

Calculus: worked examples

HSC Mathematics Extension 2

These examples show assessable skills, not an official HSC topic weighting or prediction. The 2024 NSW syllabuses have their first HSC examination in 2027; students sitting the 2026 HSC continue under the applicable 2017 syllabus.

Worked example 1 | 2 marks

Catalog reference: ext2_nsbh_2025_q11b_integration_by_parts | seed 41001 | mapping ext2-calculus-1

Integration by parts

Find $\int x \sin(2x) \, dx$.

(a) Evaluate the indefinite integral, omitting the arbitrary constant. [2 marks]

Answer: $\left(\frac{-2x}{2} \cos(2x) + \frac{\sin(2x)}{2} \right) + C$

Integration By Parts: Take $u=x$ and $dv=\sin(2x)$ dx .

Antiderivative: $\frac{-2x \cos(2x) + \sin(2x)}{2} + C$.

Worked example 2 | 3 marks

Catalog reference: ext2_cssa25_symmetric_inverse_tangent_integral | seed 41001 | mapping ext2-calculus-1

A symmetric inverse-tangent integral

Evaluate $\int_{-2}^2 \frac{6}{x^2-8x+52} \, dx$.

(a) Give the exact value. [3 marks]

Answer: $\pi/2$

Complete Square: $x^2-4sx+13s^2=(x-2s)^2+9s^2$.

Inverse Tangent Substitution: $u=(x-2s)/(3s)$ changes the bounds to -1 and 1.

Evaluate Bounds: $\arctan(1) - \arctan(-1) = \pi/2$.

Worked example 3 | 3 marks

Catalog reference: ext2_morris_2025_q11c_tangent_half_angle | seed 41001 | mapping ext2-calculus-1

Tangent half-angle substitution

Evaluate $\int_0^{\pi/2} \frac{1}{1+\cos(2x)} \, dx$.

(a) Evaluate the definite integral. [3 marks]

Answer: $1/2$

Tangent Half Angle: Let $u=\tan(2x/2)$; the limits become 0 and 1.

Simplify Integrand: The transformed integrand is constant $1/2$.

Evaluate Bounds: $1/2$.

Source and methodology

Examples are deterministic curriq catalog generations from existing QDSL archetypes at the published fixed seed. The generator copies only student-facing prompts, mark allocations, topic mappings, display tables or options, checked answers and marking-path results into this resource.

Official syllabus source:

<https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-extension-2-11-12-2024/overview/course>

Teacher verification note: check the mathematics, notation, permitted technology and syllabus fit for your cohort before classroom or assessment use.