IB MATHS AA HL · UNIT 2

Quadratic Functions: exam practice

10 questions · 38 marks · worked solutions and markschemes

Name _____ Date _____ Score / 38

- 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/hlaa/quadratic-functions-exam-practice

1. **3 marks · Paper 1 style · no calculator**

Show that the equation $2x^2 + kx - 3 = 0$ has two distinct real roots for all real values of k.

Show this. **[3]**

2. **3 marks · Paper 1 style · no calculator**

Solve $3x^2 - 5x - 2 = 0$ by factorising.

Find x. **[3]**

3. **4 marks · Paper 1 style · no calculator**

The equation $x^2 + (k-2)x + 4 = 0$ has no real roots.

Find the set of possible values of k. **[4]**

4. **4 marks · Paper 1 style · no calculator**

The quadratic $y = ax^2 + bx + c$ has x-intercepts -1 and 5 and passes through $(1, -16)$.

Find a, b and c. **[4]**

5. **4 marks · Paper 1 style · no calculator**

The line $y = mx - 1$ is a tangent to the curve $y = x^2 + 3$.

Find the possible values of m. **[4]**

6. **4 marks · Paper 1 style · no calculator**

Solve $x^4 - 13x^2 + 36 = 0$.

Find all real x. **[4]**

7. **4 marks · Paper 1 style · no calculator**

Write $x^2 - 8x + 3$ in the form $(x - h)^2 + k$, and hence solve $x^2 - 8x + 3 = 0$ exactly.

(a) Complete the square. **[2]**

(b) Solve the equation. **[2]**

8. **3 marks · Paper 2 style · calculator**

A farmer has 120 m of fencing to make a rectangular pen against a long wall, using the wall as one side. The side at right angles to the wall has length x m.

(a) Show that the area is $A = 120x - 2x^2$. **[1]**

(b) Find the maximum area. **[2]**

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

A ball is thrown so that its height after t seconds is $h = 1.5 + 14t - 4.9t^2$ metres.

(a) Find the maximum height. **[2]**

(b) Find the time when the ball hits the ground. **[2]**

10. **5 marks · Paper 1 style · no calculator**

Let $f(x) = 2x^2 + 12x + 13$.

(a) Write $f(x)$ in the form $a(x - h)^2 + k$. **[3]**

(b) Write down the equation of the axis of symmetry and the minimum value. **[2]**

Answers and worked solutions

Question 1 — 3 marks

Answer: a proof: the worked solution above is the full answer

$\Delta = k^2 + 24$ $M1$A1

$k^2 \geq 0$ so $\Delta > 0$ for all k R1

AG

Question 2 — 3 marks

Answer: $x = -\frac{1}{3}$, $x = 2$

$(3x + 1)(x - 2) = 0$ $M1$A1

$x = -\frac{1}{3}$, $x = 2$ A1

Question 3 — 4 marks

Answer: $-2 < k < 6$

$\Delta = (k - 2)^2 - 16 < 0$ $M1$ A1

$-4 < k - 2 < 4$ A1

$-2 < k < 6$ A1

Question 4 — 4 marks

Answer: $a = 2, b = -8, c = -10$

$y = a(x + 1)(x - 5)$ M1

$-16 = a(2)(-4)$, $a = 2$ A1

$y = 2x^2 - 8x - 10$ A1

$a = 2, b = -8, c = -10$ A1

Question 5 — 4 marks

Answer: $m = \pm 4$

$x^2 - mx + 4 = 0$ M1

$\Delta = m^2 - 16 = 0$ $M1$A1

$m = \pm 4$ A1

Question 6 — 4 marks

Answer: $x = \pm 2$, $x = \pm 3$

let $u = x^2$: $u^2 - 13u + 36 = 0$ M1

$u = 4$ or $u = 9$ A1

$x = \pm 2$, $x = \pm 3$ A1A1

Question 7 — 4 marks

Answer: (a) $(x - 4)^2 - 13$; (b) $x = 4 \pm \sqrt{13}$

(a)

$(x - 4)^2 - 13$ A1A1

(b)

$(x - 4)^2 = 13$ M1

$x = 4 \pm \sqrt{13}$ A1

Question 8 — 3 marks

Answer: (b) $1800\ \text{m}^2$

(a)

other side $120 - 2x$, so $A = x(120 - 2x)$ A1 AG

(b)

vertex at $x = 30$ M1

$1800\ \text{m}^2$ A1

Question 9 — 4 marks

Answer: (a) $11.5\ m$; (b) $2.96\ s$

(a)

$t = \frac{14}{9.8}$ M1

$11.5\ m$ A1

(b)

$4.9t^2 - 14t - 1.5 = 0$ M1

$t = 2.96\ s$ A1

Question 10 — 5 marks

Answer: (a) $2(x + 3)^2 - 5$; (b) $x = -3$; minimum -5

(a)

$2(x^2 + 6x) + 13$ M1

$2(x + 3)^2 - 5$ A1A1

(b)

$x = -3$ A1

-5 A1

Every solution is also on ibmathrevision.com/hlaa/quadratic-functions-exam-practice
Our own original questions, written and checked by IB Math Revision. IB Math Revision is independent and is not affiliated with, endorsed by or connected to the International Baccalaureate Organization. This work/product/service has been developed independently from and is not endorsed by the International Baccalaureate Organization. International Baccalaureate, Baccalauréat International, Bachillerato Internacional and IB are registered trademarks owned by the International Baccalaureate Organization.