

Calculus: worked examples

HSC Mathematics Extension 1

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: ext1_jr25_log_inverse_tangent_derivative | seed 41001 | mapping ext1-c2-2

Logarithm of an inverse tangent

Differentiate $y = \ln(\tan(2x))$.

(a) Find $\frac{dy}{dx}$. [2 marks]

Answer: $\frac{2}{\tan(2x)(1 + 4x^2)}$

Inverse Tangent Derivative: $\frac{2}{1+4x^2}$.

Chain Rule: $\frac{2}{\tan(2x)(1+4x^2)}$.

Worked example 2 | 2 marks

Catalog reference: ext1_cssa25_inverse_tangent_definite_integral | seed 41001 | mapping ext1-c2-2

Inverse-tangent integral

Evaluate $\int_0^3 \frac{1}{(3^2+x^2)} dx$.

(a) Give the exact value. [2 marks]

Answer: $\pi / 12$

Inverse Trig Integration: $1/3$

Definite Integral: $\pi / 12$

Worked example 3 | 2 marks

Catalog reference: ext1_ind_2025_q11b_separable_equation | seed 41001 | mapping ext1-c3-2

A separable differential equation

Solve $\frac{dy}{dx} = 6\sqrt{y}$ given $y=1$ when $x=0$.

(a) Find y as a function of x and state the branch domain $x \geq -1/3$. [2 marks]

Answer: $((3x + 1))^2$

Separate Variables: $\sqrt{y} = 3x + C$.

Apply Initial Condition: $y = (3x+1)^2$ on $x \geq -1/3$.

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-1-11-12-2024/overview/course>

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