SECONDARY MATHEMATICS TEACHERS' ASSOCIATION

SMATA

20 24

O'LEVEL MATHEMATICS SEMINAR

THE 8TH ANNUAL GRAND MATHS CBC NLSC SEMINAR RELOADED AT

ST. JOSEPH OF NAZARETH HIGH SCHOOL

Saturday 29th June,2024

SECTION A: COMPULSORY

Elements of Construct (THEMES)

ITEM 1 : NUMBERS

- Number bases
- Working with integers
- Fraction,percentages and decimals
- Numerical concept 1 (Indices)
- Numerical concept 2 (Surds)
- Rectangular Cartesian Coordinates
- Ratios and proportion

ITEM 2 : PATTERNS & ALGEBRA

- Sequences and patterns
- Equations of line and curves
- Algebra 1 & 2
- Loci
- Mapping and relations
- Inequalities and regions
- Equation of a straight line
- Simultaneous equations
- Linear programming

SECTION B: PART I & PART II

Elements of Construct (THEMES)

ITEM 3 & 4: DATA AND PROBABILITY

- Data collection and presentation
- Graphs
- Set theory
- Data collection and display
- Matrices
- Probability

ITEM 5 & 6: GEOMETRY AND MEASURES

- Geometric Construction Skills
- Bearings
- General and angle properties of geometric figures
- Reflection
- Business arithmetic
- Time and tables
- Similarities and enlargement
- Circle
- Rotation.
- Length and area properties of 2D-geom. figures
- Nets areas and volumes of solids
- Trigonometry 1

SEMINAR ITEMS

MATHEMATICS CONSTRUCT:

To produce a graduate who appreciates and uses Computational skills, Spatial reasoning, Trend analysis for decision-making in solving Societal Problems.

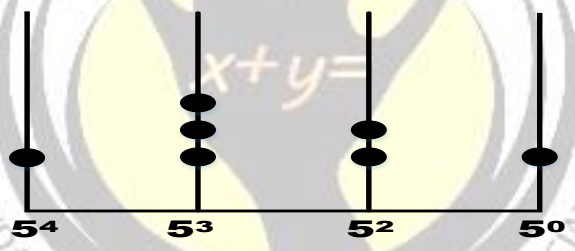
CATEGORY A: GENERAL ITEMS

THEME 1: NUMBERS

ITEM ONE:

Two twins A and B where presented with an abacus to write the number on it. A wrote one thousand fifty-five and the other wrote one thousand fifty-one. They need your help to know who amongst them is correct.

The abacus:



Twin A was sent to buy 2kg of sugar. He did not find sugar at the usual shop so he bought it at another shop and was given a balance of Ugx.37, 000 on the Ugx.50, 000 he went with. The mom asked him how much he was charged for each Kg but unfortunately, he did not ask the shop attendant.

Both twins have to go to school. They usually pay 60% of the school fees at the beginning and the rest on Visitation day according to school policy. School fees were increased to Ugx.600, 000 and now the parents need to know the school fees they are to pay for both of them at the beginning.

TASK:

a) Who amongst the two twins was correct about the number presented on the abacus?
b) How much was Twin A charged for a kg of sugar?
c) How much will the parents pay at the beginning for both twins?

THEME 2: PATTERNS AND ALGEBRA

ITEM TWO:

A man wants to construct single rooms and double rooms in his plot of land. He wants both to cover a space that is less than $5000ft^2$. He wants the double rooms to cover a space of at least $3000ft^2$. The space covered by single rooms should be three times less than the space of double rooms. He wishes to maximize income by charging each single room at Ugx. 200,000 and each double room at Ugx. 400,000. So he needs to decide on how many rooms of each category he should construct to match his specifications and at the same time maximize income.

TASK

a) (i) Form mathematical inequalities and expressions describing his situation.

(ii) Suggest to him the space of single rooms and double rooms he can construct in and justify your suggestion.

THEME 3: DATA AND PROBABILITY

ITEM THREE:

Your guardian operates a catering company. He gave you a list of major ingredients he will need to cook beans and beef at the two occasions he was called at such that you help him account for how much he will need in total for both.

OCCASION ONE:

BEEF: 1bucket of tomatoes, 2 bunches of onions and 2 liters of cooking oil.

BEANS: $\frac{1}{2}$ bucket of tomatoes, 1bunch of onions, and 1liter of cooking oil.

OCCASION TWO:

BEANS: $\frac{1}{2}$ bucket of tomatoes, I bunch of onions, and 1litre of cooking oil

BEEF: $1\frac{1}{2}$ bucket of tomatoes, 3 bunches of onions and 2litres of cooking oil.

UNIT PRICES:

A bucket of tomatoes is Ugx. 10,000, a bunch of onions Ugx. 5,000 and a liter of cooking oil at Ugx. 7,000.

TASK:

a) What are the total quantities of each ingredient he will need for beef and beans respectively for both occasions combined?
b) How much money will he need for both beef and beans respectively for both occasions combined?
c) (i) If the total amount on the budget for both occasions is Ugx. 400,000. what percentage of that amount will go on ingredients?
(ii) According to the percentage, should he cut the budget for ingredients or not? Justify your answer.

THEME 4: GEOMETRY AND MEASURES

ITEM FOUR:

One of your friends wants to create a house with a prism rooftop for the mathematics project. He wants to account for the size of ply wood plus the amount he will need to buy it using his measurements below:

HOUSE BASE:

- 2 side walls will measure 45cm by 20cm.
- 2 front and back walls will measure 17cm by 20cm.

ROOF:

- 2 isosceles triangular faces will have a base of 45cm and a height of 18cm.
- The rectangular faces will have a length of 17cm and a width equivalent to the slanting edges of the triangular faces.

He also wants the ridge of his roof to be at the Center of the two rectangular faces. He wants determine the angle at which he will meet the two faces to achieve that.

Note:
$1\ ft^2\ of\ ply\ wood = Ugx.1000$ and $1ft = 30.5cm$

TASK:

a) How many ply woods will he need and how much will he spend on them?
b) At what angle will he meet the rectangular faces of the roof to achieve what he wants?

CATEGORY B: DISCUSSION ITEMS

THEME 1: NUMBERS

ITEM 1

On their Prom party, five students plan to buy their class teacher a gift. The initial plan was that each one buys their own gift to give to the class teacher but later they realized that If they do it as a group would be cheaper. So they mobilized themselves and each person contributed as follows;

Student A contributed one hundred thirty-three thousand two hundred fifty shillings.

B contributed $1\frac{1}{2}$ of the amount of A.

C contributed 20% more than that of A.

D contributed a fraction which is $\frac{1}{5}$ less that of B of the amount of A contributed.

E She contributed the balance required to make shs 800,000/= which was the cost of the gift. On the day of Prom, the money was given to student E to pick the gift from the nearby shop. From school, she used a boda-boda moving at $10kmh^{-1}$, they moved for 30 minutes due east and then 15 minutes due north to reach the shop.

Tasks:

a). Help to direct another student to locate the shop from school in coordinate form.

b). What amount did each student contributed and who of the five contributed more money.

d). In which other way could they contribute the money more fairly and how much would each contribute that way?

ITEM 2

On Wednesday 01, May, 2024, Aunt Nyanya a tomato seller in a market purchased 8 packs of polythene bags of tomatoes, each containing 10 tomatoes from a farmer. She then sold a-quarter of the total number of packs before meeting her long time friend Peter who decided to take her out for coffee at a hotel. The she left the tomatoes with a colleague in the market.

At the hotel Peter ordered for 2 cups of tea each costing five thousand one hundred shillings and 2 plates of food each at shs 20,000/=. While enjoying the meal, Peter told her that he comes to the hotel gym every after 4 days and she also decided to be coming there every after a week to exercise.

On her departure, Peter gave her shs. 20,000/= for transport and on reaching the market, she found a sixth of the remaining packs of tomatoes damaged and could not be sold. She decided to re-park the un-damaged ones in new packs of five tomatoes to sell in small quantities that are preferred by customer.

Tasks:

a). How many packs of fives and five fives did aunt Nyanya get after repacking?

b). What percentage of the number of tomatoes got damaged?

c). Help Peter and Aunt Nyanya to know when they will meet again at the hotel.

d). How much money (in words) did Peter spend on the Outing?

THEME 2: PATTERNS AND ALGEBRA

ITEM 3

A certain number of people agreed to contribute an equal amount of money to buy books worth Ugx.12,000 for a school library.

After sometime, five of them backed out and this made one of them that remained suggest that each should contribute Ugx.100 in

excess. Their collection enabled them to buy books worth Ugx 2000 more than originally expected.

However, after buying these books, they got other funds and found it necessary to stock more books for the library. To transport these additional books, they used two means of transport, a Boda-boda and a Tuku-tuku. When a Boda-boda had made **four** trips and a Tuku-tuku **three** they had transported 116 books altogether while when a Boda-boda had made **five** trips and a Tuku-tuku **2** trips they had transported 110 books altogether.

a) How many people really made.
b) How much each was originally going to contribute for the buying of books?
c) How many books does each of the two means of transport carries per trip?

ITEM 4

You have friends who manufacture televisions and radios. During Christmas season, they want to sell at least 100 of their televisions and at least 150 of their radios. They have also found that they cannot sell more than 600 televisions and radios combined. They wish to maximize sales by selling each television at a profit of Ugx 90,000 and each radio at a profit of 30,000 but they do not know the number of televisions and radios to sell to fulfill their wish.

Task:

a) Write mathematical statements that show the relation between televisions and radios.
b) Show the feasible region of the relation on the Cartesian plane.
c) Help your friends to determine how many of each type should be sold to make the maximum profit.

ITEM 5

A fashion designer makes two types of designs; one design on trousers and another design on dresses. He takes 3 hours to make a design on a trouser and 4 hours to make a design on a dress. He works for a maximum of 120 hours to make designs on trouser and dresses. It costs him shs 4000 to make a design on a trouser and shs 1500 to make a design on a dress. The total cost does not exceed shs 90,000. He must make designs on trousers for at least 8 trousers and make designs on dresses for more than 12 dresses. He makes a profit of shs 400 on each trouser and shs 700 on each dress.

Task:

a) Write down mathematical statements that shows the relationship between the trousers and dresses.

b) Show the feasible region of the relation on the Cartesian plane.

c) Help the designer to determine the maximum possible profit he makes.

ITEM 6

A trader in Mpigi town who deals in Electronics specializes in importation of Televisions (**TVs**) from JAPAN on a weekly basis. He particularly imports two types of TVs i.e Sonny and Global-Star. In the first week of August, 2024, he wants to import a minimum of 2 Global–star **TVs**. Also he wants to import more Sonny TVs than Global-star TVs. Due to the shipping expenses and taxes, he cannot import more than 10 TVs a week. A Global – star TV is to be sold for 1.5 million while as Sonny TV to be sold for 1 million. More than 8 million must be realized from the sales, if profits are to be made.

Task:

a). Help the trader realize the number of TVs of each type he can import for a maximum profit.

b). If a trader is to remain in business, what is the least number of TV's he can import and still make a profit?

c). Given that the shipping space provided to him measures 12m by 4m, work out an equation that models the number of square meters for each TV for a maximum profit.

THEME 3: DATA AND PROBABILITY

ITEM 7

A Company holds daily morning briefings at 8:05 am for all its workers who walk to work from different places of residence. The company supervisor notices that some workers miss important communication because they arrive late. He decided to collect data about their time of arrival so that he can make necessary adjustments and also help some of them to become residents near the company premises. The collected data of their time of arrival in minutes from the start of the briefing was as follow;

52	**49**	**11**	**16**	**32**	**28**	**32**	**55**	**38**	**24**
15	**23**	**33**	**20**	**40**	**39**	**22**	**37**	**53**	**30**
29	**58**	**38**	**44**	**31**	**21**	**18**	**39**	**25**	**47**
51	**49**	**35**	**24**	**47**	**34**	**48**	**44**	**55**	**19**
27	**38**	**41**	**59**	**33**	**52**	**27**	**36**	**46**	**46**
32	**28**	**47**	**54**	**34**	**21**	**58**	**37**	**26**	**42**

Task

(a) With a reason based on the calculation from the data above, suggest the appropriate time when the morning briefs should always start.

(b) The company manager suggests that the first 25% of the workers be given transport refund, between 25% and 75% be given accommodation and the rest be stopped. Determine the maximum time of arrival one should not exceed to qualify for;

(i) Transport refund (ii) Accommodation

(c) How many workers would be stopped from work.

ITEM 8

A school is wishing to offer bursaries to sports men and women as long as more than 60% play at least one of the games in Football F, Net ball N, and Basket ball B while more than 40% must know how to play at least two of the three games.

It was discovered that out of 100 students who had applied, 40 student played football, 45 played Netball while 50 played Basket ball. 24, 18 and 19 students played F and N, F and B and B and N respectively. 18 students applied but did not know how to play any of the three games.

Task

a) Basing on the calculation from the information given, advise whether the school should offer sports bursaries.
b) Calculate the probability that a student picked at random played only one sport game.

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
- Darine: 2 Graph books, 4 exercise books, 3 pencils and 5 pens

At that time the prices were 1 Graph book shs 2000, 1 pencil shs 100, 1 exercise book shs 1,500 and 1 pen shs 500.

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 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, 800/= so that they can finish the clearing process at school and then after wards 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 the matrices help the father to determine how much he would give to each child.

b). By use of matrices determine how much each child paid to the canteen attendant in order to acquire the items.

c). Help the children determine how much each shared as pocket money after buying the items from the school canteen.

THEME 4: GEOMETRY AND MEASURES

ITEM 10

Quality Star Hotel is faced with a problem of water supply. The owner has instructed the Hotel Manager to contract **WaterServe Ltd** a water fetching company in the locality to fill the newly bought water tank at the Hotel within a period of not more than two weeks using an effective and efficient water fetching system.

WaterServe Ltd has two **systems A** and **B** of fetching water. In system A, water is fetched using Jerrycans and system B that uses Buckets as shown below.

Tank **Jerrycan** **Bucket**

The Hotel tank has a base of diameter 280 cm and height of 4 m and the jerrycans are of dimensions of 20 cm by 25 cm by 40 cm while the buckets each has diameters of 400 mm and 200 mm respectively.

In a day, WaterServe Ltd can only fetch 120 Jerrycans of water under system A or 100 Buckets when uses system B. The cost of water from the Commercial Reservoir is **shs 5/=** per litre. ($\mathbf{1}\ \boldsymbol{litre} = \mathbf{1000}\ \boldsymbol{cm^3}$**).** The transport charge per Jerrycan is **shs 300/=**

and **shs 400/=** per Bucket. The Hotel uses **560 litres** of water on a daily basis. (Take $\pi = \frac{22}{7}$).

The Hotel management policy requires that the water budget should always be submitted **three weeks** before the tank becomes empty to avoid any crisis.

The Hotel manager would like to make a budget in order to get money from his boss to facilitate the work but he is uncertain of the suitable system of fetching water to choose and the total amount of money he can request from his boss.

Task

(a) Help the Hotel Manager to make the right decision by choosing the most suitable system of fetching water that meets the requirements of his boss.
(b) With reasons, advise the Manager of Quality Star Hotel when exactly he should submit the Water budget to his boss.

ITEM 11

An international businessman who operates in United States of America (USA) has recently relocated his family to your village and settled near your home as your immediate neighbour. After a week, his wife realizes that her P.5 boy needs a boarding school. Your Cousin who is well informed about primary education offers to help her by driving them as they search to find a better school for her child. He drives them to the nearest Pearl Hill Junior school 40km away due East of their home.

Your Cousin drives at his usual average speed of **40** $\boldsymbol{kmh^{-1}}$. His car's fuel consumption is **8 km/litre**.

The Boy's father who is in USA, agrees to refund your cousin all the fuel costs and allowance of **5 US dollar per hour** spent during the entire process and Journey. A litre of Petrol costs shs **5,750/=** and **1 US dollar = Ug.shs 3,800/=** and Uganda is **7 hours** ahead of USA.

On reaching Pearl Hill Junior School at **9:20 am**, she finds out that it is a purely day school. After 15 minutes of interaction, the Headteacher refers them to Full Care Primary School (**FPS**) a good boarding school in the locality and gives your cousin the following directions:

- From Pearl Hill Junior School, take the southern direction and reach the Community Library that is 70 km away.
- From there, then take the South Eastern road and drive for half an hour to reach Full Care Primary School (**FPS**).

After reaching **FPS**, the boy was subjected to an interview for $\mathbf{1\frac{1}{4}}$ ***hours*** and later admitted. Before leaving **FPS,** they are informed of a direct route back home which they take after a quarter of an hour of consultation.

Task

a) (i) Describe the direction of your neighbour's home from Full Care Primary School.

(ii) At what time would they have reached Full Care Primary School after leaving Pearl Hill Junior School.

b) Help your cousin to determine;

(i) When he should communicate with the boy's father in USA upon reaching home immediately after the journey. (Give the time basing on USA time-zone)

(ii) The duration of the entire journey

(iii) How much money in US dollars he should demand from the boy's father upon returning home.

ITEM 12

A hawker who sells watches leaves his home in Lambu town at 0600 hours and moves to Mbuye town which is 165 km north of Lambu town. From Mbuye town, he moves east wards for one hour at a speed of 150 kmh^{-1} to Katoomi town. He then heads to Nabuti TC which is in a direction of $S20^0E$ and moves at a speed of 45 kmh^{-1} for 2 hours. From Nabuti TC, he moves South wards to Tanda market which is 135 km away.

The hawker buys golden and silver watches at Ugx. 25,000 and Ugx 20,000 each respectively and sells them at Ugx 30,000 each and Ugx 25,000 each respectively. He sells the watches at a discount of 5% off the total cost for any customer who buys more than 2 watches. While in Tanda market, he meets his friend who buys 3 golden and 5 silver watches.

In the evening, he uses the direct route and returns home in Lambu at 8:00pm. In an hour's time, he receives a call from his brother in Canada. The call lasted for a quarter an hour and Uganda's time is 7 hours ahead of Canada's time.

Task

a). What direction and distance did the hawker take through the direct route?

b). i) What percentage profit does he make on each type of watch?

ii) How much did the watches cost his friend?

c). i) How much time did he spend away from home?

ii) At what time did his brother ended the call end? (Answer in Canada's time)

ITEM 13

A bucket of homogeneous paint is in shape of a frustum with an open end of diameter 28cm, bottom diameter of 18 cm and 22cm deep. The bucket of paint is used to paint a cylindrical pillar of a storeyed building. The pillar measures a diameter of 100m and is 140m high.

Two hundred thirty five litres of the paint is made by mixing three paints A, B and C. The ratio by amount of paint A to B is 4:5 and that of B to C is 6:8. Paint A costs shs. 7200 per litre, paint B costs shs. 18,000 per litre and paint C, shs. 6375 per litre.

($\boldsymbol{Take\ \pi = \frac{22}{7}}$ **, 1 *litre of paint can paint* 440 *square meters***)

TASK

Determine;

a) i). the number of litres of paint needed to paint the cylindrical pillar.

ii). the capacity of the bucket in litres.

iii). the number of buckets of paint required to paint the pillar.

b) i). the amount of each paint in the mixture.
ii). how much is 1 litre of mixture.

THE END

THANK YOU

"SMATA"

Together for Mathematics

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