

IB Maths AA HL Unit 1 Number and Algebra Practice Exam: Mark Scheme

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

- M marks are for a correct method; A marks for an accurate answer that follows a correct method; R marks are for clear reasoning; AG means the answer is given in the question, so the working must be complete.
- Accept any correct method that reaches a correct answer, unless the question says which method to use.
- Practise these topics online with instant feedback: ibmathrevision.com/HLAAUnit1

Section A: no calculator

Question 1

2 marks

$$4.5 \times 10^4 = 0.45 \times 10^5 \text{ (or } 3.2 \times 10^5 = 32 \times 10^4) \text{ (M1)}$$

$$3.2 \times 10^5 + 0.45 \times 10^5 = 3.65 \times 10^5 \text{ A1}$$

Question 2

3 marks

a. $r = -2$ A1

b. $3(-2)^{n-1} = 3072 \implies (-2)^{n-1} = 1024 = (-2)^{10} \text{ (M1)}$

$n = 11$ A1

Question 3

3 marks

a. $9.5 \times 2.4 \times 10^{-13+10} = 22.8 \times 10^{-3} \text{ (M1)}$
 $= 2.28 \times 10^{-2} \text{ g A1}$

b. 0.0228 g A1

Question 4

6 marks

a. $n^3 + 3n^2 + 3n + 1 - n^3 \text{ M1}$
 $= 3n^2 + 3n + 1 \text{ AG}$

b. $3n^2 + 3n = 3n(n+1) \text{ M1}$
 $n(n+1)$ is a product of consecutive integers, so even R1
 even $+1$ is odd R1

c. $\frac{x(x+1) - x(x-1)}{(x-1)(x+1)} \text{ M1}$
 $= \frac{x^2 + x - x^2 + x}{x^2 - 1} \text{ A1}$
 $= \frac{2x}{x^2 - 1} \text{ AG}$

Question 5

4 marks

a. $(2.5 \times 10^n)^3 = 2.5^3 \times 10^{3n} = 15.625 \times 10^{3n} \text{ M1A1}$
 $= 1.5625 \times 10^1 \times 10^{3n} = 1.5625 \times 10^{3n+1} \text{ AG}$

b. $3n + 1 = 22 \text{ (M1)}$
 $n = 7 \text{ A1}$



Question 6

6 marks

- a. $u_1 = 4, r = 2$ **A1A1**
- b. $\frac{4(2^6 - 1)}{2 - 1}$ **(M1)**
 $= 252$ **A1**
- c. $4(2^n - 1) > 2000 \implies 2^n > 501$ **(M1)**
 $2^8 = 256 < 501 < 512 = 2^9$, so $n = 9$ **A1**

Question 7

11 marks

- a. $u_1 = S_1 = 8$ **A1**
 $u_2 = S_2 - S_1 = 22 - 8 = 14$ **A1**
- b. $u_n = S_n - S_{n-1} = 3n^2 + 5n - 3(n-1)^2 - 5(n-1)$ **M1**
 $= 6n + 2$ **A1**
 $u_{n+1} - u_n = 6$, a constant **R1AG**
- c. $3n^2 + 5n - 1000 > 0$ **(M1)**
 $S_{17} = 952 < 1000$ and $S_{18} = 1062 > 1000$ (or solving the quadratic: $n > 17.4$) **(A1)**
 $n = 18$ **A1**
- d. $S_{2k} - S_{k-1}$ **M1**
 $= 3(4k^2) + 10k - 3(k-1)^2 - 5(k-1)$ **(A1)**
 $= 9k^2 + 11k + 2$ **A1**

Question 8

8 marks

- a. let $u = 2^x$: $u^2 - 6u + 8 = 0$ **M1**
 $u = 2$ or $u = 4$ **A1**
 $x = 1$ or $x = 2$ **A1**
- b. $(e^x - 2)(e^x - 3) = 0$ **M1**
 $x = \ln 2$ or $x = \ln 3$ **A1A1**
- c. $\log_{10}\left(\frac{8}{100}\right) = 3 \log_{10} 2 - 2$ **M1**
 $= 3a - 2$ **A1**

Section B: calculator allowed**Question 9**

5 marks

- a. $u_1 = 2, r = 3$ **A1**
 $S_n = \frac{2(3^n - 1)}{3 - 1} = 3^n - 1$ **M1AG**
- b. $3^n - 1 > 10^6$ **(M1)**
 $n > \frac{\ln(10^6 + 1)}{\ln 3} = 12.57 \dots$ **(A1)**
 $n = 13$ **A1**



Question 10**10 marks**

a. A: $42\,000 + 9(1500) = 55\,500$ **A1**

B: $40\,000(1.045)^9 = €59\,443.81$ **(M1)A1**

b. A: $S_{10} = \frac{10}{2}(2 \times 42\,000 + 9 \times 1500) = €487\,500$ **A1**

B: $S_{10} = \frac{40\,000(1.045^{10} - 1)}{0.045} = €491\,528.37$ **(M1)A1**

c. $40\,000(1.045)^{n-1} > 42\,000 + 1500(n - 1)$ **(M1)**

$n = 6$ **A1**

d. $\frac{40\,000(1.045^n - 1)}{0.045} > \frac{n}{2}(84\,000 + 1500(n - 1))$ **(M1)**

$n = 9$ **A1**

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