GRADE 10 · FUNCTIONS AND GRAPHS

What a Function Really Is: Words, Tables, Formulae & Graphs (Grade 10)

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
29	45 minutes	3

Name: _____ Class: _____

Date: _____

MARK ____ / 29

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 relationship is a function when every input has ... (1)

A) at least one output
B) two outputs
C) exactly one output ✓
D) a positive output

> **Answer: C** — One input, one output — every time.
> - **A** — two outputs for one input would still be 'at least one'
> - **B** — that is exactly what a function may NOT have
> - **D** — outputs may be negative or zero

1.2 If $f(x) = 2x^2 - 3$, then $f(-2) = \ldots$ (1)

A) -11
B) 5 ✓
C) 13
D) -7

> **Answer: B** — $f(-2) = 2(4) - 3 = 5$.
> - **A** — worked out $(-2)^2$ as -4
> - **C** — squared the 2 as well: $(2 \times -2)^2 - 3$
> - **D** — doubled -2 instead of squaring it

1.3 If $f(x) = 3x - 5$ and $f(x) = 10$, then $x = \ldots$ (1)

A) 5 ✓ **B)** 25

C) 15 **D)** $1{,}67$

> **Answer: A** — $3x - 5 = 10$ gives $3x = 15$, so $x = 5$.
> - **B** — that is $f(10)$, not the input that gives 10
> - **C** — added 5 but did not divide by 3
> - **D** — subtracted 5 instead of adding it: $5 \div 3$

1.4 The domain of $f(x) = x^2$ is ... (1)

A) $x \geq 0$ **B)** $y \geq 0$

C) $x > 0$ **D)** $x \in \mathbb{R}$ ✓

> **Answer: D** — Every real number can be squared.
> - **A** — any real number may be squared
> - **B** — that is the RANGE
> - **C** — negative inputs and 0 are allowed too

1.5 The range of $f(x) = x^2 + 3$ is ... (1)

A) $y \in \mathbb{R}$ **B)** $y \geq 0$

C) $y \geq 3$ ✓ **D)** $y \leq 3$

> **Answer: C** — $x^2 \geq 0$, so $x^2 + 3 \geq 3$.
> - **A** — a square is never negative, so the outputs never drop below 3
> - **B** — forgot the $+ 3$
> - **D** — the smallest output is 3, not the largest

1.6 Which one of these does NOT represent a function? (1)

A) a non-vertical straight line **B)** a circle ✓

C) a parabola that opens upwards **D)** an exponential graph

> **Answer: B** — A vertical line can cut a circle twice, so one input would have two outputs.
> - **A** — each vertical line cuts it once
> - **C** — each vertical line cuts it once
> - **D** — each vertical line cuts it once

1.7 The table x: 1 ; 2 ; 3 ; $4 \rightarrow y$: 7 ; 11 ; 15 ; 19 has the rule ... (1)

A) $y = 4x + 3$ ✓ **B)** $y = 4x$

C) $y = x + 6$ **D)** $y = 3x + 4$

> **Answer: A** — The constant difference is 4, and $4(1) + 3 = 7$.
> - **B** — the constant difference 4 is the coefficient, but the $+ 3$ is missing
> - **C** — matches only the first pair
> - **D** — matches only the first pair

1.8 For $f(x) = 5 - 2x$, $f(3) - f(1) = \ldots$ (1)

A) 4 **B)** -2

C) 2 **D)** -4 ✓

> **Answer: D** — $f(3) = -1$ and $f(1) = 3$, so the difference is -4.
> - **A** — subtracted in the wrong order
> - **B** — that is the coefficient of x, not the change over 2 units
> - **C** — the wrong order and only one step

1.9 For $f(x) = x^2$, which input gives the same output as $x = 3$? (1)

A) $x = 9$ **B)** $x = 0$

C) $x = -3$ ✓ **D)** $x = \frac{1}{3}$

> **Answer: C** — $(-3)^2 = 3^2 = 9$ — two inputs may share an output.
> - **A** — 9 is the output, not an input
> - **B** — $f(0) = 0$
> - **D** — $f(\frac{1}{3}) = \frac{1}{9}$

1.10 A taxi charges R15 plus R8 per kilometre. The cost C of a trip of k km is ... (1)

A) $C = 15k + 8$ **B)** $C = 8k + 15$ ✓

C) $C = 23k$ **D)** $C = 8(k + 15)$

> **Answer: B** — R8 for each kilometre, plus the fixed R15.
> - **A** — swapped the fixed charge and the rate
> - **C** — the R15 is charged once, not per kilometre
> - **D** — that charges R8 on 15 extra kilometres

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 [10 MARKS]

The function f is given by $f(x) = -2x + 6$.

2.1 Calculate $f(-3)$ and $f(4)$. (3)

$f(-3) = -2(-3) + 6$ *(1)* $= \mathbf{12}$ *(1)*

$f(4) = -8 + 6 = \mathbf{-2}$ *(1)*

2.2 Determine the value of x for which $f(x) = -10$. **(3)**

> $-2x + 6 = -10$ *(1)*
> $-2x = -16$ *(1)*
> $\boldsymbol{x = 8}$ *(1)*

2.3 Write down the domain and the range of f, and explain, using the definition of a function, why f is a function. **(4)**

> Domain: $\boldsymbol{x} \in \mathbb{R}$ *(1)*
> Range: $\boldsymbol{y} \in \mathbb{R}$ *(1)*
> Every value of x gives exactly one value of $-2x + 6$ *(1)*
> so no input has two outputs *(1)*

QUESTION 3 [9 MARKS]

A cellphone contract costs R99 per month plus R1,50 per minute of calls. $C(m)$ is the monthly cost in rand when m minutes are used.

3.1 Write down a formula for $C(m)$, and explain why its domain is $m \geq 0$. **(3)**

> $C(m) = 1{,}50m + 99$ *(2)*
> the number of minutes cannot be negative *(1)*

3.2 Calculate $C(120)$, and explain what your answer means. **(3)**

> $C(120) = 1{,}50(120) + 99$ *(1)* $=$ **R279** *(1)*
> a month with 120 minutes of calls costs R279 *(1)*

3.3 Determine how many minutes can be used for R249 in a month. **(3)**

> $1{,}50m + 99 = 249$ *(1)*
> $1{,}50m = 150$ *(1)*
> $\boldsymbol{m = 100}$ **minutes** *(1)*

TOTAL: 29 marks

This question paper consists of 3 questions.

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