P425/1&2

MATHEMATICS

AUGUST 2025

3 HOURS

WAIRAKA MODERN SS,JINJA

End of Term Two Examination

Senior Five Mathematics

3 HOURS

INSTRUCTIONS

- This paper is made up of two sections A and B
- All items are ***compulsory***
- Presentation of neat and tidy work is a must.
- Poor numbering of work may lead to loss of marks.
- Show all the necessary working clearly

SECTION A; (40 MARKS) @ 5score

ITEM 1

A treasure map uses a coordinate grid to help adventures locate hidden treasures in Mubende District. The grid is labelled with coordinates (x,y), where each point represents a specific location. Two equations are used for safety of the treasures but the travellers have no knowledge of how to identify the coordinates. The equations are;

$5^{x+2} + 7^{y+1} = 3468$ and $7^{y} = 5^{x} - 76$

Task

Help them identify the location

ITEM 2

A health food company is creating a new herbal drink that requires an exact measurement of a rare extract. The amount of extract needed for one bottle is $-7\left(\frac{(\sqrt{5}-2)^2-(\sqrt{5}+2)^2}{8\sqrt{5}}\right)$ ***milliliters***. To

ensure precision in production, the machine can only handle rational numbers. The company wants to produce 50 bottles.

Task

Help the company to find the total amount of extract needed.

ITEM 3

A cinema sells snacks in Combo deals;

Combo A includes 1 tin of popcorn, 1 drink and 1 chocolate bar all at a total cost of UGX.26,250.

Combo B includes 2 tins of popcorn, 1 drink and 2 chocolate bars all at a

total cost of UGX.43,750.

Combo C includes 1tin of popcorn and 2 drinks all at a total cost of UGX.28,000. Your friend wants to buy 3 tins of popcorn, 2 drinks and 1 chocolate bar for both of you but not sure of how much to pay for all of them.

Task

Use your knowledge of mathematics to save your friend from being cheated.

ITEM4

During your first term holiday in senior five you decide to visit your uncle in the village having taken long not seeing him. He wishes to plant trees around his plot of land whose length is 2 metres longer than its width. The total area of the plot is 35 square metres according to the land tittle .He plans to use a spacing of 1m from each tree that but doesn't know how much money he will spend on buying the trees .

Hint; Each tree costs UGx 2,500

Task

Help your uncle to determine the total amount of money needed to be spent on buying trees.

ITEM 5

Your class teacher looses her phone after being stolen by thugs while coming to school. She decides to go police so that the phone can be tracked using GPS coordinates. The phone's location at different times is recorded and the police are trying to find its movement pattern. The tracking device uses a logical operation given simultaneously as;

$\log_2 x + 2\log_4 y = 4$ and xy = 16 when they got so close to the phone but couldn't tell the coordinates to locate the phone with ease. The coordinates are in metres and one point gives the position of those with the tracking device, the other point gives the position of the phone.

Task

(a) Help them find the coordinates.

(b) What is the distance between the two points?

ITEM 6

James, a senior student in a science and engineering class, is working on a school project to design a rotating platform for an art exhibition. The platform is driven by angular motion and synchronized lighting systems. To ensure accuracy and synchronization, James applies trigonometric identities to model gear rotation, light signals, and safety mechanisms

1. **Gar Angle Calibration**
   To match a precise gear ratio, James needs to calculate certain angle values
   a) i) simplify **tan 75°** in the form **a + b$\sqrt{3}$,** where a and b are rational numbers
   ii) hence, show that **tan** 105**° + cot** 105**° = -4**
2. **sensor signal processing**
   A motion sensor on the platform detects beam angles and processes the signal strength using:
$$\frac{\cos\theta}{1+\sin\theta}+\frac{1+\sin\theta}{\cos\theta}$$
   a) show that this expression simplifies to: $\mathbf{2\sec\theta}$
3. **lighting synchronization**
   For a strobe light effect, lighting is programmed using the equation:
$$\frac{\sin\beta+\sin 3\beta+\sin 5\beta}{\cos\beta+\cos 3\beta+\cos 5\beta}=\tan 3\beta$$
   a) prove the identity above
   b) Explain how it helps in keeping the light flashes synchronized with the platform's movement.

SECTION B. (APPLICATION)

1. An information security analyst designs a system where encryption keys are generated using interactions of the periodic function $\cos 2x = \sin 3x$ where x is an acute angle. In addition, the analyst combines two sine waves to create a specific audio effect. The combined signal is modelled by the equation $y = \sqrt{3}\cos\theta + 7\sin\theta + 12$. The signal is used to modulate volume for background alarms.

   Task

   Determine the

   (a) Possible values of x for the periodic function.

   (b) Values of θ for which the sound waves cross the line $y = 13$. Take $-180^0 \leq \theta \leq 180^0$. (15 scores)

2. A local community in a rural area has a large water storage tank that supplies water to households through two distribution pipes. The rate at which water flows out of the tank through these pipes depends on how full the tank is. After conducting measurements, the engineers model the rate of water flow $R(x)$ in litres per minute, with respect to time using a rational function $R(x) = \frac{5x+3}{(x-1)(x-3)^2}$ where x is the **number of hours** after the start

of the day. The engineers must first **decompose it into partial fractions** before they determine the volume of the tank.

Task

Help the engineers finish the task. Hence determine the flow rate of water after $\mathbf{5}\boldsymbol{hours}$. (15 scores)

3. The academic board at Bright Future High School is analyzing the performance of six students in their End of Term Mathematics and Physics exams. The data collected is presented below;

Student	**A**	**B**	**C**	**D**	**E**	**F**
Mathematics (x)	90	60	80	54	86	70
Physics (y)	48	72	60	78	50	65

As part of the school's student data analytics team, you have been tasked with carrying out the following analysis

(a) plot the scatter diagram of the students' Mathematics and Physics scores

(b) Draw a line of best fit for the scatter diagram , hence find physics score when mathematic score is **68**

Calculate the rank correlation coefficient for the data and comments on your results at 5% level of significance (15 scores)

(c)

4. The head technician at a solar company is conducting a quality check on the lifetime of 80 newly installed solar bulbs used in rural homes. After several weeks of monitoring, the following data was collected on how long the bulbs lasted before failure:

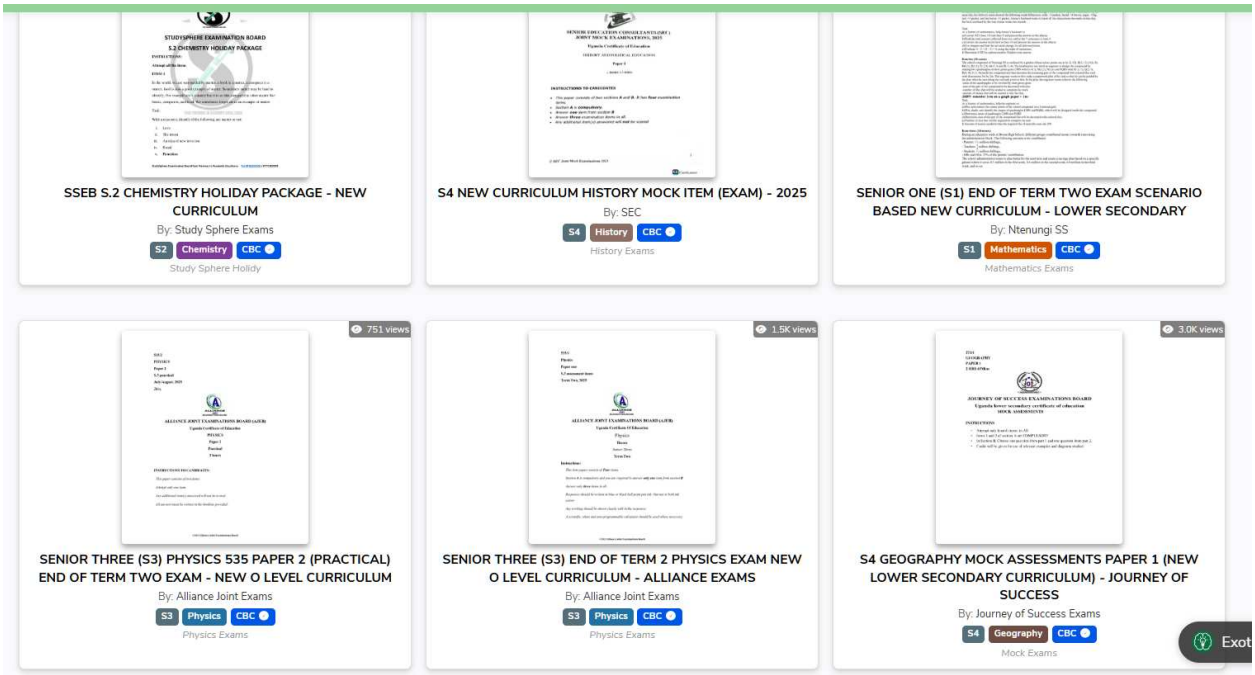
Lifetime (Hours)	**Number of Bulbs**
Below 10	14
10 and under 20	19
20 and under 30	15
30 and under 40	20
40 and under 50	12

TASK:

As the quality control assistant, calculate the **mean lifetime** and **variance** of the solar bulbs. Use the information to determine how consistent the product is. (15 scores

THE END

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