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Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International Advanced Level

Wednesday 12 June 2024

Afternoon (Time: 1 hour 30 minutes)

Paper
reference

WME03/01

Mathematics

**International Advanced Subsidiary/Advanced Level
Mechanics M3**

You must have:

Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$, and give your answer to either 2 significant figures or 3 significant figures.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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5. A uniform right solid circular cone C has radius r and height $4r$.

- (a) Show, using algebraic integration, that the distance of the centre of mass of C from its vertex is $3r$.

[You may assume that the volume of C is $\frac{4}{3}\pi r^3$]

(4)

A uniform solid S , shown below in Figure 3, is formed by **removing** from C a uniform solid right circular cylinder of height r and radius $\frac{1}{2}r$, where the centre of one end of the cylinder coincides with the centre of the plane face of C and the axis of the cylinder coincides with the axis of C .

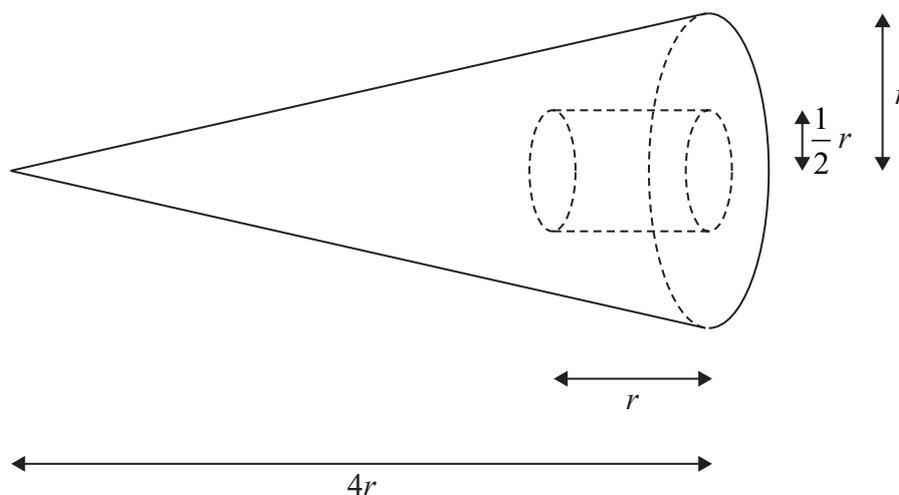


Figure 3

- (b) Show that the distance of the centre of mass of S from the vertex of C is $\frac{75}{26}r$

(5)

A rough plane is inclined at an angle α to the horizontal.

The solid S rests in equilibrium with its plane face in contact with the inclined plane.

Given that S is on the point of toppling,

- (c) find the exact value of $\tan \alpha$

(3)



6.

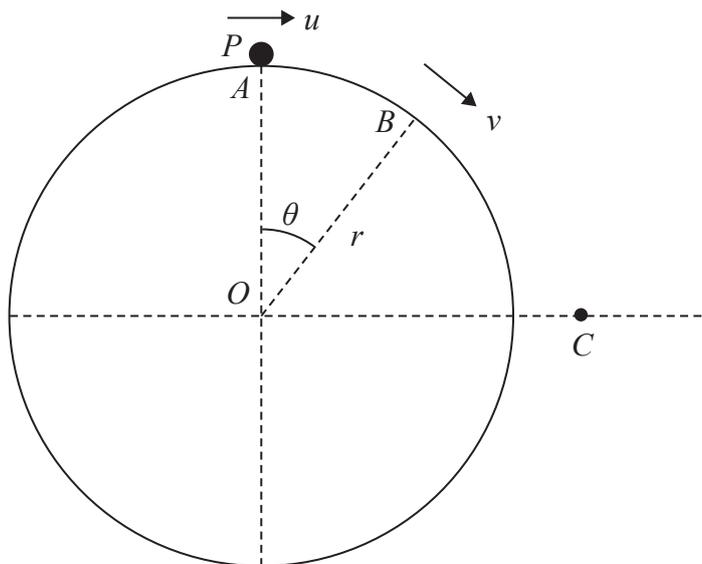


Figure 4

A fixed solid sphere has centre O and radius r .

A particle P of mass m is held at rest on the smooth surface of the sphere at A , the highest point of the sphere.

The particle P is then projected horizontally from A with speed u and moves on the surface of the sphere.

At the instant when P reaches the point B on the sphere, where angle $AOB = \theta$, P is moving with speed v , as shown in Figure 4.

At this instant, P loses contact with the surface of the sphere.

(a) Show that

$$\cos \theta = \frac{2gr + u^2}{3gr} \quad (7)$$

In the subsequent motion, the particle P crosses the horizontal through O at the point C , also shown in Figure 4.

At the instant P passes through C , P is moving at an angle α to the horizontal.

Given that $u^2 = \frac{2gr}{5}$

(b) find the exact value of $\tan \alpha$.

(6)



