MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
34	55 minutes	3

Name: _____ Class: _____

Date: _____

MARK ____ / 34

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 Solve for x: $x^2 - 4 > 0$ (1)

A) $x > 2$ only
B) $-2 < x < 2$
C) $x < -2$ or $x > 2$ ✓
D) $x > -2$

Answer: C — The parabola lies above the x-axis OUTSIDE its roots -2 and 2.

- **A** — the branch $x < -2$ works as well
- **B** — that is where the parabola is BELOW the axis
- **D** — between the roots the expression is negative, so that set is wrong

1.2 Solve for x: $x^2 - 4 < 0$ (1)

A) $x < -2$ or $x > 2$
B) $x < 2$
C) $x < 4$
D) $-2 < x < 2$ ✓

Answer: D — The parabola dips below the x-axis BETWEEN its roots.

- **A** — that is where the parabola is ABOVE the axis
- **B** — $x = -5$ satisfies $x < 2$ but gives 21, which is positive
- **C** — square-rooted one side only and never used the roots

1.3 Solve for x: $x(x - 4) + 2(4 - x) \leq 0$ (1)

A) $2 \leq x \leq 4$ ✓
B) $0 \leq x \leq 4$
C) $x \leq 2$ or $x \geq 4$
D) $-2 \leq x \leq -4$

Answer: A — The expression simplifies to $x^2 - 6x + 8 = (x - 2)(x - 4)$, which is ≤ 0 between its roots.

- **B** — read factors off the original brackets without simplifying first
- **C** — that is where the expression is POSITIVE
- **D** — the roots are $+2$ and $+4$, not negative

1.4 Solve for x: $(x+1)(x-5) \geq 0$ (1)

A) $x \geq -1$

B) $x \leq -1$ **or** $x \geq 5$ ✓

C) $x \geq 5$

D) $-1 \leq x \leq 5$

> **Answer: B** — A product of two factors is positive OUTSIDE the roots.
> - **A** — $x = 0$ lies in that set but gives $(1)(-5) = -5$
> - **C** — the branch $x \leq -1$ works as well
> - **D** — that is where the product is NEGATIVE

1.5 Solve for x: $x^2 \geq 9$ (1)

A) $-3 \leq x \leq 3$

B) $x \geq -3$

C) $x \geq 3$

D) $x \leq -3$ **or** $x \geq 3$ ✓

> **Answer: D** — $x^2 - 9 \geq 0$ holds outside the roots ± 3.
> - **A** — that is where $x^2 \leq 9$
> - **B** — $x = 0$ lies in that set, but 0 is not ≥ 9
> - **C** — $x = -4$ works too: $(-4)^2 = 16$, which is ≥ 9

1.6 The FIRST step in solving a quadratic inequality is to ... (1)

A) reverse the inequality sign

B) **move everything to one side so it is compared with 0, then factorise** ✓

C) take the square root of both sides

D) divide both sides by x

> **Answer: B** — The sign of the expression can only be read off once it is a product compared with zero.
> - **A** — the sign changes only when you multiply or divide by a negative
> - **C** — square-rooting loses the negative branch of the solution
> - **D** — dividing by x is not allowed — x may be zero or negative

1.7 Solve for x: $x^2 + x - 6 \leq 0$ (1)

A) $-3 \leq x \leq 2$ ✓

B) $-2 \leq x \leq 3$

C) $x \leq 2$

D) $x \leq -3$ or $x \geq 2$

> **Answer: A** — $(x+3)(x-2) \leq 0$ holds between the roots -3 and 2.
> - **B** — the signs of the two roots have been swapped
> - **C** — $x = -10$ satisfies $x \leq 2$ but gives 84, which is positive
> - **D** — that is where the expression is POSITIVE

1.8 If a quadratic has NO real roots and $a > 0$, then $ax^2 + bx + c > 0$ for ... (1)

A) $x > 0$ only

B) $x < 0$ only

C) **all real values of x** ✓

D) no values of x

> **Answer: C** — The parabola opens upward and never reaches the axis, so it lies entirely above it.
> - **A** — the graph is above the axis for negative x as well
> - **B** — the graph is above the axis for positive x as well
> - **D** — the whole graph is above the axis, so every x works

1.9 Solve for x: $x^2 < 0$ (1)

A) there is no real value of x ✓ **B)** all real x

C) $x = 0$ **D)** $x < 0$

> **Answer: A** — A square is never negative.
> - **B** — no square is negative, so no x works
> - **C** — $0^2 = 0$, which is not LESS than 0
> - **D** — $(-3)^2 = 9$, which is positive

1.10 Solve for x: $(x - 3)^2 > 0$ (1)

A) $x = 3$ **B)** $x > 3$

C) every real x except $x = 3$ ✓ **D)** all real x

> **Answer: C** — A square is positive everywhere except where it is zero, and it is zero at $x = 3$.
> - **A** — at $x = 3$ the value is exactly 0
> - **B** — $x = 0$ gives 9, which is greater than 0, so $x < 3$ works too
> - **D** — at $x = 3$ the value is 0, which is not GREATER than 0

ANSWER GRID — MARKING GUIDELINE

1.1	A	B	**C**	D
1.2	A	B	C	**D**
1.3	**A**	B	C	D
1.4	A	**B**	C	D
1.5	A	B	C	**D**
1.6	A	**B**	C	D
1.7	**A**	B	C	D
1.8	A	B	**C**	D
1.9	**A**	B	C	D
1.10	A	B	**C**	D

QUESTION 2 [12 MARKS]

Solve for x. Show the critical values and give your answers in interval notation where asked.

2.1 $2x^2 - 5x + 3 < 0$ (4)

> $(2x - 3)(x - 1) = 0$ gives critical values $x = \frac{3}{2}$ and $x = 1$ *(2)*
>
> The parabola opens upwards, and < 0 means BELOW the axis — between the roots *(1)*
>
> **$1 < x < \frac{3}{2}$** *(1)*

2.2 $x^2 - x - 6 \geq 0$ (4)

> $(x - 3)(x + 2) = 0$ gives $x = 3$ and $x = -2$ *(2)*
>
> ≥ 0 means ON or ABOVE the axis — outside the roots *(1)*
>
> **$x \leq -2$ or $x \geq 3$** *(1)*

2.3 $-x^2 + 4 > 0$ **(4)**

> Multiply by -1 and REVERSE: $x^2 - 4 < 0$ *(2)*
> Critical values ± 2 *(1)*
> **$-2 < x < 2$** *(1)*

QUESTION 3 [12 MARKS]

Answer the questions below.

3.1 Solve for x: $x^2 \leq 2x + 8$ **(5)**

> $x^2 - 2x - 8 \leq 0$ *(1)*
> $(x - 4)(x + 2) \leq 0$ *(2)*
> The critical values are -2 and 4, and the parabola is BELOW the axis between them *(1)*
> **$-2 \leq x \leq 4$** *(1)*

3.2 Write your answer to the previous part in interval notation. **(2)**

> **$[-2\,;\,4]$** *(2)* — square brackets because both end values are included

3.3 For which values of x is the graph of $y = x^2 - x - 6$ BELOW the graph of $y = 2x - 6$? Show all your working. **(5)**

> $x^2 - x - 6 < 2x - 6$ *(1)*
> $x^2 - 3x < 0$ *(1)*
> $x(x - 3) < 0$ *(1)*
> **$0 < x < 3$** *(2)*

TOTAL: 34 marks

This question paper consists of 3 questions.

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