plane inclined at an angle of 30^0 to the horizontal. The coefficient of friction between the particle and the plane is 0.6. Show that the particle does not slide down the plane. [4]

Find the magnitude of the least force, parallel to the plane which will cause the particle to move

(i) down the plane and [2]

(ii) up the plane. [2]

7 A straight road is inclined at an angle α to the horizontal where $\sin \alpha = 1/20$. A lorry of mass 4800 kg moves up the road at a constant speed of 12 ms^{-1}. The resistance to the motion of the lorry is constant and has a magnitude of 2000 N.

(i) Find, in kW to 3 significance figures, the rate of working of the lorry's engine. [3]

The road becomes horizontal. The lorry's engine continues to work at the same rate and the resistance to the motion remains the same. Find

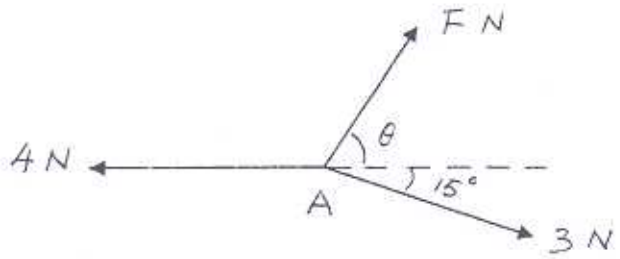
(ii) the acceleration of the lorry immediately after the road becomes horizontal, [3]

(iii) the maximum speed, in ms^{-1} to 3 significant figures, at which the lorry can travel along the horizontal road. [3]

1 A and B are two points 3 m apart on a smooth horizontal surface. A body of mass 6 kg is initially at rest at A and is pushed towards B with a constant force of 9 N.

(i) Calculate the work done by the force. [1]
(ii) Hence, find the speed of the body when it reaches B. [3]

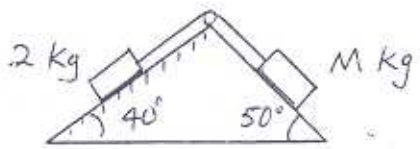
2



Three forces with magnitudes and directions as shown in the diagram, act in a horizontal plane at the point A. If they are in equilibrium, find the value of F and θ. [6]

3 A ball is thrown vertically upwards with a speed of 14 ms^{-1}. Two seconds later a second ball is dropped from the same point. Find where the two balls meet. [7]

4



Two planes, one rough and one smooth, inclined at angles 40° and 50° respectively, are placed back to back. Particles of masses 2 kg and M kg are placed on the slopes and are joined by a light inextensible string that passes over a smooth pulley as shown. The 40° slope has a coefficient of friction of 0.5 and air resistance can be ignored. The system is released from rest and the masses accelerate at 0.5 ms^{-2}. Find

(i) the two possible values of M, [4]
(ii) the tension of the string for each case. [4]