P425/2

PRINCIPAL MATHEMATICS

PAPER 2

3 hours

JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS – AUGUST, 2026

PRINCIPAL MATHEMATICS

Paper 2

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 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 as $9.8ms^{-2}$

375 ÷ 0.916
1148

SECTION: A

Item 1

The Uganda National Roads Authority (UNRA) is upgrading a 50km road that connects a trading centre to a lake community. A sino truck transports gravel from a quarry and off loads it at different points along the road according to the condition of the road surface. The following offloading records were made along the route.

At the trading centre 4 tonnes were offloaded. At the swampy area 40km from the community 3.4 tonnes were offloaded. At the beginning of the hill 20km from the centre 2.8 tonnes were offloaded. 30km from the centre 2.2 tonnes were offloaded. At a distance of 10km from the lake community 1.6 tonnes were offloaded and at the lake community 1.0 tonnes were offloaded. The roads supervisor wants to plan the distribution of stones more effectively for the remaining sections of the road. The engineer wanted to offload stones at a distance of 9km from the community and also wanted to offload 2.09tonnes of stones

Engineers also established the relationship between the quantity of stones offloaded, y tonnes, and the distance x in Kilometers as $e^x \cos x + 1 = 0$ for the section $1 \leq x \leq 2$ (kilometers) for the road design in that particular area.

The engineer wanted to perform a dry run to identify actual location to a degree of accuracy of two decimal places.

Task

(a) Advise the supervisor on the quantity of stones to be offloaded and the location for offloading from the centre.

(b) (i) Help the supervisor to establish the road design graphically, and distance where offload was made.

(ii) Advise the engineer on the most accurate location.

SECTION B

(PART 1)

Item 2

A manufacturing company partnered with a nearby secondary school to improve efficiency in its community outreach programme. During a general cleaning exercise, the time taken by learners to complete an assignment task was recorded.

At the same time, the company monitored the quality of products manufactured by four machines (A, B, C and D). In addition, traffic flow on the road leading to the company was studied to help plan transportation for workers.

The following information was obtained:

the times taken by learners to complete the activity recorded as follows:

Time (seconds)	5-	10-	15-	20-	30-	50-	100-
Number of learners	35	42	58	14	3	1	0

In order to report effectively the company required the average time, the variance from the mean and the most frequent time by the use of an appropriated statistical diagram.

The manufacturing company uses four machines to produce its products. Machine A produces 30% of the daily output, machine B produces 30%, machine C produce 15% and machine D produce 25%.

The percentages of defective products are: Machine A 1%, Machine B 2%, Machine C 3% and Machine D 5%. In order to work on customer satisfaction, the company wanted the probability of product being defective and also that machine A would be used more to produce the products.

Between 8:00am and 9:00am, 40% of the vehicles travelling on the road move from west to east, while the remaining travel from east to west. A random sample of 250 vehicles is observed.

Task.

(a) Help the company to find the statistical measures of time for informed decision making.

(b) If a product selected at random is found to be defective, determine the probability that it was produced by machine A.

(c) Determine the probability between 77 and 93 vehicles inclusive travel from west to east during the observation.

ITEM 3

A meteorological agency is studying rainfall patterns and student performance.

In a simple model of the weather in July each day is classified as either fine or rainy. The probability that a fine day is followed by a fine day is 0.8. The probability that a rainy day is followed by a fine day is 0.4. The probability that 1 July is fine is 0.75.

The meteorologist wanted to discover whether 2 July would be fine and also 3 July could be fine.

At the same time, the amount of rainfall (in cm) on a randomly selected day is modeled by the continuous random variable X with probability density function

$$f(x) = \begin{cases} 3\alpha x, & 1 \leq x \leq 3 \\ \beta(6 - x), & 3 \leq x \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

where α and β are constants.

To assess academic performance, a random sample of 250 candidates is selected from the district. The sample has a mean examination score of 68.4 and a population variance of 182.25.

Task

(a) (i) Help the meteorologist investigate probability that 2 July will be a fine day then the probability that 3 July is also a fine day.

(ii) Investigate the probability that 3 July is rainy, given 1 July is fine.

(b) Help to construct a cumulative distribution function X, and hence determine the median

(c) Investigate the standard error and construct a 98.4% confidence interval for the population mean.

Part II

ITEM 4

The Uganda Civil Aviation Authority (UCAA) is conducting a search and rescue training exercise on lake. The exercise involves a rescue helicopter, two emergency response vehicles and two rescue motor boats.

During the exercise, the helicopter launches a rescue package from a cliff with an initial speed of 30 ms^{-1} towards a target located 60m horizontally from the point of projection and at the same level. For safety reasons the launch angle must be between 20° to 67°and at the same time, two emergency response vehicles from opposite ends, A and B, of a 20 m straight road. At the same instant one vehicle starts from rest at A and travels towards B with a constant acceleration of 2 ms^{-2} and the other vehicle starts from rest at B and travels towards A with a constant acceleration of 5 ms^{-2}. The intersection occurs for the vehicle to meet.

Meanwhile, two rescue motor boats P and Q begin moving on the lake. Boat P travels at a constant speed of 20 km/h on a bearing of 060° while boat Q travels at a constant speed of 10 km/h. At 2:00 pm the operator on the boat Q observes that boat P is 4km due west of Q. The intention of operator on Q is to pass as close as possible to P.

Task

(a) Investigate whether the rescue was successful.

(b) Investigate the point on the road where the particle would meet from A.

(c) (i) Investigate the course that must be set by boat Q to pass as close as possible to P and the shortest distance.

(ii) Help the operators to know the time when the rescue will take place.

ITEM 5

An engineering team is transporting equipment to a construction site across a river. The equipment is first pulled up a rough inclined plane with an angle of inclination $sin^{-1}\left(\frac{3}{5}\right)$ coefficient of friction $\frac{1}{8}$, between P and the plane, by a light inextensible string passing over a smooth pulley. A 5kg mass on the incline is connected to a hanging load Q of 4kg. Q is initially 2m above the ground. The system is released from rest with the string taut.

At the top of the incline, four guide cables exert forces of 4N, 5N, 9N and $6\sqrt{2}$ N along EB, EC, ED and AC respectively, where ABCD is a rectangle and AB = 2AD. The engineers wish to replace these four forces with a single equivalent force.

After unloading the equipment, the team crosses a river 50m wide flowing at a constant speed of 3 ms^{-1}. Their boat has a speed of 2.5 ms^{-1} in still water. The boat leaves a point on one bank to reach a point 35m downstream from its starting point. The crew had two possible courses in crossing the river and the best would be where least time is taken

Task

(a) Investigate the acceleration of the system and the time taken for the hanging mass Q to reach the ground and the distance mass P moves up the inclined plane.

(b) Investigate the single force that could replace the four forces.

(c) advise the crew on the course to be taken.

END