4.

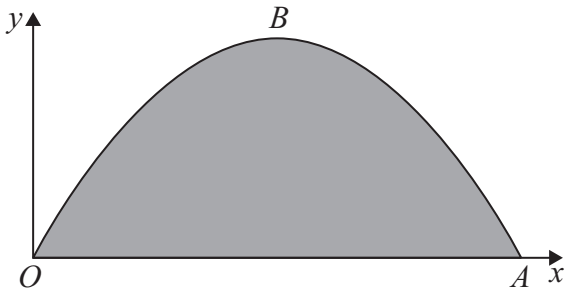


Figure 3

Figure 3 shows a shaded uniform lamina OAB which is in the shape of the region enclosed by the x-axis and the curve with equation $y = \frac{1}{a}(ax - x^2)$, where a is a positive constant. The centre of mass of the lamina is at G.

(a) Find, in terms of a, the y coordinate of G.

(6)

The lamina is now freely pivoted in a vertical plane about a smooth horizontal axis which passes through O and is perpendicular to the plane of the lamina.

The lamina is held in equilibrium by a horizontal force which is applied to the lamina at A. The line OA makes an angle θ with the downward vertical through O, where $\tan\theta = \frac{3}{4}$, as shown in Figure 4.

The line of action of the force lies in the plane of the lamina.

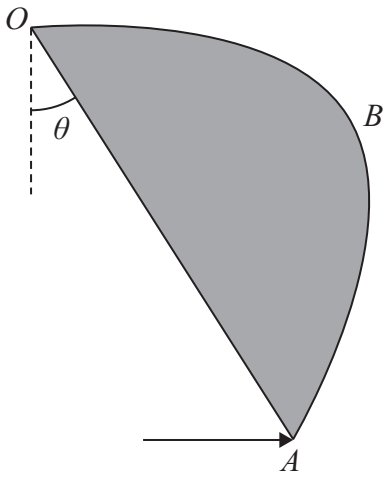


Figure 4

The mass of the lamina is M and the magnitude of the applied force is F.

(b) Find F in terms of M and g.

(6)

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Question 4 continued

(Total for Question 4 is 12 marks)