"Teach A Level Maths" Vol. 2: A2 Core Modules

29: Volumes of Revolution

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Module C3	Module C4
AQA	Edexcel
OCR	MEI/OCR

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We'll first look at the area between the lines



Can you see what shape you will get if you rotate the area through 360° about the x-axis?

Ans: A cone (lying on its side)

We'll first look at the area between the lines



For this cone, r=1, $h=1 \implies V=\frac{1}{3}\pi$

The formula for the volume found by rotating any area about the x-axis is



where y = f(x) is the curve forming the upper edge of the area being rotated.

a and b are the x-coordinates at the left- and righthand edges of the area.

We leave the answers in terms of π

$$V = \pi \int_{a}^{b} y^{2} dx$$
We must substitute for y using $y = f(x)$ before
we integrate.
$$= \pi \left[\frac{x^{3}}{3} \right]_{0}^{0}$$

$$= \pi \left(\frac{1}{3} - 0 \right)$$

$$= \frac{1}{3} \pi$$

I'll outline the proof of the formula for you.

The formula can be proved by splitting the area into narrow strips . . . which are rotated about the x-axis.

Each tiny piece is approximately a cylinder (think of a penny on its side). Each piece, or element, has a volume $\approx \pi r^2 h = \pi y^2$



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