ADDITONAL MATHEMATICS 2
0575

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2017 **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 C.

Candidates are expected to answer a combination of Section A and Section B **OR** Section A and Section C **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. Given that α and β are the roots of the equation $x^2 + 7x + 3 = 0$,
   (a) find the value of $\alpha^2 + \beta^2$.
   (b) find the quadratic equation, with integral coefficients, whose roots are $\frac{1}{\alpha^2}$ and $\frac{1}{\beta^2}$. **(8 marks)**

2. Given that $f(x) = ax^3 + bx^2 - 6x + 8$ leaves a remainder of 10 when divided by $(x + 1)$ and that $(x - 1)$ is a factor of $f(x)$, where a and b are constants,
   (a) find the values of a and b.
   With these values of a and b,
   (b) factorise $f(x)$ completely. **(10 marks)**

3. In an arithmetic progression, the first term is 2 and sum of the first six terms is 72.
   Find,
   (a) The common difference ,
   (b) The sum of the 7th to the 10th terms inclusive of the progression. **(7 marks)**

4. (a) Find the number of permutations of the letter of the word CANADA. **(3 marks)**
   (b) Find the term independent of x in the expansion of $\left(x^2 + \frac{2}{x}\right)^9$. **(5 marks)**

5. The transformation T is represented by the matrix M, where $M = \begin{pmatrix} 2 & 1 \\ 1 & -1 \end{pmatrix}$.
   Find,
   (a) The image of the point (1, 2) under the transformation T,
   (b) The inverse of M.
   Hence or otherwise, find
   (c) The image of the line $2x + 3y = 8$. **(8 marks)**

6. The points A , B and C have coordinates (3, 1),(1, 5) and (5, 7) respectively.
   (a) Find the equation of the line l_1 joining the points A and B.
   (b) Find the equation of the line l_2 perpendicular to l_1 and passing through the point B,
   (c) Show that C lies on the line l_2.
   Hence, or otherwise,
   (d) find the area of triangle ABC. **(9 marks)**

7. The function f is defined as $f(x)=\sin x+\frac{1}{2}\cos 2x$, where $0\leq x\leq\pi$.

(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
$f(x)$				0.5			

(b) Taking 1cm to represent $\frac{\pi}{6}$ on the x-axis and 4cm to represent 1 unit on the y-axis, draw the graph of $f(x)=\sin x+\frac{1}{2}\cos 2x$, for

(c) Using your graph, estimate, the maximum value of $y = f(x)$. **(9 marks)**

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

(b) Evaluate $\int_0^3 (x+4)\,dx$. **(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 P is travelling in a straight line starting at a point O on the line so that, t seconds after leaving O, its velocity in ms^{-1}, is given by $v = 2\sin \pi t$.
Find, in terms of π,

(a) the acceleration of P when $t = \frac{1}{3}s$,

(b) the distance travelled from O, when $t = \frac{1}{3}s$ **(8 marks)**

(ii) A particle A of mass 5 kg, is moving with velocity $4ms^{-1}$ and it collides with a particle of mass 2 kg, moving with velocity $2ms^{-1}$ in the opposite direction. Immediately after the collision, the velocity of A is $2ms^{-1}$. Find,
(a) the velocity of B after the collision,
(b) the loss in kinetic energy of the system due to the collision. **(9 marks)**

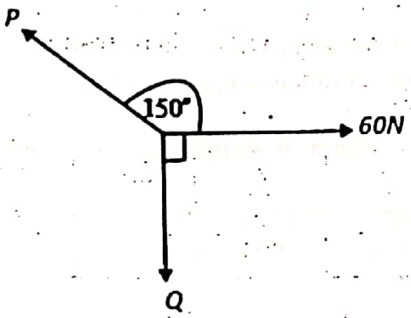
10. (i) Gas is escaping from a spherical balloon at the rate of $2cm^3s^{-1}$. Find the rate of decrease of the surface area when the radius is 4 cm
[volume of a sphere is $\frac{4}{3}\pi r^3$ and surface area of a sphere is $4\pi r^2$] **(5 marks)**

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

(iii) Find the position vector of the centre of gravity of particles of mass 2kg, 1 kg and 3 kg which are at the points with position vectors $6i + 6j, 3i + 5j, 2i - j$ respectively. **(6marks)**

Turn Over

11. (i)



Given that the system of forces in the diagram are in equilibrium. Find the values of P and Q. **(8 marks)**

(ii) A particle P of mass 1kg lies on a rough plane which is inclined at an angle θ with the horizontal, where $\sin\theta = \frac{3}{5}$. P is connected by a light inextensible string that passes over a smooth fixed pulley at the top edge of the plane to a particle Q of mass 2kg which is hanging freely. Given that the system is released from rest, with the string taut, find,

(a) The acceleration of the system,

(b) The tension in the string.

[(*the coefficient of friction between the plane and the particle P is* 1/4)]

(9 marks)

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

12. The mark distribution of 50 candidates in a Physics test is given as follows:

Marks (x)	0 – 6	7 – 13	14 – 20	21 – 27	28 – 34	35 – 41	42 – 48
No. of Candidates(f)	4	6	16	10	8	5	1

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

(ii) Taking 2cm to represent 5 units on the cumulative frequency axis and 2cm to represent 10 nits on the marks axis.

(a) Draw a cumulative frequency graph of the distribution.

(b) Using your graph, find the median mark and the semi- inter quartile range. **(8 marks)**

(iii) Calculate the mean mark of the distribution. **(4 marks)**

13. (i) In a bag containing oranges, 3 out of 12 is found to be rotten. Find

(a) the probability of selecting at random a rotten orange from the bag.

Given that six oranges are selected at random from the bag, using the binomial distribution, find,

(b) the probability that at least 2 oranges selected are rotten.

(c) the mean and standard deviation of the binomial distribution

(9 marks)

(ii) The set X and Y have five elements each.

Given that $\sum X = 25$, $\sum Y = 55$, $\sum X^2 = 165$ and $\sum Y^2 = 765$ and a linear function $y = px + q$ transforms the set X in to the set Y, where p and q are positive constants.

(a) Find the mean and variance of X and Y.

Hence, or otherwise,

(b) find the values of p and q.

(8 marks)

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14. (i) Given that A and B are independent events, where $P(A) = \frac{3}{4}$ and $P(A \cup B) = \frac{17}{20}$.

Find,

(a) $P(B)$

(b) $P(A \cap B')$

(8 marks)

(ii) A bag contains ten balls, of which seven are green and three are white. A ball is taken at random from the bag, its colour noted and not replaced. A second ball is then taken out of the bag.

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

From the tree diagram, or otherwise, find the probability that

(b) a green ball is drawn from the bag,

(c) the second ball drawn is white

(9 marks)