

**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:** KABVYE JOSEPH UD194/503

**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  $9.8 \text{ ms}^{-2}$ .**

**SECTION A: (40 MARKS)**

*Answer all questions in this section.*

1. The number of students who go to the school chapel daily is uniformly distributed between 824 to 1034 students.
  - (a) Write down the probability distribution function (pdf) of the number of students.
  - (b) Find the probability that between 830 and 990 students go to the chapel. (5 marks)
2. A particle is projected with a speed of  $28\text{ms}^{-1}$  from a point 60m high. If the particle hits the ground 50m away horizontally. calculate the;
  - (i) Possible angles of projection
  - (ii) Shortest time taken to hit the ground. (5 marks)
3. 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)
4. Events A and B are independent such that  $P(A) = \frac{3}{8}$  and  $P(\bar{A} \cup B) = \frac{3}{4}$   
 Find the; (i)  $P(B)$  (ii)  $P(A \cup B)$  (5 marks)
5. 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)
6. 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)
7. 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

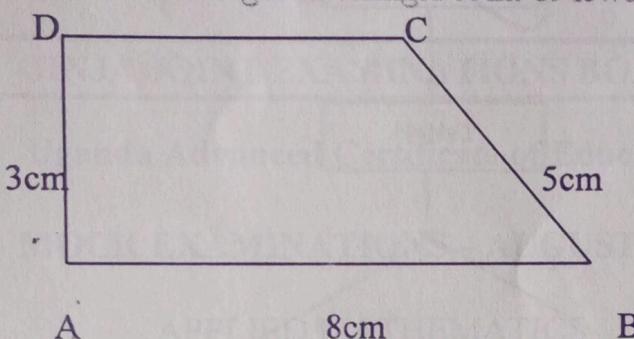
Water	100	102	121
Housing	8	100	112
Electricity	6	100	108
Clothing	22	100	118

and time the police post should take for interception to occur. (6 marks)

- (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 = 3cm and BC = 5 cm

(6 marks)



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  $10\text{ms}^{-1}$  on a bearing of  $330^\circ$  to a cyclist B moving with a velocity of  $\sqrt{8}\text{ ms}^{-1}$  on a bearing of  $045^\circ$ . 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  $15\text{kmh}^{-1}$ . At 9:00pm, a police patrol boat which is 12km South West of the robbers sets off at  $20\text{kmh}^{-1}$  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;

(a) Item 1)

(b) Item 2)

(c) Item 3)

(d) Item 4)

(e) Item 5)

(f) Item 6)

(g) Item 7)

(h) Item 8)

(i) Item 9)

(j) Item 10)

(k) Item 11)

(l) Item 12)

(m) Item 13)

(n) Item 14)

(o) Item 15)

(p) Item 16)

(q) Item 17)

(r) Item 18)

(s) Item 19)

(t) Item 20)

(u) Item 21)

(v) Item 22)

(w) Item 23)

(x) Item 24)

(y) Item 25)

(z) Item 26)

(aa) Item 27)

(bb) Item 28)

(cc) Item 29)

(dd) Item 30)

(ee) Item 31)

(ff) Item 32)

(gg) Item 33)

(hh) Item 34)

(ii) Item 35)

(jj) Item 36)

(kk) Item 37)

(ll) Item 38)

(mm) Item 39)

(nn) Item 40)

(oo) Item 41)

(pp) Item 42)

(qq) Item 43)

(rr) Item 44)

(ss) Item 45)

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(vv) Item 48)

(ww) Item 49)

(xx) Item 50)

(yy) Item 51)

(zz) Item 52)

(aa) Item 53)

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(xx) Item 102)

(yy) Item 103)

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(gg) Item 111)

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(ii) Item 191)

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(qq) Item 199)

(rr) Item 200)

(ss) Item 201)

(tt) Item 202)

(uu) Item 203)

(vv) Item 204)

(ww) Item 205)

(xx) Item 206)

(yy) Item 207)

(zz) Item 208)

(aa) Item 209)

(bb) Item 2010)

(cc) Item 2011)

(dd) Item 2012)

(ee) Item 2013)

(ff) Item 2014)

(gg) Item 2015)

(hh) Item 2016)

(ii) Item 2017)

(jj) Item 2018)

(kk) Item 2019)

(ll) Item 2020)

(mm) Item 2021)

(nn) Item 2022)

(oo) Item 2023)

(pp) Item 2024)

(qq) Item 2025)

(rr) Item 2026)

(ss) Item 2027)

(tt) Item 2028)

(uu) Item 2029)

(vv) Item 2030)

(ww) Item 2031)

(xx) Item 2032)

(yy) Item 2033)

(zz) Item 2034)

(aa) Item 2035)

(bb) Item 2036)

(cc) Item 2037)

(dd) Item 2038)

(ee) Item 2039)

(ff) Item 2040)

(gg) Item 2041)

(hh) Item 2042)

(ii) Item 2043)

(jj) Item 2044)

(kk) Item 2045)

(ll) Item 2046)

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(qq) Item 2051)

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(ss) Item 2053)

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(xx) Item 2058)

(yy) Item 2059)

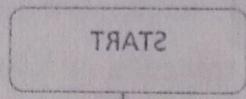
(zz) Item 2060)

(aa) Item 2061)

(bb) Item 2062)

(cc) Item 2063)

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

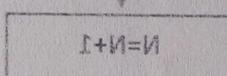


| 12. The probability density function of a continuous random variable  $X$  is given by,

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

Find the;

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

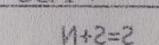


| 13. A particle of weight 49N in contact with a horizontal table connected to a light inelastic string passing over a smooth light pulley fixed at the edge of the table. The other end of the string carries another particle B of mass 2kg hanging freely. The system is released from rest and after 2seconds, 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)

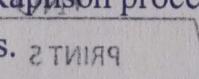


(04 marks)  
(02 marks)

| 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

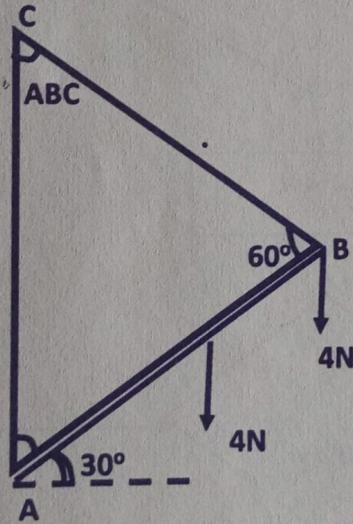
Marks (%)	Frequency density
10 – 19	0.7

$$\begin{aligned} u &= x^4 \\ \frac{du}{dx} &= 4x^3 \\ \frac{1}{u} \cdot \frac{du}{dx} &= 4x^3 \end{aligned}$$

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  $30^\circ$  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)