SC4012
WASSCE 2023
FURTHER MATHEMATICS/
MATHEMATICS (ELECTIVE) 2
2½ hours

2

CANDIDATE'S NAME	
INDEX NUMBER	SIGNATURE
DATE:	

THE WEST AFRICAN EXAMINATIONS COUNCIL

West African Senior School Certificate Examination for School Candidates

SC 2023 FURTHER MATHEMATICS/MATHEMATICS (ELECTIVE) 2 2½ hours
[100 marks]

INSTRUCTIONS TO CANDIDATES

1. *In the spaces provided above, insert your* **name, full index number,** *normal* **signature** *and the* **date of examination.**
2. *This booklet consists of* **two** *sections*: **A** *and* **B.** *Answer* **all** *the questions in Section* **A (compulsory)** *and* **four** *questions from Section* **B** with **at least one** from **each** part.
3. *In each question, all necessary details of working, including rough work,* **must** *be shown with the answer.*
4. *Give answers as accurately as data and tables allow.*
5. *Graph paper is provided for your use in the examination.*
6. *The use of non-programmable, silent and cordless calculator is allowed.*
7. *Write your* **name, index number** *and the* **number of each question you answer, at the top of each page.**
8. *Write on both sides of the paper unless otherwise instructed on the question paper.*
9. *Begin* **each** *answer to a question on a fresh page. Leave two lines between answers where there are sub-sections to the same question.*
10. *On* **no account** *should you tear off any part of the booklet. It is an examination malpractice to do so. The answer booklet will be collected at the end of the examination.*
11. *Write in the space provided below, the* **question number of the questions you have answered,** in the order in which you have answered them.

For Examiner's Use Only	
Question Number	Mark
TOTAL	

SECTION A

[48 marks]

Answer **all** *the questions in this section.*

All *questions carry* **equal** *marks.*

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1. If $2x^2 + xy - 3y^2 = 9$, find $\frac{dy}{dx}$ at (1, 6).

2. The **first term** and sum to infinity of an exponential sequence (*G.P.*) are 54 and 162 respectively. Find the sum of the 5^{th} and 6^{th} terms.

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3. If $\sqrt{q-3} + \sqrt{q+2} = 5$, find q.

4. *(a)* Solve: $9 \sin 2\theta - 28 \cos 2\theta = 0, 0° \leq \theta \leq 90°$.

(b) Find the binomial expansion of $(3r - 2s)^4$.

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5. In a town, 15% of the people speak Twi. If **four** people are selected at random from the town, find the probability that:

(a) **more than half** speak Twi;

(b) **at most 2** speak Twi.

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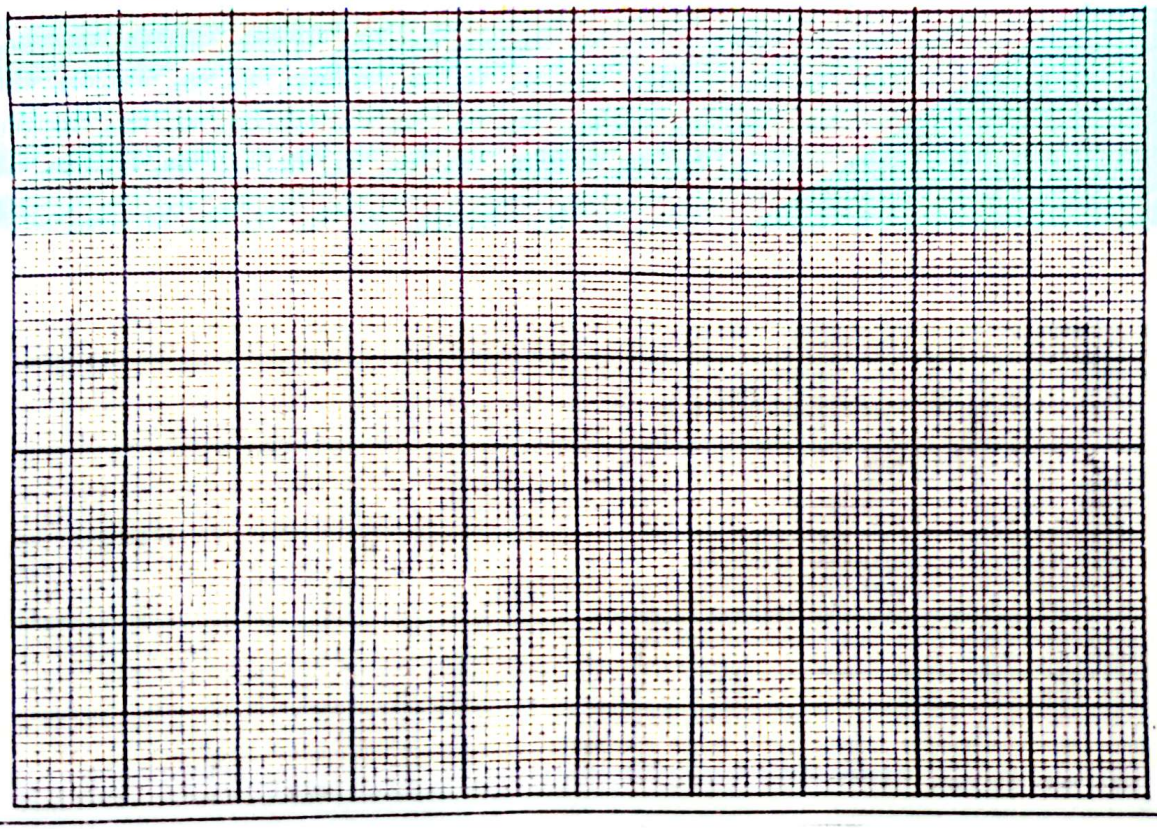
6. The table shows the distribution of heights (in *cm*) of students in a class.

Heights (in cm)	125 - 129	130 - 134	135 - 139	140 - 144	145 - 149
Number of students	5	21	23	7	4

(a) Draw a histogram for the distribution.



(b) Use the histogram in 6(a) to estimate the mode of the distribution.

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7. Three forces $F_1 = (2m + n)$, $F_2 = (-3m + 4n)$ and $F_3 = (4m - 6n)$ act on a body with mass 12 kg. Find the magnitude of the acceleration of the body.

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8. The acceleration of a lorry at any time t *seconds* from rest is given by $a = \left(\frac{3}{2} - \frac{1}{10}t\right) ms^{-2}$.

Find its:

(a) velocity after 10 *seconds*;

(b) distance at time t *seconds*.

SECTION B
[52 marks]

Do not write in this margin.

Answer **four** *questions* **only** *from this section* **with at least one** *question from* **each** *part.*

All *questions carry* **equal** *marks.*

PART I

PURE MATHEMATICS

9. A committee of **five** teachers is to be chosen from **six** French teachers and **six** Music teachers. In how many ways can this be done so that the committee will consist of:

(a) **four** French teachers;
(b) **at least one** French teacher;
(c) **at most two** Music teachers?

10. *(a)* If the volume of a hemisphere is increasing at the rate of $21\pi\ cm^3\ s^{-1}$, find the rate at which the radius is increasing when the radius is 5 *cm*.

(b) Solve $3v - w = 4$

$v^2 + 2vw - w^2 = -2,$

simultaneously.

11. *(a)* If the roots of $3x^2 + 4x - 5 = 0$ are α and β, find the equation whose roots are α^3 and β^3.

(b) Given that $5^x \times 5^{x+1} = 5^{3-x} \div (125^{-1} \times 5^{-x-1})$, find the value of x.

PART II

STATISTICS AND PROBABILITY

12. The probability that an ape will die when given a newly discovered drug is $\frac{1}{3}$. If **6** of such apes were selected for a trial, find the probabilities that:

(a) **half of them** survived;
(b) **more than two-third** survived;
(c) **less than one-third** died.

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13. The table shows the length *(in cm)* of 45 pieces of wood in a factory.

Length	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
Number of pieces of wood	2	2	$q - 1$	4	$3q - 5$	$q^2 - 3$	10	3	1

(a) Find the value of q.

(b) Using the value of q in **13** ***(a)***, draw a cumulative frequency curve for the distribution.

(c) Using the curve in **13** ***(b)***, find the:

(i) median length;

(ii) 90^{th} percentile of the distribution.

PART III

VECTORS AND MECHANICS

14. The vertices of a quadrilateral are $K(-1, 3)$, $L(2, 5)$, $Q(6, -3)$ and $R(m - 1, n - 2)$.

If $\overline{KL}$ is equal to $\overline{RQ}$, find:

(a) the values of m and n;

(b) angle LKR, correct to the **nearest** degree.

15. *(a)* An object of mass 20 *kg* is suspended at a point G by two light inextensible strings $\overline{XG}$ and $\overline{YG}$. The strings are inclined at 55° and 35° respectively to the downward vertical. Find, correct to **four** significant figures, the tensions in the strings.

[Take $g = 10\ ms^{-2}$]

(b) A bullet of mass 180 *g* is fired horizontally into a fixed wooden block with a speed of 24 ms^{-1}. If the bullet is brought to rest in 0.4 *sec* by a constant resistance, calculate the distance moved by the bullet in the wood.

END OF PAPER