MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
33	50 minutes	3

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

Date: .....

MARK ____ / 33

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 Complete: $\frac{1}{5}$ is ... (1)

A) an irrational number
B) a natural number
C) a rational number ✓
D) a non-real number

Answer: C — It can be written as a ratio of two integers, so it is rational.

- **A** — irrational numbers cannot be written as a ratio of integers
- **B** — the natural numbers are 1; 2; 3; ...
- **D** — it is a perfectly ordinary real number

1.2 Which one of the following is IRRATIONAL? (1)

A) $\sqrt{16}$
B) $\frac{2}{3}$
C) $\sqrt{18}$ ✓
D) -7

Answer: C — 18 is not a perfect square, so $\sqrt{18}$ never ends and never repeats.

- **A** — $\sqrt{16} = 4$, an integer
- **B** — a ratio of integers, so rational
- **D** — an integer, so rational

1.3 $\sqrt{9} + \sqrt{25} = \ldots$ (1)

A) 15 **B)** 8 ✓

C) $\sqrt{34}$ **D)** 34

> **Answer: B** — $3 + 5 = 8$. The roots must be taken FIRST, one at a time.
> - **A** — multiplied 3 by 5
> - **C** — the roots cannot be combined under one sign
> - **D** — added 9 and 25 without rooting

1.4 $\sqrt[3]{-27}$ is ... (1)

A) a positive number **B)** undefined

C) non-real **D)** **a real, negative number** ✓

> **Answer: D** — $\sqrt[3]{-27} = -3$, because $(-3)^3 = -27$. Only an EVEN root of a negative is non-real.
> - **A** — the cube root of a negative is negative
> - **B** — it has a perfectly good value
> - **C** — that is true of an even root, such as $\sqrt{-27}$

1.5 Between which TWO consecutive integers does $\sqrt{138}$ lie? (1)

A) **11 and 12** ✓ **B)** 12 and 13

C) 68 and 70 **D)** 10 and 11

> **Answer: A** — $11^2 = 121$ and $12^2 = 144$, and 138 lies between them.
> - **B** — 144 and 169 are both above 138
> - **C** — halved 138 instead of rooting it
> - **D** — 100 and 121 are both below 138

1.6 Which one of the following is a WHOLE number but NOT a natural number? (1)

A) -1 **B)** $\frac{1}{2}$

C) 0 ✓ **D)** 1

> **Answer: C** — The whole numbers start at 0; the natural numbers start at 1.
> - **A** — -1 is an integer, not a whole number
> - **B** — a fraction is neither
> - **D** — 1 is both

1.7 The list -23 ; -19 ; -6 ; 9 ; 17 is arranged in ... (1)

A) order of size only **B)** descending order

C) no order **D)** **ascending order** ✓

> **Answer: D** — Each number is bigger than the one before.
> - **A** — the signs are taken into account too
> - **B** — descending would start at 17
> - **C** — it is clearly ordered

1.8 Every INTEGER is also ... (1)

A) a rational number ✓ **B)** an irrational number

C) a non-real number **D)** a natural number

> **Answer: A** — Any integer n can be written as $\frac{n}{1}$.
>
> - **B** — integers can be written as ratios, so they are rational
> - **C** — integers are real
> - **D** — -3 is an integer but not natural

1.9 $0,\dot{3}$ ($0{,}333...$ recurring) is ... (1)

A) an integer **B)** non-real

C) irrational **D) rational ✓**

> **Answer: D** — A RECURRING decimal can be written as a fraction — here $\frac{1}{3}$.
>
> - **A** — it lies between 0 and 1
> - **B** — it is a real number
> - **C** — irrational decimals never repeat; this one repeats forever

1.10 Which one of the following is NOT a real number? (1)

A) $-\sqrt{4}$ **B)** $\sqrt{-4}$ **✓**

C) 0 **D)** $\sqrt[3]{-8}$

> **Answer: B** — No real number multiplied by itself gives -4.
>
> - **A** — that is -2, which is real
> - **C** — 0 is real
> - **D** — $\sqrt[3]{-8} = -2$, which is real

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]

Given the list of numbers below:

$$\sqrt{9}+\sqrt{25}\ ;\ -\sqrt{4}\ ;\ \sqrt[3]{-27}\ ;\ \frac{2}{3}\ ;\ \sqrt{18}\ ;\ -27$$

2.1 Write down a NATURAL number from the list, and explain why $-\sqrt{4}$ is not one. (3)

> $\sqrt{9}+\sqrt{25}=3+5=\mathbf{8}$ *(2)*
> $-\sqrt{4}=-2$, and the natural numbers are the counting numbers 1; 2; 3; ..., which excludes negatives *(1)*

2.2 Write down a NEGATIVE IRRATIONAL number from the list. If there is none, say so and give a reason. (3)

> There is **none** *(1)*
> $-\sqrt{4}=-2$, $\sqrt[3]{-27}=-3$ and -27 are all rational *(1)*; $\sqrt{18}$ is irrational but POSITIVE *(1)*

2.3 Write down a NON-REAL number from the list. If there is none, say so, give a reason, and give ONE example of a number that IS non-real. (3)

> There is **none** *(1)*
> A number is non-real only when an EVEN root of a negative is taken, and the cube root of -27 is an ODD root *(1)*
> An example of a non-real number: $\sqrt{-4}$ *(1)*

2.4 Write down a rational number from the list that is NOT an integer, and one from the list that IS an integer. (3)

> $\frac{2}{3}$ — it is a ratio of two integers but cannot be written without a fraction part *(2)*
> An integer from the list: $\mathbf{-27}$ *(1)*

QUESTION 3 [11 MARKS]

Answer the questions below WITHOUT using a calculator.

3.1 Determine between which TWO consecutive integers $\sqrt{138}$ lies. (3)

> $11^2=121$ and $12^2=144$ *(2)*
> 138 lies between them, so $\mathbf{11<\sqrt{138}<12}$ *(1)*

3.2 Is $\sqrt{18}$ rational or irrational? Give a reason for your answer. (2)

> **Irrational** *(1)* — 18 is not a perfect square, so the decimal never ends and never repeats *(1)*

3.3 Explain why $0{,}666...$ is a rational number, and write it as a common fraction. (3)

> It is a RECURRING decimal *(1)*, and every recurring decimal can be written as a fraction *(1)*
> $0{,}666...=\frac{2}{3}$ *(1)*

3.4 Define a rational number, and use your definition to explain why every integer is rational. **(3)**

> A number that can be written as $\frac{a}{b}$, with a and b integers *(1)* and $b \neq 0$ *(1)*
>
> Any integer n can be written as $\frac{n}{1}$, which fits the definition, so every integer is rational *(1)*

TOTAL: 33 marks

This question paper consists of 3 questions.

© Danemathics — free to print and share for classroom use.