

Calculus: worked examples

HSC Mathematics Advanced

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 | 3 marks

Catalog reference: adv_jr24_first_principles_quadratic_derivative | seed 41001 | mapping adv-c1-1

Derivative from first principles

Let $f(x) = x^2 - 2x + 7$.

(a) Differentiate $f(x)$ from first principles. [3 marks]

Answer: $2x - 2$

First Principles Substitution: $(f(x+h)-f(x))/h$

Expand Difference Quotient: $h(2x+h-b)/h$

Evaluate Limit: $2x - 2$

Worked example 2 | 2 marks

Catalog reference: adv_cssa20_differentiate_exponential_quotient | seed 41001 | mapping adv-c2-1

Differentiate an exponential quotient

Differentiate $(e^x)/(x^2+9)$.

(a) Give the simplified derivative. [2 marks]

Answer: $(\exp(x)((x^2 - (2x)) + 9)) / ((x^2 + 9)^2)$

Quotient Rule: $((\exp(x)(x^2 + 9)) - ((2x) \exp(x))) / ((x^2 + 9)^2)$

Algebraic Simplification: $(\exp(x)((x^2 - (2x)) + 9)) / ((x^2 + 9)^2)$

Worked example 3 | 2 marks

Catalog reference: adv_cssa20_definite_polynomial_integral | seed 41001 | mapping adv-c4-1

Definite polynomial integral

Evaluate $\int_{-1}^0 x(3x-4) \, dx$.

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

Answer: 3

Power Rule Integration: $\frac{1}{2}x^3 - (2x^2)$

Fundamental Theorem: 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-advanced-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.