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When the angular speed is increased to ω_2 , the angle between the upward vertical and the normal reaction of the surface on P becomes θ_2 , where $\tan \theta_2 = \frac{4}{3}$.

Find the ratio $\frac{\omega_1}{\omega_2}$.

[4]

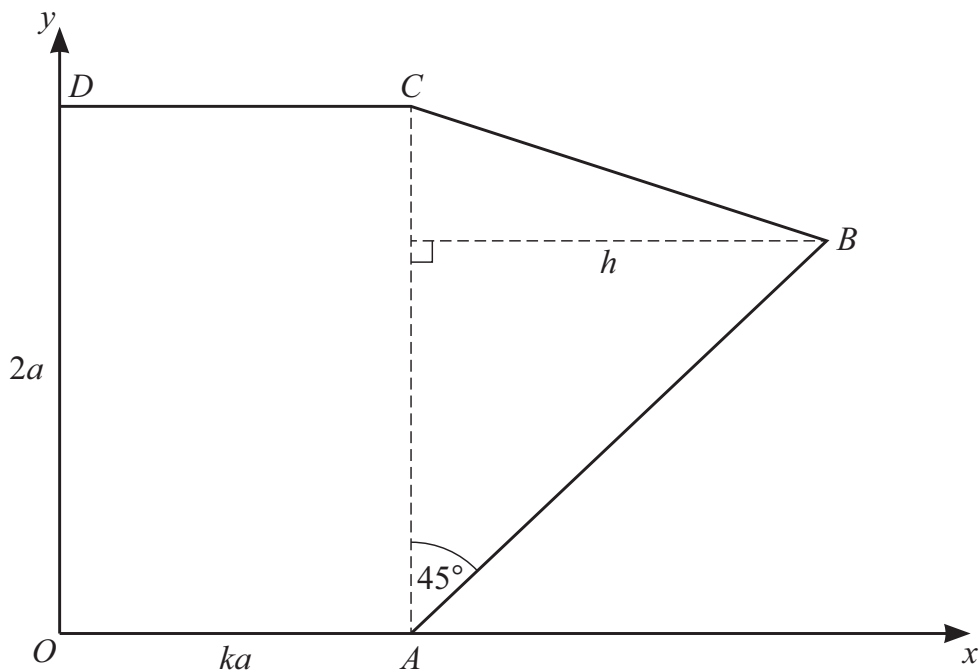
- 3

(a)

[5]

②

[illegible]



A uniform lamina $OABCD$ consists of a rectangle $OACD$ and a triangle ABC . The length of OA is ka , the length of OD is $2a$, the height of triangle ABC is h and angle CAB is 45° (see diagram). Relative to axes through O , parallel and perpendicular to OA as shown, the centre of mass of triangle ABC is $(\bar{x}, \bar{y})$.

- (a) Show that $\bar{x}$ is $\frac{1}{3}(3ka + h)$, and find an expression for $\bar{y}$. [3]

[illegible]

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(a)

[5]

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At point A , the particle strikes a fixed smooth barrier, rebounds, and lands on the horizontal plane. The barrier is inclined at an angle of 45° to the horizontal.

- (b)** Find the speed of P immediately before it collides with the barrier. [3]

[illegible]

- (c) Given that the coefficient of restitution between the barrier and the particle is $\frac{1}{9}$, find the horizontal distance travelled by P after it strikes the barrier. [4]

Handwriting practice lines (dotted lines on a grid background).

Additional page

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

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the sheet.