



SUBSIDIARY MATHEMATICS SEMINAR HELD AT BISHOP CIPRIANO KIHANGIRE
SENIOR SECONDARY SCHOOL- BBIINA HELD ON 20TH JUNE 2026 IN THE MAIN
HALL

POWERED BY

SUPER PLATINUM MATHEMATICS

S475/1 SUBSIDIARY MATHEMATICS ASSESSMENT FORMAT

SECTION	PARTS	THEME/ CONSTRUCT	TOPICS	NUMBER OF ITEMS SET	ITEMS ATTEMPTED
A	COMPULSORY	COORDINATE GEOMETRY	9.Vectors 10.Trigonometry	1	1
		CALCULUS	12. Differentiation 13. Integration 16. Differential Equations	1	1
B	I	ALGEBRA	2. Quadratics 4. Numerical Concepts 5. Series 6. Permutations and Combinations	2	1
	II	DATA AND PROBABILITY	1. Matrices 3. Descriptive Statistics 8. Scatter Graphs and Correlations 7. Time Series Analysis 11. Probability Theory 14. Random Variables 15. Probability Distributions	2	1
TOTAL ITEMS				6	4

THEME ONE: COORDINATE GEOMETRY

THEME 1: CALCULUS

Item 1

Mr. Kibira's plot of land is located in Masaka city and one of the extreme boundaries in the shape $y = x^2(5 - x)$, where x and y are measured in feet, the government has given an offer to anyone who would wish to take electricity to the nearby town from the city. As a policy by Uganda Electricity Transmission Company Limited (UETCL), no one is allowed to settle or do any human activity under these electricity lines, the electricity lines align with the horizontal line $y = 0$ (x - axis). In this area one square feet of land is sold at UGX250,000. Mr Kibira needs to have a sketch of his affected piece of land and to determine the amount of money he should claim for that is worth part of his plot that will be cut off by the electricity lines but is not sure of how to estimate the amount of money.

Task

Help mr Kibira to solve this puzzle.

Item 2

Mellisha wants to start up a business of selling motorcycles on hire purchase form. She wants to make sure she understands the dynamics of the business before investing in it. On inquiring about common distances and fuel consumption, she was given a scenario by the chairperson Bodaboda riders in Rwakhaha town, "A boda-boda rider accelerates away from a traffic light in Mbale. His velocity V (in m/s) after time t (in seconds) is given by $v(t) = t + 3 - \frac{1}{t^2}$ for $0 < t \leq 20$. She wanted to determine the

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displacement within this time interval. The chairperson did not provide her with a way of working it out. She also needs to determine the maximum velocity in this time period.

Task

Help Mellisa to understand the above information.

Item 3

A farmer visited an area and identified a big challenge of famine which was as a result of drought. He introduced the irrigation system which is to be done in rectangular plantations at time t hours modelled by $R(t) = 12t - 3t^2$ litres per hour with $0 \leq t \leq 4$.

For successful irrigation, the maximum time of supplying water is to be done in less than 3 hours and the maximum rate of water should not exceed 40 litres per hour. The farmer does not know the maximum time to be used and the maximum rate at which water is to be supplied. He also needs to know the total amount of water to be used in the first 4 hours.

The amount of water in the storage tank at time t hours is w litres. Due to leakage of the tank, the rate of change of water is proportional to the amount of water present and is given by the relationship

$$\frac{dw}{dt} = R(t) - 0.2w$$

The farmer needs to show the model governing the amount of water in the tank as $\frac{dw}{dt} + 2w = 12t - 3t^2$ but he does not know how to do it.

Task

Make justifications for the farmer.

THEME 2 COORDINATE GEOMETRY

Item 4

Mr. Kintu has a garden of tomatoes he wishes to irrigate. He plans to place water nozzles at the extreme corners A(10,20) and B(30,40), and a third nozzle at point M, which is exactly halfway between points A and B. His water tank will stand at corner W(45,52). He will proceed with this setup if the angle between WM and AB is acute, which guarantees enough pressure. Also the length of the pipe AB should be more than 5metres.

Mr. Kintu is worried about weed management after irrigation. Research shows that the number of new weeds(w) growing per square metre can be modelled by $3 \cos w + 2 \sec w + 7 = 0$. If the number of weeds that can grow is more than 360 per square metre, they will naturally die out due intense competition for sunlight and minerals. However, the farmer could not determine the actual number of weeds that can grow in that part of the garden.

Task

Help Mr. Kintu to analyse the information and make meaningful decisions decide.

Item 5

The Uganda National Roads Authority(UNRA) is installing two observation towers in Kabale District. Tower A is at A(6,8) and Tower B is at B(15,20), both points relative to the central depot O(0,0). Engineers need help to find the coordinate displacement before installing a communication cable from A to B and also decide whether they will install a safety barrier if approach roads along OA and OB meet perpendicularly at the depot.

An engineer measures the angle of elevation to tower A as 32° from the level ground. He walks close to the tower and the angle increases to 55° . The team must find the height of the tower using these two observations for a staff briefing but they have failed.

Task

Help the engineers to solve their challenges.

THEME 3: ALGEBRA

Item 6

A senior six student, Kato, was revising logarithmic equations in preparation for his final examinations. While solving one of the problems in his revision booklet, he encountered the equation

$\log_2 x - \log_x 8 = 2$. He attempted several approaches but failed to obtain a solution and is now uncertain about the correct method to apply. He decided to go to the ICT laboratory and make some discoveries, as he was opening some websites he discovered that in a certain area, the bacteria keep tripling in every hour. In the start there were 20 bacteria available and Kato wanted to find out the total number of bacteria available after 7 hours.

Task:

Help Kato to solve his challenges

Item 7

Allen is a student offering foods and nutrition, in one of the lessons she was told that In a mixture of the key components of making cookies, the teacher considered wheat (α) and sugar(β) and the teacher said these quantities can be mixed to satisfy the quadratic equation $3x^2 - 4x - 1 = 0$. Allen wanted more cookies so she thought of more ingredients in form; ($\alpha^2 + 1$) and ($\beta^2 + 1$) but she was not sure of how the new quadratic equation would look like. She was given different alternatives of arranging sits in the room for the visitors;

- (i) To arrange 8 seats around a dining table or
- (ii) only bring a 5-seater sofa-set in which a group of 10 guests consisting of 4women and 6 men can sit making sure all the ladies seat on the sofa set and the rest of the guests go chat outside the house.

The plate of salads was to be arranged on the table in rows such that the first row has 3 plates, the second row had 2 more plates than the previous and the pattern continued like that. She was not sure of the number of small flowers to prepare to decorate all the plates of salads because they were arranged in 6 rows

Task

Help Allen to solve her queries.

Item 8

A young entrepreneur in one of the cities in Uganda is reviewing her new dairy processing business. She needs help to decide whether to expand her factory space based on her weekly yogurt sales to schools and supermarkets. Her weekly profit, (in thousands of UGX) is modelled by: $P(x) = -2x^2 + 20x - 32$, were x is the number of hundreds litres of yogurt made. She will only proceed with the expansion if her maximum possible weekly profit exceeds UGX 15,000.

For buy new packing machine, she saves UGX 150,000 in the first month and increases this amount by UGX 30,000 every month. The machine she needs cost UGX 1,000,000 but she does not know whether will get that money by the end of 10 months.

At the same time, she has a separate investment fund growing by the rule: $V(n) = 200,000 \times (1.05)^n$, after n months. Furthermore, she needs to choose 3 packaging workers from 8 job seekers consisting of 5 women and 3 men. She will buy a new packing machine the exact month her investment fund exceeds UGX 500,000, and she will only finalise her hiring if there are more than 50 valid ways to form a team that includes at least one woman.

Task

Help the younger entrepreneur resolve her challenges.

THEME 4: DATA AND PROBABILITY

Item 9

A nursery school in Ntinda is focused on developing both the reading and writing skills for their toddlers in preparation for primary level. Mr Charles wants to understand whether there is a relationship between his pupils' reading and writing abilities. She believes that pupils who perform well in reading may also perform well in writing, but she wants to use data to confirm this before designing a combined reading-writing support program. She records the following scores for nine pupils:

Pupil	A	B	C	D	E	F	G	H	H
Reading score	62	81	74	20	36	41	25	91	55
Writing Score	78	71	86	57	62	52	37	75	72

In the same class, due to changes in weather patterns, the head teacher decided to motivate the teachers by giving them some fruits. Charles and Betty are some of the teachers in this school. The head teacher came with a box with 5 green apples and 7 red apples, every teacher was supposed to pick two apples one after the other without looking into the box.

The teachers wanted to know the chance of selecting the both red apples

Task

Help the teachers to determine Relationship between the reading and writing scores, the chance that madam betty will pick both red apples and the chance that Mr Charles will pick apples of different colour

Item 10

In THX pharmaceutical corps' research and development team has been testing new drugs where two drugs X and Y being approved have probabilities basing on the following conditions stated below; $P(X \cup Y) = \frac{17}{24}$, $P(X) = \frac{2}{3}$, $P(Y) = \frac{1}{4}$. The company executives board wants to know after the first internal test what the probabilities that both are allowed ($X \cap Y$), drug X is allowed only ($X \cap Y'$), and neither of the two are allowed ($X' \cap Y'$), for proper decision making on more funding or shutting down the program.

In this pharmaceutical, the number of people visiting the place in search for jobs on daily basis are normally distributed with a mean age of 24 years and standard deviation 2.5years. Managers are not sure of the chance getting the actual number of applicants who are less than 22 years and those who are aged between 21 and 27 years. In a week they received 200 applicants.

Task: Help executive managers come to a decision to continue funding the development of drug X provided;

- if chance for both being allowed is less than 0.25 but the one for X only being allowed more than 0.422

- b) Or shut down the whole program if the chance of neither being accepted is more than 0.25
- c) The chance of getting an applicant who is below 22 years of age
- d) The number of applicants aged between 21 and 27 years.

Item 11

As part of Namilyango College's centenary drive to upgrade into a smart school, the administration decided to overhaul the physics, chemistry, and biology laboratories into high-tech learning environments. To support the new practical lower secondary curriculum, the school needed to purchase three essential digital tools: **Digital Sensors (x)**, **Micro-scale Kits (y)**, and **Smart Display Tablets (z)**.

The deputy headteacher in charge of the Science Department placed a bulk order with a tech supplier across three distinct academic terms. However, due to a system glitch in the school's bursary software, the itemized receipts were partially corrupted. The bursar could only retrieve the total budget spent, the total storage space required for the items, and the total power consumption load for each term's delivery.

The Problem Constraints

The bursar's retrieved termly logs show the following aggregated data:

- **Term One Delivery:** The school ordered a total of 14 equipment packages for the Physics Lab. This delivery required a total storage volume of 27 cubic decimeters and drew a collective power load of 38 Watts (W) when running diagnostics.
- **Term Two Delivery:** For the Chemistry Lab, the supplier shipped twice the number of Digital Sensors, the same number of Micro-scale Kits, and three times the number of Smart Tablets as delivered in Term One. This delivery took up 53 dm³ of storage space and drew 73 Watts of power.
- **Term Three Delivery:** For the Biology Lab, the inventory changed to three times the initial number of Digital Sensors, twice the number of Micro-scale Kits, and four times the number of Smart Tablets. This final delivery required 76 dm³ of storage space and generated a power load of 107 Watts.

According to the manufacturer's technical handbook, the resource specifications for an individual unit of each equipment type are detailed below:

Equipment Type	Storage Space Required (per unit)	Power Consumption (per unit)
Digital Sensors (x)	1 dm ³	2 W
Micro-scale Kits (y)	2 dm ³	1 W
Smart Display Tablets (z)	3 dm ³	4 W

The previous performance in the biology class in the two streams was summarised below

Learners score	Number of learners
< 10	25
< 20	38
< 30	52
< 40	110
< 50	130
< 60	154
< 70	190

The deputy will implement all the ideas and even recruit more man power if the difference between the average mark and modal mark is more than 1.5 marks

Tasks

As the dynamic leader of the Namilyango College Students' ICT Club, the Headmaster has tasked you to audit these records, bypass the software glitch, and verify the exact inventory using matrix algebra.

- (a) State the system of equations in the matrix form.
- (b) Using **Cramer's Rule**, determine the exact number of Digital Sensors, Micro-scale Kits, and Smart Display Tablets delivered in Term One.
- (c) The supplier charges 150,000 UGX per Digital Sensor, 80,000 UGX per Micro-scale Kit, and 450,000 UGX per Smart Tablet. Determine the total financial expenditure incurred by Namilyango College across all three terms combined for this lab upgrade.
- (d) determine the modal mark of the marks

Item 12

A community health centre plans to introduce a Holiday Nutrition and Wellness Program for children and teenagers living within the surrounding villages. Before the program begins, health workers conduct a health screening exercise and recorded the masses (kg) of learners who have registered for the program as given below.

Mass(kg)	20-29	30-39	40-49	50-59	60-69	70-79
Number of learners	3	5	10	15	6	1

The masses are approximately normally distributed.

The program will only be implemented if the probability that a randomly selected learner has a mass greater than 39 kg is more than 0.5.

To improve the health and well-being of the learners, the centre plans to offer weekly activities such as Nutrition Education Sessions, Physical Fitness Sessions and Health Counselling Sessions.

Information collected from similar community programs shows that:

- (i) Two Nutrition Education sessions, five Physical Fitness sessions, and two Health Counselling sessions take a total of 9 hours per week.
- (ii) Nine Nutrition Education sessions, four Health Counselling sessions, and three Physical Fitness sessions take a total of $18\frac{1}{2}$ hours per week.
- (iii) Two Health Counselling sessions, three Physical Fitness sessions, and seven Nutrition Education sessions take a total of 14.5 hours per week.

The community health centre would like to identify the activity with the longest duration in order to schedule it first during daily training sessions.

Task

Based on calculations, Advise the community health centre.

Item 13

The school agricultural club is investigating the best fertilizer option for improving maize production in the school garden. The two recommended fertilizers are GrowFast (M) and SuperYield (N).

Pre-tests on crop performance indicate that the probability of obtaining a high harvest when GrowFast fertilizer is used is 0.5, and when GrowFast or SuperYield fertilizer is used, the probability of obtaining a high harvest is 0.8.

The two fertilizers can be used independently and the agriculture teacher wishes to opt for the fertilizer with higher chances of a good harvest.

According to the teacher's past experience, the time, t weeks, taken for maize to mature can be modelled by the function:

$$f(x) = \begin{cases} ht & ; 0 \leq t \leq 2 \\ h(4 - t) & ; 2 \leq t \leq 4 \\ 0 & ; \text{otherwise} \end{cases}$$

Where h represents a constant growth factor.

Her supervisor asked her to represent the maturity time on a chart (sketch) for better visualization and determine the expected number of weeks for the maize to mature. The details are to be presented during a departmental meeting. However, the teacher has not yet completed the task due to other school activities.

Task

As a student leader in the agricultural club, which fertilizer should the teacher opt for? Give a reason for your answer. Assist the agriculture teacher to perform the task assigned by her supervisor.

Item 14

A Biology teacher investigated the time taken by students to complete exam tasks across different subjects. He discovered that on average, 45% of the students complete tasks within the allotted time. For an upcoming review, he selected a random sample of 12 students.

He desires to know the expected number of students who complete tasks in time and the probability that more than three-quarters of them do so. He wishes to use these values to recommend exams time adjustments to the examination committee.

Following the teacher's report, the school procurement Director, noticed that student exam readiness closely relates with infrastructural growth and expansion. To ensure classroom construction projects are never delayed by material shortages, he analyzed the country's quarterly sales of cement bags over three-year period as shown in the table below:

Years	1 st	2 nd	3 rd	4 th
2019	850	630	700	920
2020	820	610	640	840
2021	710	560	620	780

He desires to establish the underlying market trend, eliminate seasonal fluctuations using a 4- quarterly moving average, and predict the number of bags cement to be sold in the first quarter of 2022 but does not know how.

Task

Help the teacher and the Director with their challenges.

Item 15

The head teacher of a boarding school is evaluating the school's feeding program for next term amidst changing market conditions. She collected price data for four foundational food groups used in the school kitchen for Term 1 (Base Period) and Term 2 (Current Period). She needs help to know if the cost of living has increased in order to enhance on the budget for next term.

Food Group	Term 1 Price (UGX)	Term 2 Price (UGX)	Weight
Maize Flour	2,500	3,200	120
Beans	3,500	4,000	80
Rice	4,500	5,200	50
Sugar	4,000	4,800	30

The school clinic distributes glucose packets (x) to weak students during sports days. The table below shows the chance of a student getting each number of packets.

Number of packets(x)	0	1	2	3
Chance $P(X=x)$	C	$2c$	$3c$	0.4

The head teacher will add more glucose to the school clinic if the standard deviation is less than 2.

Task

Help the head teacher with her concerns

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