Super PLATINUM MATHEMATICS

GEORGE NAPULU

NEW CBC

For Lower Secondary

Super PLATINUM MATHEMATICS

S.1-S.4

120+ Scenario Based Items
Various Worked Out Items

George NAPULU
0772404437/0757373064

JURAN PUBLISHERS

PLATINUM MATHEMATICS

LOWER SECONDARY MATHEMATICS

SCENARIO BASED ITEMS

456/1 MATHEMATICS PAPER 1

S.1 - S.4

BASED ON THE NEW LOWER SECONDARY CURRICULUM

- ✓ Tips on how to pass mathematics
- ✓ New UNEB changes
- ✓ Sample UNEB papers and solutions
- ✓ Guidance on graph work
- ✓ Some worked examples
- ✓ Multiple trial questions

NAPULU GEORGE

0772404437/0757373064

INTRODUCTION

Mathematics plays a profound role in the growth and development of the country's economy but also very much applicable in our daily lives. No wonder it is the language of science. This book is designed to help both teachers and learners in understanding the new lower competence-based curriculum. This book is suitable for learners in the ordinary level since the tasks range from senior one to senior four.

The author carefully selected tasks according to class and level of mastery of content to motivate the learners in this exciting subject. This book contains a sample of the UNEB mathematics paper one sent in June 2024, its solutions and the past paper of UNEB Uganda certificate of Education mathematics paper.

Napulu George (author) teaches physics and mathematics teacher, helps learners to understand mathematics concepts by breaking them down. He does this through using life scenarios, one – on – one guidance to learners and his free weekly you tube channels.

In 2021 he was headhunted to contribute to the development of the new lower competence-based curriculum teaching materials – a project he happily supported. Since then, has participated in many workshops of handling the competence Based curriculum and has been resourced for facilitation in over 30 schools in the country.

He has written Super platinum mathematics book as a tool to advance understanding and application of mathematics in real life scenarios.

TIPS OF PREPARING AND PASSING UNEB MATHEMATICS PAPER ONE

- ✓ Always remember that mathematics is the easiest subject in the world
- ✓ Always make sure you have scholastic materials before entering the examination hall
- ✓ Double check the functionality of your calculator before entering the examination hall
- ✓ Be careful of the environment we live in, almost everything can be examined, starting from the water vessels we use, flower vases, gardens, tents, cakes, tables and many more
- ✓ Start with the cheapest question according to you as a learner
- ✓ After giving a response, endeavor to ask yourself this question "have I answered the question?" this simple question acts as a check
- ✓ Conclude your answers with complete sentences
- ✓ Endeavor to read topics in each theme
- ✓ Remember to write many decimal places before rounding off to the final answer

MAJOR CHANGES IN THE MATHEMATICS PAPER

- ✓ The papers were merged from two papers to one
- ✓ Six items replaced the 34 questions in the old curriculum
- ✓ The questions are no longer set according to topics but instead they are now set according to themes
- ✓ Formerly, learners were doing 15 questions in a paper now they are to do 4 items out of the 6 items.
- ✓ The time of the paper changed from 2 hours and 30 minutes to 2 hours and 15 minutes
- ✓ The items demand understanding and application of the learnt knowledge in real life as compared to the previous questions that were only demanding knowledge

NEW LOWER SECONDARY UNEB SETTING FORMAT

Item	Area of construct	Topics covered
SECTION A: COMPULSORY		
Item one	**Numbers** Learner appreciates and uses computational skills to solve problems in real life situations	1) Number bases
		2) Working with integers
		3) Fractions, percentages and decimals
		4) Numerical concept 1 and 2 (i) Indices (ii) surds
		5) Ratios and proportions
Item two	**Patterns and algebra** Learner appreciates and uses analysis to solve problems in real life situations	1) Sequence and patterns
		2) Equation of lines and curves
		3) Algebra 1and 2
		4) Mappings and relations
		5) Vectors and translations
		6) Inequalities and regions
		7) Equation of a straight line
		8) Simultaneous equations
		9) Quadratic equations
		10) Composite functions
		11) Linear programming
		12) Loci
SECTION B		
PART I (CHOOSE ONE ITEM)		
Item 3 and 4	**Data and probability** Learner appreciates and uses logical reasoning to solve problems in real life situations	1) Data collection/display and presentation
		2) Graphs
		3) Set theory
		4) Matrices
		5) Probability
PART II (CHOOSE ONE ITEM)		
Item 5 and 6	**Geometry and measures** Learner appreciates and uses spatial6 reasoning to solve problems in real life situations	1) Geometric construction skills
		2) Bearings
		3) General and angle properties of geometrical figures
		4) Reflection
		5) Business mathematics

		6) Time and timetables
		7) Similarities and enlargement
		8) Circles
		9) Rotation
		10) Reflection
		11) Length and area properties of two dimensional geometrical figures
		12) Nets, areas and volumes of solids
		13) Trigonometry
		14) Vectors
		15) Matrix transformations
		16) Circle properties
		17) Lines and planes in three dimensions

TABLE OF CONTENENTS

Contents

SAMPLE ITEMS FOR SENIOR ONE CLASS

SECTION A

ITEM ONE: NUMBERS

Sample Items on Number Bases

Item 1

Anne had a password in her phone represented by the word “HARD” with each letter representing a number written in base five. H represents 12 A represents 1, R represents 11 and D represents 4. The digits have to be converted to the decimal base to obtain the real password. On cracking the password, Daniella was gifted with a prize of Ugx. 720,000 which she shared with Amos and Bryan in a ratio of 5:3:2. After sharing, Amos saved 20% while Bryan saved a third of his share.

Tasks:s

(a) Write down Anne’s password
(b) Determine the amount of money Daniella remained with.

(c) How much money did Amos and Bryan save?
Solution

Task(a) Anne's password

T	O
1	2

$$1 \times 5^1 + 2 \times 5^0$$
$$= 1 \times 5 + 2 \times 1$$
$$= 5 + 2$$
$$= 7$$

T	O
1	1

$$1 \times 5^1 + 1 \times 5^0$$
$$= 1 \times 5 + 1 \times 1$$
$$= 5 + 1$$
$$= 6$$

T	O
0	1

$$1 \times 5^0$$
$$= 1 \times 1$$
$$= 1$$

T	O
0	4

$$4 \times 5^0$$
$$= 4 \times 1$$
$$= 4$$

The password is 7164

Anne's pass word is 7164

Tasks:(b)

Amount received = shs. 720,000

Total ratio $5 + 3 + 2 = 10$

$$Daniella = \frac{5}{10} \times 720{,}000$$
$$= shs.360{,}000$$

$$Amos = \frac{3}{10} \times 720{,}000$$
$$= shs.216{,}000$$

$$bryan = \frac{2}{10} \times 720{,}000$$

$$= shs.144{,}000$$

Daniella remained with $shs.360{,}000$ after giving out some to Amos and Bryan

Tasks: (c) savings

Amos saved 20%of his share

$$\frac{20}{100} \times 216{,}000$$

$$= Shs.43{,}200$$

Amos saved shs. 43,200

Bryan saved a third of the share

$$\frac{1}{3} \times 144{,}000$$

$$= shs.48{,}000$$

Bryan saved $shs.48{,}000$

ITEM 2

Musoke had two wives one in Kanginima village and the other in Mukono town. In addition to the ancestral land, he also bought more land which is two – fifths of the ancestral land in Kanginima. Time came when he was too old and he lost the sight. But before losing his sight he had written a will on how to use his land. He had directed 0.6666666…of the land to be used for farming. A half of the remainder to sold and the remainder to be left for the mukono family. When the heir contacted a surveyor to get the actual land size, he discovered that the neighbor had encroached 5% of the ancestral land and the remaining land size was 28.5 acres.

Tasks:

(a) How big was the ancestral land?
(b) What is the fraction of the land to be used for farming?
(c) How big was the land he bought?
(d) What was to total land size?

(e) If the buyer offered Ugx.3,500,000 per acre. How much money did the family get from the land?

Item 3

On the last Sunday of the holiday Your uncle decided to play a simple money game with his four sons, Mike, Marvin, Marcus and Medard, the names arranged in their order of birth. He informed them that he had UGX. 1,000,000 for upkeep but he set the condition for his four children to crack the code before getting the money. He got a small piece of paper and he wrote **"t e 6"** the digits were in the duodecimal base and they needed to be changed to the decimal base in order to get the password for his Airtel money account. he later informed them that the winner would get forty – percent of the money while the rest was to be shared according to the birth order to the ratio 2:3:5. Unfortunately none of them could get the pin. So the youngest son approached you.

Tasks:

(a) Assist your cousin to get the Airtel money pin

(b) Determine the exact money every person got.

Item 4

During their baking lesson, the students were given a recipe for 10 scones using the following ingredients:

- 80g butter
- 350g self-raising four
- 30g sugar
- 2 eggs

However, the student has the following ingredient and is preparing for the exhibition due to take place at school and wishes to bake 25 scones for the exhibition because he expects parents and visitors to support his entrepreneurial venture.

- 100g butter
- 1kg self-raising four
- 50g sugar
- 4 eggs

Tasks:

(a) Determine if the student has enough of each ingredient to bake 25 scones based on the recipe. (b) Determine how much more of each ingredient the student needs to buy.

(c) If the prices of the ingredients are as follows:

- Butter: 5,000 shillings per 100g
- Self-raising our: 6,000 shillings per kg
- Sugar: 1,000 shillings per 50g
- Eggs: 500 shillings per egg

Calculate the total cost for the additional ingredients needed.

(c) Determine how much the student should sell each scone. Electricity and other expenses are provided free by the school.

Item 5

A certain member of your family re-wrote each digit of his 4- digit ATM card pin from number system tem (decimal base) to another number system less than four. He did this in fear of theft. Now he is sick in the hospital, he cannot talk nor write but the money on his account is needed to finance the hospital bill. This is how he wrote the pin 12 20 22 10. Assuming you have been able to encrypt the ATM pin for the family and funds are available to take care of him.

The hospital has a nurse who takes checks on him after every two hours and a medical doctor who checks on him after every four hours. Both medical personnel last checked on him together at 9:30am. He was treated well and discharged and advised as follows; he was advised to spend three eighths of the day resting, one sixth of the day eating, two thirds of the remainder having a healthy diet and the rest of the day visiting hospitals for further checkup.

Tasks:

(a) Which number system do you think he used to re-write the pin and why?
(b) Use the identified number system to help the family generate the original pin
(c) At what time did both the doctor and the nurse check on him again at the same time?

(d) How many hours of the day in a week does he spend on visiting hospital?

SAMPLE ITEMS ON WORKING WITH INTEGERS

Item 1

Your father spent Ugx 16,000 in buying mangoes, he wants to distribute mangoes equally among his five children. He gives each child y mangoes. After reading the super market receipt, you discover each mango costs Ugx. 800. But you do not know the number of mangoes in the bag and how many mangoes each child will get.

In addition, Abel, Bryan and Chloe are among your best friends since they are your class mates. On a certain day you discover Abel had 18 apples in his bag, Bryan has 24 apples in his bag while Chloe has 30 apples. They want to find the highest equal number of apples that should be put in each bag and the least equal number of apples each bag can contain

Tasks:

(a) How many mangoes did your father buy from the market?
(b) Determine the number of mangoes (y) each child received from your father.
(c) Help Abel, Bryan and Chloe to handle the challenge.

Solution

Task (a) how many mangoes were bought from the supermarket

Total amount spent on mangoes = Shs.16,000

Price of 1 mango = shs.800

Number of mangoes bought = $\frac{Total\ cost\ of all\ the\ mangoes}{Price\ of\ one\ mango}$

$$\frac{16{,}000}{800}$$

$$= 20\ mangoes$$

The number of mangoes bought from the supermarket was 20.

Task (b) number of mangoes (y) each child got

Number of mangoes bought = 20

Number of children to share = 5

$$y \times 5 = 20$$

$$y = \frac{20}{5}$$

$$y = 4$$

Each child got 4 mangoes

Task (c) to find the highest equal number of apples to put in each bag

We shall calculate the LCM and HCF

2	18	24	30
2	9	12	15
2	9	6	15
3	9	3	15
3	3	1	5
5	1	1	5
	1	1	1

LCM $= 2 \times 2 \times 2 \times 3 \times 3 \times 5$

$$= 8 \times 9 \times 5$$

$$= 72 \times 5$$

$$= 360$$

LCM of 18, 24 and 30 is 360

The highest equal number of apples that can be put in each bag is 360 apples

The least equal number of apples they can put in each bag can be obtained by calculating the HCF

2	18	24	30
3	9	12	15
	3	4	5

HCF $= 2 \times 3 = 6$

The least equal number of apples that can be put in each bag is 6 apples

Item 2

At Kaligo's enterprise, a company that makes pens. A machine produces the least number of pens per turn, that enable packing in boxes in equal numbers of 24, 36 and 60 without any pen being left out.

On a given day, Mabo Sacco made an order of 720 pens. On their price list, a dozen of pens costed shs.9600 but the manager of the sacco did not know the least number of turns a machine had to make in order to deliver the expected pens.

Tasks:

(a) Help the manager to determine the least number of turns the machine has to make in order to supply the Sacco.
(b) Determine the amount of money the manager needs to put aside for the purchase of the pens.

Item 3

Your school wants to build a multipurpose science complex of Ugx. 3 BILLION. It organized a fundraising function in which they invited parents, the clergy and other stake holders to help mobilize funds in order to realize this big goal.

The table below shows the income generated from the function.

Visitors' contributions	Capes, key holders and umbrellas	Dinner	Tents and chairs (Expenses)	Food (Expenses)
USD 50,000	USD 12,500	USD 120	USD 1,800	USD 12,000

If the current exchange rate is USD1 = UGX 3,800/=

(a) How much money (in Ugandan shillings) did the school collect?
(b) How much money (in Ugandan shillings) did the school spend on the event?
(c) Was the target of the science complex achieved? If not now much more money (in USD) is needed for the dream to be achieved?

Item 4

A certain school organized inter - house football competitions in which five houses participated. Every win would make a house to get 3 points, 1 point

for a draw and no point for a loss. The table below shows the performance of the houses.

HOUSE	PERFORMANCE		
	Win	Draw	loss
RHINO	4	5	1
ELEPHANT	1	5	4
LION	6	2	2
PANTHER	3	4	3
TIGER	5	3	2

The winning house were to get a prize of Ugx. 1.6million while the last house would be given a goat to roast and enjoy so that they are not discouraged.

Tasks:

Assuming you are the official in charge of sports help the school administration to identify which house to get a UGX. 1.6million and which house to be given a goat.

Item 5

In a certain village in Ntungamo, the borehole got spoiled some years ago and they have challenges in finding clean water for domestic work. As a result, a group of boys decided to dig a simple well. It was discovered that for every 4 feet the boys dug, the soil hip would raise 2 feet high. The chair person LC4 was impressed with their decision to improve the livelihood of their community. So he promised to pay UGX.64000 for every 10 feet dug down. After some days of committed digging, they reached clean water and the LC4 gave the boys Ugx. 480,000 which was the exact amount for the depth of the well. He was later informed that it would cost the community at least UGX.102,000/= daily for 4 days to pay the builders in order to have the well built fully and protected from damage and accidents.

Tasks:

(a) Determine depth of the well.
(b) Determine the height of the hip of soil from the well.
(c) Determine the overall cost of the well.

Item 6

You are playing a game on your computer using a spinner. You start with a spinner at a blue and the score is 12. And spin the spinner three times to orange, spin the spinner five times again to green and finally spin the spinner four times to red. Each spin gives a score of 5.

Tasks:

(a) Write your total score in words
(b) Using two different charts, display the scores at blue, orange, green and red

SAMPLE ITEMS ON FRACTIONS, DECIMALS AND PERCENTAGES

Item 1

Mr kintu was given a certain piece of land by his grandfather in the village. Of this land he intends to use 25% of the land for pumpkins, $\frac{2}{5}$ of the land for maize. the remainder of the land he planted cassava. However, He was advised by the Agricultural officer to intercrop maize with beans. Since beans add fertility to the soil. So he planted beans in half of the maize plantations**.**

Tasks:

(a) If the total land area was 42 hectares, determine the percentage occupied by the maize
(b) Determine the fraction occupied by the pumpkins
(c) What percentage of the land was occupied by beans?
(d) What percentage of the land had cassava?

Solution

Task (a) percentage of maize

Maize = $\mathbf{\frac{2}{5} \times 42 = \frac{84}{5}}$

$$= \mathbf{16.8}\ \boldsymbol{hectares}$$

Percentage of maize $\mathbf{\frac{16.8}{42} \times 100}$

Maize = $\mathbf{\frac{2}{5} \times 100}$

$$= \mathbf{40\%}$$

The percentage occupied by maize is 40%

Task(b) fraction occupied by pumpkins

Pumpkins =25%

$$\frac{\mathbf{25}}{\mathbf{100}}$$

$$= \frac{\mathbf{1}}{\mathbf{4}}$$

The fraction occupied by pumpkins is $\frac{1}{4}$

Task (c) percentage of land occupied by beans

Beans occupy the same percentage as maize because they are intercropped

Beans occupy 40%

Task (d) land occupied by cassava

Maize = $\frac{2}{5}$

Pumpkins =25%

Cassava = Remainder

Remainder $= 1 - \left(\frac{25}{100} + \frac{2}{5}\right)$

$$= 1 - \left(\frac{1}{4} + \frac{2}{5}\right)$$

$$= 1 - \frac{13}{20}$$

$$= \frac{17}{20}$$

Percentage $= \frac{17}{20} \times 100$

$$= 85\%$$

Item 2

Your aunt is planning to enroll you in a boarding school for your O-level education. She has a budget of Shs 5,000,000 for your school expenses. To visit the school, she decides to take a boda-boda. The boda-boda travels 3 km west from your home to the main road, then 4 km south to reach the school. However, you later realize there's a shortcut path that leads directly from your home to the school. Upon reaching the school, your aunt learns that the school fees are Shs 3,000,000, boarding fees are Shs 1,500,000, and the cost of school supplies is Shs 500,000. Fortunately, the school offers a scholarship program. Students with excellent primary school leaving exam results receive a 50% discount on school fees, a Shs 200,000 reduction in boarding fees, and a Shs. 150,000 voucher for school supplies. You are eligible for this scholarship based on your outstanding performance. The school also offers two payment options for school fees:

- Option 1: Two Installments - Pay two-fifth of the school fees at the beginning of the term and the remaining balance before the midterm exams.
- Option 2: Four Installments - Pay equal amounts at the beginning of the term, before midterm exams, after midterm, and before final exams.

Tasks:

(a) What is the distance from your home to the school using the direct path?

(b) (i) Considering the scholarship, calculate the total amount your aunt will pay for your school expenses.

(ii) Can your aunt afford the school expenses based on her budget?

(c) (i) For those paying the full school fees amount, calculate the amount paid per installment for each payment option.

(ii). Which payment option would you recommend and why?

Item 3

Kintu has some land that he wishes to use for agriculture. He plans to use one-fifth for maize, 3 acres for sugar canes and the rest for rearing his livestock. If the sugar canes and maize cover half of his total land. He further tells you that he wishes to sell 20% of the land to Mr Makumbi who has two wives and the wives will use the land according the number of children. If the first wife has 6 and the second one has 4 children.

Tasks:

(a) Help Mr Kintu to understand the number of acres he has.
(b) Help Mr Makumbi to know the land size each wife will use.

Item 4

Five boys from Namwendwa town decided to collect some money in order to purchase some bunch of clothes to be sold to the village since the village businessmen where making exceedingly high profits.

The first boy contributed two hundred forty-eight thousand, five hundred shillings

The second boy contributed 15% more than the first boy

The third boy contributed $\frac{3}{5}$ of the amount the first boy contributed

The fourth boy contributed 10% less than the share contributed by the third boy

The fifth boy contributed $1\frac{2}{5}$ of the share contributed by the second boy

Tasks:

(a) How much money did each boy contribute?
(b) By how much more money did the fifth boy exceed the first boy?
(c) Express the share paid by the third boy as a percentage of the total.

SAMPLE ITEMS ON RECTANGULAR COORDINATE SYSTEM

Activity

Using a ruler, pencil and a pen, draw a rectangular coordinate system (a) Name the axes (b) Label the axes

(c) Plot a star in the graph of a reasonable size
(d) Present the work to your teacher for marking

Item 1

In a simple game, Clara had a certain piece of cardboard which when placed on a square ground, the with vertices were at positions A(1,1), B(5,1), C(1,7) and D(5,7). Arnold her friend asked to know the name of shape but she did not know the exact name to give the cardboard.

Tasks:

(a) As a senior one learner, plot the vertices of the cardboard on a square paper and state the name of the cardboard.

(b) Determine the area occupied by the cardboard.

(c) If the same cardboard was shifted by two units to the right, what would be the new coordinates of the cardboard?

Item 2

In a bid to alleviate poverty in one of the rural districts of Uganda, the number of villages in a given district and the corresponding estimated grams of food they eat daily was recorded. This information was to support in the planning process to come up with the budget estimates for the government to support. The data is represented in the table below

UNEB SAMPLE PAPER JUNE 2024

SECTION A

Answer **all** *items in this section.*

Item 1.

Alice is supposed to pay 4,500,000 shillings per year at the University. This a mount is divided in the ratio 4:3:3 for her fees, accommodation and meals respectively. She is supposed to pay 60 % of the fees in the first instalment, pay 1/3 of the remainder of the fees in the second instalment and the rest of the fees in the third instalment.

Alice is supposed to get the money for fees from a mobile money agent using a 4-digit code. For safety reasons, her father gave her the code written as 234 in base ten and Alice has to convert this code to base six to get the actual code.

Task:

(a) How much will Alice pay for fees in the last instalment?

(c) How much money will Alice pay for accommodation?

(c) Help Alice to determine the actual code for withdrawing the money from the mobile money agent.

Item 2.

Your parents have given you the following instructions to make juice for sale while ensuring minimum costs of production. The juice should consist of passion fruits and oranges and you should start with a total of at most 25 fruits.

In order to make very good juice, you should make sure that the difference between the number of passion fruits and oranges is at least 4. The number of oranges must not be less than 5.

Each passion fruit costs Shs300 and an orange costs Shs200.

Task:

(a) Express the conditions for making juice as inequalities.

(b) (i) Show the feasible region of the conditions on the cartesian plan.

(ii) Determine the number of passion fruits and oranges you should use to minimise the cost of production.

SECTION B

This Section has two Parts: **I** *and* **II**

Part I

Answer **one** *item from this part*

Item 3.

Learners visited a factory making biscuits. The manager showed them records of the masses of biscuits produced by the factory as in the table below.

Mass (g)	100 - 109	110 – 119	120 – 129	130 – 139	140 – 149	150 – 159	160 - 169
Number of biscuits	1	3	11	21	8	4	2

When the learners asked the manager about the value of the mass below which half of the biscuits produced lie he was not so certain of the actual value.

Task:

Help the manager to estimate the value of the mass below which half of the biscuits lie.

Item 4.

Simon sells ice cream in schools and the ice cream is of three flavours; chocolate, vanilla and strawberry. He wants to introduce the same business in your school. He knows that for the 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 his business success in your school. The study you have carried out in your school indicates that 158 learners like chocolate flavour, 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 advise Simon to introduce the business in your school? Give a reason for your advice.

Answer **one** *item from this part.*

Item 5.

Juma is tasked to take company goods from a factory to three trading centres.

The car he is going to use has 20 litres of fuel and it uses 1 litre of fuel for every 15 km. He left the factory to the first trading centre which is 70 km away on a bearing of N 60° E. He then moved Eastwards at an average speed of 60 km/hr for 30 minutes to the second trading centre. From this centre he took a bearing of 200° and moved a distance of 50 km to the third trading centre.

At this centre he was shown a direct-route that would take him back to the factory but was not sure whether the remaining fuel in the car was enough for that journey since he did not know the distance.

Task:

(a) Help Juma to determine;

(i) the distance of the direct route from the third trading centre to the factory.

(ii) whether the remaining fuel in the car will be enough for journey using the direct route.

Item 6.

Mariam has a room that she plans to use as a hair salon. She has wall paper of 4.7 m^2. The wall she plans to cover with 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 shillings 32,000/=

She also plans to use three employees and pay each of her three employees a gross monthly salary of shillings 350,000. The gross monthly salary includes a non-taxable transport allowance of shillings 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 in the table below.

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

Mariam is having difficulty in using the tax bands.

Task:

(a) (i) How many more square metres of wall paper should Mariam buy?

(ii) How much will she pay for the extra wall paper

(b) (i) What is the total amount of income tax Mariam will deduct from her employees?

(ii) How much will she pay each of the employees as net salary?

SOLUTIONS SAMPLE MATHEMATICS PAPER1

Item 1

Total ratio $= 4 + 3 + 3$

$$Total\ ratio = 10$$

Proportion of fees $= \frac{4}{10} \times 4{,}500{,}000$

$$= shs.\ 1{,}800{,}000$$

Proportion of Accommodation $= \frac{3}{10} \times 4{,}500{,}000$

$$= shs.\ 1{,}350{,}000$$

Proportion of meals $= \frac{3}{10} \times 4{,}500{,}000$

$$= shs.\ 1{,}350{,}000$$

First fees installment = 60% of the fees

$$\frac{60}{100} \times 180{,}000 = 1{,}080{,}000$$

First fees installment is shs. 1,080,000

Second fees installment $= \frac{1}{3}$ of the remainder

$$Remainder = 1800{,}000 - 1{,}080{,}000$$

$$= 720{,}000$$

Second fees installment $= \frac{1}{3} \times 720{,}000$

$$= shs.\ 240{,}000$$

Third fees installment is $720{,}000 - 240{,}000 = 480{,}000$

Third fees installment is shs.480,000

Tasks: (a) How much will Alice pay for fees in the last installment

Alice will pay shs.480,000 for fees in the last installment.

Tasks: (b) how much will Alice pay for accommodation

Alice will pay $shs.1{,}350{,}000$ for accommodation

Tasks: (c) actual code for withdrawing money

Since the pin 234 is in base ten, to convert to base six we divide by six as shown below

Base	Number	Remainder
6	234	0
6	39	3
6	6	0
	1	

$$243_{ten} = 1030_{six}$$

Therefore, the secret code for withdrawing money is 1030

ITEM 2

Let x represent the number of passion fruits and y represent the number of oranges required to make juice

$$Total\ of\ the\ fruits\ is\ atmost\ 25$$

$$x + y \leq 25 \ldots\ldots (i)$$

$$Difference\ between\ passion\ fruits\ and\ oranges\ is\ atleast\ 4$$

$$x - y \ \geq 4 \ldots\ldots (ii)$$

$$Number\ of\ oranges\ must\ not\ be\ less\ than\ 5$$

$$y \geq 5 \ldots\ldots\ldots (iii)$$

$$For\ non\ negative\ number\ of\ oranges\ and\ Mangoes$$

$$x \geq 0 \ldots\ldots (iv)\ and\ y \geq 0 \ldots\ldots\ldots\ldots\ldots (v)$$

Objective function $P = 300x + 200y$

$$Plotting\ inequalities,$$

For $x + y \leq 25$;

Boundary line is $x + y = 25(solid)$

x	5	10	15

y	20	15	10

Points to plot (5,20), (10,15) and (15,10)

For $x - y \leq 4$;

Boundary line is $x - y = 4 (solid)$

x	4	10	15
y	0	6	11

Points to plot (4,0), (10,6) and (15,11)

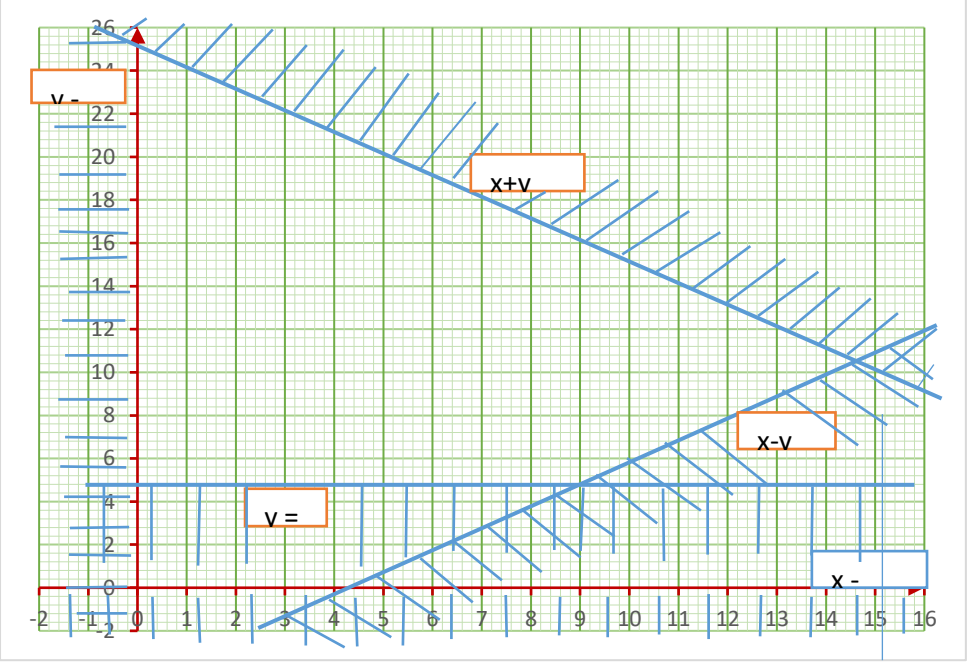
For the line $y \geq 5$

Boundary line is $y = 5\ (solid)$

x	0	10	15
y	5	5	5

Points to plot (0,5), (10,5) and (15,5)

A graph representing the inequalities formed and the feasible region



From the graph we use the following points for minimum profit

Point	$300x$	$200y$	$Profit$
(0,5)	0	1000	1000
(9,5)	2700	1000	3700

(14,10)	4200	2000	6200

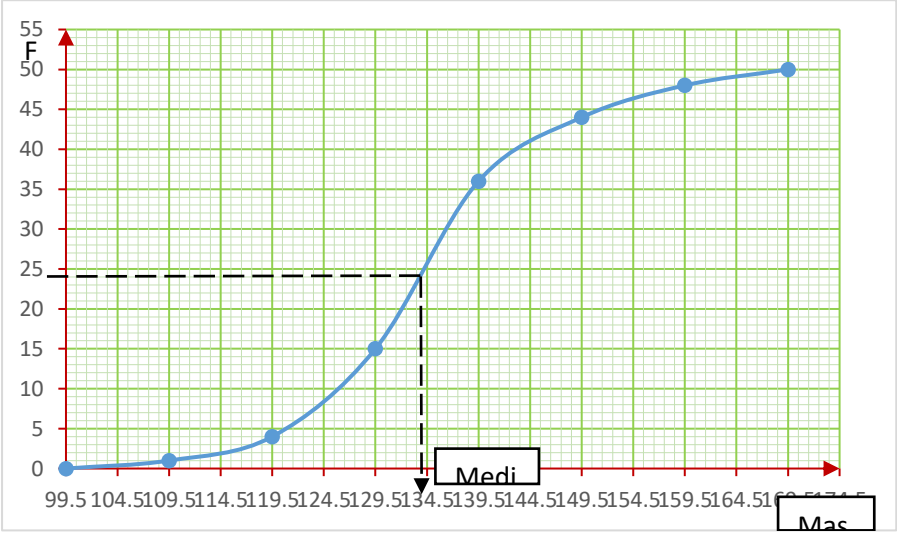
The minimum profit is shs. 3700 and it is achieved when we buy 9 passion fruits and 5 oranges.

ITEM 3

Consider the table below

Mass (g)	Frequency	Cumulative Frequency	Class boundaries
100 – 109	1	1	99.5 – 109.5
110 – 119	3	4	109.5 – 119.5
120 – 129	11	15	119.5 – 129.5
130 – 139	21	36	129.5 – 139.5
140 – 149	8	44	139.5 – 149.5
150 – 159	4	48	149.5 – 159.5
160 – 169	2	50	159.5 – 169.5

An ogive used to estimate the mass below which half of the biscuits lie



The mass below which half of the biscuits lie is 134.5g

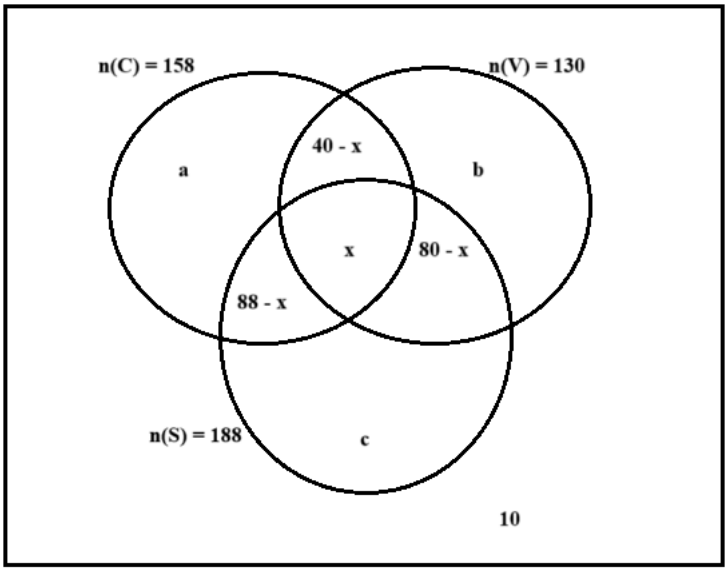
Item 4

Let n(c) represent the number of learners who love chocolate flavor,

n(V) represent the number of learners who love Vanilla flavor

and n(S) be the number of learners who love strawberry flavor

The information is summarized in the Venn diagram below



The number of members who love all the three flavors is equal to those who love chocolate and vanilla only

n(CnVnS) = n(CnS) only 40 - x = x x = 20 n(CnVnS) = 20	n(c) only a = 158 - (40 + 88 - x) = 158 - (40 + 68) = 50 n(C) only = 50	n(v) only b= 130 - (40 +80 - 20) = 130 - (40+60) b = 130 - 100 = 30 n(v)only = 30

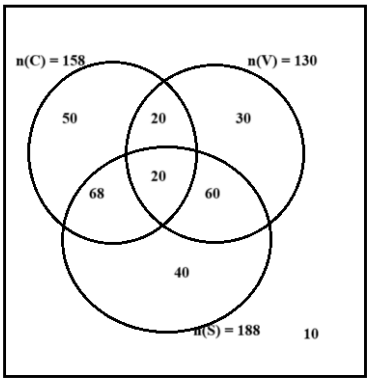
$$n(C)only$$

$$c = 188 - (80 + 88 - x)$$

$$c = 188 - (80 + 68)$$

$$= 188 - 148$$

$$n(C)only = 40$$



Probability of at least two flavors

$Probability = \frac{no\ of\ events}{sample\ space}$

$n(\varepsilon) = 158 + 30 + 60 + 40 + 10 = 298$

$\boldsymbol{n(e) = 20 + 20 + 60 + 68 = 168}$

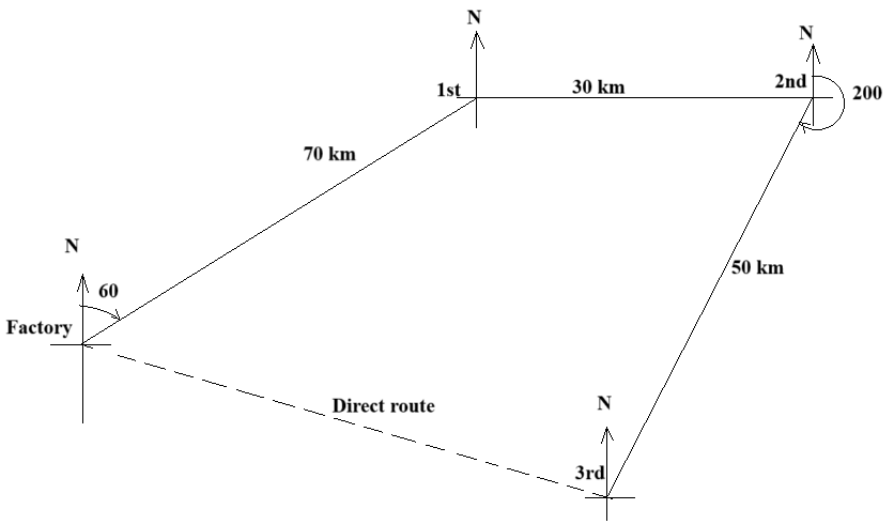
$Probability = \frac{168}{298}$

$= \frac{7}{12}$

Since the probability of learners loving at least two flavors is $\frac{7}{12}\ or\ 0.5833$ and it is greater than 0.5. the business will succeed.

ITEM 5

Sketch



Scale

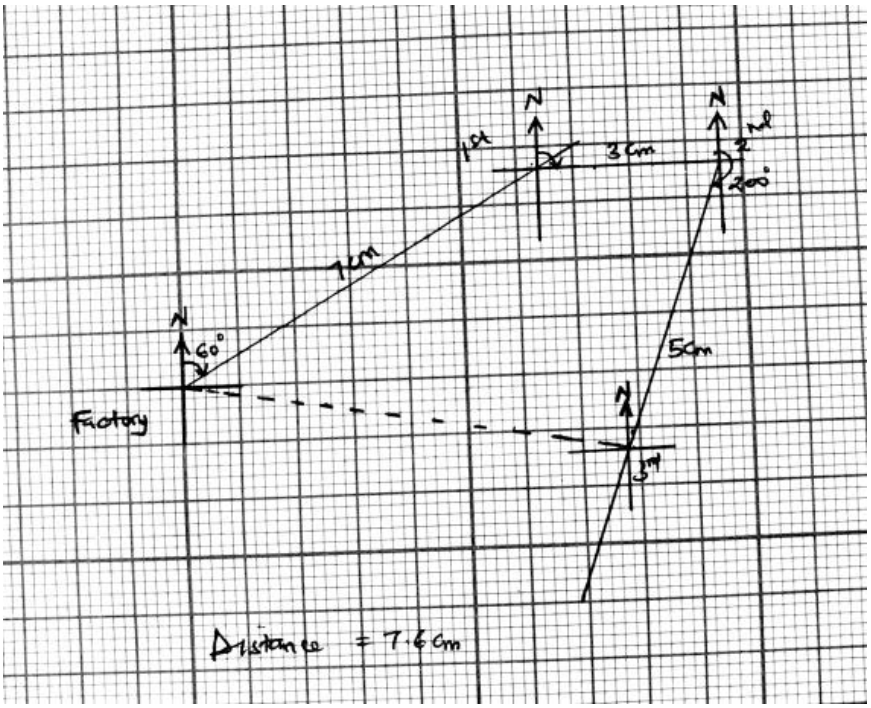
1 cm represent 10km

Distance 70km = $\left(\frac{70}{10}\right) cm = 7cm$

Distance 30km = $\left(\frac{30}{10}\right) cm = 3\ cm$

Distance 50km = $\left(\frac{50}{10}\right) cm = 5\ cm$

Accurate diagram



Distance from the third trading centre to the factory is 7.6cm

$= 7.6 \times 10 = 76km$

Task (b)

Total distance covered to move from factory to third trading centre = $70km + 30km + 50km = 150km$

Amount of fuel used $= \frac{150}{15}$

$$= 10litres$$

$$Remaining\ fuel = 20 - 10$$

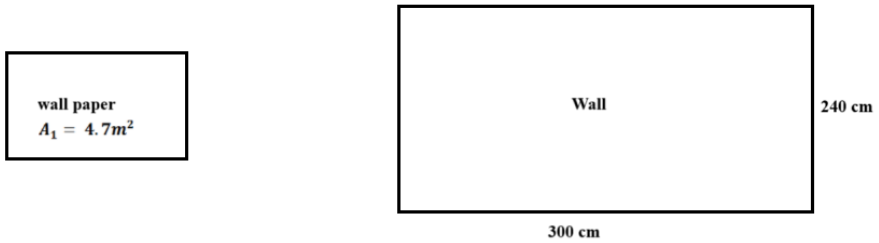
$$= 10\ litres$$

Distance using the direct route = 76km

Amount of fuel required to travel this journey $= \frac{76}{15} = 5.06667 litres$

Since we are left with 10 litres and the direct route from third trading centre to the factory requires $5.06667 litres$, the fuel is enough for the journey

ITEM 6



Wallpaper $A_1 = 4.7m^2$

$$Area\ of\ the\ wall = \frac{300}{100} \times \frac{240}{100}$$

$$= 7.2m^2$$

$$Required\ wallpaper = \begin{matrix} Area\ of\ the\ wall \\ A_2 \end{matrix} - \begin{matrix} Area\ of\ the\ available \\ wall\ paper\ A_1 \end{matrix}$$

$$= 7.2m^2 - 4.7m^2$$

$$= 2.5\ m^2$$

Tasks: (a) (i) how many more meters are to be bought?

Mariam needs to buy 2.5 square meters of wallpaper in order to cover the entire wall

Price of the wall paper

$$1 \quad Roll\ of\ 10m^2\ costs\ 32{,}000$$

$$1m^2 = \frac{32000}{10}$$

$$= shs.\ 3{,}200$$

$$2.5\ m^2 = 3200 \times 2.5$$

$$= shs.8000$$

Tasks: (a) (ii) how much money will she pay for the extra wallpaper?

She needs to pay shs. 8,000 for the extra 2.5square metres of wallpaper.

$$Gross\ income = shs.350{,}000$$

$$Total\ allowances = shs.90{,}000$$

Taxable income = Gross income – Total allowances

$$Taxable\ income = 350{,}000 - 90{,}000$$

$$= shs.260{,}000$$

Taxable income	Rate (%)	Income tax
0 – 100000	0	0
100000 – 200000	5	$\frac{5}{100} \times 100{,}000 = 5000$
200000 – 260000	15	$\frac{15}{100} \times 60{,}000 = 9000$
Total		Shs. 14,000

Each employee will be deducted an income tax of shs. 14,000

For three employees = $shs.14{,}000 \times 3 = shs.42{,}000$

Tasks: (b) (i) she needs to deduct an income tax of shs. 42,000 from her three employees.

$$Net\ income = Gross\ income - Income\ tax = 350{,}000 - 14{,}000$$

$$= shs.336{,}000$$

Tasks: b(ii) She will pay each employee a net salary of shs. 336,000

End