ADDITONAL MATHEMATICS 2
575

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2015 **ORDINARY LEVEL**

Subject Title	**Additional Mathematics**
Paper No.	**Paper 2**
Subject Code No.	575

Two and a half hours

Answer ALL QUESTIONS IN SECTION A and ANY TWO QUESTIONS FROM EITHER SECTION B or 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 questions 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.

Calculators are allowed.

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

SECTION A: PURE MATHEMATICS

THIS SECTION IS COMPULSORY TO ALL CANDIDATES

(ANSWER ALL QUESTIONS)

1. A quadratic equation $x^2 + 2x + 5 = 0$ has roots $\propto$ and β. Without solving the equation,
   (a) write down the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.
   (b) find the quadratic equation, with integral coefficients, whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$. (7 marks)

2. Given that $(x-1)$ are factor of $f(x)$, where $f(x) = x^3 + 2x^2 + ax - 2$,
   (a) find the value of the constant a,
   Hence or otherwise,
   (b) solve the equation $f(x) = 0$. (8 marks)

3. The sum of the first five terms of an arithmetic progression is 25 and the sum of the terms from the sixth to the fifteenth terms inclusive is 200. Find the first term and common difference. (8 marks)

4. (i) Find the number of permutations of the letters of the word BANANA (4 marks)
   (ii) Given that $f(x) = \left(x - \frac{1}{2x}\right)^{12}$, find the coefficient of the term independent of x. (5 marks)

5. The transformation T is defined by $T : (x, y) \mapsto (3x - 2y, -x + 2y)$.
   Find,
   (a) The image of the point $(-2, 5)$ under the transformation T,
   (b) The matrix of the transformation T,
   (c) The point whose image is $(7, -5)$ under the transformation T. (9 marks)

6. Given the lines l_1 and l_2 where,
   $l_1: \mathbf{r} = -\mathbf{i} + 2\mathbf{j} + t(3\mathbf{i} + \mathbf{j})$.
   $l_2: \mathbf{r} = 3\mathbf{i} + 2\mathbf{j} + s(\mathbf{i} - \mathbf{j})$.
   Find,
   (a) The position vector of the point of intersection of l_1 and l_2.
   (b) The cosine of the angle between l_1 and l_2. (8 marks)

7. Solve for $0 \leq \theta \leq 360°$, the equations
   (a) $\cos \theta = \sin 30°$
   (b) $\cos^2 x = \sin 2x$. (9 marks)

8. (i) $f(x) = \frac{\sin x}{1 + \cos x}$.
   Find $f'(\frac{\pi}{3})$ (4 marks)
   (ii) Find the area enclosed by the line $y = 2x$ and the curve $y = x^2$. (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 move in the xy plane such that at time t seconds, A has position vector $[(3t^2-1)i+(t^2+t-1)j\ m]$ and B has position vector $[3t^2i+(4t-6)j\ m]$.

(a) Calculate the distance between A and B when $t=2$.

(b) Find the magnitude and direction of the velocity of A relative to B when $t=2$.

(c) The acceleration of A when $t=2$. **(10 marks)**

(ii) A particle moving in a straight line has acceleration $a=(2t+3)ms^{-2}$ at time t seconds. Initially the particle is at a fixed point O on the line, with a velocity of $2ms^{-1}$.

Find;

(a) the velocity of the particle when $t=1$,

(b) the distance from O covered by the particle when $t=1$. **(7 marks)**

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10. (i) Four forces $F_1=(-2i+j)N$, $F_2=(4i-7j)N$, $F_3=(-3i+8j)N$ and $F_4=(4i+j)N$ act on a particle of mass 6 kg which is at rest. Find;

(a) the magnitude and direction of the their resultant force,

(b) the acceleration of the particle at time t seconds,

(c) the impulse exerted on the particle when $t=2$ seconds **(10 marks)**

(ii) A ball P of mass 2 kg moving with speed $6ms^{-1}$ collide directly with another ball Q of mass 3kg moving in the opposite direction with speed $2ms^{-1}$. Given that after impact P moves with velocity $3ms^{-1}$, find,

(a) the velocity of Q after impact,

(b) the loss in kinetic energy at impact. **(7 marks)**

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11. (i) A particle P of mass 5 kg lies on a rough horizontal table and is connected by light inextensible string passing over a fixed smooth light pulley at the edge of the table to a particle Q of mass 4 kg hanging freely.

The coefficient of friction between the 5 kg mass and the table is $\frac{1}{5}$ and system is released from rest, with the string taut,

Find;

(a) the common acceleration of the particles,

(b) the tension in the string.

(7 marks)

(ii) The area bounded by the curve $y=x+2$, the x- axis and the ordinates at $x=1$ and $x=2$ is rotated completely about the x- axis. Find the volume of the solid generated.

(4 marks)

(iii) Find the position vector of the centre of gravity of particles of masses 5kg, 6kg and 2kg which are at the points with position vectors $5i+7j$, $-3i+2j$ and $3i+2j$ respectively.

(6 marks)

Turn over

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

12. (i) The weight to the nearest kilogram of 160 students of a certain class are given below:

Weight (kg), x	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49
No. of student, f	4	9	18	28	39	30	15	17

(a) Estimate to 2 decimal places, the mean weight of the students.
(b) Construct a cumulative frequency curve for the data.
From the graph, estimate,
(c) the median weight of the students. **(9 marks)**

(ii) For a set X of 30 students, $\sum X = 300$ and $\sum X^2 = 5500$. For a set Y of 50 students $\sum Y = 450$ and $\sum Y^2 = 9600$. Find;

(a) the mean and variance of X,
(b) the mean and variance of Y,
(c) The combined mean of the set of the 80 numbers. **(8 marks)**

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13. (i) The probability that an orange selected at random from a basket of oranges sold by a particular woman is rotten is $\frac{1}{2}$. Ten oranges are selected at random from the basket one after the other without replacement. Using the binomial distribution correct to 3Significant figures, find the probability that;

(a) exactly one orange is rotten,
(b) two or more oranges are rotten.
(c) Find the mean and the variance of the distribution. **(8 marks)**

(ii) The marks X scored by 20 students in a mathematics test scored out of 20 is giving in the table below:

Marks (x)	0	1	2	3	4	5
No. of students (f)	2	p	5	6	q	1

Using $\sum f = 20$ and that the mean is $\frac{9}{4}$ or otherwise,

(a) Show that $p + q = 6$ and $p + 4q = 12$.
(b) Find the values p and q.
Due to poor performance in the test, the mathematics teacher decided to scale the marks X to Y where $y = 3x - 2$.
(c) Find the mean of Y. **(9 marks)**

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14. (i) Events A and B are such that $p(A) = \frac{1}{3}$, $p(B) = \frac{2}{5}$ and $p(A \cup B) = \frac{7}{10}$.
Find;

(a) $p(A \cap B)$,
(b) $p(A \cap B')$.

Show that A and B are neither mutually exclusive nor independent. **(9 marks)**

(ii) An experiment was conducted in a class of 50 students of which 30 are girls and 20 are boys. It was noticed that 40% of the girls and 70% of the boys are colour blind. A student X is selected at random from the class, find the probability that X ,

(a) is colour blind,
(b) is a boy or colour blind . **(8 marks)**
