P425/1
MATHEMATICS
Theory
Paper 1
APRIL 2025
2 hours

ASK INTEGRATED TEACHER'S EXAMINATIONS BUREAU LTD

Uganda Advanced Certificate of Education

END OF TERM 1 ASSESSMENT 2025

S.5 MATHEMATICS
(Theory)

2 Hours

INSTRUCTIONS TO CANDIDATES:

Answer all questions in section A

Attempt two items from section B

All necessary working must be shown clearly

Begin each answer on a fresh sheet of paper.

Graph paper is provided.

Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

In numerical work, take g to be 9.8 ms-2.

SECTION A

ITEM 1

Phresh School Management System is a digital platform used by schools to streamline administrative tasks, track student performance, and manage school activities efficiently. Over the past five years, the number of schools adopting Phresh has been growing exponentially. The system initially had 850,000 registered users in 2020, with a steady annual growth rate.

As a data analyst for Phresh, you are tasked with evaluating this growth to support future infrastructure planning. By 2023, the number of active users had reached 1,309,500.

Tasks:

a) Utilizing the knowledge of logarithms, determine the annual growth rate of Phresh School Management System users. Express your answer as a percentage to one decimal place.
b) Predict the number of active users Phresh will have in 2025.
c) How many years would it take for the number of users to reach 5 million?
d) How can exponential growth models be used by school management systems for planning resource allocation?

ITEM 2

A small-scale bakery in Kampala produces handcrafted cakes and pastries. Their kitchen prepares cakes and muffins using locally sourced ingredients. Each cake requires 5 hours of baking and preparation time along with 8 kilograms of flour, while each muffin requires 3 hours and 2 kilograms of flour. The bakery has a total of 60 hours of available labor and 72 kilograms of flour per week.

Tasks:

a) Obtain all the constraints as inequalities that can help the bakery manager determine the optimal production strategy.
b) The profit is UGX 70,000 per cake and UGX 25,000 per muffin. Model the total weekly profit as a function of the number of cakes and muffins.
c) Illustrate the feasible region defined by the constraints and use it to find the optimal strategy that maximizes the profit.

SECTION B

ITEM 3

Aitel Examinations Bureau Limited is analyzing student enrollment data for UCE pre-registration assessments across various schools to ensure proper resource allocation and exam planning. The bureau has compiled data showing the number of students from different schools who subscribed for the assessments
Below is the data on student subscriptions from 12 schools in Uganda:

School	Number of Students Subscribed
Gayaza High School	145
King's College Budo	187
Seeta High School	203
Uganda Martyrs Secondary School Namugongo	168
St. Mary's College Kisubi	227
Namilyango College	192
Mt. St. Mary's Namagunga	254
St. Henry's College Kitovu	176
Immaculate Heart Girls School	219
Iganga Secondary School	238
St. Joseph's Secondary School Naggalama	182
Mary Hill High School	209

Tasks:
(a) Organize the data into a frequency distribution and represent it on a histogram.
(b) Determine:
i. The mean number of student subscriptions
ii. Median number of student subscriptions
iii. The coefficient of variation.
(c) If resources are allocated proportionally to the number of students, and UGX 60 million is available, how much will be allocated to each school?

ITEM 4

The Ministry of Energy and Mineral Development is implementing a rural electrification project in three neighboring districts. Each district has distinct energy demands and infrastructure challenges. An electrical engineer is assigned to design an efficient power distribution system that ensures adequate supply across all areas. The system is modeled using three equations representing total energy availability, voltage regulation, and transmission efficiency. Additionally, a polynomial equation determines the reliability of transformers used in the project.

Mathematical Model:
The power distribution system is modeled by the following equations:

$$A+2B+C=2400 \text{ (Total available energy supply in kilowatts per hour)}$$
$$2A+B+3C=3900 \text{ (Voltage regulation equation)}$$

$3A+4B+2C=5100$ (Transmission efficiency equation)

Where A, B, and C represent the energy supply in kilowatts per hour for districts X, Y, and Z respectively.

The polynomial equation $T(A)=A^3-7A^2+14A-8$ models the reliability of the transformers in the system.

Tasks:

a) Assist the engineer in determining the optimal energy distribution for each district.

b) If district X's energy demand increases by 200 kilowatts per hour, what adjustments should be made to maintain system balance?

c) Determine all possible values of A where the reliability of the transformers is zero.

ITEM 5

The Kampala City Authority is redesigning a section of the central business district to improve traffic flow and pedestrian accessibility. The urban planning team is using a coordinate system where each unit represents 50 meters. A transport engineer needs to plan new roads, determine optimal crossing points, and ensure safe and efficient movement. The proposed **Road X** will connect points P(5,10) and Q(15,30), while another **Road Y** will connect points R(8,12) and S(20,24).

Tasks:

a) Assist the transport engineer to determine:

i. The length of Road X in kilometers.
ii. The gradient of Road X and its equation modeling the path of the road.

b) Check whether Roads X and Y intersect, and if they do, determine the coordinates of the intersection and the angle between the two roads to the nearest degree.

c) If a pedestrian plaza needs to be located at a point equidistant from points P, Q and R, find the coordinates of this point.

END