P425/2
APPLIED
MATHEMATICS
Paper 2
July/Aug. 2023
3 hours

SECONDARY SCHOOLS JOINT MOCK EXAMINATIONS, 2023

Uganda Advanced Certificate of Education

MATHEMATICS

Paper 2

3 HOURS

INSTRUCTIONS TO CANDIDATES

*Answer all the **eight** questions in Section A and any **four** questions from Section B*

Any additional question(s) answered will not be marked

All necessary working MUST be shown clearly

Graph paper is provided

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

In numerical work, take acceleration due to gravity g to be 9 ms^{-2}

Turn Over

SECTION A

*Answer **all** questions in this section*

1. A canoe crosses a river to a point directly opposite the starting point with a speed of $12ms^{-1}$, if the river is flowing with a speed of $5ms^{-1}$ and is of width 60m, determine the;
   (a) Speed the canoe sets off to cross the river.
   (b) Time taken by the canoe to cross the river directly. (05 marks)

2. (a) Show that the equation $x^{-2}xsinx = 0$ has a root between $x=0.5$ and $x=0.6$.

   (b) Hence use linear interpolation method to find the initial approximation (x_o) correct it to 2 decimal Places.

   (05 marks)

3. Given that X~B (20,P) with mean E(x) =5, Determine the;
   (a) Variance.
   (b) P($x \geq 10$).

   (05 marks)

4. A particle of mass 4kg moves with a velocity of $e^t\underline{i} + 2e^{4t}\underline{j} - \sin t\ \underline{k}$, Where t is time inseconds. Determine the magnitude of acceleration at t = 4seconds and hence find the magnitude of the force at t =45. (05 marks)

5. The numbers $x = 4.2$, $y = 16.02$ and $z = 25$ have corresponding percentage errors of 0.5, 0.45 and 0.02, find the;
   (a) errors of x, y and z.
   (b) hence maximum value of $\frac{xy}{z}$.

   (05 marks)

6. The table below represents the prices of 5 items in 2023 and 2022.

Item	Price in 2022	Price in 3023	Quantity
Petrol	5,900	4,500	120
Sugar	5,900	5,500	80
Transport	15,000	10,000	40
Posho	3,000	3,5000	30

Calculate the average weighted price index based on 2022 and comment.

(05 marks)

7. A particle of weight 30N rests on a rough horizontal plane and is pulled by a force of magnitude 20N inclined at an angle of 60° to the horizontal. If the particle does not move, find the minimum value of the co-efficient of friction between the particle and the plane. (05 marks)

8. Events A and B are such that $P(A)=\frac{4}{7}$, $P(A \cap B)=\frac{3}{3}$ and $P(\quad)=\frac{5}{14}$. (05 marks)
Determine the;
(a) $P(A \cap B)$.
(b) P(B).

SECTION B: (60 MARKS)

Answer any **five** *questions from this section.*

All *questions carry equal marks.*

9. (a) A lorry moving at a constant speed of $36kmhr^{-1}$ passes a bus as it begins to move in the same direction, the bus maintains on acceleration of $0.4ms^{-2}$ for 40 seconds, find the distance between them. (04 marks)

(b) If after 40 seconds the bus moves uniformly while the lorry maintains the speed, if the bus over takes the lorry, determine the distance and time the bus takes to overtake the lorry. (0 8 marks)

10. (a) Derive the simplest iterative formula based on Newton Raphson method for the equation e^{x}- N= O and show its given by $x_{n+x} = \frac{(x_n - 1)e^{xn} + N \cdot n = 0,1}{e^{xn}}$

(b) Construct a flow chart that;
(i) Reads the initial approximation (x_o) and N.
(ii) Compute the root to 3 decimal places.
(iii) Print the root.

(c) If N =10 and the initial approximation (x_o) = 2.3 perform a dry run for the flow chart above. (12 marks)

11. The table below shows marks obtained by students in applied mathematics in a certain school.

Marks	Frequency
30-<45	4
45-<55	6
55-<65	8
65-<70	12
70-<75	10
75-<85	7
85-<100	3

(a) Construct a histogram and estimate the mode.

(b) Calculate the;

(i) mean mark.

(ii) standard deviation. (12 marks)

12. (a) ABCD is a square lamina of side 2cm from which a triangle EDC is removed, E being a point on AD such that ED is x cm, If portion EDC is removed show that the Centre of gravity of the remainder is $\frac{12 - 6x + x^2}{3(4 - x)}$ from AB

(b) Show that if the lamina is placed in a vertical plane with AE on a horizontal plane, it will topple if x is greater than $3 - \sqrt{3}$. (12 marks)

13. (a) Use the trapezium rule with six ordinates to estimate $\int_0^2 \frac{x}{(7x^2 - 3)}\,dx$, correct to 3 decimal places.

(b) Find the exact value correct it to 3 decimal places, hence find the absolute error and percentage error and state how the error may be reduced. (12 marks)

14. A continuous random variable x has the cumulative distribution function.

$$F(x) = \begin{cases} 0 & ; \ x < 0 \\ \frac{x^2}{16} & ; \ 0 < x < 2 \\ ax - b & ; \ 2 < x < 4 \\ \frac{3}{4}x - \frac{x^2}{16} - \frac{5}{4} & ; \ 2 < x < 6 \\ 1 & ; \ x > 2 \end{cases}$$

Where a and b are constants. Determine the;

(a) Values of a and b.

(b) Probability density function ($f(x)$) and hence the mean $E(x)$. (12 marks)

15. A footballer kicks a ball with a velocity of $52ms^{-1}$ at an angle $(\theta) = \tan^{-1}\left(\frac{5}{12}\right)$ to the horizontal.
Determine the;

(a) Difference between the times when the ball is 15m above the ground level.

(b) Horizontal distance covered by the ball between the two times in (a) above. (Take $g = 10ms^{-2}$). (12 marks)

16. Given that X is a continuous random variable which is normally distributed with mean(m) and standard deviation(s), such that
$P(x<30) = 0.4$ and $P(30 < x < 50) = 0.3$, find the;

(a) Values of mean(m) and standard deviation(s)

(b) Percentage of $P(35<x<45)$. (12 marks)

END