Name	Date started	Target end date

GCE A LEVEL — PURE MATHEMATICS B QUESTION PACK

0976-01 (Legacy C4) · New spec Unit 3 Topic 13 · A2 unit, 35% of A-level, 120 marks, 2h 30min paper

REVISE
.wales

MATHEMATICS — PURE B · INTEGRATION - VOLUME OF REVOLUTION

Integration (Volume of Revolution)

Every volume of revolution question from the legacy WJEC C4 papers (June 2011 – June 2017) for new-spec A2 Unit 3 integration applications

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~0 hours 50 minutes

*Derived from the legacy C3/C4 paper's pace of **~1.25 min/mark** (40 marks over 7 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains questions from the legacy WJEC C3 and C4 papers (2008 modular spec) that maps onto new-spec A2 Unit 3 Topic 13 (2.3.12).

Questions are ordered chronologically.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

A calculator is allowed (except where specified by individual questions). The WJEC Formula Booklet may be referred to.

For Examiner's use only

Q	Source	Max	Mark
1	Jun 11 Q5	5	
2	Jun 12 Q4	5	
3	Jun 13 Q4	5	
4	Jun 14 Q4	6	

Q	Source	Max	Mark
5	Jun 15 Q4	6	
6	Jun 16 Q9	6	
7	Jun 17 Q4	7	
Total		**40**	

Integration (Volume of Revolution) — what the new spec asks

WJEC GCE A Level Mathematics (from 2017) · Unit 3: Pure Mathematics B · Topic 2.3.12.

Volume of revolution 2.3.12

- About the x-axis: $V = \pi \int_a^b y^2 \, dx$.
- About the y-axis: $V = \pi \int_c^d x^2 \, dy$.
- Always square the function (not the whole integrand!).

Setting up the integral 2.3.12

- Identify limits from the bounding lines.
- Sketch first to understand the region.
- Don’t forget the π — very common slip.

Crib sheet »

Integration - Volume of Revolution in one page

Quick-reference notes — revisit before each section. Don't use during questions.

About x-axis

$V = \pi \int_a^b y^2 \, dx$.

Don't forget to square y as a function of x.

About y-axis

$V = \pi \int_c^d x^2 \, dy$.

Need x as a function of y — rearrange first.

Limits

Read limits from the bounding lines.

If sketched, check that you've correctly identified the region.

Common pitfalls

Forgetting π.

Squaring incorrectly (e.g. $(a+b)^2 \neq a^2 + b^2$).

Mixing dx and dy.

Worked example

Region under $y = \sin x$ from 0 to π, rotated about x-axis:

$$V = \pi \int_0^{\pi} \sin^2 x \, dx = \pi \int_0^{\pi} \frac{1-\cos 2x}{2} \, dx$$

Trig simplifications

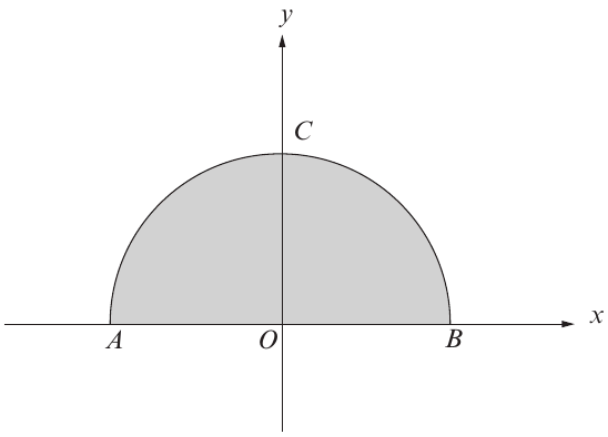
Use $\sin^2 x = \frac{1-\cos 2x}{2}$ and $\cos^2 x = \frac{1+\cos 2x}{2}$ to integrate trig squares.

SECTION T13

Integration (Volume of Revolution)

Questions 1–7 · 40 marks

5. The region shaded in the diagram below is bounded by the x-axis and that part of the curve with equation $x^2 + y^2 = 9$ lying above the x-axis. The points of intersection of the curve with the coordinate axes are denoted by A, B and C.



(a) Write down the coordinates of A, B and C. [1]

(b) (i) By carrying out an appropriate integration, find the volume generated when the region shaded in the diagram is rotated through four right-angles about the x-axis.

(ii) Give a geometrical interpretation of your answer. [4]

$\frac{1}{2}$ 1

4. The region R is bounded by the curve $y = \sqrt{x} + \frac{5}{\sqrt{x}}$, the x-axis and the lines $x = 3$, $x = 4$.

Find the volume generated when R is rotated through four right-angles about the x-axis. Give your answer correct to the nearest integer. [5]

4. The region R is bounded by the curve $y = \sin 2x$, the x-axis and the lines $x = \frac{\pi}{6}$, $x = \frac{\pi}{2}$.

Find the volume generated when R is rotated through four right angles about the x-axis. Give your answer correct to three decimal places. [5]

4. The region R is bounded by the curve $y = 3 + 2\sin x$, the x-axis and the lines $x = 0, x = \frac{\pi}{4}$.

Find the volume of the solid generated when R is rotated through four right angles about the x-axis. Give your answer correct to the nearest integer. [6]

4. The line *L* has equation $y = mx$, where $m > 0$. The region *R* is bounded by *L*, the x-axis and the line $x = a$, where $a > 0$.

(a) Using integration, find an expression, in terms of a and m, for the volume *V* generated when *R* is rotated through four right angles about the x-axis. [3]

(b) The point with coordinates (a, b) lies on *L*.

(i) Rewrite the expression for the volume *V* found in part *(a)* in terms of a and b.

(ii) Give a geometrical interpretation of your answer. [3]

9. The region R is bounded by the curve $y = \cos x + \sin x$, the x-axis and the lines $x = \frac{\pi}{5}$, $x = \frac{2\pi}{5}$. Find the volume of the solid generated when R is rotated through four right angles about the x-axis. Give your answer correct to two decimal places. [6]

4. The region R is bounded by the curve $y = \cos x + \sec x$, the x-axis and the lines $x = \frac{\pi}{6}$, $x = \frac{\pi}{3}$. Find the volume of the solid generated when R is rotated through four right angles about the x-axis. Give your answer correct to two decimal places. [7]

END OF INTEGRATION - VOLUME OF REVOLUTION PACK

Source: WJEC C3 + C4 (2008 modular spec) · 2011–2017
Curated for WJEC Maths 2017 spec A2 Unit 3 — Topic 13 (2.3.12)