

P425/2
Principal Mathematics
Paper 2
July 2026
3 Hours



ACEITEKA JOINT MOCK EXAMINATIONS 2026
Uganda Advanced Certificate of Education

Principal Mathematics

Paper 2

Time: 3 hours

INSTRUCTIONS TO CANDIDATES:

- This examination paper consists of **two** sections; **A** and **B**. It has **five** examination items.
- Section **A** consists of **one compulsory** item.
- Section **B** has two parts, **I** and **II** each with two optional items. Respond to only **two** items from Section **B**, choosing one item from **each** of the parts, **I** and **II**.
- Respond to **three** items in all.
- Any additional item(s) responded to will **not** be scored.
- Begin each item on a fresh page.
- **All** necessary working **must** be shown clearly.
- Graph paper is provided.
- Where necessary, use $g = 9.8 \text{ ms}^{-2}$
- Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A:

Item in this section is compulsory

ITEM 1

An engineer is designing a new town road. The layout of the road follows the path $y = 2x + 7\cos 2x$. This road must cross a straight river located at $y = 0$. To plan bridge construction, the engineer needs to find where the road and river intersect. The engineer wants to show graphically that the road meets the river at a point between 2km to 3km measured from one boundary B_1 of the town. To pinpoint the exact spot, he plans to use an iterative formula based on the Newton Raphson Method until his answer stabilizes. The difference between two consecutive approximations must be less than a tolerance threshold of 0.0001 km. The town will only approve the project if the determined approximate location of the bridge falls within a safety zone between 2.0440 km and 2.0452 km measured from the boundary B_1 .

The engineer also plans to first visit the location of the river to make some observations. He plans to use a bus that moves between the boundaries of the town along this road. The bus starts from B_1 and makes stops at different stages 500m apart the bus fares up to the first, second, third and fourth stages are shs11,000, shs15,000, shs18,500 and shs20,000 respectively. The engineer has established that he can use interpolation to approximate the fare to the bridge location which 1800m from B_1 . The engineer wishes to spend at most shs42,000 to and from back to B_1 or else he postpones the visit for the following day.

The engineer also wants to use an approximate method to determine the area enclosed by the road and the river which is described $\int (2x + 7 \cos 2x) dx$ from $x = 3\text{km}$ to $x = 4\text{km}$ using 6 ordinates but he has been opposed by some of his colleagues claiming that this will result into an error of more than 1% and this will give wrong conclusions on the costs involved in the contract. The engineer wishes to determine the percentage error in this area to ascertain whether his friends are right so that he can address the fear of his colleagues.

Task:

Help the engineer obtain the information he needs to make informed decisions.

SECTION B:

PART I: Respond to one item from this part

PART I

Item 2

In the bid to improve the performance of mathematics, the head of curriculum in a certain school wants to analyze the performance of students in senior six. He wishes to know the mean and standard deviation. He also wishes to graphically show the distribution of the performance from which he will estimate the most likely mark of a particular test, students had performed as shown in the table below;

Marks	30-<40	40-<50	50-<55	55-<60	60-<70	70-<90	90-<100
Number of students	2	15	19	22	18	17	3

He wishes that if the difference between the mean and the mode is less than the standard deviation, then a facilitation class will be arranged only for the challenged students

He notices that the general performance of students in Mathematics is approximately normally distributed with mean 60.65 and standard deviation of 13.3. He wants to determine whether the percentage of students who scored above 75 is less the percentage of students who scored below 45 so that he can arrange for a retooling seminar for the teachers of the subject.

The probability of picking a football player from the mathematics class is 0.2. if a student is from the football player, the probability that they get D1 is 0.6. for students on the football team, the probability of getting D1 is 0.65. The head of the curriculum wants to find the probability that a math student is a football player given that they received a D1. if this probability is less than 0.5, extra Math lessons will be arranged for the football players.

Task:

Help the head of curriculum to prepare the information he needs for his analysis and make informed decisions.

ITEM 3

From the recently concluded mock examinations, 20 students of a certain school were not satisfied with their scores.

As a concern, the director examinations picked 8 of these students' scripts for a remark to determine the effectiveness of the mock examiners of this subject. The following table gives the scores for the 8 scripts;

Original mark	65	65	70	75	75	80	85	85
New mark	50	55	58	55	58	61	65	65

The director examination wants to verify if the two results correlate by using a suitable statistical diagram. The director examination wishes to write to the mock body to address the challenge in case the correlation in the two results is not significant at 1% level of significance.

The secretary to the director examinations recorded the scores of the twenty students using the original results but failed to clearly show the proportion of those who had scored 85 as follows;

Original mark	65	68	70	72	75	80	83	85
Proportion of students	0.05	0.15	0.1	0.22	0.15	0.05	0.1	a

The director examination wants to know the expectation and variance of these marks and also represent this data graphically for easy identification of the mode to be used in his write up to the mock body. He wishes that the difference in the expectation and the mode is less than the standard deviation to recommend the mock body examination for coming mock examinations.

The director examination also has established that the probability of one of these 20 students scoring a distinction in the final examinations is 0.65. He wants to know the percentage of exactly 15 of students scoring a distinction in their finals. If this percentage is less than 30%, then he will have to arrange for facilitation for the class.

Task:

Help the director of examinations obtain the information he needs to make informed decisions.

PART II:

Respond to one item from this part

ITEM 4

A newly trained pilot flying from airfield A to airfield B faces three distinct challenges: managing stability of a cargo, navigating safely to avoid mid-air collision and executing a precise projectile release.

He plans to fly an aircraft from airfield A to airfield B, carrying a 10 kg cargo attached by an inelastic string. During the flight, a constant horizontal force of 50 N acts on the cargo in the opposite direction of motion, causing the string to displace from the vertical by a certain angle. To ensure a safe flight, the pilot needs to determine this angle of displacement and calculate the tension in the string, knowing that if the tension exceeds 120 N, he will be forced to double the strength of the string.

At 8:00 AM, the pilot sets off from airfield A at a velocity of 110 km/h in a direction of 320° . Airfield B is located 32 km away from airfield A in a direction of 250° . Simultaneously, a second aircraft departs from airfield B, flying at the same altitude with a velocity of 104 km/h in a direction of 030° . To avoid a collision, the pilot wants to determine the shortest distance between the two aircraft during their motion and the exact time it occurs. If this shortest distance is less than 10 km, he will have to adjust his flight altitude.

Once past the point of closest approach, the pilot intends to release the cargo at a point when flying at a height of 250 m above ground and when moving at a velocity of 110 km/h, he must release the cargo so that it undergoes projectile motion and lands precisely at a target point C. The ground distance from the point of release to point C must not exceed 220 m for the cargo to remain within a recoverable distance.

Task

Help the pilot get clear information on this flight and make informed decisions before he sets off.

ITEM 5

The traffic control office is monitoring two motorcycle ambulance riders who are responding to calls from different parts of a town in Eastern Uganda. The town centre roundabout is taken as the origin on a coordinate grid. Distances are measured in kilometres and speeds in kilometres per hour. At exactly 10:00 am, the control screen gives the following information.

For rider A: $R_A = \begin{pmatrix} 2 \\ 8 \end{pmatrix} \text{ km}$, $V_A = \begin{pmatrix} 18 \\ -12 \end{pmatrix} \text{ km/h}$

For rider B: $R_B = \begin{pmatrix} 8 \\ 2 \end{pmatrix} \text{ km}$, $V_B = \begin{pmatrix} 6 \\ 0 \end{pmatrix} \text{ km/h}$

The control officer must decide whether the two riders are on a collision course. The situation is dangerous only if the riders would reach the same position at the same time within 30 minutes if neither changes direction or speed. If the situation is dangerous, the officer must warn the riders.

Later, a community tractor breaks down while carrying sacks of maize. A pickup truck is used to tow it along a rough horizontal road to a safe parking yard. Before towing begins, the local mechanic must check whether the operation is safe. The following data is provided.

Mass of broken

quantity	Value
Mass of broken tractor	1500kg
Mass of pickup truck	1700kg
Driving force of pickup	7200N
Coefficient of friction for tractor	$\mu = 0.18$
Road resistance on pickup	950N
Gravitational acceleration	$g = 9.8 \text{ ms}^{-2}$
connection	Light inextensible chain

The towing is approved only if the tension in the chain does not exceed 4350 N.

The ambulance riders have completely run out of critical medical supplies and have to fetch them from a nearby trading center. The trading center is separated from the town by a fast flowing part of a river 0.8 km wide flowing at 5 km/h due East. Rider A is selected to pilot a speedboat capable of travelling at a constant speed of 15 km/h to fetch

supplies from the trading center. Rider A departs from port P to reach a port Q, which is located 0.65 km downstream of point P on the opposite bank. After loading the supplies, the rider must return from point Q to point P; however the boat's speed drops to 12 km/h on this return journey. The speedboat's digital navigation display runs entirely on a small battery which, at the start of the journey, indicates only 12 minutes of power remaining before shutdown.

Tasks:

Help to decide whether the:

- a) ambulance riders should be warned.
- b) towing operation should be approved.
- c) rider A will return to point P before the battery shuts down.

END