

IB Maths AA HL Unit 1 Number and Algebra 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: Exponential and Logarithm Properties; Geometric Sequences; Algebraic Identities; Arithmetic Sequences.
- The mark scheme is a separate free PDF: ibmathrevision.com/downloads/practice-exams/hlaa/ib-maths-aa-hl-unit-1-number-algebra-practice-exam-mark-scheme.pdf

Section A: no calculator

- Calculate $3.2 \times 10^5 + 4.5 \times 10^4$, giving your answer in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. [2]

- The sequence 3, − 6, 12, − 24, ... is geometric. [3]
 - Write down the common ratio. [1]
 - Find which term of the sequence is equal to 3072. [2]

- A single bacterium has a mass of 9.5×10^{-13} g. A sample contains 2.4×10^{10} bacteria. [3]
 - Find the total mass of the bacteria in the sample, giving your answer in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. [2]
 - Write your answer to part (a) as an ordinary decimal number. [1]

- This question is about proving identities. [6]
 - Show that $(n + 1)^3 - n^3 = 3n^2 + 3n + 1$. [1]
 - Hence prove that the difference between the cubes of two consecutive integers is always odd. [3]
 - Prove that $\frac{x}{x-1} - \frac{x}{x+1} \equiv \frac{2x}{x^2-1}$, for $x \neq \pm 1$. [2]



5. It is given that $(2.5 \times 10^n)^3 = 1.5625 \times 10^{22}$, where $n \in \mathbb{Z}$. [4]

a. Show that $(2.5 \times 10^n)^3 = 1.5625 \times 10^{3n+1}$. [2]

b. Hence find n . [2]

6. Consider the series $\sum_{r=1}^n 2^{r+1}$. [6]

a. Write down the first term and the common ratio. [2]

b. Find the value of $\sum_{r=1}^6 2^{r+1}$. [2]

c. Find the smallest value of n for which the sum exceeds 2000. [2]

7. The sum of the first n terms of a sequence is $S_n = 3n^2 + 5n$, for $n \in \mathbb{Z}^+$. [11]

a. Find u_1 and u_2 . [2]

b. Show that $u_n = 6n + 2$, and hence that the sequence is arithmetic. [3]

c. Find the least value of n for which $S_n > 1000$. [3]

d. The terms $u_k, u_{k+1}, \dots, u_{2k}$ are added. Find this sum in terms of k . [3]



8. This question should be answered without a calculator. [8]
- a. Solve $4^x - 6 \times 2^x + 8 = 0$. [3]
 - b. Solve $e^{2x} - 5e^x + 6 = 0$, giving your answers exactly. [3]
 - c. Given that $\log_{10} 2 = a$, express $\log_{10} 0.08$ in terms of a . [2]

Section B: calculator allowed

9. Consider the geometric series $2 + 6 + 18 + 54 + \dots$ [5]
- a. Show that the sum of the first n terms is $S_n = 3^n - 1$. [2]
 - b. Find the least number of terms needed for the sum to exceed one million. [3]
10. Zara is offered two salary plans. Plan A pays €42 000 in the first year, increasing by €1500 each year. [10]
Plan B pays €40 000 in the first year, increasing by 4.5% each year.
- a. Find the salary in year 10 under each plan. [3]
 - b. Find the total amount earned over the first 10 years under each plan. [3]
 - c. Find the first year in which the annual salary under Plan B exceeds that under Plan A. [2]
 - d. Find the least number of complete years after which the total earned under Plan B exceeds the total earned under Plan A. [2]



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