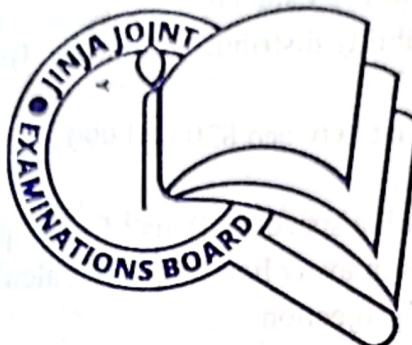


P425/2
APPLIED MATHEMATICS

Paper 2
August 2023
3 hours



JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education
MOCK EXAMINATIONS – AUGUST 2023

APPLIED MATHEMATICS

Paper 2
3 hours

INSTRUCTIONS TO CANDIDATES:

Answer all the eight questions in section A and any five from section B.

Any additional question (s) answered will not be marked

All necessary working must be shown clearly

Begin each answer on a fresh sheet of paper

Squared paper is provided

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

In numerical work, take g to be 9.8 ms^{-2} .

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Turn Over

SECTION A: (40 MARKS)

Answer all questions in this section.

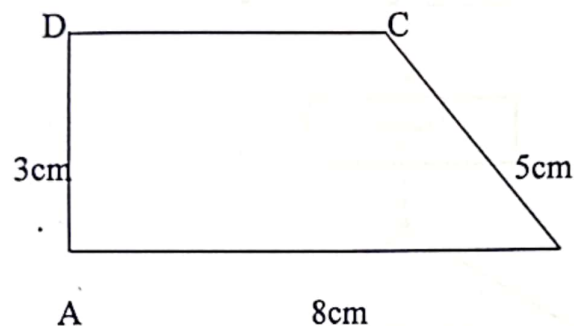
- The number of students who go to the school chapel daily is uniformly distributed between 824 to 1034 students.
 - Write down the probability distribution function (pdf) of the number of students.
 - Find the probability that between 830 and 990 students go to the chapel. (5 marks)
- A particle is projected with a speed of 28ms^{-1} from a point 60m high. If the particle hits the ground 50m away horizontally. calculate the;
 - Possible angles of projection (5 marks)
 - Shortest time taken to hit the ground.
- Given that $x = 4.7$, $y = 80.00$ and $z = 15.900$ are rounded off with corresponding percentage error of 0.5, 0.5 and 0.05, calculate the relative error in, $x - y$ correct to two significant figures. (5 marks)
- Events A and B are independent such that $P(A) = \frac{3}{8}$ and $P(\bar{A} \cup B) = \frac{3}{4}$
Find the;
 - $P(B)$
 - $P(A \cup B)$ (5 marks)
- A force of 10N acting in the direction of $3\mathbf{i} - 4\mathbf{j}$ moves a body from a fixed point A (-1, 5, 6) to point B (6, -2, 1). Calculate the work done by the force. (5 marks)
- A motorist rides from Jinja to Kampala a distance of 80km. He leaves Jinja at 8:00am and reaches a distance 20km, 50km, 70km, at 10:00am, 1:45pm, and 8:15pm respectively. One that day at 2:00pm his tyre burst and had to hire a lorry to carry his car to Kampala. If the car was charged shs. 1,000 per km. Find how much he paid for carrying the car. (5 marks)
- The table below shows the price relatives for the years 2012, 2015 and 2017 together with their weights for a certain family

		PRICE (SHS)		
ITEM	WEIGHT	2012	2015	2017
food	35	100	98	125

Water	11	100	102	121
Housing	8	100	103	112
Electricity	6	100	100	108
Clothing	22	100	115	118

- (i) Using 2012 as the base year, calculate the cost of living index for 2015 and 2017 (05 marks)

8. ABCD is a uniform lamina in the shape of a trapezium with $AB = 8$ cm, $AD = 3$ cm and $BC = 5$ cm



Find the distance of the center of gravity of the lamina from the side AD (5 marks)

SECTION B: (60 MARKS)

Answer any five questions from this section. All questions carry equal marks

9. (a) The chance that a chicken recovers from a rare disease after treatment is 20%. If 80 chicken are treated by the same vaccine, find the 97.5% confidence limits for the mean number of chicken to recover. (5 marks)
- (b) A machine cuts poles whose length are normally distributed with a standard deviation of 1.2m. A sample of 100 poles cut on a particular day gave a mean length of 4.2m. Determine;
- (i) a 99.8% confidence interval for the mean length of all the poles. (03 marks)
- (ii) the probability that the poles were of the mean lengths between 4.0 and 4.3m. (04 marks)
- 10.(a) A cyclist A appears to be moving at a velocity of 10ms^{-1} on a bearing of 330° to a cyclist B moving with a velocity of $\sqrt{8}\text{ms}^{-1}$ on a bearing of 045° . If the velocity of cyclist A is $+bj$, find the values of a and b. (6 marks)

- (a) A motor boat used by robbers on a certain lake is travelling due East at 15kmh^{-1} . At 9:00pm, a police patrol boat which is 12km South West of the robbers sets off at 20kmh^{-1} to intercept the robbers. Determine the bearing and time the police boat should take for interception to occur. (6 marks)

11.(a) Use the trapezium rule with 5 strips to estimate the;

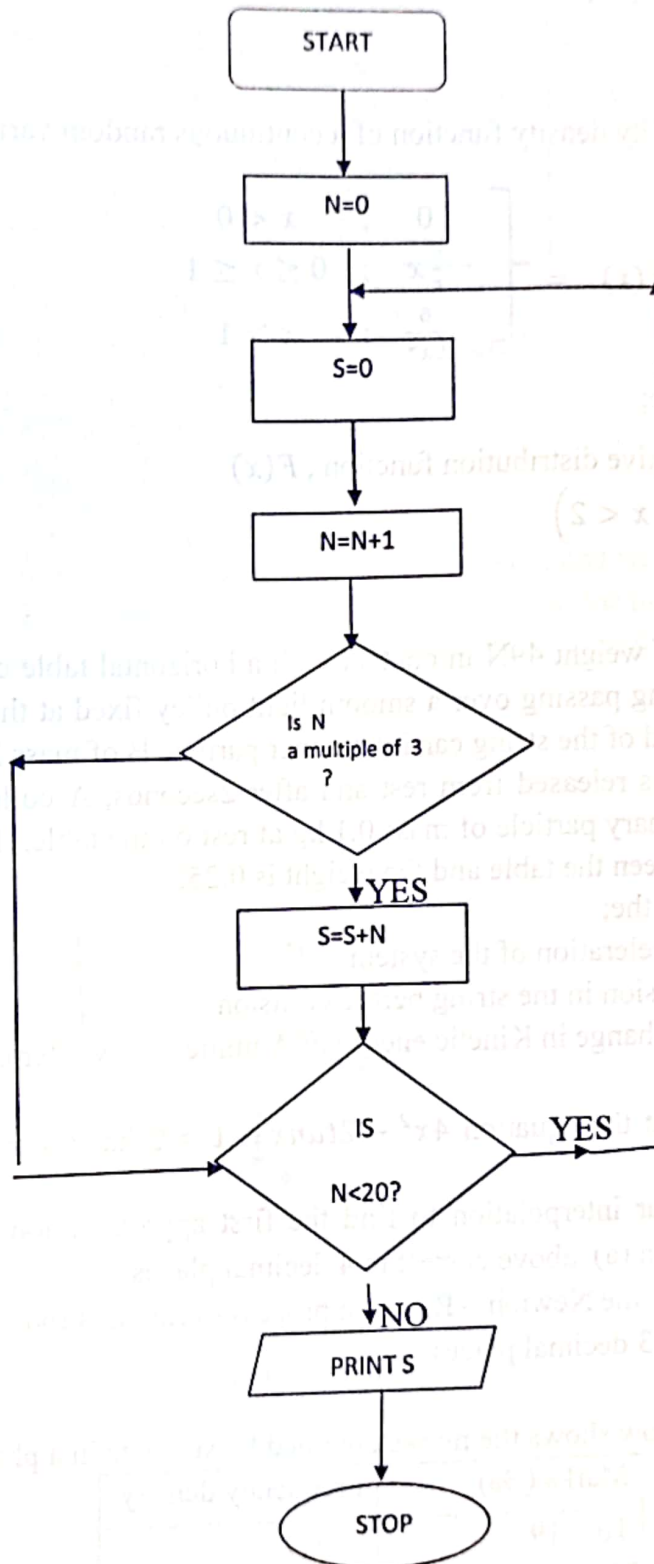
$$\int_1^2 x(1 + e^{-x}) dx$$

Truncate your answer to three significant figures.

(6 marks)



(b) Study the chart below and answer the questions that follow;



- (i) Perform a dry run for the flow chart (4 marks)
 (ii) State the purpose of the flow chart (1 mark)

12. The probability density function of a continuous random variable X is given by,

$$f(x) = \begin{cases} 0 & ; \quad x < 0 \\ \frac{6}{5}x & ; \quad 0 \leq x \leq 1 \\ \frac{6}{5x^4} & ; \quad x > 1 \end{cases}$$

Find the;

- (i) cumulative distribution function, $F(x)$ (07 marks)
 (ii) $p\left(\frac{1}{2} < x < 2\right)$ (02 marks)
 (iii) median (03 marks)

13. A particle of weight 49N in contact with a horizontal table connected to a light inelastic string passing over a smooth light pulley fixed at the edge of the table. The other end of the string carries another particle B of mass 2kg hanging freely. The system is released from rest and after 2 seconds, A collided and coalesced with a stationary particle of mass 0.1 kg at rest on the table. If the coefficient of friction between the table and the weight is 0.25,

- (a) Calculate the;
 (i) acceleration of the system (04 marks)
 (ii) tension in the string before collision (02 marks)
 (b) Find the change in Kinetic energy of A immediately after collision (6 marks)

14. (a) Show that the equation $4x^2 - 2\tan x - 1 = 0$ has a root between $x = -1$ and $x = 0$ (3 marks)
 (b) Use linear interpolation to find the first approximation to the root of the equation in (a) above correct to 4 decimal places. (13 marks)
 (c) Hence use the Newton – Raphson process to find this root giving your answer correct to 3 decimal places. (6 marks)

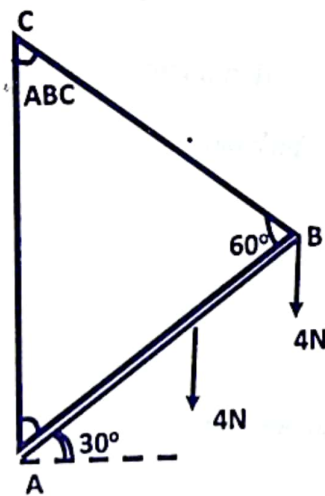
15. The table below shows the marks obtained by students in a physics test

Marks (%)	Frequency density
10 – 19	0.7

20 – 29	2.6
30 – 34	4.2
35 – 44	3.8
45 – 54	4.6
– 64	2.8
65 – 69	2.6

- (a) Draw a histogram and use it to estimate the modal mark. (04 marks)
- (b) Calculate the;
- (i) median mark (03 marks)
 - (ii) standard deviation (05 marks)

16. The diagram below shows a light rod AB, of length 6m and weight 4N, hinged to the vertical wall at A and is supported at an angle 30° to the horizontal (B above A) by a string of length 6m attached to B and to a point C on the wall vertically above A.



If a load of weight 4N is hang from B and angle $ABC = 60^\circ$, Find the;

- (a) tension in the string (05 marks)
- (b) magnitude and direction of the reaction at the hinge. (07 marks)