BUKASA HIGH SCHOOL

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MATHEMATICS DEPARTMENT

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456/1 MATHEMATICS

O'LEVEL MATHEMATICS SEMINAR HELD AT BUKASA HIGH SCHOOL
FOR NEW LOWER SECONDARY CURRICULUM
ON SATURDAY 28TH JUNE 2025

FORMAT OF THE PAPER:

SECTION A: This will comprise of two items and they are compulsory.

SECTION B: This comprises of part 1 and part II each having two questions and a learner answers one question from each part.

ITEM	Area of construct	Topics covered
SECTION A: Compulsory		
Item 1	**Numbers**	• Number bases
		• Working with integers
		• Fractions, percentages and decimals
		• Numerical concept 1 and 2

		• Ratios and proportions
Item 2	Patterns and algebra	• Sequences and patterns
		• Equations of lines and curves
		• Algebra 1 and 2
		• Mapping and relations
		• Inequalities and regions
		• Rectangular cartesian plane
		• Simultaneous equations
		• Linear programming
		• Loci
SECTION B		
PART I (choose one question)		
Item 3 and 4	Data and probability	• Data collection and presentation
		• Graphs
		• Set theory
		• Matrices
		• Probability
PART II (choose one question)		

Item 5 and 6	Geometry and measures	• Geometric construction
		• Bearings
		• General and angle properties of geometric figures
		• Reflection
		• Business arithmetic
		• Time and tables
		• Similarities and enlargement
		• Circle properties
		• Rotation
		• Length and area properties of two-dimensional geometrical figures
		• Nets, areas and volumes of solids
		• Trigonometry 1 and 2
		• Matrix transformation
		• Lines and planes in 3 dimensions

THEME: NUMBERS

ITEM 1

Your father upon his retirement deposited sh. 10,500,000 in a joint family account to support you and your two brothers, Moses and Joshua. You being the eldest will receive 40% while Moses and Joshua share the rest in a 3:4 ratio respectively.

You withdraw at different intervals: you every 8 days, Moses every 12 days and Joshua every 15 days. The last time you all met at the bank was 5th May. As per the family tradition, when you meet at the bank on the same day, you visit your father together. Now there are two concerns, Moses has an exam on 6th September and Joshua has a trip on 4th August. They wonder if they will have a common date, allowing you to visit your father together again.

TASK

(a) Compute the amount each of you will receive.
(b) Determine the next date all the three of you will meet at the bank.
(c) Will that date be suitable for all of you to visit your father?

ITEM 2

At the beginning of term two, your school faced a pressing issue: - a shortage of dormitory space for students. To address this sleeping accommodation deficit, the school's management developed a plan to construct new hostels with a rectangular design, where the length is $\sqrt{3}$ times the width, resulting in a perimeter of $(14+6\sqrt{3})$ units. To fund this project, the administration required a 97% collection rate of school fees from students

By the end of the first week of the term, two-thirds of the student body had settled their fees. In the subsequent week, an additional 100 students paid their fees, resulting in a significant increase in the proportion of students who had paid their fees, reaching three-quarters of the total student population.

TASK

a) Guide the school management to ascertain the land area, ensuring a surd form solution with rationalized numerals and simplified radicals.
b) Ascertain the precise number of students in the school.
c) Guide the school administration on whether the construction can be undertaken, with supporting reasons.

ITEM 3

You and your friend Samantha started a partnership business and agreed to deal in poultry feeds. You contributed Sh. 750,000 while Samantha contributed Sh. 900,000. You both agreed to save $\frac{1}{5}$ of the gross profit in a joint account and further use 20% of the remainder to buy more requirements for business and there after share the net profit in the ratio of your initial contributions.
At the end of the 1st year of operation, the business made gross profits amounting to Sh. 3,160,000 and Samantha deposited your share on your account but you were not sure if it was the actual amount you were supposed to get.
You sent Samantha to withdraw some money from your phone but you had forgotten the pin however you remembered that you had saved it as 31 in decimal base which is supposed to be converted to base three to get the actual pin.

TASK

a) Determine the actual amount of money that was to be deposited on your account.
b) What is the actual pin in order to make the withdraw from your phone?

THEME: PATTERNS AND ALGEBRA

ITEM 4

Henry is planning for a small birthday party for his son and wishes to spend sh. 98,000 to buy 5 kg of meat and 7 kg of rice. However, some guests that he had invited communicated that they would not make it for the party. Therefore, he had to reduce both quantities by 2 kg hence leading to a reduction in his expenditure by sh. 32,000. When Henry went to the market, there was an 80% increase in the price of each kilogram of meat and an offer given to him on rice as 25% discount on each kilogram of rice.

Tasks:

a) Help Henry to estimate the initial price of meat and the rice per kilogram.
b) What amount does he pay in order for the party to be a success?

ITEM 5

Mr. Orute is retired teacher from a government school. The government has been deducting NSSF saving for the years he has taught in this government school and he is now having 120 million on his account. He wants to use his savings to construct single and double rooms for rentals from which he plans to collect a minimum of sh 540,000 monthly. He intends to charge rent of sh 90,000 monthly from each double room and sh 60,000 monthly from each single room. He wants less than 6 double rooms. He also wants to construct at most twice as many single rooms as double rooms. It will cost him sh12 million to construct each double room and sh10 million to construct each single room.

TASK:

(a) Write down mathematical statements which relate the number of double rooms and single rooms.
(b) With the aid of a cartesian plane, advise Mr. Orute on how to maximize monthly rent income.

ITEM 6

Ichuli is starting a baking business, selling cakes and cookies. To estimate profits, he consulted a friend in the industry. The friend shared data from their own experience: Initial phase: 40 cakes, 30 cookies, total profit UGX 29,000; Later phase: 50 cakes, 20 cookies, total profit UGX 31,000.

Ichuli aims to start by producing at least 120 items (cakes and cookies combined). Since cakes sell more, he wants to make at most 80 cakes and at most 60 cookies. He needs to determine the optimal number of cakes and cookies to produce initially.

TASK;

a) What are the expected earnings from each cake and cookie, based on his friend's experience?
b) (i) What mathematical inequalities are making decision-making hard for Ichuli?
(ii) Use the inequalities to help him decide on the highest number of cakes and cookies he can start with.

DATA AND PROBABILITY

ITEM 7

Solomon sells yoghurt in schools and the yoghurt is of three flavours; chocolate, vanilla and straw berry. He wants to introduce the same business in your school. He knows that for business to succeed, the probability that the learners will take at least two of the flavours should be greater than 0.5.
He is uncertain of the business success in your school. The study you have carried out in your school indicates that 158 learners like chocolate flavours, 130 like vanilla, and 188 like straw berry.
40 learners like chocolate and vanilla, 80 like straw berry and vanilla, 88 like chocolate and straw berry and 10 like none of the three flavours.
The number of learners who like all the three flavours is equal to the number of those who like chocolate and vanilla only.
TASK:
Using the data from your study, do you advice Solomon to introduce the business in your school? Give a reason for your advice.

ITEM 8

The school administration is conducting a survey to find missing information and make decisions on the available data. In a class of 200 students, 128 students offer mathematics, some offer religious education and 92 offer computer studies. Two students offer computer studies and religious education only, 30 students offer computer studies only, and 28 students offer both mathematics and religious education. The number of students offering both computer studies and mathematics only is twice the number of students offering all the three subjects. Students offering religious studies only are half the number of students offering all the three subjects. The administration is missing data on students who offer none of the three subjects, those who offer religious studies, and those who offer mathematics only. The are also planning to create a new stream either for students offering mathematics only, or for those offering computer studies only or religious education; depending on which group is larger, to help them focus more during revision,

TASK

a) Determine the number of students who offer;
   (i) All the three subjects
   (ii) Religious education
   (iii) Do not offer any of the three subjects
b) Which stream will the school administration need to create? Give reason

ITEM 9

A parent intends to make shopping of scholastic materials for his children who are going back to school for a new term by the names of Jane, Mary and Darin. They budgeted as below basing on the list of requirements that they were given by their class teachers. - Jane: 6 exercise, 3 pencils, 2 Graph books, 3 pens

- Mary: 3 pencils, 1 Graph book, 6 exercise books, 3 pens
- Darien: 2 Graph books, 4 exercise books, 3 pencils and 5 pens

At that time the prices were 1 Graph book shs2000, 1 pencil shs100, 1 exercise book shs1,500 and 1 pen shs500. On reaching school they found out that the canteen manager had increased prices of the

items by 10 % and also, they found out that the school administration had decided that on each item listed, they should increase the number for each by 2 since the school administration had decided that the students extend by two weeks when the term ends in order to compensate for the time students had lost the previous term.

Before leaving their home, they were given by their father shs 200, shs 800 so that they can finish the clearing process at school and then afterwards they share equally the remaining money to be used as their pocket money.

TASK

a) Assuming they were to buy the items before going to school, using matrices help the father to determine how much he would give to each child.

b) By using matrices determine how much each child paid to the canteen attendant in order to acquire the items. Help the children determine how much each share shared as pocket money after buying the items from the school canteen

ITEM 10

To enhance the yields of Rice, Beans, Sugarcane, and Peas in Iganga district, the Ministry of Agriculture's Farmer Training on peas and rice. Additionally, 5 farmers dedicate their land solely to rice. The number of farmers who grow beans, sugarcane, peas, and rice is equal to those who grow peas, sugarcane, and rice. Moreover, the farmers who cultivate rice, and sugarcane only are equal in number to those who grow rice, peas, and beans, and are 5 fewer than those who grow all four crops.

The ministry plans to provide support to these farmers as follows:

- A farmer who cultivates all four crops (beans, sugarcane, peas, and rice) will receive a package consisting of 4 tractors and a cash grant of UGX 3,000,000.
- One who plants only three crops will receive 3 tractors and UGX 2,000,000.
- A farmer who grows two crops only will receive 2 tractors and UGX 1,500,000.
- For a single crop will receive 1 tractor and UGX 1,000,000.

This support aims to motivate farmers to diversify their crops and boost their productivity.

and Capacity Building program conducted a survey, yielding the following findings; Among the 80 rice farmers surveyed, 45 also grow beans, 60 cultivate sugarcane, and 5 focus solely

The ministry needs to calculate the total cost of **tractors** for farmers, based on the number of tractors needed for each group, with each tractor costing UGX 68,000,000.

TASK

a) Assist the ministry in determining:
   (i) The total number of farmers cultivating all four crops
   (ii) The number of farmers growing only three crops
   (iii) The chance of selecting a farmer who grows only two crops in Iganga district
   (iv) The likelihood of selecting a farmer who does not grow Peas
b) Set the total funding required for the ministry's farmer support initiative.

ITEM 11

To address concerns about bulb durability, a LED bulb factory in Uganda, conducted a thorough test on a random sample of 50 bulbs. Their experts carefully selected and examined these bulbs, yielding the following results (rounded to the nearest minute):

423	369	387	411	393
394	405	369	372	410
371	377	389	409	392
408	409	396	431	391
431	401	363	391	405
382	396	381	438	422
400	381	399	415	428
422	397	399	401	398
396	372	410	419	386
390	362	373	391	402

The director has decided to withdraw batteries with a life equal to or less than the average lifespan of the tested samples and has directed the experts to manufacture only batteries that achieve at least 99% of the median life of the 50 tested batteries.

TASK

a) (i) Organize the data into intervals of 10 using a statistical table and analyze the trends to recommend the most effective battery replacement strategy to the director

(ii) Elaborate on the reasoning that led to your conclusion in a) i)

b) (i) Develop a graphical display to illustrate the data, allowing the director and their team to estimate the median, visualize and analyze the information

(ii) Identify the target battery lifespan for manufacturing, as recommended by the director.

(iii) Analyze the graph and explain the situation, backing your argument with data and logical reasoning.

c) Aid the manager in recognizing the chance of selecting a battery with a lifespan greater than or equal to the median value.

THEME: GEOMETRY AND MEASURES

ITEM 12:

Four tourists plan to visit sites A, B, and C in Uganda. Their journey begins in Entebbe, from where they will travel 400 km on a bearing of 060° to reach site A, then 600 km due east of site A to site B. From site B, they will travel 700 km on a bearing of 240° to site C. Finally, they will fly directly from site C back to Entebbe. They've budgeted UGX 12,000,000 for transport, and the private plane costs $35 per 100 km per person. According to the latest forex rates at a local bureau, 1 US dollar equals 3,700 Ugandan shillings. The tourists wonder if their budget will cover the trip. Additionally, a weather warning advises flights from site C to Entebbe to use a bearing

below 320° due to unfavourable conditions beyond that direction. Pilots have been told to choose a bearing below 320° for safety.

TASKS:

(a) Find out if the transport budget will be enough for the whole journey.

(b) Advise them if the bearing they will set from site C to Entebbe will be safe for them to use that direct route.

ITEM 14

Your brother wants to design a children's playground. The playground will have a triangular garden and a circular fence around the garden. The whole two sides of the rectangular garden will measure 50m and 70m, and the angle between them will be 45^0.

Your brother also wants to construct a circular fence around the garden such that the circular fence perfectly touches the three vertices of the triangular garden. Your brother intends to put pavers in the region outside the triangular garden but inside the circular fence. Each square meter of pavers costs shs 35, 000.

Your brother needs help in identifying the type of triangle represented by the triangular garden, coming up with an accurate design of the playground as well as the cost of the pavers.

Task:

Help your brother to:

a) Construct an accurate design of the children's playground.

b) Identify the type of triangle represented by the triangular garden and give a reason for your answer.

c) Determine the amount of money needed to buy the pavers.

ITEM 15

Mugu Moja who is new employee of a company has just learnt that his monthly income tax is UGX 1,102,000. He wants to buy a used car priced at USD 8,900. One option is to pay cash and get a 5% discount, while the other involves paying a deposit of UGX 10,000,000 and covering the balance over six months with monthly equal instalments of UGX 4,500,000. He is also not sure of how to arrive at his actual take-home pay due to PAYE.

Assume the exchange rate is: 1 USD = UGX 3,700

PAYE Taxation Schedule

Monthly taxable income	Tax rate
UGX 0 – 235,000	0%
UGX 235,001 – 335,000	10%
UGX 335,001 – 410,000	20%
UGX 410,001 and above	30%

Task

a) Compare the payment options clearly showing the financial difference.

b) Estimate the Mugu Moja's monthly net pay.

c) If he is to save 60% of his monthly net income, how many months would it take in order to purchase the car?

ITEM 16

A man took out a loan of 5,000,000 Ugandan shillings from the bank at a compound interest rate of 20% and was supposed to repay it within 3 years. However, with the deadline approaching, he has yet to raise the necessary amount.

He decides to sell one of his plots of land for 14,000,000 Ugandan shillings to raise the funds to pay off the loan. However, the buyer negotiates a 10% discount on the price. If he accepts the offer and sells the land, the broker will charge a 5% commission on the sale price. Additionally, the LC1 is requesting 350,000 Ugandan shillings to sign the agreements. He is uncertain whether the remaining amount will be sufficient to cover the loan he needs to repay.

He needs to pick up the child from school by 5:00 pm. However, it's currently 4:45 pm, and he's just leaving the broker's house, which is located a certain distance away from the school (as shown below). Considering he drives at an average speed of 50 km/h, he's unsure if he'll arrive on time.

TASK:

a) (i) What is the outstanding loan amount he needs to settle with the bank?
   (ii) Will he be able to pay off the loan if he sells the land?
b) Will he arrive at the child's school on time?

ITEM 17

Moses, an employee at a gift box manufacturing company, has been tasked with designing a foldable gift box with square faces and a capacity of 2744 cubic centimeters. He's struggling to create a sketch that will guide him in arranging the faces of the box to fold and close, as well as determining the dimensions of each cardboard piece to cut and join to achieve the desired outcome.

He normally receives a monthly salary of 300,000 Ugandan shillings with no additional allowances. However, the company will start deducting taxes from his pay every month, and he needs to determine his new take-home pay. The company will follow the tax brackets shown below:

Monthly taxable income (Ugx.)	Rate (%)
0–100,000	0
100,001–200,000	5
200,001–300,000	10

He needs to deliver the gift box to the customer and charges a delivery fee based on the amount of fuel used. His motorcycle uses 0.035 liters of fuel per kilometer, and he travels at an average speed of 20 meters per second. With fuel priced at 5,000 Ugandan shillings per liter, he wants to calculate the delivery fee. According to the customer, the journey will take 45 minutes.

TASK:

a) Help Moses develop a sketch outlining the specifications he needs.
b) What is the new salary Moses will be receiving monthly?
c) How much will Moses charge the customer for delivery?

ITEM 18

Jane has a room that she plans to use as a hair salon. She has a wall paper of 4.7m^2. The wall she plans to cover with the paper is 240 cm by 300 cm. She knows the wall paper she has is not enough. So she needs your advice on how much more she should buy. A roll of 10 m^2 of wall paper is sold at UGX 32,000. She also plans to use three employees and pay each of her employees a gross monthly salary of UGX 350,000. The gross monthly salary includes a non- taxable transport allowance of UGX 90,000. However, before she pays them, she has to deduct income tax as a requirement by the tax authority. The tax bands are shown the table below.

Monthly taxable income (shillings)	Tax rate (%)
0-100,000	0
100,001-200,000	5
200,001-300,000	15

Jane is having difficulty in using the tax bands.
Task:
a) How many more square meters of wall paper should Jane buy?
b) How much will she pay for the extra wall paper?
c) What is the total amount of income tax Jane will deduct from her employees?
d) How much will she pay each of the employees as net salary?

Practice makes mathematics easier.