tr joelPCM Academic Council

UGANDA ADVANCED CERTIFICATE OF EDUCATION (UACE)

END OF FIRST TERM EXAMINATIONS 2026 — SET 2

S.6 P425/1 PURE MATHEMATICS (Paper 1)

Time Allowed: **3 HOURS**

STUDENT NAME:

.....

PERSONAL NUMBER: ..... **SIGNATURE:** .....

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO BY THE INVIGILATOR

INSTRUCTIONS TO CANDIDATES:

1. Do not write anything in this paper; any rough work should be written in the response booklet(s) provided and crossed out.
2. The time allowed for this paper is strictly **3 Hours** and no additional time shall be granted.
3. This paper consists of **three** sections; **A, B** and **C** with a total of **6 items**.
4. Section A has 2 items, attempt **any one** item.
5. Section B has **One COMPULSORY** item.
6. Section C has **Three** items, attempt any **two** of your choice.
7. **FOUR ITEMS** should be attempted in total. Any additional item(s) attempted will not be marked.
8. Begin each item on a fresh page and clearly indicate them in the response booklet provided.
9. Tidy handwriting, meaningful mathematical judgement and conclusion may increase your chances of excelling.
10. Silent non-programmable calculators and logarithmic tables may be used. Take $g = 9.8\ m/s^2$ where applicable.

FOR SCORER'S USE ONLY

SECTION	**A**		**B**	**C**			**TOTAL**
ITEM	1	2	3	4	5	6	
SCORE							
INITIAL							

SECTION A

Attempt any One item in this Section

ITEM 1

Mrs. Nanteza is the events manager at a luxury conference centre in Kampala. She is organising a corporate banquet and needs to hire chairs, rent table centrepieces, and access the centre's digital safe to retrieve advance payments. The number of banquet tables to be set up is the product of the two values that satisfy the equation $(\log_2 x)^2 - 3\log_2 x + 2 = 0$, and each table set costs UGX 450,000 to hire.

To access the digital safe, Mrs. Nanteza must enter a 4-digit PIN. A note she kept reads:

- The first two digits are the values of x satisfying $4^{2x} - 5(4^x) + 4 = 0$, written in ascending order.
- The next two digits are a and b obtained by expressing $(7 - 2\sqrt{2})/(\sqrt{2} - 1)$ in the form $a + b\sqrt{2}$, where a takes position three and b takes position four.

When pricing supplies from her vendor, Mrs. Nanteza noted the following:

- 2 crates of fruit juice, 3 platters of snacks and 1 cake cost UGX 19,000
- 1 crate of fruit juice, 2 platters of snacks and 4 cakes cost UGX 22,000
- 3 crates of fruit juice, 1 platter of snacks and 2 cakes cost UGX 16,000

She needs to purchase 120 crates of juice, 80 platters of snacks and 100 cakes for the full conference season. Her major goals are to determine the total table hire cost, recover the digital safe PIN, and calculate the total cost of conference supplies.

Task:

Help Mrs. Nanteza to:

a) Determine, with clear working, the total cost of hiring the banquet tables.

b) Recover the digital safe PIN.

c) Calculate the total cost of conference supplies for the full season.

ITEM 2

Mr. Byekwaso is a portfolio investment manager at a leading commercial bank in Kampala. He is managing a client's savings plan, forming an internal audit team, and verifying digital access codes for the bank's secure vault system.

A client's monthly savings follow a Geometric Progression. The savings in the 2nd month amounted to UGX 60,000 and in the 5th month they amounted to UGX 1,620,000. Mr. Byekwaso needs to find the total savings accumulated over the first 6 months of the plan.

For an internal audit exercise, an audit team of 4 members is to be selected from 7 Senior Managers and 3 Financial Analysts. Company policy requires that the team must contain exactly 2 Senior Managers.

The bank's vault access system requires solving the complex number equation $(2 - i)z + (1 + 3i)\overline{z} = 10 + 5i$, where $\overline{z}$ denotes the complex conjugate of z. The real and imaginary parts of z form the final access verification sequence.

His major objectives are to compute the total client savings, determine the number of valid audit team formations, and recover the vault access code.

Task:

Help Mr. Byekwaso to:

a) Find the total savings accumulated by the client over the first 6 months of the plan.

b) Determine the number of valid audit team formations.

c) Find the complex number z, expressing it in the form a + bi, and state its modulus.

SECTION B

This section has ONE Compulsory Item

ITEM 3

Ms. Ainebyoona is a licensed land surveyor working on a cadastral survey project in Wakiso district. She uses coordinate geometry, trigonometry and vectors in her daily mapping calculations.

In mapping a water supply network, a main pipeline runs along the boundary line L whose equation is $x + 2y = 5$ (where one unit represents 1 km). A new borehole is drilled at point H(4, 3). Ms. Ainebyoona needs to find the shortest distance from the borehole to the pipeline and locate the exact point on the pipeline closest to the borehole.

In surveying a triangular land parcel ABC, Ms. Ainebyoona measures AB = 150 m, AC = 120 m and the angle BAC = 55°. She needs to find the length of the third boundary BC and the size of angle ABC.

On the site map, a water pump is located at point P with position vector $\mathbf{p} = \mathbf{i} + 5\mathbf{j}$ km, and a reservoir is at point Q with position vector $\mathbf{q} = 5\mathbf{i} + \mathbf{j}$ km. A valve station V is to be installed along the direct route from P to Q such that PV : VQ = 3 : 1.

Her major objectives are to locate the closest pipeline point to the borehole, determine the missing boundary measurements of the land parcel, and find the position of the valve station.

Task:

Help Ms. Ainebyoona to:

a) (i) Find the perpendicular distance from borehole H(4, 3) to the pipeline L: $x + 2y = 5$.

(ii) Find the coordinates of the foot of the perpendicular from H to L.

b) Find the length BC and the angle ABC of the land parcel. (Give answers to 1 decimal place.)

c) (i) Find the position vector of the valve station V.

(ii) Find the unit vector in the direction of PQ.

SECTION C

Attempt any Two items from this Section

ITEM 4

Dr. Musisi is an agricultural economist studying the profitability of maize farming in Uganda. The net profit (in millions of UGX) at a production level of x tonnes is modelled by the function:

$$P(x) = 2x^3 - 9x^2 + 12x - 4, \quad 0 \le x \le 4$$

In a crop spacing experiment, the density of seedlings (in thousands per hectare) at distance x metres from the centre of a plot is described by $y = 4x - x^2$ on one side and $y = x^2$ on the other. Dr. Musisi needs to find the total area of the region enclosed between these two curves.

He also needs to evaluate the integral $\int_2^4 (2x + 1) / ((x - 1)(x + 2))\, dx$ using partial fractions, to determine the cumulative resource utilisation index over a production cycle.

His major objectives are to analyse the profit model for optimal production decisions, determine the area of the seedling density region, and evaluate the resource utilisation integral.

Task:

Help Dr. Musisi to:

a) Find the values of x at which the rate of change of profit is zero. Determine the nature of each stationary point and state the maximum and minimum values of P.

b) Find the area enclosed between the curves $y = 4x - x^2$ and $y = x^2$.

c) Using partial fractions, evaluate $\int_2^4 (2x + 1) / ((x - 1)(x + 2))\, dx$.

ITEM 5

Mrs. Akello is a quality assurance supervisor at a tea processing factory in Fort Portal. She monitors the weight of sealed tea packets and analyses production defect patterns using statistical methods.

The weights of 50 randomly sampled tea packets from a production batch are recorded in the frequency table below:

Weight (g)	95−99	100−104	105−109	110−114	115−119	120−124
Frequency	4	12	20	9	4	1

From extensive production records, it is established that 15% of all packets produced are overweight (above the target range) and 20% are underweight. A packet is selected at random from the factory.

Quality monitoring shows that major sealing defects occur in the factory at an average rate of 3 defects per 100 packets inspected. A batch of 100 packets is randomly selected for inspection. Let X represent the number of major sealing defects found. Assume X follows a Poisson distribution.

Mrs. Akello's major objectives are to summarise the packet weight distribution, assess the probability of selecting a non-standard packet, and predict defect occurrences using the Poisson model.

Task:

Help Mrs. Akello to:

a) Calculate the mean and standard deviation of the tea packet weights.

b) Given that a randomly selected packet is not of standard weight (i.e., it is either overweight or underweight), find the probability that it is overweight.

c) Given that $X \sim Po(3)$, find:

(i) $P(X = 0)$

(ii) $P(X \le 2)$

(iii) $P(X \ge 1)$

ITEM 6

Ms. Atim is a road safety engineer at Uganda National Roads Authority (UNRA). She is conducting a vehicle performance analysis for a delivery van of mass 2,000 kg operating on roads in northern Uganda.

During a braking assessment test on a straight level road, the van's engine is disengaged and it decelerates uniformly from 28 m/s to rest in exactly 35 seconds under the action of a constant resistance force alone.

Under normal loaded operation on the same level road, the van's engine provides a constant driving force of 5,600 N while the resistance force to motion remains the same as determined in the braking test.

The van is later driven up a straight inclined road where $\sin\theta = 1/4$. The engine maintains the same driving force of 5,600 N and the resistance force remains unchanged. Take $g = 9.8\ m/s^2$.

Ms. Atim's major objectives are to determine the resistance force, analyse the van's normal horizontal motion, and assess its ability to ascend the incline.

Task:

Help Ms. Atim to:

a) Determine the resistance force to motion and the acceleration of the van during normal horizontal operation.

b) Find the velocity of the van and the distance covered 12 seconds after it starts from rest during normal horizontal operation.

c) Calculate the net force acting on the van on the incline, find its acceleration, and state with justification whether the van accelerates or decelerates up the slope.