GradeMax

* 0000800000001 * DFD

CAMBRIDGE
International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 7 2 2 4 2 1 2 4 9 5 *

FURTHER MATHEMATICS **9231/34**

Paper 3 Further Mechanics **May/June 2026**

1 hour 30 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- Where a numerical value for the acceleration due to gravity (g) is needed, use $10\,\text{m}\,\text{s}^{-2}$.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (PQ/JG) 360451/6
© Cambridge University Press & Assessment 2026

[Turn over

GradeMax

BLANK PAGE

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

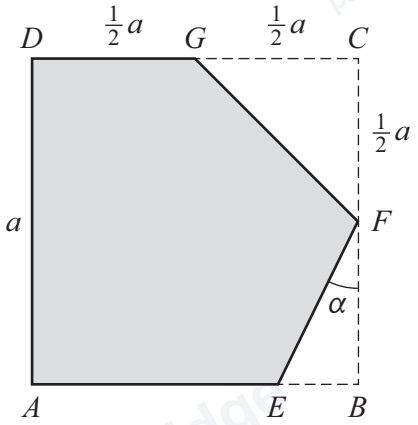
GradeMax

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

1 One end of a light inextensible string of length a is attached to a fixed point O. The other end of the string is attached to a particle of mass m. The string is taut and makes an angle θ with the downward vertical through O. The particle moves in a horizontal circle with speed $2\sqrt{ag}$.

Find the value of $\cos\theta$. [4]

2



A uniform lamina *AEFGD* is formed by removing two triangles from a square *ABCD* of side length a. Triangle *FCG* is isosceles and the two equal sides each have length $\frac{1}{2}a$. The angle between *EF* and *BF* is α, where $\tan\alpha = \frac{1}{2}$ (see diagram).

The centre of mass of the lamina is at a distance $\overline{x}$ from *AD* and at a distance $\overline{y}$ from *AE*.

(a) Show that $\overline{x} = \frac{5}{12}a$ and find a corresponding expression for $\overline{y}$ in terms of a. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

(b) The lamina is freely suspended from the point G and hangs in equilibrium. The angle between DA and the downward vertical through G is θ.

Find the value of θ. [2]

GradeMax

3 A particle of mass m is attached to a fixed point O by a light inextensible string of length a. The particle moves in complete vertical circles about O. Points A and B are on the path of the particle. OA makes an angle of 60° with the upward vertical through O. The speed of the particle at A is u and the tension in the string at A is T_A. The point B is vertically below O. The speed of the particle at B is $2u$ and the tension in the string at B is T_B.

(a) Show that $T_B = kT_A$, where k is a constant to be determined. [6]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Find the loss in kinetic energy of the particle between its lowest and highest points. Give your answer in terms of m, g and a. [1]

.....

.....

.....

.....

.....

.....

GradeMax

4 Two particles A and B have masses km and m respectively. Particle A is at rest on a smooth horizontal surface and is exactly halfway between two fixed parallel smooth vertical walls. Particle B is moving on the surface with speed u in a direction perpendicular to the walls, and collides directly with A. The coefficient of restitution between the two particles is 0.2. As a result of the collision, the direction of motion of B is reversed.

(a) Show that $k > 5$. [3]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

(b) Particle B then collides with one of the vertical walls and rebounds. The coefficient of restitution between B and the wall is 0.8. It then collides again with particle A at the instant when A collides with the other vertical wall.

Find the value of k. [3]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

PapaCambridge papacambridge.com

GradeMax

5 A particle P of mass m is moving in a straight horizontal line under a variable force $m\left(v^2 - ku^2\right)$, where v is the velocity of P at time t, u is the initial velocity of P, and k is a positive constant. It is given that $u > 0$ and $k > 1$.

(a) Explain why, initially, the acceleration and velocity of P have opposite directions. [1]

.....

.....

.....

(b) Find, in terms of k, the distance travelled by P until it first comes to instantaneous rest. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

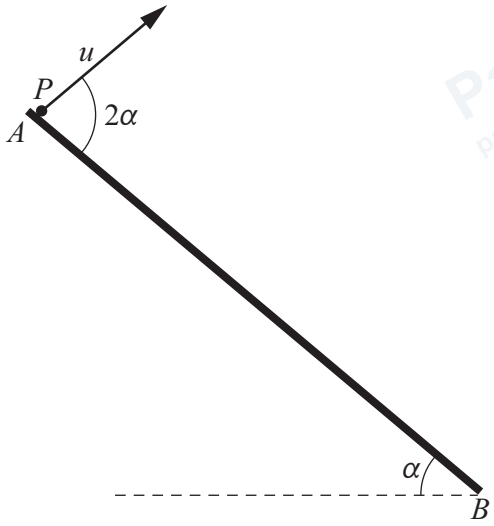
(c) Find, in terms of k and u, the time taken for P to first come to instantaneous rest. [4]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

6



The points A and B lie on the line of greatest slope of a smooth inclined plane, with A above B. The plane is inclined to the horizontal at an acute angle α.

At time $t = 0$, a particle P is projected from A with speed u at an angle 2α to the plane and moves freely under gravity (see diagram). At the same time, a second particle Q is released from rest at A. Particle Q moves down the plane along the line of greatest slope. The two particles move in the same vertical plane. At time $t = T$, the two particles collide at point B. The length of AB is d.

(a) By considering the motion of particle Q, show that $T = \sqrt{\dfrac{2d}{g \sin \alpha}}$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

© Cambridge University Press & Assessment 2026

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

(b) Find the value of α. [5]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

GradeMax

7 One end of a light elastic string of natural length $8a$ and modulus of elasticity $6mg$ is attached to a fixed point O on a rough plane. The plane is inclined at an angle θ to the horizontal where $\sin\theta = \frac{5}{13}$. A particle P of mass m is attached to the other end of the string. The string lies along a line of greatest slope of the plane, with P below the level of O. The particle is held at a point such that the extension of the string is $3a$.

When P is released from rest, its acceleration is $\frac{5}{4}g$ in the direction PO.

(a) Find the coefficient of friction between the particle and the plane. [4]

DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

(b) In its subsequent motion, P comes to rest at the point C.

Find, in terms of a, the distance OC. [6]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

© Cambridge University Press & Assessment 2026

GradeMax

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (Cambridge University Press & Assessment) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in our Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge International Education is the name of our awarding body and a part of Cambridge University Press & Assessment, which is a department of the University of Cambridge.

© Cambridge University Press & Assessment 2026