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6. [*The centre of mass of a semicircular arc of radius r is* $\frac{2r}{\pi}$ *from the centre.*]

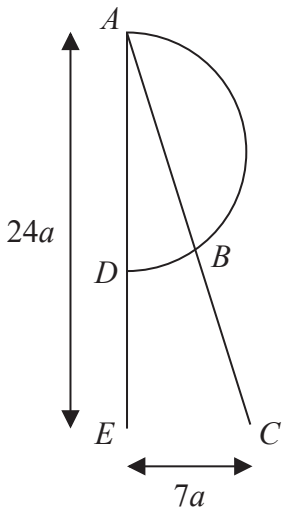


Figure 2

Uniform wire is used to form the framework shown in Figure 2.

In the framework,

- ABC is straight and has length $25a$
- ADE is straight and has length $24a$
- ABD is a semicircular arc of radius $7a$
- $EC = 7a$
- angle $AEC = 90°$
- the points A, B, C, D and E all lie in the same plane

The distance of the centre of mass of the framework from AE is d.

(a) Show that $d = \frac{53}{2(7+\pi)}a$

(4)

The framework is freely suspended from A and hangs in equilibrium with AC at angle $\alpha°$ to the downward vertical.

(b) Find the value of α.

(7)

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Q6