Name: ……. Comb: ……/……

ARCHBISHOP SITENSERA S S BUWAMA

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

S.5

END OF YEAR ASSESSMENT 2025

2 Hours 30 Minutes

INSTRUCTIONS:

- This paper consists of six items.
- Attempt all items in this paper.
- Graph paper is provided.
- Be neat.

Item 1

Mr. Mukasa and family organized a field tour to western Uganda, they hired a caravan for the long journey, they towed a caravan of mass $1000kg$ on the car of mass $800kg$ by means of coupling (light rigid tow bar).

On a straight level road, the car exerted a driving force of $1270N$ and if the resistances to the forward motion of the car and caravan was $400N$ and $600N$ respectively.

At some point Mr. Mukasa encountered a hill while travelling at $40km/hr$ inclined at $\sin^{-1}(\frac{1}{1000})$ and plans to overcome it in 2minutes when the driving force and resistances remain constant.

Task

Help Mr. Mukasa to determine his acceleration on the level road and distance covered on the inclined road(hill).

Item 2

In order to improve on the performance of Mathematics, the head of department laid down strategies, which included a test that was administered and the marks were distributed as shown in the table below.

Marks	<20	<26	<35	<45	<55	<60	<68	<80	<95
Cumulative number of learners	0	6	24	66	110	130	154	174	180

Other strategies included:

- A reward from administration to be given to the learner who scores not less than 85 marks

- Remedial lessons to be organized for those who score below average.

Those to get distinctions were limited to only 16 learners.

The performance is inconsistent if the measure of dispersion of all the marks away from the average mark is more than 10 marks.

TASK:

a) Hel the Head of department to determine;

i) The number of leaners who are to be rewarded

ii) The number of learners who are to attend remedial lessons

iii) The minimum mark of a distinction

b) Were the learners consistent in their performance?

Item 3

The points scored by eight universities in high (x) and long jump (y) were recorded as shown in the table below:

Universities	A	B	C	D	E	F	G	H
High jump (x)	50	54	40	100	22	54	54	100
Long jump (y)	136	130	140	121	150	132	130	120

a) Represent the above information graphically to show how the performance in High jump and Long jump are related.
i) Compare the universities performance in the competitions
ii) Determine the score in long jump for a university which scored 18 points in high jump.

b) Calculate a rank correlation coefficient and comment on your results.

Item 4

In an experiment to demonstrate the effect of forces on a body, a teacher applied the following forces on a solid metallic block; 5N and 13N forces acting vertically upwards, 11N force acting vertically downwards, 3N and 5N forces acting horizontally to the left and 14N force acting horizontally to the right.

The teacher asked the students to determine a single force resulting from the effect of these six forces acting on the block.

In his further demonstration, he played a video that involved a monster truck at the centre of five (5) small cars, each connected to it using a strong cable. The cars pulled apart with forces of 30N, 60N, 100N, 70N and 20N in the directions of 270°, 040°, 120°, 330°, and 225° respectively. The teacher also asked the students to use the system of the above forces to determine a single force with which a monster truck will resultantly move and he direction it'll take.

Task

Help students to accomplish the tasks in each of the cases above.

Item 5

A statistics student from Makerere university was conducting a survey at a popular Rolex stand in Wandegeya, and notices that customers can choose to add extra toppings: onions, tomatoes, or cabbage. In his noting he let the random variable X be the number of extra toppings a customer chooses. He in his interaction with the owner he was able to get information from past sales and he derived the following probability distribution for X:

x (Number of toppings)	0	1	2	3
$P(X = x)$	0.1	0.3	0.4	0.2

Task:

a) Help the student to verify that this is a valid probability mass function.
b) Determine the expected number of toppings per customer, E(X) and the variability in customer choices Var(X).
c) If a topping costs the owner UGX 200 to add, what is the expected cost of toppings per customer? Advise on how this information could be used to set the price of a Rolex.

Item 6

The waiting time, T (in minutes), for a Pioneer bus at the Kampala Constitution Square stage during peak hours is modelled as a continuous random variable. The probability density function (PDF) for a bus to at any point in 10 minutes' interval is given by:

$$f(t) = \begin{cases} \frac{1}{10}, & 0 \leq t \leq 10 \\ 0, & otherwise \end{cases}$$

Task:

a) Establish whether $f(t)$ is a valid probability density function
b) A passenger arrives at the stage. What is the probability that they will have to wait for less than 3 minutes before the bus arrives?
c) Determine the mean waiting time for the bus.

END