2.

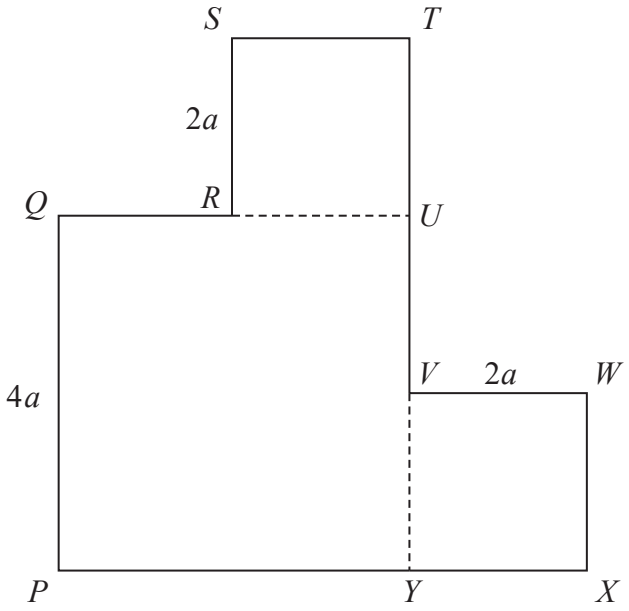


Figure 1

Figure 1 shows a template where

- $PQUY$ is a uniform square lamina with sides of length $4a$
- $RSTU$ is a uniform square lamina with sides of length $2a$
- $VWXY$ is a uniform square lamina with sides of length $2a$
- the three squares all lie in the same plane
- the mass per unit area of $VWXY$ is **double** the mass per unit area of $PQUY$
- the mass per unit area of $RSTU$ is **double** the mass per unit area of $PQUY$
- the distance of the centre of mass of the template from PX is d

(a) Show that $d = \frac{5}{2}a$

(5)

The template is freely pivoted about Q and hangs in equilibrium with PQ at an angle of θ to the downward vertical.

(b) Find the value of $\tan\theta$

(6)

The mass of the template is M

The template is still freely pivoted about Q, but it is now held in equilibrium, with PQ vertical, by a horizontal force of magnitude F which acts on the template at X.
The line of action of the force lies in the same plane as the template.

(c) Find F in terms of M and g

(3)

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