MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
36	55 minutes	3

Name: ..... Class: .....

Date: .....

MARK ____ / 36

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 $\sqrt{50}$ in simplest surd form is ... (1)

A) $2\sqrt{5}$ **B)** $\sqrt{25}$

C) $25\sqrt{2}$ **D)** $5\sqrt{2}$ ✓

Answer: D — $50 = 25 \times 2$, and $\sqrt{25} = 5$.

- **A** — took the root of the wrong factor
- **B** — dropped the factor of 2 altogether
- **C** — left the 25 under the root as well as outside it

1.2 $\sqrt{12} + \sqrt{27} = ...$ (1)

A) $5\sqrt{3}$ ✓ **B)** $\sqrt{39}$

C) $6\sqrt{3}$ **D)** $5\sqrt{6}$

Answer: A — $\sqrt{12} = 2\sqrt{3}$ and $\sqrt{27} = 3\sqrt{3}$, so the sum is $5\sqrt{3}$.

- **B** — added the numbers UNDER the roots — surds do not add that way
- **C** — MULTIPLIED the coefficients 2 and 3 instead of adding them
- **D** — added the coefficients but added the surds as well

1.3 $\sqrt{8} \times \sqrt{2} = \ldots$ (1)

A) $\sqrt{10}$ **B) 4 ✓**

C) $2\sqrt{2}$ **D)** 16

> **Answer: B** — $\sqrt{8} \times \sqrt{2} = \sqrt{16} = 4$.
> - **A** — ADDED under the roots instead of multiplying
> - **C** — that is $\sqrt{8}$ on its own
> - **D** — forgot to take the root of 16

1.4 Rationalise the denominator of $\frac{3}{\sqrt{5}}$. (1)

A) $\frac{\sqrt{15}}{5}$ **B)** $\frac{3\sqrt{5}}{\sqrt{5}}$

C) $\frac{3\sqrt{5}}{5}$ ✓ **D)** $\frac{3}{5}$

> **Answer: C** — Multiply top and bottom by $\sqrt{5}$: $(3\sqrt{5}) \div (\sqrt{5} \times \sqrt{5}) = \frac{3\sqrt{5}}{5}$.
> - **A** — multiplied 3 by $\sqrt{5}$ as though 3 were $\sqrt{3}$
> - **B** — multiplied only the numerator by $\sqrt{5}$
> - **D** — dropped the $\sqrt{5}$ from the numerator

1.5 Rationalise the denominator of $\frac{2}{\sqrt{3}-1}$. (1)

A) $\sqrt{3}+1$ ✓ **B)** $\frac{2(\sqrt{3}+1)}{4}$

C) $\sqrt{3}-1$ **D)** $2\sqrt{3}+2$

> **Answer: A** — Multiply top and bottom by the conjugate $\sqrt{3}+1$; the denominator becomes $3-1=2$, which cancels the 2 on top.
> - **B** — used $3+1=4$ for the denominator instead of $3-1=2$
> - **C** — used $\sqrt{3}-1$ as the conjugate — the SIGN must be changed
> - **D** — forgot to divide by the denominator of 2

1.6 The CONJUGATE of $\sqrt{7}+2$ is ... (1)

A) $2+\sqrt{7}$ **B)** $-\sqrt{7}-2$

C) $\sqrt{7}-2$ ✓ **D)** $\sqrt{7}+2$

> **Answer: C** — The conjugate keeps both terms and changes the sign BETWEEN them.
> - **A** — that is the same expression with its terms swapped
> - **B** — changed the sign of BOTH terms — that is the negative of the expression, not its conjugate
> - **D** — that is the expression itself, unchanged

1.7 If $\sqrt{x} = 5$, then $x = \ldots$ (1)

A) 10 **B)** 5

C) 25 ✓ **D)** $\sqrt{5}$

> **Answer: C** — Squaring both sides gives $x = 25$.
> - **A** — doubled 5 instead of squaring it
> - **B** — that is $\sqrt{x}$, not x
> - **D** — square-rooted again instead of squaring

1.8 $\sqrt{47}$ lies between which TWO integers? (1)

A) 23 and 24 **B)** 7 and 8

C) 5 and 6 **D) 6 and 7 ✓**

> **Answer: D** — $6^2 = 36$ and $7^2 = 49$, and 47 lies between them.
> - **A** — halved 47 instead of square-rooting it
> - **B** — $7^2 = 49$ is ABOVE 47, so 7 is the upper integer, not the lower
> - **C** — $6^2 = 36$ is already below 47, so 5 is too low

1.9 $(\sqrt{5})^2 - (\sqrt{3})^2 = \ldots$ (1)

A) $\sqrt{15}$ **B)** 8

C) $\sqrt{2}$ **D) 2 ✓**

> **Answer: D** — Squaring a square root removes it, leaving $5 - 3 = 2$.
> - **A** — multiplied the two surds instead of squaring and subtracting
> - **B** — ADDED instead of subtracting
> - **C** — left the answer under a root

1.10 For $\sqrt{x-3}$ to be REAL, x must satisfy ... (1)

A) $x \leq 3$ **B) $x \geq 3$ ✓**

C) $x > 3$ **D)** $x \geq -3$

> **Answer: B** — The expression under the root may not be negative, so $x - 3 \geq 0$.
> - **A** — that makes $x - 3$ negative
> - **C** — $x = 3$ gives $\sqrt{0} = 0$, which IS real, so 3 is included
> - **D** — solved $x + 3 \geq 0$ instead of $x - 3 \geq 0$

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 [11 MARKS]

Simplify the following WITHOUT the use of a calculator. Leave your answers in simplest surd form.

2.1 $\sqrt{12} + \sqrt{27} - \sqrt{3}$ (4)

$= 2\sqrt{3} + 3\sqrt{3} - \sqrt{3}$ *(3)*
$= \mathbf{4\sqrt{3}}$ *(1)*

2.2 $(\sqrt{5}-2)(\sqrt{5}+2)$ **(3)**

A difference of two squares *(1)*
$= 5 - 4$ *(1)* $= \mathbf{1}$ *(1)*

2.3 $\sqrt{72}-\sqrt{50}+\sqrt{8}$ **(4)**

$= 6\sqrt{2} - 5\sqrt{2} + 2\sqrt{2}$ *(3)*
$= \mathbf{3\sqrt{2}}$ *(1)*

QUESTION 3 [15 MARKS]

Rationalise the denominators and answer the questions that follow.

3.1 $\dfrac{4}{1+\sqrt{2}}$ **(5)**

Multiply by the CONJUGATE $1-\sqrt{2}$ *(1)*
$= \dfrac{4(1-\sqrt{2})}{1-2}$ *(3)*
$= \mathbf{4\sqrt{2} - 4}$ *(1)*

3.2 $\dfrac{\sqrt{3}}{\sqrt{3}-1}$ **(5)**

Multiply by $\sqrt{3}+1$ *(1)*
$= \dfrac{3+\sqrt{3}}{3-1}$ *(3)*
$= \dfrac{\mathbf{3+\sqrt{3}}}{\mathbf{2}}$ *(1)*

3.3 Determine, without a calculator, between which two consecutive integers $\sqrt{72}$ lies. **(3)**

$8^2 = 64$ and $9^2 = 81$ *(2)*
$\mathbf{8 < \sqrt{72} < 9}$ *(1)*

3.4 Explain why $\sqrt{9}+\sqrt{16} \neq \sqrt{25}$. **(2)**

$3 + 4 = 7$ but $\sqrt{25} = 5$ *(1)*; the root of a SUM is not the sum of the roots *(1)*

TOTAL: 36 marks

This question paper consists of 3 questions.

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