



QUESTION WORKBOOK

Centres of mass by integration

Further Mechanics 2 · Year FM

7 questions · 33 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** Write down the two integrals for the centre of mass of a lamina under a curve, and explain why they are not symmetric. [3]

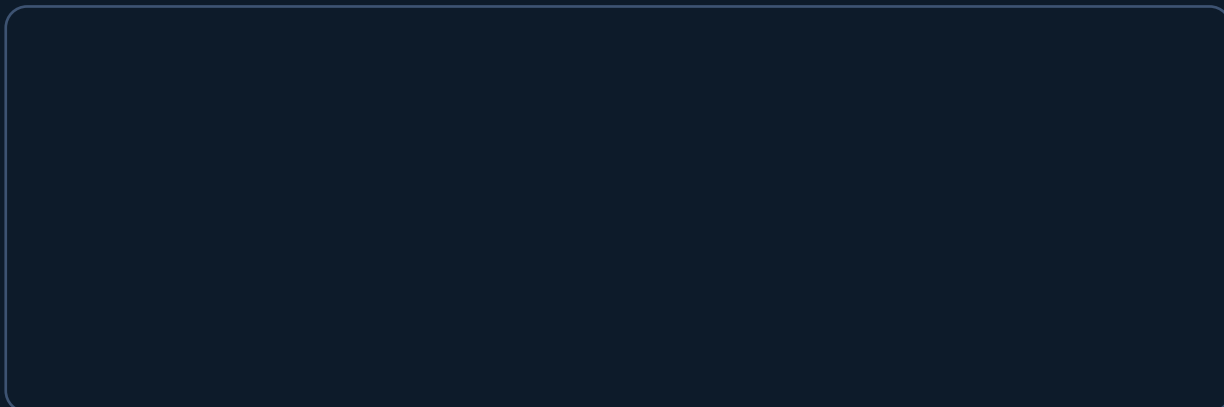
- A2** Find the centre of mass of the uniform lamina bounded by the curve $y = 4 - x^2$, the y -axis and the positive x -axis. [6]

SECTION B · Standard

- B1** The region under $y = \sqrt{x}$ from $x = 0$ to $x = 4$ is rotated about the x -axis. Find the centre of mass of the solid. [5]

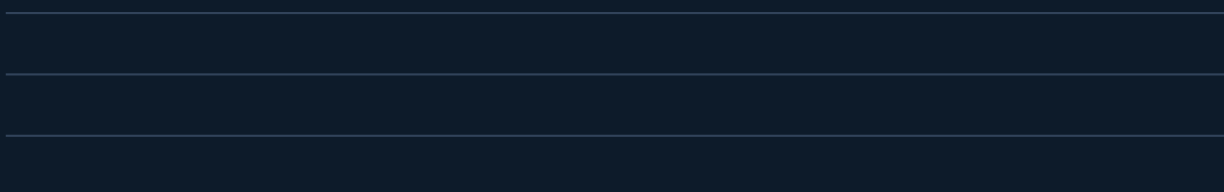
- B2** A uniform solid hemisphere of radius r is formed by rotating $y = \sqrt{(r^2 - x^2)}$ about the x -axis for x from 0 to r . Show that its centre of mass is $3r/8$ from the flat face.

[5]



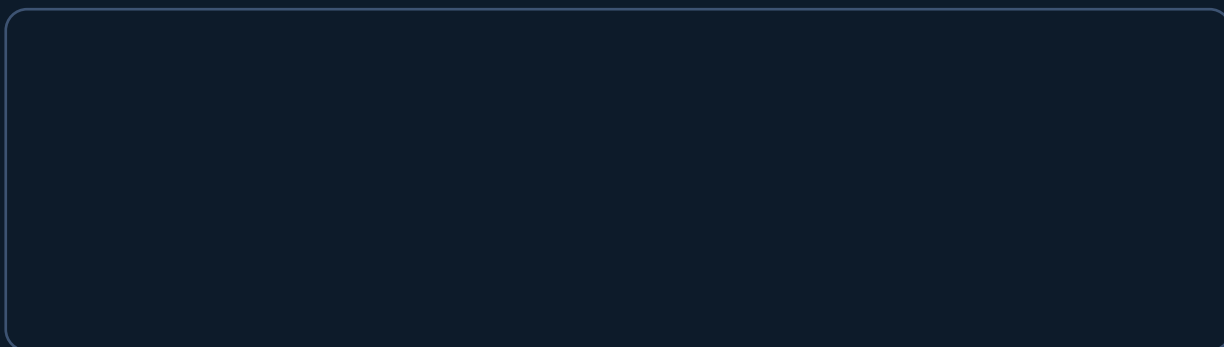
- B3** Explain how the method changes for a body whose density varies with position.

[3]



- B4** A rod of length 2 m lying along the x -axis from the origin has density $(1 + x)$ kg per metre. Find its centre of mass.

[4]



SECTION C · Stretch

- C1** A uniform lamina occupies the region enclosed by the curve $y = x^2$ and the line $y = 2x$. Find the coordinates of its centre of mass. [7]