DDITONAL MATHEMATICS 2
575

CAMEROON GENERA' CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2019 **ORDINARY LEVEL**

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

Two and a half hours

nswer ALL QUESTIONS IN SECTION A and ANY TWO QUESTIONS FROM EITHER ECTION B or SECTION C. IN SECTIONS B AND C, ALL QUESTIONS CARRY EQUAL IARKS.

'andidates are expected to answer a combination of Section A **and** Section B **OR** Section A **and** Section C ut **NOT** a combination of all three

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

'lectronic calculators may be used.

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

SECTION A: PURE MATHEMATICS

THIS SECTION IS COMPULSORY TO ALL CANDIDATES

(ANSWER ALL QUESTIONS)

1. (i) Given that $(x - 3)$ is a factor of $f(x) = x^3 - 6x^2 + kx - 6$.
   (a) Find the value of k. **(2 marks)**
   With this value of k,
   (b) Factorise $f(x)$ completely. **(2marks)**

   (ii) Given that the roots of the equation $x^2 - 3x - 5 = 0$ are α and β.
   (a) Find the values of $\propto + \beta$ and $\propto \beta$. **(1 mark)**
   (b) Evaluate $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$. **(3 marks)**

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2. (i) Find the number of permutations of the letters of the word " **LEVELS** ". **(3 marks)**
   (ii) Write down the first four terms in the binomial expansion of $(1 - 3x)^6$ in ascending powers of x, simplifying your answer as far as possible. **(4 marks)**

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3. (i) A cement dealer piles bags of cement in such a way that the first layer from the bottom has 19 bags of cement, the second layer has 17 bags of cement and the third layer has 15 bags of cement. Given that he keeps piling the cement in the same pattern, find:
   (a) the number of bags of cement in the tenth layer. **(2 marks)**
   (b) the total number of bags of cement in the ten layers. **(3 marks)**

   (ii) The sum to infinity of a geometric progression is 6 and the first term is 3, find:
   (a) the common ratio, **(2 marks)**
   (b) the fifth term of the progression. **(2 marks)**

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4. (i) The set $S = \{a, b, c, d\}$ and the operation * forms a group.
   (a) Copy and complete the table. **(2 marks)**

*	a	b	c	d
a	b		a	c
b	d	c		a
c	a		c	
d	c	a		

   From the table,
   (b) State the identity element **(1 mark)**
   (c) State the inverse of each element. **(2 marks)**

   (ii) $M = \begin{pmatrix} 2 & -1 \\ -1 & 3 \end{pmatrix}$
   (a) Find the image of the point $(1, -2)$ under the linear transformation represented by the 2 by 2 matrix, M. **(2 marks)**
   (b) Find the inverse of M. **(2 marks)**
   Hence or otherwise,
   (c) find the image of the line $2x + y = 1$ under the linear transformation represented by the matrix, M. **(2 marks)**

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5. Tambe has only 12,000FCFA to organise a birthday party for the son. He invites x adults and y children. Given that:

(a) He uses 1000FCFA to entertain an adult and 500FCFA for a child.

(i) Show that $2x + y \leq 24$. **(2 marks)**

(b) The number of children must not be more than the number of adults.

(ii) Write down an inequality in terms of x and y that satisfies this condition. **(1 mark)**

On a graph paper, taking 1cm to represent 1 unit on the x-axis and 1cm to represent 4 units on the y-axis,

(iii) shade so as to leave unshaded the region represented by these inequalities. **(3 marks)**

(iv) Hence, find the greatest number of persons to be invited for the party. **(2 marks)**

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

(ii) The function $g(x) = \cos 2x - \sin x$, $0 \leq x \leq \pi$ **(2 marks)**

(a) Copy and complete the table.

x	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{5\pi}{6}$	π
$g(x)$	1			-2			1

Taking 2cm to represent $\frac{\pi}{6}$ radian units on the x-axis and 4cm to represent 1 unit on the y-axis,

(b) Draw the graph of $y = g(x)$ **(2 marks)**

From your graph,

(c) Find the minimum value of $g(x)$. **(1 mark)**

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

$l_1: r = -2i + 3j + \lambda(3i - 5j)$,

$l_2: r = 3i - j + \mu(2i + j)$, where λ and μ are constants.

Find:

(i) the position vector of the points of intersection of l_1 and l_2. **(5 marks)**

(ii) 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 $\frac{dy}{dx}$. **(3 marks)**

(ii) Find $\int_0^2 (x^2 + 2x + 1)dx$. **(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 moves in a straight line from a fixed point, O with velocity $12ms^{-1}$ and after t seconds of motion, the acceleration, $a = (2t - 8)ms^{-2}$.
Find:
(a) the velocity of the particle when $t = 2$ **(3 marks)**
(b) the distance of the particle from O when $t = 2$. **(3 marks)**

(iii) A particle P, of mass $4kg$, is connected by a light inelastic string, which passes over a fixed light smooth pulley to a particle of mass mkg where $m > 4$. The string is taut and the particles are released from rest. Given that the acceleration of each particle is $2ms^{-2}$,
Find:
(a) the tension in the string, **(3 marks)**
(b) the value of m **(2 marks)**
(c) the force exerted on the pulley. **(1 mark)**

(iii) Two particles S and T, of masses 3 kg and 2 kg respectively, are moving towards each other in a straight line with velocities $2ms^{-1}$and $5ms^{-1}$ respectively. The particles collide, coalesce and move in the direction of S. Calculate;
(a) their common velocity after collision **(3marks)**
(b) the loss in kinetic energy after collision. **(2marks)**

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10. (i) The rate of change of the radius of a sphere is $3cms^{-1}$ at the instant when the radius is $5cm$.
Find the rate of change of the surface area of the sphere.
$[surface\ area\ of\ a\ sphere = 4\pi r^2]$ **(5 marks)**

(ii) The area bounded by the curve $y^2 = 3x + 2$, the x – axis and the ordinates $x = 0$ and $x = 1$ is rotated completely about the x-axis.
Find, in terms of π, the volume of the solid generated. **(6 marks)**

(iii) The position vector of the centre of gravity of particles of mass mkg, nkg and $3\ kg$ which are at the points with position vectors $7j, 3i$ and $(5i + 4j)$ respectively is $(3i + 6j)$. Given that m and n are constants, find the values of m and n.
(6 marks)

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11. (i) The forces $F_1 = (3i - 4j)N$, $F_2 = (-5i + 6j)N$, and $F_3 = (4i + 6j)N$ act on a particle of mass $2kg$.
Find:
(a) the resultant of the three forces acting on the particle. **(2 marks)**
(b) the magnitude of the acceleration of the particle. **(4 marks)**
Given that a fourth force $F_4 = (xi + yj)N$ is added to the system and the system is at equilibrium.
(c) Find, the values of x and y. **(3 marks)**

(ii) A particle P is displaced from the origin, O to a point A with position vector $(-3i + 5j)m$ by a force $(2i + 7j)N$. Find the work done by the force in displacing the particle from O to A.. **(4 marks)**

(iii) A car is moving at a maximum speed of $10ms^{-1}$ on a level road against a constant resistance of $500N$.
Find the power generated by the engine. **(4 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 marks scored by 80 students in an examination are distributed as follows:

Marks (x)	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Number of students (f)	1	4	11	17	28	12	4	3

(i) (a) Draw a cumulative frequency graph of the distribution. **(5 marks)**
From your graph, estimate
(b) the median, **(3 marks)**
(c) the semi-interquartile range, **(4 marks)**
(ii) Find the mean of the distribution. **(5 marks)**

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

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

where, k, is a constant.

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

x	0	1	2	3	4	5
$P(X = x)$	$5k$			$11k$		

Find:
(b) the value of the k. **(2 marks)**
(c) the mean and variance of X. **(5 marks)**

(ii) The probability that a man chosen at random from a village owns a car is $\frac{1}{5}$.
Four men are chosen at random from the village. Using the binomial distribution, find the probability that:
(a) none of them owns a car, **(3 marks)**
(b) one of them owns a car. **(2 marks)**
(c) Find the mean and variance of the distribution. **(3 marks)**

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14. (i) Two events A and B are such that
$P(A) = \frac{1}{4}, P(B) = \frac{1}{2}, P(A \cup B) = \frac{2}{3}$.

(a) Find $P(A \cap B)$ **(3 marks)**
(b) $p(A' \cup B)$ **(2 marks)**
(c) $p(A / B)$ **(3 marks)**

(ii) Dion goes to school either by trekking or by a bicycle. The probability that Dion gets early to school if he uses a bicycle is $\frac{1}{3}$ and if he treks is $\frac{1}{5}$, Given that the probability that Dion uses a bicycle to school is $\frac{1}{2}$.
Find the probability that on one particular day,
(a) Dion gets early to school. **(3 marks)**
(b) Dion gets to school late **(3 marks)**
(c) Dion gets early to school given that he uses a bicycle, **(3 marks)**