ADDITIONAL MATHEMATICS 2
0575

GOVERNMENT BILINGUAL HIGH SCHOOL YAOUNDE

MOCK EXAMINATION

APRIL 2021 ORDINARY LEVEL

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

Two and a half hours

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 question carry equal marks.

All necessary working must be shown. No marks will be awarded for answers without brief statements showing how the answers have been obtained.

Electronic calculators and mathematical table may be used.

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 $(x-1)$ is a factor of $f(x)$, where $f(x) = 2x^3 + 5x^2 - kx - 3$.

   a) Find the value of k, **(2 marks)**

   With this value of k,

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

   (ii) Given that α and β are the roots of the equation $x^2 + 4x - 3 = 0$

   a) Find the values of $\alpha + \beta$ and $\alpha\beta$ **(2 marks)**

   Hence

   b) Write down another quadratic equation with integral coefficients whose roots are $-\frac{\alpha}{\beta}$ and $-\frac{\beta}{\alpha}$. **(2 marks)**

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2. (i) In how many ways can a group of 2 boys and 4 girls can be selected from a class of 5 boys and 9 girls? **(3 marks)**

   (ii) Find the numerical coefficient of the term in x^4 in the binomial expansion of $\left(x^2 + \frac{1}{2x}\right)^8$ **(5 marks)**

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3. i) The common difference of an arithmetic progression is 2 and the sum of the first 12 terms is 180. Find the first term of the progression. **(4 marks)**

   ii) Given that the coordinates of the points A and B are $(1, 2)$ and $(3, -2)$ respectively. Find the equation of the perpendicular bisector of the line AB. **(4 marks)**

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4. (i) The set $S = \{1, 3, 5, 7\}$ and the operation $*$ is defined as $a * b = (a + b + 3)\ mod\ 8$, where $a, b \in S$, forms a group.

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

*	1	3	5	7
1	5			
3			3	
5	1			7
7		5		

   From the table,

   b) State the identity element **(1 mark)**

   c) State the inverse of each element **(2 marks)**

   d) Write down one subgroup **(1 mark)**

   (ii) The transformation, T, is represented by the matrix M, where $M = \begin{pmatrix} 2 & -1 \\ -4 & 3 \end{pmatrix}$.

   a) Find the inverse of M. **(2 marks)**

   Hence or otherwise,

   b) Find the point whose image is $(3, -1)$ under the transformation, T. **(2 marks)**

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5. A student has only 14,400 FCFA to buy x exercise books and y text books.

a) Given that an exercise book cost 1800 FCFA and a text book cost 2400 FCFA. Show that $3x + 4y \leq 24$. **(2 marks)**

b) Given also that:

- the number of text books is at most half the number of exercise books,
- the sum of an exercise books and a text books is at least 4,

write down two inequalities in terms of x and y that satisfy the conditions in (b) **(2 marks)**

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

d) From your graph, find the maximum number of books she bought **(2 marks)**

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6. (i) Show that $\frac{sin2A}{2tanA} = 1 - sin^2A$ **(3 marks)**

(ii) The function f, is defined as $f(x) = 4sin2x$, where $0 \leq x \leq \pi$

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

x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π
$f(x)$		3.5		0			

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

b) Draw the graph of $y = f(x)$. **(3 marks)**

From your graph

c) Write down the greatest and the least value of $f(x)$ **(2 marks)**

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

$l_1: \boldsymbol{r} = -\boldsymbol{i} - 6\boldsymbol{j} + \lambda(3\boldsymbol{i} - 2\boldsymbol{j})$,

$l_2: \boldsymbol{r} = 5\boldsymbol{i} - \boldsymbol{j} + t(3\boldsymbol{i} + \boldsymbol{j})$, where λ and t are constants.

a) Find the position vector of the point of intersection of l_1 and l_2 **(5 marks)**

b) Find the cosine of the angle between l_1 and l_2. **(3 marks)**

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8. (i) Given that $y = (5 - 2x)^4$. Find $\frac{dy}{dx}$ **(4 marks)**

(ii) Find the area bounded by the curve $y = 3x - x^2$ and the x-axis for $0 \leq x \leq 2$. **(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, of mass $3kg$, moves in a strainght line so that its displacement, r metres after t seconds is given by $r = 2t^3 - 3t^2 + 4t$. Find
   a) the initial velocity of the particle **(2 marks)**
   b) the velocity of the particle when $t = 2$ **(2 marks)**
   c) the magnitude of the impulse exerted on the particle when $t = 2$ **(2 marks)**

   ii) A particle, P, of mass mkg where $m > 4$ is connected by a light inextensible string, which passes over a smooth fixed pulley to a particle Q of mass $4kg$, hanging freely. The string is held taut and the particles are then released from rest with an acceleration of $2ms^{-2}$.
   Find;
   a) the tension in the string, **(2 marks)**
   b) the value of m **(2 marks)**
   c) the force exerted on the pulley. **(2 marks)**

   iii) Two particles A and B of masses $3kg$ and $2kg$ respectively, are moving towards each other in a straight line with velocities $10ms^{-1}$ and $6ms^{-1}$ respectively. The particles collide and after collision, the particles moves in the direction of particle A with velocities $10ms^{-1}$ and $v\ ms^{-1}$ respectively.
   Find;
   a) the value of v **(3 marks)**
   b) the impulse exerted on particle A. **(2 marks)**

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10. i) The rate of change of the radius of a hemisphere at time t seconds is $6cms^{-1}$. Find the rate of change of the surface area of the hemisphere when the radius decrease to $4cm$
   [$surface\ area\ of\ hemisphere\ is\ 2\pi r^2$] **(5 marks)**

   ii) The finite area enclosed by the line $y = 3x - 2$, the x-axis and the ordinates $x = 0$ and $x = 2$ is rotated completely about the x-axis, calculate the volume of the solid formed. **(6 marks)**

   iii) Given that $(2, 3)$ is the position vector of the centre of gravity of particles of mass $2kg, 3kg$ and $4kg$ which are at the point with position vectors $-3\boldsymbol{i} - n\boldsymbol{j}$, $4\boldsymbol{i} - \boldsymbol{j}$ and $m\boldsymbol{i} + 4\boldsymbol{j}$ respectively, find the values of m and n **(6 marks)**

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11. i) A car of mass $850kg$ moving along a level road has its speed reduced from $25ms^{-1}$ to $10ms^{-1}$ by a breaking force of $2975N$. Calculate
   a) the deceleration of the car **(2 marks)**
   b) the distance travelled as the speed reduced from $25ms^{-1}$ to $10ms^{-1}$ **(3 marks)**

   ii) The engine of a car is working at the steady rate of $12KW$. The car of mass $800kg$ is being driven along a level straight road against a constant resistance to motion of $200N. Find,$
   a) the acceleration of the car when its speed is $6ms^{-1}$, **(3 marks)**
   b) the maximum speed of the car on the level road. **(3 marks)**

   iii) The forces $3\boldsymbol{i} - \boldsymbol{j}, 2\boldsymbol{i} + 7\boldsymbol{j}, 3\boldsymbol{i} - \boldsymbol{j}$ and $-3\boldsymbol{i} + 5\boldsymbol{j}$ act on a particle.
   a) Find the magnitude and direction of the resultant force. A fifth force $x\boldsymbol{i} + 2y\boldsymbol{j}$ is added to the system and equilibrium is established, **(3 marks)**
   b) find the values of x and y. **(3 marks)**

SECTION C: STATISTICS AND PROBABILITY

(IF THIS SECTION IS CHOSEN, THEN SECTION B MAY NOT BE CHOSEN)

IF THIS SECTION IS CHOOSEN, THEN ANSWER ANY TWO QUESTIONS

12. The probability mass function, f, of a discrete random variable, X, is defined by

$$f(x) = \begin{cases} k(4-x), & for\ \ x = 1,2,3, \\ k(x-3), & for\ x = 4,5,6, \\ 0, & otherwise \end{cases}$$

a) Complete the probability distribution table below. **(2 marks)**

x	1	2	3	4	5	6
$P(X = x)$	$3k$			k		

i) Find the value of k **(3 marks)**

With this value of k,

ii) State the modal and the median of the distribution **(2 mark)**

iii) calculate the mean and the standard deviation to on decimal place **(6 marks)**

iv) calculate $P(2 < X \leq 6)$ **(2 marks)**

v) Calculate the mean and the variance of the distribution of the random variable Y, defined by $Y = 2X - 3$. **(4 marks)**

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13. The marks distribution of 60 students in a mathematics test is given as follows:

Mark (x)	$0-9$	$10-19$	$20-29$	$30-39$	$40-49$	$50-59$	$60-69$
No. of students (f)	5	7	8	12	17	8	3

i) Draw a histogram to show the distribution above and from it estimate the mode **(5 marks)**

ii) Draw the cumulative frequency graph for the above distribution. **(3 marks)**

Hence, from your graph, find

a) the median mark **(2 marks)**

b) the semi- interquartile range of the distribution **(2 marks)**

iii) Find the mean and variance mark of the distribution **(5 marks)**

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14. i) The evens A and B are such that $P(A) = \frac{3}{5}$, $P(A \cup B) = \frac{17}{20}$ and $P(A \cap B) = \frac{3}{8}$. Find

a) $P(B)$ **(3 marks)**

b) $P(A \cap B')$ **(3 marks)**

c) $P(B|A)$ **(2 marks)**

ii) There are two boxes A and B in a bag containing blue and white balls. Box A contains 50% of blue balls and 40% of white balls in the bag. If the probability of chosen box B at random from the bag is 25% .

a) Draw a tree diagram to show all the possible outcomes. **(3 marks)**

From the tree diagram, find the probability that

b) a blue ball is drawn, **(3 marks)**

c) a blue ball and a white ball is drawn, **(3 marks)**
