GRADE 8 · FUNCTIONS AND RELATIONSHIPS

Functions & Relationships: Flow Diagrams, Tables and Formulae

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 A flow diagram multiplies the input by 3 and then adds 1. When the input is 5, the output is ... (1)

A) 16 ✓ **B)** 15

C) 9 **D)** 18

> **Answer: A** — $5 \times 3 = 15$, then $15 + 1 = 16$.
>
> - **B** — forgot to add the 1
> - **C** — added 3 instead of multiplying
> - **D** — ADDED 1 first and then multiplied

1.2 For the same rule, which input gives an output of 25? (1)

A) 8 ✓ **B)** 75

C) 26 **D)** 24

> **Answer: A** — Work backwards with INVERSE operations: $25 - 1 = 24$, then $24 \div 3 = 8$.
>
> - **B** — multiplied by 3 instead of dividing
> - **C** — added 1 instead of subtracting
> - **D** — subtracted 1 but did not divide

1.3 The rule "multiply by 3, then add 1" written as a formula is ... (1)

A) $y = x + 3$ **B)** $y = 3 + x + 1$

C) $y = 3x + 1$ ✓ **D)** $y = 3(x + 1)$

> **Answer: C** — The multiplication happens first, so the 1 is added afterwards.
> - **A** — left out the multiplication
> - **B** — left out the multiplication
> - **D** — that adds 1 BEFORE multiplying

1.4 Working BACKWARDS through a flow diagram, you must ... (1)

A) use the same operations in the same order **B)** use the inverse operations in the same order

C) double every operation **D)** **use the INVERSE operations in the REVERSE order** ✓

> **Answer: D** — The last step done forwards is the first to be undone.
> - **A** — that goes forwards, not backwards
> - **B** — the order must be reversed too
> - **C** — doubling an operation does not undo it

1.5 For $y = 4x - 3$, the value of y when $x = 5$ is ... (1)

A) 20 **B)** 17 ✓

C) -17 **D)** 23

> **Answer: B** — $4(5) - 3 = 20 - 3 = 17$.
> - **A** — forgot to subtract the 3
> - **C** — subtracted 20 from 3 the wrong way round
> - **D** — added the 3

1.6 For $y = 4x - 3$, the value of x when $y = 25$ is ... (1)

A) 97 **B)** $5{,}5$

C) 22 **D)** 7 ✓

> **Answer: D** — $4x = 28$, so $x = 7$.
> - **A** — multiplied instead of dividing
> - **B** — subtracted 3 instead of adding it: $22 \div 4$
> - **C** — subtracted 3 instead of adding it, and did not divide

1.7 A rule gives the outputs 3 ; 5 ; 7 ; 9 for the inputs 1 ; 2 ; 3 ; 4. The rule is ... (1)

A) $y = x + 2$ **B)** $y = 3x$

C) $y = 2x + 1$ ✓ **D)** $y = 2x$

> **Answer: C** — The outputs go up by 2 for each step of 1 in x, and $2(1) + 1 = 3$.
> - **A** — gives 3 for $x = 1$ but 4 for $x = 2$
> - **B** — gives 3 then 6
> - **D** — gives 2, not 3

1.8 For $y = x^2 + 1$, the value of y when $x = 4$ is ... (1)

A) 16 **B)** 25

C) 9 **D) 17 ✓**

> **Answer: D** — $4^2 + 1 = 16 + 1 = 17$.
> - **A** — forgot to add the 1
> - **B** — added 1 before squaring
> - **C** — multiplied 4 by 2 and added 1

1.9 For $y = x^2 + 1$, which input ALSO gives $y = 17$? (1)

A) -17 **B) −4 ✓**

C) 17 **D)** there is no other

> **Answer: B** — $(-4)^2$ is also 16, because squaring removes the sign.
> - **A** — $(-17)^2$ is far bigger than 16
> - **C** — that is the output, not an input
> - **D** — the negative root works too

1.10 Which of the following is NOT a way of showing the same relationship? (1)

A) a flow diagram **B)** a formula

C) the answer alone ✓ **D)** a table

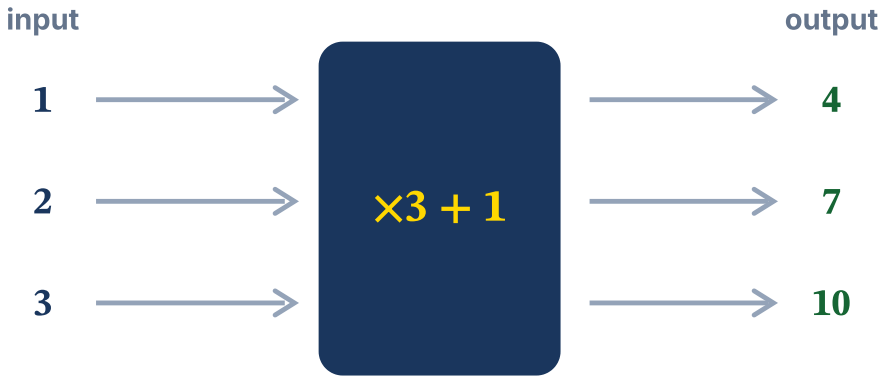
> **Answer: C** — A single answer shows one pair of values, not the rule connecting them.
> - **A** — a flow diagram shows the operations
> - **B** — a formula states the rule
> - **D** — a table shows matching inputs and outputs

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]

The flow diagram below shows a rule applied to three input values.



2.1 Write down the output value when the input is 5, and the input value that produces an output of 25. (3)

> $5 \times 3 + 1 = \mathbf{16}$ *(2)*
> $3x + 1 = 25$ gives $3x = 24$, so the input is $\mathbf{8}$ *(1)*

2.2 Write the rule as a formula in the form $y = \ldots$, and state what the 3 and the 1 each do to the input. (3)

> $y = \mathbf{3x + 1}$ *(1)*
> The 3 MULTIPLIES the input *(1)*
> and the 1 is then ADDED to that answer *(1)*

2.3 Determine the input value if the output is 31. (3)

> $3x + 1 = 31$ *(1)*
> $3x = 30$ *(1)*
> $\boldsymbol{x = 10}$ *(1)*

2.4 Explain why working backwards through a flow diagram means using the INVERSE operations in the opposite order. (2)

> Going forwards you multiply then add *(1)*; going backwards you must undo the last step first, so you subtract then divide *(1)*

QUESTION 3 [12 MARKS]

The same relationship can be written as a rule in words, a flow diagram, a table or a formula. Answer the questions below on the rule $y = 4x - 3$.

3.1 Determine the value of y when $x = 5$, and the value of x for which $y = 25$. (3)

> $y = 4(5) - 3 = \mathbf{17}$ *(2)*
> $4x - 3 = 25$ gives $4x = 28$, so $x = \mathbf{7}$ *(1)*

3.2 Determine the value of x when $y = 17$. (3)

> $4x - 3 = 17$ *(1)*
> $4x = 20$ *(1)*
> $\boldsymbol{x = 5}$ *(1)*

3.3 A different rule gives the outputs 3; 5; 7; 9 for the inputs 1; 2; 3; 4. Determine the rule in the form $y = \ldots$ **(3)**

> The outputs go up by 2 each time, so $y = 2x + c$ *(1)*
> $2(1) + c = 3$, so $c = 1$ *(1)*
> $\boldsymbol{y = 2x + 1}$ *(1)*

3.4 For the rule $y = x^2 + 1$, determine y when $x = 4$, and explain why $x = -4$ gives the same value of y. **(3)**

> $y = 4^2 + 1 = \mathbf{17}$ *(2)*
> $(-4)^2$ is also 16, because squaring removes the sign, so $y = 17$ again *(1)*

TOTAL: 33 marks

This question paper consists of 3 questions.

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