IB MATHS AI HL · UNIT 2

Quadratic Modelling: exam practice

10 questions · 29 marks · worked solutions and markschemes

Name _____ Date _____ Score / 29

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/quadratic-modelling-exam-practice

1. **2 marks · Paper 2 style · calculator allowed**

A stone is thrown from a cliff and its height above the sea is $h = -4.9t^2 + 15t + 40$ m.

Find when the stone hits the sea. **[2]**

2. **2 marks · Paper 2 style · calculator allowed**

A cable hangs between two towers 60 m apart. Its height is $h(x) = 0.01x^2 - 0.6x + 20$, for $0 \le x \le 60$.

Find the lowest height of the cable. **[2]**

3. **3 marks · Paper 2 style · calculator allowed**

A rectangular garden has perimeter 50 m and area $144\ \text{m}^2$.

Find its length and width. **[3]**

4. **3 marks · Paper 1 style · calculator allowed**

A company's revenue is $R(p) = p(400 - 8p)$ dollars at a price of $\$p$.

Find the price that maximises revenue and the maximum revenue. **[3]**

5. **3 marks · Paper 2 style · calculator allowed**

A quadratic model passes through $(1, 6)$, $(2, 11)$ and $(4, 15)$.

Find the model in the form $y = ax^2 + bx + c$. **[3]**

6. **3 marks · Paper 1 style · calculator allowed**

The number of units sold is $N = -2p^2 + 48p$ when the price is $\$p$.

Find the price range that gives sales of at least 160 units. **[3]**

7. **3 marks · Paper 2 style · calculator allowed**

A field is enclosed by 200 m of fencing along three sides of a rectangle, with a river forming the fourth side.

Find the maximum area. **[3]**

8. **4 marks · Paper 2 style · calculator allowed**

The path of a ball is $h(x) = -0.05x^2 + 1.2x + 1.5$ metres, where x is the horizontal distance.

Find the maximum height and the horizontal distance when the ball lands. **[4]**

9. **4 marks · Paper 2 style · calculator allowed**

An arch is modelled by $y = a(x - 10)^2 + 8$ and passes through $(0, 0)$.

Find a, the width of the arch at ground level and its height at $x = 4$. **[4]**

10. **2 marks · Paper 2 style · calculator allowed**

The data (t, h): $(0, 2.0)$, $(1, 6.8)$, $(2, 9.7)$, $(3, 10.5)$, $(4, 9.4)$ give the height of a model rocket. A quadratic regression is fitted.

Find the regression equation. **[2]**

Answers and worked solutions

Question 1 2 marks

Answer: $4.77\ s$

$h = 0$ **M1**

$t = 4.77\ s$ **A1**

Question 2 2 marks

Answer: 11

$x = 30$ **A1**

$11\ m$ **A1**

Question 3 3 marks

Answer: $16\ m$ by $9\ m$

$x(25 - x) = 144$ **M1**

$x^2 - 25x + 144 = 0$ **A1**

$16\ m$ by $9\ m$ **A1**

Question 4 3 marks

Answer: $\$25$; $\$5000$

$R(p) = 400p - 8p^2$ **A1**

$p = 25$ **A1**

$\$5000$ **A1**

Question 5 3 marks

Answer: $y = -x^2 + 8x - 1$

system of three equations **M1**

GDC **(M1)**

$y = -x^2 + 8x - 1$ **A1**

Question 6 3 marks

Answer: $4 \leq p \leq 20$

$-2p^2 + 48p \geq 160$ **M1**

$p^2 - 24p + 80 \leq 0$ **A1**

$4 \leq p \leq 20$ **A1**

Question 7 3 marks

Answer: $5000\ \text{m}^2$

$A = x(200 - 2x)$ **M1**

$x = 50$ **A1**

$5000\ \text{m}^2$ **A1**

Question 8 4 marks

Answer: $8.7\ m$; $25.2\ m$

vertex $x = 12$ **M1**

$h = 8.7\ m$ **A1**

$h = 0$ **M1**

$x = 25.2\ m$ **A1**

Question 9 4 marks

Answer: $a = -0.08$; $20\ m$; $5.12\ m$

$0 = 100a + 8$, $a = -0.08$ $M1$ **A1**

width $20\ m$ **A1**

$5.12\ m$ **A1**

Question 10 2 marks

Answer:

$h = -0.993t^2 + 5.82t + 1.99$

GDC quadratic regression **(M1)**

$h = -0.993t^2 + 5.82t + 1.99$ **A1**

Every solution is also on ibmathrevision.com/hlai/quadratic-modelling-exam-practice

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