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සියලු ම හිමිකම් ඇවිරිණි/முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2024
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

සංයුක්ත ගණිතය II இணைந்த கணிதம் II Combined Mathematics II	10 E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීම් කාලය - මිනිත්තු 10 යි.
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index Number							

Instructions:

* *This question paper consists of two parts:*
  Part A (Questions 1 – 10) *and* **Part B** (Questions 11 – 17)
* **Part A:**
  Answer all questions. Write your answers to each question in the space provided. You may use additional sheets if more space is needed.
* **Part B:**
  Answer five questions only. Write your answers on the sheets provided.
* *At the end of the time allotted, tie the answer scripts of the two parts together so that* **Part A** *is on top of* **Part B** *and hand them over to the supervisor.*
* *You are permitted to remove* ***only*** **Part B** *of the question paper from the Examination Hall.*

* In this question paper, g denotes the acceleration due to gravity.

For Examiners' Use only

(10) Combined Mathematics II		
Part	**Question No.**	**Marks**
A	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
B	11	
	12	
	13	
	14	
	15	
	16	
	17	
	Total	

Total

In Numbers	
In Words	

Code Numbers

Marking Examiner		
Checked by:	1	
	2	
Supervised by:		

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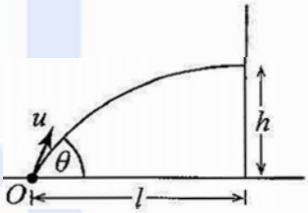
Alevel Apis උසස් පෙළ විද්‍යා/ගණිත/කලා/වාණිජ හා තාක්ෂණ විෂය ධාරාවන්ට අදාළ සියලුම ප්‍රශ්න පත්‍ර/සටහන් හා තවත් බොහෝ දෑ ලබා ගැනීමට පිවිසෙන්න www.alevelapi.com වෙත.

Part A

1. A particle A of mass $2m$ and a particle B of mass m moving on a smooth horizontal table along the same straight line towards each other with speeds u and $3u$ respectively, collide directly. After the collision A and B move in opposite directions. The coefficient of restitution between A and B is e. Show that $e > \frac{1}{8}$.

2. A particle is projected from a point O on a horizontal ground, with an initial speed u at an angle $\theta\left(0 < \theta < \frac{\pi}{2}\right)$ to the horizontal. The particle hits a vertical wall which is at a horizontal distance l from O at a height h (> 0) from the ground (see the figure).



Show that $h = l\tan\theta - \frac{gl^2}{2u^2}\sec^2\theta$ and **deduce** that $\sin 2\theta > \frac{gl}{u^2}$.

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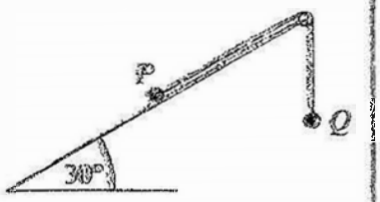
3. A particle P of mass m lies on a rough inclined plane whose inclination to the horizontal is 30°. Particle P is connected, by a light inextensible string passing over a fixed smooth pulley at the top of the inclined plane, to a particle Q of mass $4m$ which is free to move vertically (see the figure). The part of the string on the inclined plane lies along a line of greatest slope of the plane.



The coefficient of friction between P and the plane is $\frac{1}{2}$. The system is released from rest with the string taut. It is given that P moves up the inclined plane. Obtain equations sufficient to determine the tension of the string.

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4. A car of mass M kg travels along a horizontal straight road with its engine working at a constant power of P W. There is a constant resistance of R N to the motion of the car. Find the acceleration of the car at the instant when its speed is u m s^{-1}.
Now, the car travels at a constant speed up a straight road that is inclined at an angle $\theta \left(0 < \theta < \frac{\pi}{2}\right)$ to the horizontal. Find this constant speed if the car is subjected to the same resistance R N and have the same power P W.

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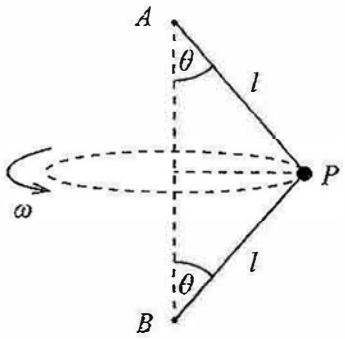
5. A particle P of mass $2m$ is connected to two fixed points A and B lying on a vertical line by two light inextensible strings each of length l. The particle P moves in a horizontal circle with a constant angular velocity ω with both strings taut and making an angle θ $\left(0 < \theta < \frac{\pi}{2}\right)$ to the vertical, as shown in the figure.



Show that the tension in the string AP is $m(l\omega^2 + g\sec\theta)$.

6. Let $\mathbf{u}$ and $\mathbf{v}$ be two unit vectors such that $\mathbf{u} \cdot \mathbf{v} = \frac{1}{2}$. Also, let $\mathbf{a} = \alpha\mathbf{u} + \mathbf{v}$ and $\mathbf{b} = \mathbf{u} + \beta\mathbf{v}$, where $\alpha, \beta \in \mathbb{R}$. If the vectors $\mathbf{a}$ and $\mathbf{b}$ are perpendicular, and $\mathbf{a} + \mathbf{b}$ is parallel to $\mathbf{u}$, find the values of α and β.

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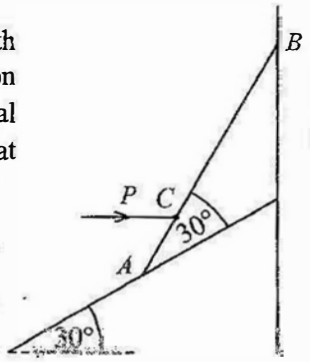
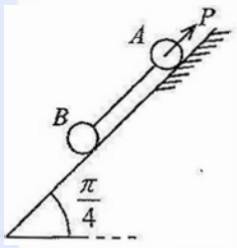
7. A uniform rod AB of length $4a$ and weight W is kept in equilibrium with its upper end B against a smooth vertical wall and the lower end A on a smooth plane inclined at 30° to the horizontal by applying a horizontal force P to the rod at the point C, where $AC = a$. The rod is inclined at 30° to the inclined plane, as shown in the figure. Find the value of P.



8. Two particles A and B of masses m and $2m$ respectively, are placed on a plane inclined at an angle $\frac{\pi}{4}$ to the horizontal and are connected by a light inextensible string and kept in equilibrium by a force P applied to A, as shown in the figure. The line of action of P and the string lie along a line of greatest slope of the plane. The particle A lies on the rough part of the plane and the particle B lies on the smooth part of the plane. The coefficient of friction between A and the plane is $\frac{1}{2}$.
Show that $2\left|\sqrt{2}\,P - 3mg\right| \leq mg$.



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9. Let A and B be two events of a sample space Ω. It is given that $P(A) = \frac{1}{5}$, $P(A \mid B) = \frac{1}{10}$ and $P(B \mid A) = \frac{3}{10}$. Find $P(B)$ and $P(A \cup B)$.

10. The median, the mode and the mean of the following seven observations, arranged in the ascending order, are 5, 7 and 5 respectively:

$$1,\ 3,\ 4,\ p,\ q,\ r,\ s$$

Here p, q, r and s are real numbers.

Find the values of p, q, r and s, and show that the variance of the seven observations is $\frac{38}{7}$.

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