2.

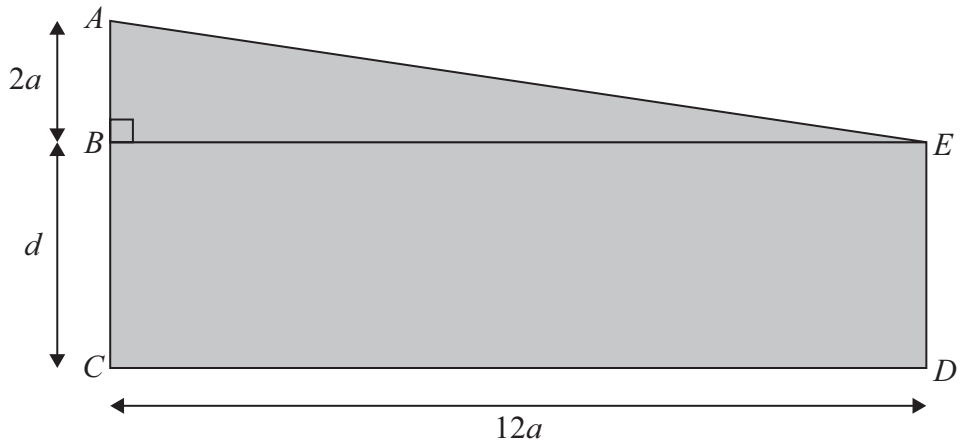


Figure 1

The uniform **lamina** $ABCDE$ shown shaded in Figure 1 is formed by joining a rectangle to a right-angled triangle.

The right-angled triangle ABE has $AB = 2a$ and $BE = 12a$

The rectangle $BCDE$ has $BE = CD = 12a$ and $BC = ED = d$

The distance of the centre of mass of the lamina from AC is $\bar{x}$

(a) Show that

$$\bar{x} = \frac{2a(2a + 3d)}{(a + d)}$$

(5)

The lamina has weight W.

A particle of weight $\frac{W}{2}$ is attached to the lamina at D.

The lamina is free to rotate in a vertical plane about a smooth horizontal axis through A. The axis is perpendicular to the plane of the lamina.

When a horizontal force of magnitude F is applied to the lamina at C towards D, the lamina rests in equilibrium with the line CD horizontal.

Given that $d = 4a$,

(b) find F in terms of W.

(4)

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Question 2 continued

(Total for Question 2 is 9 marks)