

PRINCIPAL MATHEMATICS
P425
S.5 END OF TERM 2 EXAMINATION 2025
TIME: 3 HOURS.

INSTRUCTIONS.

This paper consists of two section A and B.

Attempt all questions in section A and only 5 items in section B.

SECTION A (COMPUTATIONS)

1. Solve the equation: $\sec^2 x - 3\sec x + 2 = 0$ for $0^\circ < x < 360^\circ$.
2. The following values were recorded in a frequency table;
 $\sum fx = 600$, $\sum fx^2 = 10,000$. The standard deviation was calculated as 5. Find the total number of items that were considered.
3. Express $\frac{6}{x^2-x-2}$ into partial fractions.
4. Two events A and B are such that $P(A' \cap B) = 3x$, $P(A \cap B') = 2x$,
 $P(A' \cap B') = x$ and $P(B) = \frac{4}{7}$. Find;
(a) $P(A \cap B)$
(b) $P(A \cup B)$
5. A polynomial $f(x)$ leaves the remainder 7 when divided by $x + 1$ and remainder -8 when divided by $x - 4$. Find the remainder when it's divided by $(x + 1)(x - 4)$.
6. Solve the inequality: $x > \frac{2}{x+1}$.
7. Solve the equation: $4^{2x} - 4^{x+1} + 4 = 0$.
8. Find the equation of the line through the intersection of the line $3x - 2y - 12 = 0$ and $2x + y - 1 = 0$ which makes an angle 45° with the x-axis.

SECTION B. (APPLICATION).
Attempt only five items in this section

ITEM 1.

A new shop attendant at a clothing and stationery store was reviewing some recent sales summaries. According to the records, the combined cost of one book, one shirt, and one trouser is shs. 55,000. Another record shows that two books, two shirts, and three trousers cost shs. 140,000, while four books, three shirts, and two trousers cost shs. 145,000. Later that day, a customer walked in and inquired whether she could purchase five books, four shirts, and six trousers with a budget of shs. 250,000. She added that if the budget is not enough, she would consider reducing the books by 2 and trousers by three. However, she is unsure which option her budget can accommodate.

Task:

Help the shop attendant:

- (i) Calculate the cost of each individual item.
- (ii) Advise the customer on which of the two options fits within her shs. 250,000 budget.

ITEM 2.

The Health Department at Kakaire High School recently initiated a wellness monitoring program to assess the nutritional impact of the school lunch menu. To evaluate the current state, they collected weight data from a sample of 40 students. Their goal is to determine whether any dietary adjustments are necessary. According to the policy, if the average weight of the sampled students is below 35 kg, meat will be added to the menu on Tuesdays and Fridays; otherwise, the current meal plan will be maintained. Additionally, the department wants to identify the most common weight range among students using a graphical representation, which will be presented to the school administration. Concerned about rising obesity levels, they also intend to calculate the number of students weighing above 45 kg to include in their official health report.

They managed to collect the following data.

Weight(kgs)	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59
Number of students	2	10	15	8	5

Task:

The Health Department is seeking your assistance to:

- (i) find out if they need to change their lunch menu.
- (ii) Use a graph to identify the most common weight (mode).
- (iii) Determine the number of students who weigh more than 45 kg.

ITEM 3.

At an inter-school talent competition, six students Tom, Jane, Peter, Mary, John, and Vic performed in front of a panel of three judges: Judge A (the senior judge), Judge B, and Judge C. Each judge awarded marks out of 50 to every student.

The competition organizers intend to award medals as follows:

Gold for the student in 1st place, Silver for 2nd place and Bronze for 3rd place.

To ensure fairness and consistency, the final rankings will not rely on all three judges' scores. Instead, the organizers have decided that:

- The final scores will be based on the average of the senior judge's scores (Judge A) and one other judge either Judge B or Judge C.
- The second judge will be selected based on who has the highest correlation in scoring with Judge A, as this reflects greater alignment and consistency in their evaluations.

The judges' scores for each student are shown in the table below:

Students	TOM	JANE	PETER	MARY	JOHN	VIC
Judge A	30	50	35	20	48	30
Judge B	40	45	50	45	30	15
Judge C	32	48	40	30	49	28

Task:

Help the organizers to:

- (i) Identify the judge with the highest correlation with the senior judge.
- (ii) Determine which students will receive the gold, silver, and bronze medals based on the highest average scores from the selected judges.

ITEM 4.

A landscaping team is redesigning a section of a public park and needs to determine the exact distance and angles between two tall, decorative trees Tree A and Tree B in order to plan the placement of walking paths, benches, and a central monument. However, due to a large flowerbed and a small pond situated between the two trees, it is impractical to measure the distance between them directly.

To solve this, a team member named Grace walks to a point C within the park, where both trees are clearly visible. She hires a team of land surveyors, and the following measurements are recorded:

- The distance from Tree A to point C is 50 meters
- The distance from Tree B to point C is 65 meters
- The angle between the two lines of sight from point C (i.e., $\angle ACB$) is 70°

Grace now needs to calculate the distance between Tree A and Tree B (side AB), as well as the remaining two angles of the triangle formed by points A, B, and C. These calculations will assist the team in achieving a symmetrical and mathematically accurate layout for the planned features.

Additionally, the team has agreed that if the distance between the two trees is less than 60 meters, they will install a paved walkway or

If the distance is 60 meters or more, they will cement the area for durability

Task:

Help the team determine:

- (i) Whether they will pave or cement the distance between the two trees.
- (ii) The angles between the trees and point C.

ITEM 5

Kigulu High School recently enrolled 200 new students into its A-Level science program. During the selection process, the cut-off grade for Mathematics was set higher than that for Biology. The administration recorded data on subject combinations and found that the probability of a student offering either Biology (B), Mathematics (M), or both is 70%, while the probability of a student offering both Biology and Mathematics is 20%. It is also known that the offering Biology and offering mathematics are independent and that probability of students offering biology is bigger than that of those offering mathematics.

The school administration is now interested in understanding student subject preferences. They wish to determine the probability that a randomly selected student offers Biology, offers Mathematics, and offers Biology but not Mathematics. Additionally, they are reviewing whether to lower the mathematics cut-off grade to a Grade B. This decision will be based on whether the number of students offering only Mathematics is less than 100.

Task:

Help the administration determine:

- (i) The probability that a student offers Biology
- (ii) The probability that a student offers Mathematics
- (iii) The probability that a student offers Biology but not Mathematics
- (iv) The number of students who offer only Mathematics, and advise on whether to lower the cut-off grade.

ITEM 6

The Town Council Committee is planning to construct two new roads in the city centre to ease traffic congestion. Before construction begins, engineers must determine the exact alignment of these roads to ensure smooth traffic flow and proper connectivity.

- The first proposed road will pass through two points on the map: one located 10 km east and 10 km north, and another at 60 km east and 40 km north.
- The second road will connect a point 20 km east and 50 km north to another point 30 km east and 90 km north.

To ensure safety and efficiency, engineers must calculate the angle of inclination (θ) between the two roads. For optimal road design, this angle should not be too sharp, and the space between the roads should not be below 30°

Additionally, due to emergency response requirements, the town plans to construct a hospital along the first road at a point located 20 km east and 10 km south. However, for quick emergency access, the distance from this point to the road should not exceed 10 km. If this condition is not met, the hospital will be relocated to a backup site located 5 km east and 6 km north on the map.

Task:

Help the committee:

- (a) Compute the equations of the two roads and determine if the inclination angle between them is safe.
- (b) Assess whether the initially proposed hospital location lies within the required 10 km from the first road. If not, confirm if the backup location is suitable.

END