Core Pure 2

Volumes of Revolution

Chapter Overview

1: Revolving around the x-axis.

2: Revolving around the y-axis.

3: Volumes of revolution with parametric curves.

4: Modelling

5 **Further calculus**	5.1	**Derive formulae for and calculate volumes of revolution.**	**Both** $\pi\int y^2\,dx$ **and** $\pi\int x^2\,dy$ **are required.** Students should be able to find a volume of revolution given either Cartesian equations or parametric equations.

This chapter involves volumes of revolution but with trickier integration than in CP1.

Revolving around the x-axis

Recap: When revolving around the x-axis, $V = \pi \int_b^a y^2 \, dx$

Example

The region R is bounded by the curve with equation $y = \sin 2x$, the x-axis and $x = \frac{\pi}{2}$. Find the volume of the solid formed when region R is rotated through 2π radians about the x-axis.

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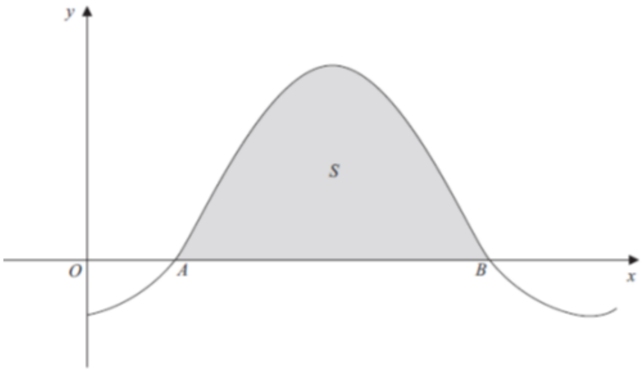


Figure 3 shows a sketch of part of the curve with equation $y = 1 - 2\cos x$, where x is measured in radians. The curve crosses the x-axis at the point A and at the point B.

(*a*) Find, in terms of π, the x coordinate of the point A and the x coordinate of the point B. **(3)**

The finite region S enclosed by the curve and the x-axis is shown shaded in Figure 3. The region S is rotated through 2π radians about the x-axis.

(*b*) Find, by integration, the exact value of the volume of the solid generated. **(6)**

Ex4A p. 78-80

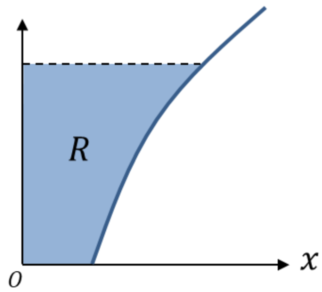
Revolving around the y-axis

Recap: When revolving around the y-axis, $\boldsymbol{V = \pi \int_b^a x^2 \, dy}$

i.e. we are just **swapping the roles of x and y**.

Example

The diagram shows the curve with equation $y = 4\ln x - 1$. The finite region R, shown in the diagram, is bounded by the curve, the x-axis, the y-axis and the line $y = 4$. Region R is rotated by 2π radians about the y-axis. Use integration to show that the exact value of the volume of the solid generated is $2\pi\sqrt{e}(e^2 - 1)$.



Ex4B p. 81-83