

IB Maths AA HL Unit 5 Calculus Practice Exam

IB Mathematics: Analysis and Approaches HL · 10 questions · 58 marks

Name _____

Date _____

Score / 58

- Answer every question. Show your working: most marks are for method.
- Section A no calculator; Section B calculator allowed. Includes core questions from the SL AA unit, which HL students also sit.
- Topics: Derivative from Definition; Derivative concepts and applications; Power and Basic Derivatives; Basic Indefinite Integrals; Advanced Function Derivatives; Tangents, Normals and Extrema; Chain Rule; Definite Integrals and Area.
- The mark scheme is a separate free PDF: ibmathrevision.com/downloads/practice-exams/hlaa/ib-maths-aa-hl-unit-5-calculus-practice-exam-mark-scheme.pdf

Section A: no calculator

1. Use differentiation from first principles to find $f'(x)$ for $f(x) = 3x^2 - x$. [3]
2. Let $g(x) = x^3 - 12x + 5$. [4]
 - a. Find $g'(x)$. [1]
 - b. Find the values of x for which g is decreasing. [3]
3. The curve $y = ax^3 + bx^2$ passes through $(1, -1)$ and has gradient 0 at that point. [10]
 - a. Write down two equations in a and b . [2]
 - b. Find a and b . [3]
 - c. Find the coordinates of the other point where the gradient is 0. [2]
 - d. Find the equation of the tangent to the curve at $x = 2$. [3]



4. Find $\int \frac{x^3 - 2x}{x^3} dx$, for $x \neq 0$. [3]

5. Use differentiation from first principles to show that the derivative of $f(x) = \frac{1}{x^2}$ is $-\frac{2}{x^3}$. [4]

6. Let $f(x) = x \arctan(2x)$. [8]

a. Find $f'(x)$. [3]

b. Find the exact gradient of the graph of f at $x = \frac{1}{2}$. [2]

c. Find $\frac{d}{dx}(3^x \sec x)$. [3]

7. The curve C has equation $y = x^2 - 4x + 7$. The point $P(3, 4)$ lies on C . [8]

a. Find the equation of the tangent to C at P . [3]

b. Find the equation of the normal to C at P . [2]

c. The normal meets C again at Q . Find the coordinates of Q . [3]



8. Let $h(x) = x\sqrt{2x+1}$, for $x > -\frac{1}{2}$. [8]

a. Show that $h'(x) = \frac{3x+1}{\sqrt{2x+1}}$. [3]

b. Find the x -coordinate of the stationary point of h . [2]

c. Find the equation of the tangent to the graph of h at $x = 4$. [3]

9. The function f is defined by $f(x) = \begin{cases} x^2 + a, & x \leq 1 \\ bx - 1, & x > 1 \end{cases}$. [7]

a. Given that f is continuous at $x = 1$, find a relationship between a and b . [2]

b. Given also that f is differentiable at $x = 1$, find a and b . [3]

c. Using the definition of the derivative, confirm that $f'(1) = 2$ from both sides. [2]

Section B: calculator allowed

10. Let $f(x) = \sqrt{x}e^{-x/3}$, for $x \geq 0$. [3]

a. Use technology to find $\int_0^4 f(x) dx$. [2]

b. Write down what this value represents for the graph of f . [1]



