Additional Mathematics 2
0575

GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2025 **ORDINARY LEVEL**

Subject Title	**Additional Mathematics**
Subject Code No.	**0575**
Paper No.	**2**

Duration: Two and a Half Hours

Answer ALL QUESTIONS IN SECTION A and ANY TWO QUESTIONS FROM EITHER SECTION B or SECTION C. IN SECTIONS B AND C, ALL QUESTIONS CARRY EQUAL MARKS.

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 marks will be awarded for answers without brief statements showing how the answers have been obtained.

Non-programmable electronic calculators and Mathematical Formulae booklets published by the GCE Board are allowed.

Where necessary take g as $10ms^{-2}$.

SECTION A: PURE MATHEMATICS

THIS SECTION IS COMPULSORY TO ALL CANDIDATES

(ANSWER ALL QUESTIONS)

1 (i) Given that $(x+2)$ is a factor of $f(x)$, where $f(x) = x^3 + kx^2 - 10x - 8$,

a) find the value of the constant k. **(2 marks)**

With this value of k,

b) factorize $f(x)$ completely. **(2 marks)**

(ii) The quadratic equation $x^2 + 4x + 1 = 0$, has roots α and β.

a) State the values of $\alpha + \beta$ and $\alpha\beta$, **(1 mark)**

b) Write down another quadratic equation with roots 2α and 2β. **(3 marks)**

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2. (i) A committee of 3 boys and 4 girls is to be chosen from 5 boys and 6 girls. Find the number of committees that can be formed. **(4 marks)**

(ii) Find the numerical value of the term independent of x in the binomial expansion of $\left(x^2 - \frac{2}{x^2}\right)^{12}$ **(4 marks)**

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3. A farmer plants yam in a farmland which is divided into10 plots, and an average of $4500FCFA$ is spent on fertilizer and labour on each plot. Given that the farmer harvests the yams from the 10 plots and sell each yam at an average of 2500 $FCFA$. The table below shows the harvest and the sales of the yams for the first 3 plots.

Number of plots	Number of yams harvested	Amount per Yam	Total selling price	Amount spent on fertilizer and labour	Income made by the farmer from each plot
1	20	2500	50000	4500	45500
2	24	2500	60000	4500	55500
3	28	2500	70000	4500	65500

Find;

a) the number of yams harvested from the 10^{th} plot, **(3 marks)**

b) the total selling price from the 10 plots, **(3 marks)**

c) the total income made from the farmland. **(2 marks)**

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4. (i) An operation $*$ defined on the set $S = \{1.5, 7, 11\}$ where $*$ is multiplication modulo 12.

a) Copy and complete the table below. **(2 marks)**

*	1	5	7	11
1		5		
5				7
7			1	
11	11			

b) Show that S forms a group under $*$. **(4 marks)**

[Assume associativity]

(ii) The transformation, T is defined by $T: (x, y) \mapsto (2x - y,\ x - y)$.
Find the point whose image under the transformation T is $(5, 3)$. **(4 marks)**

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5. An ex-student of a school has 19200 FCFA only to buy x Mathematics and y English text books for the school library.

a) Given that each Mathematics text book cost 2400 FCFA and each English text book cost 3200 FCFA, show that, $3x + 4y \leq 24$. **(2 marks)**

b) Given also that the number of English text books must be at most 75% of the number of Mathematics text books, write down another inequality in terms of x and y that satisfies this condition **(1 mark)**

c) On a graph paper, taking 2 cm to represent 1 unit on both axes, shade so as to leave unshaded, the region satisfied by these inequalities. **(3 marks)**

Hence,

d) Find the maximum number of text books the ex-student can buy. **(2 marks)**

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6. (i) Show that $\frac{1+\cos 2A}{\sin 2A} \equiv \cot A$. **(3 marks)**

(ii) The function, f, is defined by $f(x) = 3sinx + 2cosx$, for $0 \leq x \leq \pi$.

(a) Copy and complete the table below:

x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π
$f(x)$	2.0					-1.7	

(3 marks)

(b) Taking 2 cm to represent $\frac{\pi}{6}$ radians on the x-axis and 2 cm to represent 1 unit on the $y-$axis, draw the graph of $y = f(x)$ for $0 \leq x \leq \pi$. **(2 marks)**

(c) Using your graph, estimate the maximum value of $f(x)$. **(1 mark)**

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

$l_1: \boldsymbol{r} = 2\boldsymbol{i} + 4\boldsymbol{j} + s(-2\boldsymbol{i} + 6\boldsymbol{j})$ and

$l_2: \boldsymbol{r} = 3\boldsymbol{i} - \boldsymbol{j} + t(3\boldsymbol{i} - 3\boldsymbol{j})$, intersect,

find:

(a) the values of the parameters s and t, **(4 marks)**

(b) the position vector of the point of intersection of the lines, **(2 marks)**

(c) the cosine of the angle between the lines l_1 and l_2. **(2 marks)**

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8. (i) Given that $y = (3 - 2x)^5$, find $\frac{dy}{dx}$. **(3 marks)**

(ii) Evaluate $\int_0^{\pi} (x - cos2x)\, dx$. **(4 marks)**

SECTION B: MECHANICS

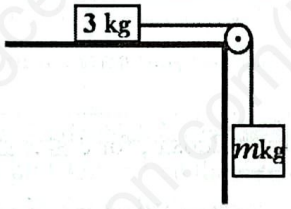
IF THIS SECTION IS CHOSEN, THEN SECTION C MAY NOT BE CHOSEN.

(ANSWER ANY TWO QUESTIONS.)

9. (i) Two particles A and B are moving in the plane of the coordinate axes, OX and OY. At time, t seconds, the position vectors of A and B are $(t^2\boldsymbol{i} + 2\boldsymbol{j})m$ and $(2\boldsymbol{i} - 4t\boldsymbol{j})m$ respectively.
Calculate:
a) the distance between A and B when $t = 2$, **(3 marks)**
b) the velocity of A relative to B when $t = 2$. **(3 marks)**

(ii) Two particles, of masses $2kg$ and $3kg$ are moving towards each other with speeds $6ms^{-1}$ and $2ms^{-1}$ respectively. After collision, they coalesce.
Find;
a) their common velocity after collision, **(3 marks)**
b) the loss in kinetic energy due to the collision. **(2 marks)**

(iii)



A particle P *of mass* $3kg$ resting on a smooth horizontal table is connected by a light inextensible string passing over a smooth pulley to a particle Q of mass $m\ kg$ hanging freely. The particles are relèased from rest with the string taut as shown in the diagram above and they moves with an acceleration of $2\ ms^{-2}$.
a) Draw a diagram showing all the forces acting on the particles. **(1 mark)**
Calculate;
b) the value of m, **(3 marks)**
c) the tension in the string. **(2 marks)**

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10. (i) The rate of increase of the surface area of a sphere is $36\pi\ cm^2s^{-1}$ at the instant when the radius is $3\ cm$
Find:
a) the rate of increase of the radius of the sphere, **(3 marks)**
b) rate of increase of the volume of the sphere. **(3 marks)**
$\left[\boldsymbol{The\ surface\ area\ of\ a\ sphere, A = 4\pi r^2\ and\ the\ volume\ of\ a\ sphere, V = \frac{4}{3}\pi r^3}\right]$

(ii) The area enclosed by the curve $y = \sqrt{x+3}$ and the x-axis, from $x = 1$ to $x = 2$ is rotated completely about the x-axis. Find the volume of the solid generated. **(5 marks)**

(iii) Three particles of masses 3kg, 2kg and 1kg are at the points with coordinates $(-1,3)$, $(5,2)$ and $(-1,-4)$ respectively. Find the coordinates of the centre of gravity of these three particles. **(6 marks)**

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11. (i) The resultant of the forces $(7\boldsymbol{i} - \boldsymbol{j})\ N$, $(x\boldsymbol{i} + 5\boldsymbol{j})\ N$, $(-5\boldsymbol{i} + y\boldsymbol{j})\ N$ and $(4\boldsymbol{i} + 2\boldsymbol{j})\ N$ is $(10\boldsymbol{i} + 4\boldsymbol{j})\ N$.
a) Find the values of x and y. **(4 marks)**
A fifth force is introduced and the system is now in equilibrium.
Find:
b) the fifth force , **(2 marks)**
c) the magnitude and direction of the fifth force ,leaving your answer to one decimal place. **(2 marks)**

(ii) A stone of mass $20kg$ is thrown vertically upward to a height of $15m$.
Find the work done against the weight of the stone. **(3 marks)**

(iii) A car of mass $500kg$ is travelling at a maximum speed of $10ms^{-1}$ on a rough hill inclined at $sin\theta = \frac{3}{5}$ to the horizontal. Given that the power exerted by the engine of the car is $36kW$, find the resistance to the motion. **(6 marks)**

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SECTION C: STATISTICS AND PROBABILITY

IF THIS SECTION IS CHOSEN, THEN SECTION B MAY NOT BE CHOSEN.

(ANSWER ANY TWO QUESTIONS.)

12. A random sample of 60 children in a clinic had the following distribution of mass in kg

Mass(kg) X	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
Frequency f	5	10	13	12	10	5	3	2

a) Find, to one decimal place,
(i) the mean of X, **(4 marks)**
(ii) variance of X. **(4 marks)**

b) (i) Draw a cumulative frequency graph for the distribution. **(3 marks)**
From the cumulative frequency graph, estimate:
(ii) the median, **(3 marks)**
(iii) the semi inter-quartile range. **(3 marks)**

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13. (i) A random variable X has a probability mass function $p(x)$, where,

$$p(x) = \begin{cases} kx^2, & x = 1, 2, 3, 4, 5 \\ 0 & otherwise \end{cases},$$

where k is a constant.

a) Copy and complete the table below. **(2 marks)**

x	1	2	3	4	5
$P(X = x)$			$9k$		

Find:

b) the value of k, **(3 marks)**

c) the mean and the variance of the distribution. **(4 marks)**

(ii) The probability that a watermelon selected at random from a bag is defective is $\frac{1}{3}$.
6 watermelons are selected at random from the bag one after other without replacement.
Using the binomial distribution, find the probability that:
a) no water melon is defective, **(2 marks)**
b) less than 2 watermelons are defective. **(3 marks)**
c) find the mean and variance of the distribution. **(3 marks)**

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14. (i) The events A and B are such that $P(A) = \frac{3}{10}$, $P(B) = \frac{2}{5}$ and $P(A \cup B) = \frac{3}{5}$.
Find:
a) $P(A \cap B)$, **(2 marks)**
b) $P(A/B)$, **(3 marks)**
c) $P(A' \cap B)$. **(3 marks)**

(ii) In a certain school of 200 students, 80 are boys and 120 are girls. 30% of the boys and 60% of the girls play handball. A student X is selected at random from the school.
Find the probability that:
a) X is a boy who plays handball, **(3 marks)**
b) X plays handball, **(3 marks)**
c) X is a boy or plays handball. **(3 marks)**
