

IB Maths AI HL Unit 2 Functions Practice Exam: Mark Scheme

IB Mathematics: Applications and Interpretation HL · 12 questions · 60 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.
- 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/HLAIUnit2

Question 1

4 marks

- (2, 8) **A1**
- (6, 5) **A1**
- (2, 10) **A1**
- (−2, 5) **A1**

Question 2

3 marks

- horizontal stretch **A1**
scale factor 3 **A1**
- reflection in the x -axis **A1**

Question 3

3 marks

- 2.00, 2.01, 2.01, 2.01, 2.01 **A1**
- ratios approximately constant, so the belief is supported **R1**
 $P \approx 2.01\sqrt{L}$ **A1**

Question 4

4 marks

- translation: $y = (x + 3)^2 + 2$ **A1**
stretch: $y = 4(x + 3)^2 + 8$ **A1**
- (−3, 8) **A1**
- no: stretching first gives $y = 4x^2$, then translating gives $y = 4(x + 3)^2 + 2$, a different vertex **R1**

Question 5

5 marks

- horizontal translation 2 units to the right (2 hours later) **A1**
vertical translation 4 units up (4 degrees warmer) **A1**
- $12 + 6 + 4 = 22$ °C **A1**
 $15(t - 2) = 90$ **M1**
 $t = 8$ (08:00) **A1**



Question 6

5 marks

- a. increasing exponential through (0, 2) **A1**
 decreasing straight line with gradient -1 through (0, 8) **A1**
- b. (2.50, 5.50) **A1A1**
- c. $y = 0$ **A1**

Question 7

6 marks

- a. ratios 1.36, 1.34, 1.36, 1.34, 1.36 (approximately constant) **A1**
 exponential **R1**
- b. $a = 50.1$, $b = 1.35$ **A1A1**
- c. 554 thousand **A1**
 extrapolation; growth cannot continue indefinitely (market saturation) **R1**

Question 8

5 marks

- a. 20, 28, 20 **A1A1**
- b. $\frac{|20 - 22|}{22} \times 100$ **(M1)**
 $= 9.09\%$ **A1**
- c. good fit: predictions within about 10% of the actual values **R1**

Question 9

5 marks

- a. $f(-x) = -x^3 + 3x$ **A1**
 $g(x) = -x^3 + 3x - 2$ **A1**
- b. $(-1, -4)$ **A1A1**
 local minimum: a reflection in the y -axis and a vertical translation do not turn a minimum into a maximum **R1**

Question 10

8 marks

- a. $T = 2.96$ s **A1**
- b. $t = 1.43$ s **A1**
 $h = 11.5$ m **A1**
- c. concave-down parabola starting at (0, 1.5) **A1**
 maximum and t -intercept labelled **A1**
- d. $-4.9t^2 + 14t + 1.5 = 8$ **(M1)**
 $t = 0.583$ or $t = 2.27$ **(A1)**
 1.69 s **A1**

Question 11

6 marks

- a. period = 12 hours **(A1)**
 $b = \frac{360}{12} = 30$ **M1AG**
- b. $a = \frac{7.4 - 1.8}{2} = 2.8$ **A1**
 $d = \frac{7.4 + 1.8}{2} = 4.6$ **A1**
- c. $2.8 \cos(30t) + 4.6 < 3.5$ (or intersection of graphs on GDC) **(M1)**
 $3.77 < t < 8.23$ (between about 03:46 and 08:14) **A1**



Question 12

6 marks

- a. horizontal translation 3 units to the right **A1**
vertical stretch, scale factor 1.5 **A1**
- b. $R = 120$ **A1**
the rival's number of subscribers approaches 120 000 in the long term **R1**
- c. $N(t) = R(t)$, solved graphically or otherwise **(M1)**
 $t = 10.0$ months **A1**

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