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Additional Maths 2
0575



March 2022

WOURI COMMON MOCK EXAMINATION
GENERAL CERTIFICATE OF EDUCATION

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, IN SECTION B AND C, ALL QUESTIONS CARRY EQUAL MARKS

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.

You are required to answer ANY FIVE questions. ONLY THE FIRST FIVE QUESTIONS ANSWERED WILL BE MARKED

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 10 ms^{-2}

Formulae Booklets may be used.

..... TURNOVER

WOURI/0575/P2/MOCK 2022

- Given that $(x - 1)(x + 2)$ are factors of $f(x) = x^3 - 2x^2 - 5x + 6$, find the other factor.
 - Given that the quadratic equation $x^2 + bx + c = 0$ has roots α and β such that $\alpha - \beta = 2\sqrt{3}$ and $\alpha^2 + \beta^2 = 14$, find the possible values of b and c . (8 marks)
- Solve for x the equations
 - $3^{2x} - 5(3^x) + 6 = 0$
 - $\log_3 x + 3\log_x 3 + 4 = 0$(8 marks)

3. i) Given that $(t - 3)$, $(2t + 1)$ and $(7t - 3)$ are three consecutive terms of an arithmetic progression, find the value of t .
 ii) Given that $\sum_{r=1}^{\infty} \frac{c}{2^{r-1}} = 10$, find the value of c . (6 marks)

4. i) In a meeting of 5 women and 7 men how can a committee of 5 people be formed such that the number of men must be a majority?
 ii) Expand $(1 + x)^4$ and use it to find an approximate value of $(1.95)^4$ to 4 decimal places. (8 marks)

5. i) Given the set $G = \{P, Q, R, S\}$ where $P = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$, $Q = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, $R = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ and $S = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$.
 a) Write down a combination table for the set G under the operation of matrix multiplication.
 b) Show whether or not the set G together with the operation forms an abelian group (7 marks)

ii) a) show that $\frac{1}{1+\sin x} = \sec^2 x - \tan x \sec x$ (3marks)

b) Complete the table in figure 1 below for the graph of $y = 2\cos(2\theta - 30^\circ)$

θ°	0°	15°	30°	45°	60°	75°	90°	105°	120°
y		2		1		-1			-1.7

Figure 1

c) Draw the graph of the curve y and state the minimum value. (6 marks)

6. i) Differentiate $y = (-x^2)\cos x$ with respect to x (2marks)
 ii) Evaluate $\int_0^{\frac{\pi}{3}} 2\sin x \cos x dx$ (2marks)
 iii) Find the equation of tangent and normal to the curve $y = x^3 - 3x^2 + 2x - 6$ at the point $(3,0)$ (4 marks)

7. In figure 2 below angle $ABC = y^\circ$ and angle $CAB = x^\circ$

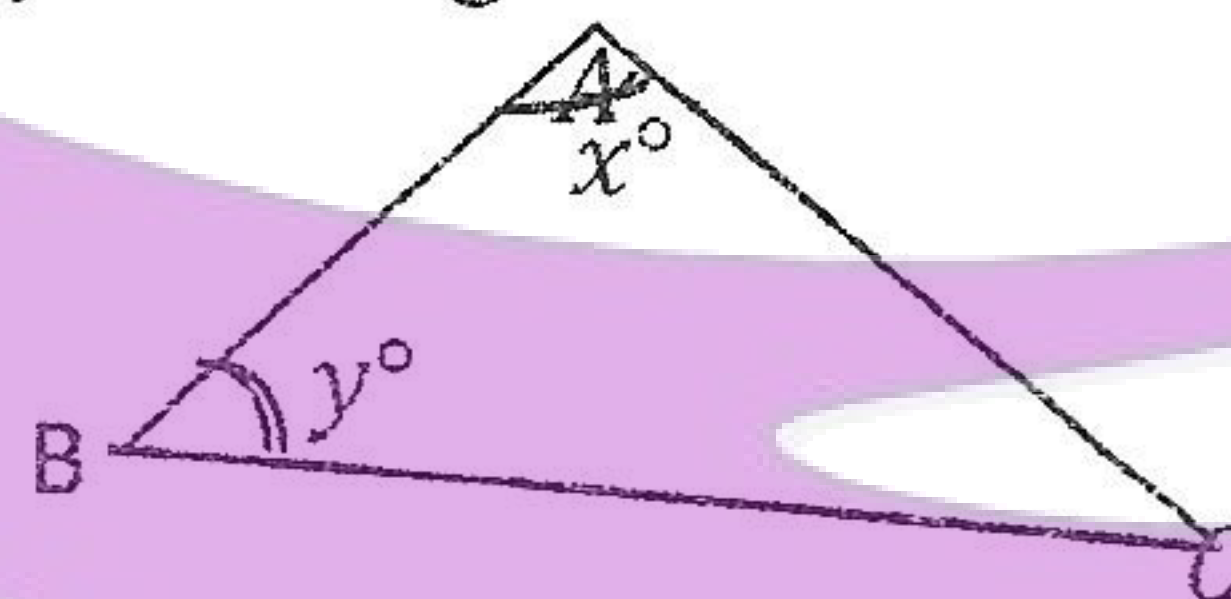


Figure 2

- a) Write down an expression for angle BCA in terms of x and y .
 It is known that:
 i) No angle of the triangle is larger than x°
 ii) No angle is smaller than angle BCA
 iii) The triangle is not obtuse-angled.
 iv) No angle is smaller than 20° .
 b) Show that the above constraint can be represented by the following inequalities:
 1) $y \leq x$ 2) $x \leq 90^\circ$ 3) $x + y \leq 180$ 4) $x + 2y \geq 0$
 c) On a graph paper, using a scale of 1 cm to represent 10 units on each axis, shade the region corresponding to the pair of values of x and y that are rule out by the above inequalities.
 d) State the values of the three angles of the triangle. (10 marks)

8. a) Find the vector equation of the line of action of the forces $F_1 = 3i + j$ and $F_2 = i - j$ acting through the points $(-1, 2)$ and $(3, 2)$ respectively.
 b) Given that F_1 and F_2 intersect, find the position vector of their line of intersection.
 c) Find the angle between the two forces F_1 and F_2 . (8 marks)

SECTION B (MECHANICS)

9. i) A particle of mass 2kg moves in the xy -plane such that its position vector is given by



- $\vec{r} = [(t^3 - t^2 - 4t + 3)i + (t^3 - 2t^2 + 3t - 7)j]m$ where t is the time in seconds. Find the
- velocity of the particle at time $t = 2\text{sec}$.
 - times when the particle crosses the line $y = x$ and the position vector from the origin to the point.
 - the force acting on the particle at time $t = 1\text{sec}$.

- Two particles A and B of masses 2kg and mkg respectively are moving towards each other with speeds 5m/s and 3m/s. Find
 - the value of m
 - the magnitude of the impulse experienced by A
 - the loss in kinetic energy after impact.
 - A car of mass 10,000kg is ascending a hill which is inclined at $\arcsin\left(\frac{1}{100}\right)$ to the horizontal. Given that the car is accelerating at $\frac{3}{2}m/s^2$ and the constant resistant to the motion of the car is 500N. Find the tractive force exerted by the engine of the car.
- A uniform beam AB of length 10m and weight 100N rest horizontally in equilibrium on two smooth pegs C and D where AC = 2m, DB = 4m. Loads of 10N and 2N are attached to the beam at A and B respectively.
 - Draw a diagram indicating all the forces acting on the system.
 - Determine the reaction at C and D.
 - A spherical balloon when inflated increases at the rate of $10cm^3s^{-1}$ when its radius is 4cm. Find the rate at which its surface area increases.

SECTION C (STATISTICS)

- The masses, in Kgs, of bags of oranges loaded into a truck are grouped as follows:

Mass x in kg	30 - 35	36 - 41	42 - 47	48 - 53	54 - 59	60 - 65
Number of bags	18	34	58	42	24	10

- Calculate, to 2 decimal places, the mean mass of the masses of the bags.
 - By drawing a histogram, estimate from it the mode of the distribution of the masses of the bags of oranges.
 - Draw a cumulative frequency curve for the distribution and use it to estimate
 - The median mass of the bags.
 - The interquartile range.
- The set X and Y of numbers are given as:
 $X = \{12, 13, 15, 17, 19\}$ and $\{38, 41, 47, 53, 59\}$
 - Calculate the mean and variance of each of the sets X and Y, showing all working. Set X is transformed to set Y by the transformation $Y = \alpha x + \beta$.
 - Find the values of α and β .
 - Using these values of α and β , write down the relationship between X and Y.

- A random variable X can take any of the two values 5 and 10, as shown in the below.

x	5	10
$P(X = x)$	p	q

Given that $E(X) = 8$, find the values of p and q.



14. i) Two events A and B are such that $P(A) = \frac{3}{5}$, find
- a) $P(B)$ when A and B are exhaustive.
 - b) $P(B)$ when A and B are independent.
 - c) $P(A)$ when A and B are mutually exclusive and $P(A \cup B) = \frac{5}{6}$.
- ii) A bag contains 4 red sweets and 6 blue sweets. Two sweets are taken at random from the bag, one after other and eaten.
- a) Draw a tree diagram to represent this information.
 - b) Use your tree diagram to find the probability that
 - i) the two sweets are of the same colour.
 - ii) the second sweet is red.
 - iii) the sweets are of different colours.



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