

4.4) Modelling with volumes of revolution

Worked example

A vase is modelled using a diagram. The maximum diameter of the vase on the diagram is 4 *cm*.

The cross-section of the model is described by the curve with parametric equations

$x = 2 \sin 2t$, $y = 4 \cos t + 2$, $0 \leq t \leq \frac{\pi}{2}$, where the units of x and y are in *cm*.

The vase is formed by rotating this curve about the y -axis to form a solid of revolution.

(a) Find the volume of water required to fill the vase to a height of 3*cm*.

The real goldfish bowl has a maximum diameter of 24*cm*.

(b) Find the volume of water required to fill the real goldfish bowl to the corresponding height.

Your turn

A goldfish bowl is modelled using a diagram. The diameter of the bowl on the diagram is 4 *cm*.

The cross-section of the model is described by the curve with parametric equations

$x = 2 \sin t$, $y = 2 \cos t + 2$, $\frac{\pi}{6} \leq t \leq \frac{11\pi}{6}$, where the units of x and y are in *cm*.

The goldfish bowl is formed by rotating this curve about the y -axis to form a solid of revolution.

(a) Find the volume of water required to fill the model to a height of 3*cm*.

The real goldfish bowl has a maximum diameter of 48*cm*.

(b) Find the volume of water required to fill the real goldfish bowl to the corresponding height.

(a) $9\pi \text{ cm}^3$

(b) 48900 cm^3 (3 sf)