2.

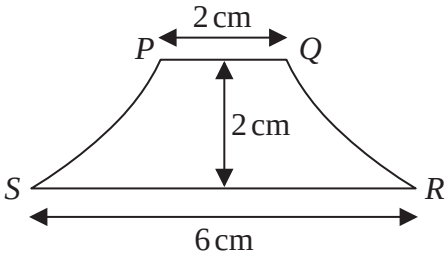

Figure 1

Figure 1 shows the central vertical cross section *PQRS* of a handle for a drawer. Measurements were taken and the handle was found to have a height of 2 cm and the lengths of the straight lines *PQ* and *SR* were 2 cm and 6 cm respectively, as shown in Figure 1.

The handle is modelled by a solid of revolution of a curve *C* about the *y*-axis. The curve *C* has parametric equations

$$x = a\cos^2\theta \qquad y = b\tan\theta \qquad \frac{\pi}{6} \leqslant \theta \leqslant \frac{\pi}{3}$$

where *a* and *b* are constants.

Find, according to the model,

(a) (i) the value of *a*,

(ii) the value of *b*.

(4)

(b) Hence, using calculus, determine the volume of the handle, according to the model.

(6)