ADDITONAL MATHEMATICS 2
0575

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2018 **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 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.

Electronic calculators 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 $(x+2)$ is a factor of $f(x)$, where $f(x) = x^3 - x^2 + kx + 4$
   - (a) Find the value of k. **(2 marks)**
   - With this value of k,
   - (b) factorise $f(x)$ completely. **(2 marks)**

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

2. (i) A committee of two boys and one girl is to be selected from a class of four boys and three girls. Find the number of ways in which this committee can be formed. **(4 marks)**

   (ii) Write down the first 3 terms in the Binomial expansion of $(2-x)^7$ in ascending powers of x simplifying your answer as far as possible. **(4 marks)**

3. (i) Given that $(2t+1)$, $(4t-2)$ and $(4t+1)$ are the first three terms of an arithmetic progression, find
   - (a) the value of t **(2 marks)**
   - (b) the sum of the first ten terms of the progression **(2 marks)**

   (ii) The sum to infinity of a geometric progression is 4 and the first term is 2. Find
   - (a) the common ratio **(2 marks)**
   - (b) the sixth term of the progression **(2 marks)**

4. (i) The set $S = \{2, 4, 6, 8\}$ and the operation $*$ is defined as multiplication modulo 10 forms a group.
   - (a) Copy and complete the table **(2 marks)**

*	2	4	6	8
2	4			
4				
6			6	
8		2		

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

   (ii) The transformation T is defined by T: $(x, y) \mapsto (2x - 3y, x + 3y)$.
   - (a) Write down the coordinates of the image of the point (3,4) **(2 marks)**
   - (b) Write down the 2 by 2 matrix representing the transformation T. **(2 marks)**
   - (c) Find the invariant point under this transformation. **(2 marks)**

5. (i) Find the range of values of x for which $|2x - 3| \le 2$ **(3 marks)**

   (ii) P and Q are the points of intersection of the curve $y = x^2 - 9$ and the line $y = x - 3$.

   Find;
   - (a) the coordinates of P and Q. **(3 marks)**
   - (b) the length of the line joining P and Q. **(2 marks)**

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

(ii) The function g(x) is defined as follow:

$$g(x) = 2\cos x - \sin x, 0 \le x \le \pi$$

(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)	2			-1			-2

(2 marks)

Talking 2cm to represent $\frac{\pi}{6}$ radians 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 maximum value of g(x). **(1 mark)**

7. Given the lines l_1 and l_2

Where $l_1: r = -5i + 2j + s(3i - j)$

$l_2: r = -2i + j + t(2i + j)$

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)**

8. (i) Given that $y = x^2 \cos x$,

Find $\frac{dy}{dx}$, simplifying your answer as far as possible. **(3 marks)**

(ii) Find the equation of the tangent to the curve $y = 2x^3$ at the point (1,2) **(3 marks)**

(iii) Find $\int (1 + \sin x)dx$. **(2 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 5kg, moves in a straight line so that its displacement, x metres after t seconds is given by $x = t^3 - 4t^2 + 4t$. 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 4 kg, lies on a smooth plane which is inclined at an angle of 30° to the horizontal. P is connected by a light inelastic string, which passes over a smooth fixed pulley at the top edge of the plane, to a particle Q, of mass 4kg, which hangs freely. Given that the system is released from rest with the string taut and the hanging part vertical.

(a) Draw a diagram showing all the forces acting on the particles. **(1 mark)**
Find
(b) the common acceleration of the particles and the tension in the string. **(5 marks)**

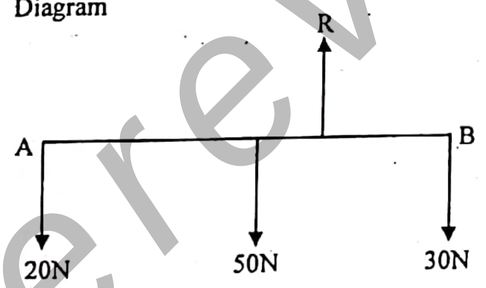
(iii) Two particles P and Q, of masses 5 kg and 3 kg respectively, are moving towards each other in a straight line with velocities $2ms^{-1}$ and $4ms^{-1}$ respectively. The particles collide, coalesce and move in the direction of P. Calculate;
(a) their common velocity after collision **(3 marks)**
(b) the magnitude of the impulse of P after collision. **(2 marks)**

10. (i) The rate of change of the surface area of a sphere is $12\pi\ cm^2s^{-1}$ at the instant when the radius is 2cm. Find the rate of change of the radius of the sphere.
[$surface\ area\ of\ a\ sphere = 4\pi r^2$] **(5 marks)**

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

(iii) Find the position vector of the centre of gravity of particles of masses 2kg, 3kg and 7 kg which are at the points with position vectors $(5i + 2j)$, $(-i + 4j)$ and $(2i - j)$ respectively. **(6 marks)**

11. (i) Diagram



The diagram shows a uniform plank AB, 3m long, which has weights 20N and 30N attached to its ends, A and B respectively .Given that the weight of the plank is 50N, find the point on the plank from B where a support R can be placed so that the plank is in equilibrium in a horizontal position. **(9 marks)**

(ii) A car, of mass 1000 kg, has an engine capable of developing power of 15 kw against a constant resistance R N. The maximum speed of the car on a level road is $\frac{100}{3} mS^{-1}$
(a) Calculate the value of R.
Given that the resistance and the power remain unchanged
(b) Find the maximum speed of the car up a plane which is inclined at an angle θ to the horizontal, where Sin $\theta = \frac{1}{25}$. **(8 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.

Speed (x)	0-9	10-19	20-29	30-37	40-49	50-59	60-69	70-79
Number of cars (f)	1	4	11	27	38	12	4	3

The table shows the speeds, in Kmh^{-1}, of 100 cars, which moved in the same direction along a straight level road.

(i) (a) Draw a cumulative frequency graph of the distribution. **(5 marks)**

From your graph, estimate

(b) the median speed **(3 marks)**

(c) the number of cars which were travelling at a speed greater than $55kmh^{-1}$ **(4 marks)**

(ii) Find the mean of the distribution. **(5 marks)**

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13. A discrete random variable X has probability density function f defined by

$$f(x) = \begin{cases} kx^2, & for\ x = 1,2,3,4 \\ k\,(8-x)^2, & for\ x = 5,6,7 \\ 0, & otherwise \end{cases}$$

(i) Copy and complete the distribution table.

(x)	1	2	3	4	5	6	7
f (x)	k			$16k$			

(4 marks)

Find

(ii) the value of the constant k **(3 marks)**

(iii) the mean and variance of X. **(7 marks)**

(iv) $P(2 \le x \le 6)$. **(3 marks)**

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14. (i) Two events A and B are such that

$$P(A) = \frac{1}{2}, P(B) = \frac{7}{10}, P(A \cup B) = \frac{4}{5}.$$

(a) Find $P(A \cap B)$ **(3 marks)**

(b) Show that A an B are neither mutually exclusive nor independent. **(4 marks)**

(ii) A bag contains 3 green balls and 5 red balls. Two balls are selected at random, in succession and without replacement.

(a) Draw a probability tree diagram to illustrate the possible outcomes **(4 marks)**

Hence, or otherwise, find the probability that

(b) both balls are red **(2 marks)**

(c) at least one red is drawn **(4 marks)**
