

P425/2
MATHEMATICS
Paper 2
29 July 2026
3 hours



ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

*The paper has **two** Sections: **A** and **B**. It consists of **five** items.*

*Section **A** has **one** compulsory item.*

*Section **B** has **two** Parts I and II, Respond to **one** item from each Part.*

*Any additional item(s) responded to will **not** be scored.*

All responses must be written in the answer booklet(s) provided.

Begin each item on a fresh page.

Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

Graph paper is provided.

Where necessary, use $g = 9.8 \text{ m/s}^2$.

SECTION A

This Section is compulsory.

ITEM 1

A civil engineering company is constructing a drainage canal across a valley. During the design process, the engineers collect measurements, estimate the amount of construction material needed, and develop a computer program to solve design equations.

The width of the canal $X = 3.7$ km, the distance from the starting point to a reference marker $Y = 7.0$ km and the distance from the marker to the end of the canal $Z = 6.25$ km are recorded, each rounded to the stated number of decimal places. To assess the possible effect of measurement errors on the design, the engineers calculate the interval within which the exact value of $\frac{X}{Y-Z}$ lies. The engineers will be given a go-ahead assurance only if the estimated interval is within (4 to 6) km.

To estimate the cross-sectional area of earth to be excavated, the engineers model the profile using the function $y = 3^{2x}$ over the interval $0 \leq x \leq 4$. To come up with this area, the engineers use 5 km equal intervals using approximations. The evacuation of the earth will be easy only if this cross-sectional area is less than 40000 km^2 .

One of the design equations cannot be solved directly and must be solved iteratively. The engineers decide to use an iterative numerical method with an initial approximation of 1.4 km. The engineering team is required to come up with a diagrammatic representation of the steps involved in solving this problem. The design equation was given by $2x^3 + 5x - 8 = 0$ estimating the root x with an error less than 0.001. The contract will be approved if this root is not beyond 2 km.

Task

- (a) With evidence, find out whether the engineers will be given a go-ahead assurance with the contract.
- (b) Will the evacuation of the earth be easy?
- (c) Will the contract be approved?

SECTION B

*Answer only **two** items from this Section, responding to **one** item from each **Part**.*

PART I

ITEM 2

A Mathematics and Physics teacher wants to find out whether students who perform well in Mathematics also perform well in Physics. The teacher randomly selects 10 students and records their scores in the two subjects as shown below.

Mathematics (X)	28	20	40	28	21	31	36	29	33	24
Physics (Y)	30	20	40	28	22	35	35	27	31	23

The teacher wants to observe the relationship between the performance of Mathematics and Physics by these students through a diagram to give a correct comment on the performance of the two subjects. Later, the teacher needs to determine the magnitude of this relationship which will help him make conclusions. It is said that if the magnitude of this relationship is greater than 0.7, then Mathematics is vital in the performance of Physics. A student called Stella who scored 32 in Mathematics will not be

good enough in Physics if she scores a mark less than 25 in Physics and therefore advised to go for coaching.

Tasks

- (a) Help the teacher to observe the relationship between the performance of the two subjects and make desired comments.
- (b) Is Mathematics vital in the performance of Physics?
- (c) Will Stella go for coaching or not?

ITEM 3

A food processing company, Fresh Harvest Ltd, purchases potatoes from farmers in different districts. The quality of the potatoes and the efficiency of their delivery determine whether the potatoes arrive at the processing plant in good condition.

To improve its operations, the company carries out three investigations. The logistics manager uses rail, air or road to transport potatoes to the processing plant. Historical records show that the chances of using rail, air and road are 0.3, 0.5, and 0.2, respectively. The corresponding chances that the shipment arrives at the processing plant on time are 0.2, 0.8 and 0.1, respectively. For improved operations, the chance that the shipment arrives on time must be greater than 0.4.

The marketing department records the number of customer orders received each day. Let the random variable Y represent the number of orders (in tens) received on a randomly selected day. The probability distribution of Y is given below.

Y	5	6	7	8	9
P (Y = y)	a	0.1	a	0.4	0.1

The marketing department was tasked to calculate the value of $E(3Y - 8)$. If the value obtained is above 150, the marketing department will be given an allowance of Shs 1,000,000, but if less than 150, the marketing department gets an allowance of Shs 500,000. The department also wishes to find out how far the number of orders is spread out from their mean value.

During quality inspection, it is found that 25% of the potatoes supplied are rotten. A quality control officer randomly selects 6 potatoes from a large sack for inspection before processing. Quality is assured if only the chance that at least two potatoes selected at random is less than 0.5.

Tasks

- (a) Help and find out whether the operations are improved.
- (b) Help and find out the allowance which the marketing department will receive.
- (c) Assess how far the number of orders is spread out from their mean value.
- (d) Will quality be assured?

PART II

ITEM 4

A construction company is transporting building materials to the top of a hill using a simple pulley system. A 6 kg crate is temporarily placed on a rough loading ramp inclined at 30° to the horizontal while workers prepare the lifting equipment. The crate is observed to be just about to slide down the ramp, indicating that it is in limiting equilibrium. The company intends to find the coefficient of

friction between the mass and the plane. The transportation of the building materials will be easy if the coefficient of friction calculated is less than 0.6. If this condition is satisfied, the company uses Shs 35,000 as transport; if not, then the company uses transport as Shs 40,000. The company intends to minimize the cost of transportation.

The workers then connect the crate to a 3 kg counterweight using a light inextensible string passing over a smooth fixed pulley located at the top of the ramp. Once the system is released from rest, the two masses begin to move. The speed of the two masses will be low if the acceleration obtained is less than 5 m/s^2 .

Assume that the pulley is frictionless, the string is light and inextensible.

Task

- (a) Will the transportation of the building materials be easy?
- (b) Will the company minimize the transportation cost?
- (c) Assess the speed of the two masses.

ITEM 5

A drone delivery company is testing a new aerial delivery system in an open field. During a trial, a delivery package is projected from a point on a horizontal platform with an initial velocity of 28 m/s at an angle of elevation of 60° above the horizontal. The engineers want to determine the greatest height reached by the package and the time taken to reach that height to ensure safe operation. The delivery system will be effective if the height reached is less than 35 m . The time taken to reach this height should be below 3 seconds for the package to be allowed to move in the airspace.

At the same time, two monitoring drones, Drone A and Drone B, are moving through the airspace to track the package. Their positions at time (t) seconds are represented by the following position vectors:
 $r_A(t) = (3i + j + 5k) + t(4i + j - 3k)\text{m}$ and $r_B(t) = (i - 3j + 2k) + t(i + 2j + 2k)\text{m}$.

The engineers need to analyze the motion of the package and the two drones to avoid collision and improve the efficiency of the delivery system. To do this, the engineers need to determine the value of t when A and B are closest, and the least distance between A and B. There is efficiency in delivery only if the least distance obtained is less than 5 m .

Task

- (a) Will the delivery system be effective?
- (b) Is the package allowed to move in the airspace?
- (c) Will there be efficiency in system delivery?