Name	Date started	Target end date

GCE A LEVEL — PURE MATHEMATICS B QUESTION PACK

0975-01 (Legacy C3) + 0976-01 (Legacy C4) · New spec Unit 3 Topic 1 · A2 unit, 35% of A-level, 120 marks, 2h 30min paper

REVISE
.wales

MATHEMATICS — PURE B · NUMERICAL METHODS - SIMPSON'S RULE

Numerical Methods (Simpson's Rule)

Every Simpson's rule question from the legacy WJEC C3 papers (June 2011 – June 2017) that maps onto new-spec A2 Unit 3 numerical methods

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~1 hours 10 minutes

*Derived from the legacy C3/C4 paper's pace of **~1.25 min/mark** (56 marks over 10 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 1 (2.3.13).

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 Q1	5	
2	Jan 12 Q1	6	
3	Jun 12 Q1	6	
4	Jan 13 Q1	4	
5	Jun 13 Q1	5	
6	Jan 14 Q1	6	
7	Jun 14 Q1	6	
8	Jun 15 Q1	5	
9	Jun 16 Q1	6	
10	Jun 17 Q1	7	
	Total	**56**	

Numerical Methods (Simpson's Rule) — what the new spec asks

WJEC GCE A Level Mathematics (from 2017) · Unit 3: Pure Mathematics B · Topic 2.3.13.

Numerical Integration 2.3.13

- Use Simpson's Rule with an odd number of ordinates.
- Approximate integrals where antiderivatives are awkward (e.g. $\ln(\cos x)$, e^{x^2}).
- Quote answers to a stated decimal place — show all working.

Reading the question 2.3.13

- Identify n (number of strips) and h (strip width) from the ordinate count.
- Tabulate ordinates carefully: $y_0, y_1, y_2, \ldots$.
- Part (b): rewrite the second integral in terms of part (a) using log properties.

Numerical Methods - Simpson's Rule in one page

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

Simpson's Rule formula

For $n+1$ ordinates (n even) with step h:

$$\int_a^b f(x)\,dx \approx$$

$\frac{h}{3}\left[y_0 + y_n + 4(y_1 + y_3 + \ldots) + 2(y_2 + y_4 + \ldots)\right]$

The number of strips n is always even; the number of ordinates is $n+1$.

Worked layout

1. Calculate $h = (b-a)/n$.
2. Tabulate $y_0, y_1, \ldots, y_n$ to 4-5 d.p.
3. Apply $\frac{h}{3}[\ldots]$ formula.
4. Round to required d.p. at the very end.

Linking two integrals

Part (b) often asks you to deduce another integral.

Use a log identity: $\ln(ab) = \ln a + \ln b$, or recognise that the integrand is a shifted/scaled version of part (a).

Newton-Raphson

$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$.

Converges fast if started near root; can diverge if $f'(x_n)$ is small.

Trapezium rule

$\int_a^b f(x)\,dx \approx$
$\frac{h}{2}\left[y_0 + y_n + 2(y_1 + \cdots + y_{n-1})\right]$.

Less accurate than Simpson's for the same number of strips.

Errors to avoid

Number of strips $\neq$ number of ordinates.

Forgetting the $\frac{h}{3}$ multiplier.

Mis-grouping odd/even ordinates.

SECTION T1

Numerical Methods (Simpson’s Rule)

Questions 1–10 · 56 marks

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_1^2 \ln(3+x^2)\,dx.$$

Show your working and give your answer correct to four decimal places. [4]

(b) Use your answer to part *(a)* to deduce an approximate value for the integral

$$\int_1^2 \ln\left(\frac{1}{3+x^2}\right)dx.$$

[1]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^{\frac{\pi}{3}} \cos^2 x \, \mathrm{d}x.$$

Show your working and give your answer correct to four decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^{\frac{\pi}{3}} \sin^2 x \, \mathrm{d}x.$$ [2]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^1 e^{x^2}\,dx.$$

Show your working and give your answer correct to four decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^1 e^{x^2+3}\,dx.$$ [2]

1. Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_1^2 \frac{1}{2+e^x}\,dx.$$

Show your working and give your answer correct to three decimal places. [4]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_1^3 \ln\left(x^3 + 6\right) \mathrm{d}x.$$

Show your working and give your answer correct to three decimal places. [4]

(b) Use your answer to part *(a)* to deduce an approximate value for the integral

$$\int_1^3 \ln\sqrt{x^3 + 6}\, \mathrm{d}x.$$ [1]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^{\frac{\pi}{3}} \tan^2 x \, dx.$$

Show your working and give your answer correct to four decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^{\frac{\pi}{3}} \sec^2 x \, dx.$$ [2]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^3 \ln\left(8 + e^x\right) dx.$$

Show your working and give your answer correct to two decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^3 \ln\left(16 + 2e^x\right) dx.$$ [2]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^{\frac{4\pi}{9}} \ln(\cos x)\,dx.$$

Show your working and give your answer correct to four decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^{\frac{4\pi}{9}} \ln(\sec x)\,dx.$$ [1]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_0^{\frac{\pi}{5}} e^{\tan^2 x}\,dx.$$

Show your working and give your answer correct to five decimal places. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_0^{\frac{\pi}{5}} e^{\sec^2 x}\,dx.$$ [2]

1. *(a)* Use Simpson's Rule with five ordinates to find an approximate value for the integral

$$\int_5^7 \ln\left(1+x^2\right)\mathrm{d}x.$$

Show your working and give your answer correct to one decimal place. [4]

(b) **Use your answer to part *(a)*** to deduce an approximate value for the integral

$$\int_5^7 \ln\left(\frac{3}{\sqrt{1+x^2}}\right)\mathrm{dx}.$$

[3]

END OF NUMERICAL METHODS - SIMPSON'S RULE PACK

Source: WJEC C3 + C4 (2008 modular spec) · 2011–2017
Curated for WJEC Maths 2017 spec A2 Unit 3 — Topic 1 (2.3.13)