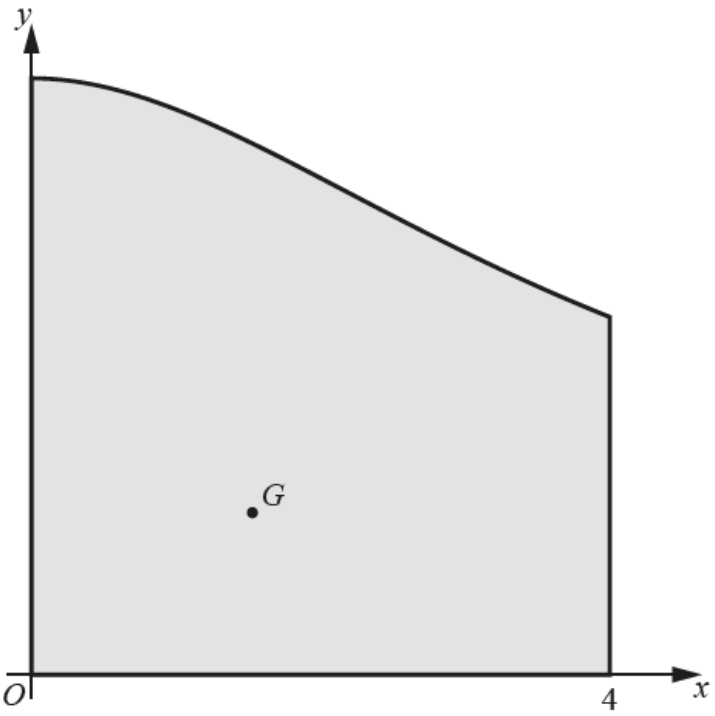
Centre of Mass – 2022 GCE Mechanics Further Math A Y543

1. June/2022/Paper_ Y543/01/No.5

In this question you must show detailed reasoning.

The region bounded by the x-axis, the y-axis, the line $x = 4$ and the curve with equation $y = \frac{15}{\sqrt{x^2+9}}$ is occupied by a uniform lamina.

The centre of mass of the lamina is at the point $G(\overline{x}, \overline{y})$ (see diagram).



(a) Show that $\overline{x} = \frac{2}{\ln 3}$. **[3]**

(b) Determine the value of $\overline{y}$. Give your answer correct to **3** significant figures. **[3]**

P is the point on the curved edge of the lamina where $x = 3$. The lamina is freely suspended from P and hangs in equilibrium in a vertical plane.

(c) Determine the acute angle that the longest straight edge of the lamina makes with the vertical. **[3]**