



MARCH 2022

The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy, in collaboration with MTA	SUBJECT CODE NUMBER 0575	PAPER NUMBER 2
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATION	SUBJECT TITLE ADDITIONAL MATHEMATICS	
ORDINARY LEVEL		

Time Allowed: **TWO and a half hours**
INSTRUCTIONS TO CANDIDATES

Mobile phones are **NOT ALLOWED** in the examination room.

- ❖ Answer **ALL QUESTIONS** in Section A and any Two Questions from either Section B or Section C.
- ❖ Candidates are expected to answer a combination of Section A and Section B **OR** Section A and Section C but **NOT** a combination of all three.
- ❖ All necessary working must be shown. No mark will be awarded for answers without brief statements showing how the answers have been obtained.
- ❖ Calculators are allowed.

SECTION A: PURE MATHEMATICS

INSTRUCTIONS: ANSWER ALL QUESTIONS IN THIS SECTION.

1. (i) Given that $(x - 1)$ is a factor of $f(x) = 2x^3 + x^2 - (m + m^2)x + m^2$, (2 marks)
 (a) Find the value of m .
 With this value of m ,
 (b) Factorize $f(x)$ completely (2 marks)
- (ii) Given that α and β are the roots of the equation $2x^2 - 3x + 1 = 0$, (2 marks)
 (a) Write down the value of $\alpha - \beta$. (2 marks)
 (b) Find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ (2 marks)

2. (i) In how many different ways can the letters of the word **CONSTITUTION** be arranged? (2 marks)
 (ii) A committee of 4 high school students and 2 first cycle students is to be selected from 6 high school students and 5 first cycle students.
 Calculate the number of different committees that can be formed. (2 marks)
- (iii) Find the term independent of x in the expansion of $(x^2 + \frac{1}{2x^2})^8$ (4 marks)

3. (i) The first term of a Geometric Progression (G.P) is 2 and the geometric mean of the third and first term is 1. Find the sum to infinity of the GP. (3 marks)
 (ii) In order to buy a plot, a hawker decides to save 10,000FCFA for the first month. In subsequent months, he planned to be adding 5,000FCFA to the previous amount to save each time.
 The table below shows the savings he made for the first 3 months

Month	saving	Amount
1	10,000	10,000
2	15,000	25,000
3	20,000	45,000

- Find (2 marks)
 (a) The amount to be saved in the 12th month (2 marks)
 (b) The total amount saved after 2 years. (3 marks)
4. (i) The binary operation $*$ is defined over the set, $S = \{0, 1, 2, 3, 4\}$ as $x * y = x + y$ modulo 5. (2 marks)
 (a) Form a combination table under the operation $*$ (2 marks)
 (b) Show that $(S, *)$ forms a group. (2 marks)
 (c) Give one reason to show that $(S, *)$ is abelian. (1 mark)
- (ii) The transformation T is defined by $T: (x, y) \mapsto (-3x + y, 5x + 2y)$
 Find the coordinates of the point whose image is $(-11, 44)$ (4 marks)

5. A transport agency loads x buses in the morning and y buses in the evening every day. Given that:
 o the agency must load at least 8 buses in the morning and at most 16 buses in the evening.
 o the number of buses to load in the evening must be greater than or equal to 2 times the number of buses to load in the morning.
 o the agency has at most 50 buses.
- (a) Write down 4 inequalities in terms of x and y that satisfy these conditions. (3 marks)
 On a graph paper, taking 2cm to represent 10 units on both axes,
 (b) Shade so as to leave unshaded, the region represented by these inequalities. (3 marks)
 Given that there are 5 toll gates on the journey and a bus that loads in the morning pays 500 FCFA at each toll gate and a bus that loads in the evening pays 500FCFA each toll gate,
 (c) Find the maximum amount paid at the toll gate by these buses. (2 marks)

6. (i) Show that $\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta} \equiv \frac{2}{\sin\theta}$ (3 marks)
 (ii) Solve for x , in the range $0^\circ \leq x \leq 180^\circ$, the equation $3\cos^2x = \cos x$ (3 marks)
 (iii) The function $f(x) = 3\sin 2x$, where $0^\circ \leq x \leq \frac{7\pi}{6}$

(a) Copy and complete the table (1 mark)

x	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	π	$\frac{7\pi}{6}$
$f(x)$	0	2.6		2.6	0		0	2.6

Taking 2cm to represent $\frac{\pi}{6}$ radian units on the x - axis and 2cm to represent 1 unit on the y - axis,

- (b) draw the graph of $y = f(x)$ (2 marks)
 (c) write down the maximum value of $f(x)$ (1 mark)

7. Given that the lines l_1 and l_2 whose vector equations are :

$$l_1: r = (6 - 2\lambda)i + (\lambda - 5)j$$

$$l_2: r = \mu i + 3(1 - \mu)j, \text{ where } \lambda \text{ and } \mu \text{ are constants.}$$

Find:

- (a) The position vector of the point of intersection of l_1 and l_2 . (4 marks)
(b) The angle between l_1 and l_2 . (4 marks)

8. (i) Given that $y = \left(\frac{1}{3}x - 5\right)^6$, find $\frac{dy}{dx}$. (3 marks)

(ii) Find $\int_0^4 \left(x^2 - 5 - \frac{1}{x^2}\right) dx$ (4 marks)

SECTION B: MECHANICS

IF THIS SECTION IS CHOSEN, THEN SECTION C MAY NOT BE CHOSEN

(ANSWER ANY TWO QUESTIONS)

9. (i) A particle has position vector $r = 5t^2i + t^3j$ at time t seconds.

Find:

- (a) The velocity when $t = 3$ (3 marks)
(b) The acceleration when $t = 3$ (2 marks)

- (ii) Two particles P and Q of mass 2kg and 3kg respectively are connected by a light inextensible string passing over a smooth frictionless pulley. The system is released from rest with both particles 1m above ground level.

Find:

- (a) The acceleration of the system when the string is taut (3 marks)
(b) The tension in the string (2 marks)
(c) The time taken for particle B to hit the ground (2 marks)

- (iii) A particle A of mass 2m moving with a speed of 5u strikes particle B of mass m which is at rest. After collision both particles move in the same direction but the speed of particle B is twice the speed of particle A.

Find:

- (a) The speed of particle A after collision. (3 marks)
(b) The magnitude of the impulse exerted on B by A during the impact. (2 marks)

10. (i) The constant rate of increase in the volume of a spherical balloon is $2cm^3s^{-1}$.

Find the rate of increase of:

- (a) The radius of the spherical balloon when the radius is 3cm. (3 marks)
(b) The surface area of the spherical balloon at this instant. (3 marks)

- (ii) Find the volume generated when the area bounded by the curve

$$y = (x + 1)(x - 1) \text{ is completely rotated about the } x \text{ -axis. (5 marks)}$$

- (iii) Given that the masses of 2kg, 3kg and 5kg are positioned on the xy - plane having coordinates $(2, 3)$, $(4, 2)$ and $(7, 2)$ respectively.

Find the coordinates G of the Centre of mass of the system. (6 marks)

11. (i) The forces $F_1 = (11i - 3j)N$, $F_2 = (14i + j)N$ and $F_3 = (-i + 10j)N$ act on a particle of mass 8kg

- (a) Find the magnitude of the resultant forces, leaving your answer in surd form. (5 marks)
(b) Find the acceleration of the particle. (3 marks)

- (ii) A car of mass 1000kg travels up a hill inclined at an angle θ to the horizontal, where $\sin\theta = \frac{1}{25}$. The non-gravitational resistance to motion is 1800N and the power output from the engine is 60KW.

- (a) Draw a diagram showing the forces acting on the car. (3 marks)
(b) Find the acceleration of the car when it is travelling at a speed of 20m/s. [Take $g = 10m/s^2$] (6 marks)

SECTION C: STATISTICS AND PROBABILITY
(IF THIS SECTION IS CHOSEN, THEN SECTION B MAY NOT BE CHOSEN)
ANSWER ANY TWO QUESTIONS.

12. The distance, to the nearest metre, of each throw made by an athlete practicing for a competition is shown in the table below.

Distance(m)	20-24	25-27	28-29	30-31	32-34	35-38	39-44
frequency	8	9	38	44	23	16	12

- (i) (a) Draw a histogram of this distribution (5 marks)
 (b) From the histogram estimate the mode of the distribution (3marks)
- (ii) Find, to one decimal place,
 (a) the mean (4 marks)
 (b) standard deviation. (5 marks)

13. (i) A discrete random variable, X has probability mass function, p defined by

$$p(x) = \begin{cases} \frac{k(x-1)}{6} & 2 \leq x \leq 4 \\ \frac{8-x}{6} & 5 \leq x \leq 7 \\ 0, & \text{otherwise} \end{cases}$$

Where k is a constant.

Find :

- (a) The value of the constant k . (4marks)
 (b) The mean and standard deviation of X . (4marks)

(ii) A random variable X is such that $X \sim \text{Bin}(n, 0.6)$ and $E(X) = 4.8$.

Find:

- (a) The value of n . (3marks)
 (b) The standard deviation of X . (3mark)
 (c) $P(X > 2)$ (3marks)

14. (i) Two events A and B are such that $P(A) = \frac{1}{3}$, $P(B) = \frac{6}{10}$, and $P(A \cup B) = \frac{72}{100}$

Find:

- (a) $P(A \cap B)$ (2marks)
 (b) $P(A^1 \cup B^1)$ (2marks)
 (c) $P(A \cup B)^1$ (2marks)

Show that

- (a) Events A and B are independent. (2marks)
 (b) Events A and B are not mutually exclusive (2marks)

(ii) A shop stocks wines of two brands, X and Y of which 80% are of brand X and 20% of brand Y . Given that 70% of the stock of brand X and 60% of the stock of brand Y are from Spain.

- (a) Draw a tree diagram to illustrate the information. (3marks)
 (b) Hence, find the probability that a wine chosen at random from the stock is:
 (i) from Spain. (2marks)
 (ii) either be from Spain or of stock X . (2marks)

END