456/1
MATHEMATICS
Paper 1
July/August

TIME: 2 ½ Hours

BUIKWE DISTRICT JOINT MOCK EXAMINATIONS BOARD (BUSSHA)

MOCK EXAMINATIONS 2023

Uganda Certificate of Education

MATHEMATICS

Paper 1

2 Hours 30 minutes

INSTRUCTIONS

- Answer all questions in section A and NOT more than five from section B.
- Show all the necessary calculations.
- Mathematical tables and silent, non-programmable calculators may be used.
- Where necessary, graph papers are to be provided.

SECTION A (40 MARKS)

1. Given that $p \wedge q = \frac{1}{3}(q^2 - 2p)$, evaluate

   (i) $2 \wedge -4$

   (ii) $3 \wedge (2 \wedge -4)$

2. Without using tables or calculators, evaluate $3.75 \times 3.85 - 3.75^2$.

3. If $\frac{a+b}{3a-2b} = \frac{3}{4}$, express a in terms of b. Hence find the value of $\frac{a^2-b^2}{2ab}$.

4. Given that matrix $P = \begin{pmatrix} 2 & 2 \\ -2 & -2 \end{pmatrix}$.

   Find (i) P^2

   (ii) Name matrix P^2

5. Point A(4,3) was mapped onto A'(-2,0) after enlargement of scale factor -2. Find the coordinates of the centre of enlargement.

6. Given that matrix $A = \begin{pmatrix} x^2 & \frac{1}{4} \\ 1 & 1 \end{pmatrix}$. Determine the values of x for which A is singular.

7. Solve the inequality $\frac{2x+3}{6} - \frac{x+8}{4} \leq \frac{1}{3}(2x - 3)$.

8. The sum of ages of the girls Ann and Martha is 30 years and twice Ann's age is 18 years more than Martha's. Find the ages of the two girls.

9. Factorise completely $27y^3 - 3y$.

10. The mean of the numbers m-2, m-1, -2, m+2, m+3, 2m is 4.

    Find (i) value of m.

    (ii) median of the data.

SECTION B (60 MARKS)

11. Below are the marks obtained by 40 students in a mathematics test.

43	70	50	35	64	62	50	53
46	62	65	83	59	54	58	64
55	54	32	59	48	54	35	48
40	58	64	40	71	74	55	70
72	48	75	45	55	40	57	53

(a) Starting with 30 as the lower class limit of the first class, and using interval of 5 marks, form a frequency distribution table for the data.

(b) Calculate the mean mark using a working of 57.

(c) Plot the ogive and use it to estimate the median mark. (12 marks)

12. (a) The unit square OIKJ where O(0,0), I(1,0), K(1,1) and J(0,1) is reflected in the line $y = -x$ to give image OI'K'J'.

(i) Find the matrix of transformation R for this reflection. (2 marks)

(ii) Find the image points of OI'K'J' under matrix R. (2 marks)

(b) If OI'K'J' is then enlarged by a linear scale factor -2 at the origin to give OI"K"J", find

(i) Matrix of enlargement (2 marks)

(ii) Coordinates of the image of OI"K"J". (2 marks)

(iii) The area of OI"K"J" (2 marks)

(iv) A matrix which maps OI"K"J" back onto OIKJ. (2 marks)

13. (a) The length of an equilateral triangle is ycm. With the help of a triangle find the value of $\cos 30^0$. (6 marks)

(b) A chord of a circle of radius r, subtends an angle 60^0 at the centre of the circle and that the area of the minor segment is $50cm^2$, calculate the radius r, of the circle to 4 significant figures. (6 marks)

14. A plane flies 540km from station A on a bearing 060° to B. From B it travels 455km to station C in a direction of S32°E. From C it heads for station D for 400km away in a direction of S76°W.

(i) Draw to scale a diagram showing the route of the plane, use a scale 1cm to represent 50km. (7 marks)

(ii) From your diagram, determine the distance and the direction of station A from station D. (2 marks)

(iii) Calculate how long it would take a plane travelling at a speed of 400km/h to travel direct from station A to station C. (3 marks)

15. (a)(i) Draw on the same coordinates axes the graph $y = (2x + 3)(x - 1)$ and $y = 3x + 1$ for $-3 \leq x \leq 3$. (6 marks)

(ii) State the points of intersection of the curve and the line. (2 marks)

(b) Using your graph find the value of x for which

(i) $2x^2 + x - 3 = 0$

(ii) $2x^2 + x - 6 = 0$

(4 marks)

16. (a) Solve for x in $\frac{2x-5}{3} - \frac{3x-1}{4} = 1\frac{1}{2}$ (4 marks)

(b) Solve the simultaneous equations

$$x^2 + 3y^2 = 7$$

$$y - x = 3$$

(8 marks)

17. A farmer wishes to spray weeds in his coffee plantation, using type **A** and type **B** of weed killers. Type A costs shs. 4000 per litre and type B costs shs. 6000 per litre. The farmer has shs. 40,000 for buying the weed killers. Each litre of type **A** can spray 3 hectares of the plantation and each litre of type **B** weed killers can spray 4 hectares of the plantation 15 hectares. Three times the quantity of type **A** weed killers used should exceed two times the quantity of type **B** by less or equal to four. If the farmer uses **x** litres of type **A** and **y** litres of type **B**.

a) Write down the five inequalities representing this information.

b) By shading the unwanted regions show the region satisfying these inequalities.

c) Find the number of litres of each type of weed killers that minimizes the cost of spraying the plantation. (12 marks)

END

456/2
MATHEMATICS
Paper 2
July/August
TIME: 2 ½ Hours

BUIKWE DISTRICT JOINT MOCK EXAMINATIONS BOARD (BUSSHA)

MOCK EXAMINATIONS 2023

Uganda Certificate of Education

MATHEMATICS

Paper 2

2 Hours 30 Minutes

INSTRUCTIONS

- Answer all questions in section **A** and any **five** in section **B.**
- Any additional question(s) answered will not be considered.
- All necessary calculations must be done in the answer sheets provided.

  No paper for rough work is provided.
- Graph paper is provided.
- Silent, non-programmable scientific calculators and mathematic tables with a list formulae may be used.

SECTION A [40 MARKS]

1. Given that N = {all natural numbers divisible by 2 less than 20}

   T = {all triangle numbers less than 20}

   (i) List all members of sets N and T (2 marks)

   (ii) Find n(N n T)' (2 marks)

2. Express $0.5\overline{27}$ as a rational number in the form $^{p}/_{q}$ in the simplest from.

   (4 marks)

3. Find the equation of a straight line passing through the points A(1, -2) and B(3, 4). (4 marks)

4. Given that set P = $\{x: 2 \geq x \geq -3\}$

   Q = $\{x: 1 \geq x\}$

   Represent P n Q on a number line. (4 marks)

5. If $\sqrt{5} = 2.236$ and $\sqrt{2} = 1.414$, evaluate $\frac{1}{\sqrt{5}+\sqrt{2}}$. (4 marks)

6. The distance between Town A and Town B is 300km. A car moves from town A to town B and back. Its average speed on the return journey is 30kmh^{-1} greater than that on the outward journey and it takes 50 minutes less. Find the average speed of the outward journey. (4 marks)

7. Solve for x in the equation.

   $$\frac{1}{3}(32)^{\frac{3}{5}x}\left(\frac{8}{27}\right)^{\frac{-1}{3}} = 2x$$

   (4 marks)

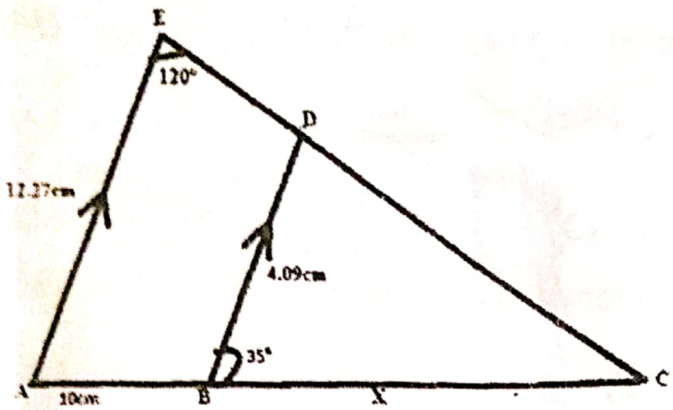
8. Mr. Mango bought a smart phone at a cash discount of 10%. Given that the marked price was shs. 700,500.

   (i) Find the actual amount he paid for it. (2 marks)

   (ii) If he sold it to Amoni at a loss of 12½%. How much did Amoni pay for it.

   (2 marks)

9. In the figure below, $\overline{AE} = 12.27cm, \overline{AB} = 10cm, \overline{BD} = 4.09cm$, angle AED = 120^0, angle DBC = 35^0 and line $\overline{AE}$ is parallel to line $\overline{BD}$.



Find (i) size of angle EAB (1 mark)

(ii) value of x, hence state length $\overline{AC}$. (3 marks)

10. A cylindrical container of radius 5.0cm and height 10.0cm contains water filled to capacity. If 282.6cm² of water is poured. Calculate the height of water left in the container (Use $\pi = 3.14$) (4 marks)

SECTION B [60 MARKS]

11. 46 traders in Kikuubo deal in the following brands of drinks; Beers (B), Pepsi (P) and Coke cola (C).

25 sell Beers, 21 sell Pepsi and 12 sell Coke cola. 9 sell both Beers and Pepsi and 4 sell Beers and Coke.

No trader sells all the three brands. The number of traders who sell Pepsi and Coke is equal to that selling Coke only.

(a) Represent the above information on a venn diagram. (5 marks)

(b) Find the number of traders who sell (i) Beers only (1 marks)

(ii) Pepsi only (2 marks)

(iii) none of the three brands (2 marks)

(c) Find the probability that a trader picked at random sells only one or none of the three brands. (2 marks)

12. (a) If $f(x) = x - 1$ and $g(x) = x^2 - 5x + 4$.

Find (i) $g(-2)$ (2 marks)

(ii) the values of x for which $f(x) - g(x) = 0$ (3 marks)

(b) Given that $g^{-1}(x) = 2x^2 + 3$

Determine (i) the value of $g^{-1}(3)$ (2 marks)

(ii) an expression for $g(x)$ (3 marks)

(iii) value of $g(11)$ (2 marks)

13. The cost (C) of running a ship on a certain journey partly varies as the speed (V) an partly as the square root of the speed. If the speed is 16 knots, the cost is shs. 34,800 and if it is 25 knots the cost is shs. 53,500.

(a) Write an equation for C in terms of V. (8 marks)

(b) Find the cost for a speed of $20\frac{1}{4}$ knots. (4 marks)

14. The monthly incme rates of acertain country are as follows.

Taxable Income (shs)	Rate (%)
0001 – 300,000	Tax free
300,001 – 600,000	20%
600,001 and above	30%

He is entitled to an allowance of shs. 100,000 per month

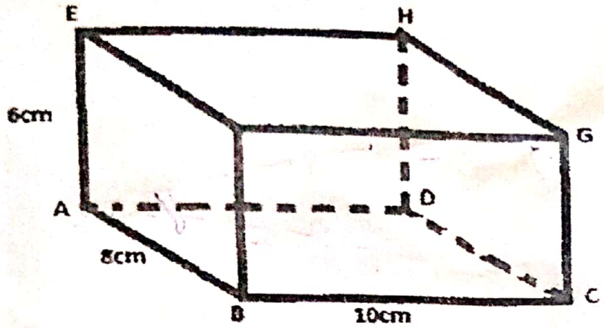
(a) Find the taxable income of aman who paid shs. 102,000 as tax. (10 marks)

(b) Calculate his gross income. (2 marks)

15. (a)Without using mathematical tables or calculator, evaluate $\frac{0.42x0.08x\sqrt{12.25}}{0.49x0.012}$ (4 marks)

(b)Evaluate $\frac{(1934)^2x\sqrt{0.000324}}{486x0.5172}$ to three significant figures (3sf) using a mathematical table. (8 marks)

16. In the figure below AB = 8cm, BC = 10cm and AE = 6cm.



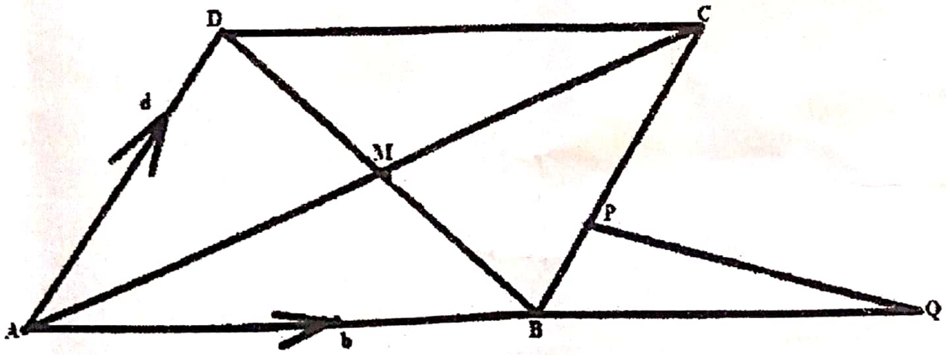
Calculate (i) length AG (4 marks)

(ii) the angle between line AG and plane ABCD. (3 marks)

(iii) the angle between plane ABGH and the base. (3 marks)

(iv) Volume of the cuboid. (2 marks)

17. In the diagram below ABCD is a parallelogram. 2BC = 3PC, AQ = 2AB, AB = b and AD = d



(a) Express in terms of b and d

(i) BP

(ii) AP

(iii) PQ

(b) Show that the three points M, P and Q are collinear. (12 marks)

END

456/1
MATHEMATICS
PAPER 1
July/August 2023
2½ hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

MATHEMATICS

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- *Answer **all** questions in section A and any **five** questions from section **B**.*
- *Any additional question(s) answered will not be marked.*
- *All necessary calculations **must** be done in the same answer booklet/sheets provided, with the rest of the answers. Therefore no paper should be given for rough work.*
- *Graph paper is provided.*
- *Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A (40 marks)

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

1. Given that $x \Delta y = x^2 - 6y^2$, evaluate $(3 \Delta 6) \Delta 4$. (4 marks)

2. The bearing of point A from point B is 210^0.
Find the bearing of point B from point A. (4 marks)

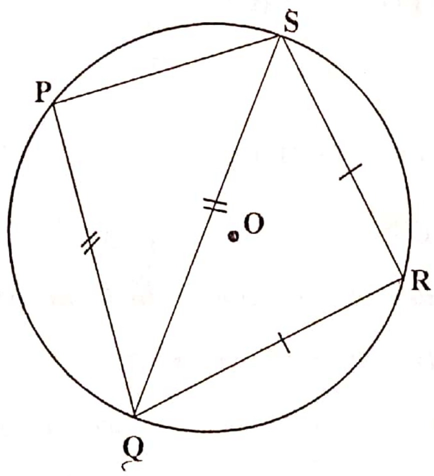
3. Given that matrix $P = \begin{pmatrix} 3 & 0 \\ 5 & 1 \end{pmatrix}$. Show that $P^2 - 4P + 3\mathbf{I} = 0$ where **I** is the identity matrix of order 2 by 2. (4 marks)

4. Factorise completely $12p^2 - 27q^2$. (4 marks)

5. A school bus carries 78 passengers when full. The bus has a total of 30 seats.
Some of the seats are for 3 passengers and others are for 2 passengers.
Determine the number of seats for three passengers and for two passengers. (4 marks)

6. Given that $\tan x = 0.5774$. Find the two possible values of x for which $\tan x = -0.5774$. (4 marks)

7. In the figure below PQ = QS and RQ = RS, angle PQS = 36^0, where O is the centre. (4 marks)



Find angle SQR. (4 marks)

8. Solve the inequality
$\frac{1}{4}(2x + 3) \leq 4 - \frac{1}{4}(3 - x)$, hence show your answer on the number line. (4 marks)

9. Make L the subject of the expression $T = 2\pi\sqrt{\frac{L^2+M}{MH}}$ (4 marks)

10. A number is chosen at random from the integers 1 to 10.
Find the probability that the number chosen is either a factor of 10 or a prime number. (4 marks)

SECTION B (60 marks)

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

11. The table shows marks scored by 46 students in a mathematics test.

Marks	Cummulative frequency
29.5 – 34.5	2
34.5 – 39.5	7
39.5 – 44.5	17
44.5 – 49.5	32
49.5 – 54.5	40
54.5 – 59.5	44
59.5 – 64.5	46

(a) Caculate the mean mark, using the working mean of 47 marks. (8 marks)

(b) Draw a cumulative frequency curve and use it to estimate the number of students who scored above 47 marks. (4 marks)

12. (a) Draw a graph of $y = x^2 - 2x - 3$ for $-2 \leq x \leq 4$.
Use a scale of 2 cm to represent 1 unit on both axes. (6 marks)

(b) Use your graph in (a) above to solve equations:-

(i) $x^2 - 2x - 3 = 0$. (2 marks)

(ii) $x^2 - 3x = 0$. (4 marks)

13. (a) Given that $\begin{pmatrix} 3 & 2 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 3 & p \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 11 & q \\ 3 & 3 \end{pmatrix}$ Find the values of p and q. (3 marks)

(b) A painter bought 40 tins of Red paint, 25 tins of Yellow paint and 40 tins of Orange paint. In Kikuubo market, the price of a tin of Red, Yellow and Orange paint is Shs. 20,000/=, Shs. 15,000/= and Shs. 25,000/= respectively.
In Nakasero market, the price of a tin of Red, Yellow and Orange paint is Shs. 21,000/=, Shs. 14,000/= and Shs. 26,000/= respectively.
By writing the matrices, for the items bought as row matrix and the cost of items bought as column matrix. Use matrix multiplication to find;

(i) the cost of the paints in each market. (6 marks)

(ii) where is it cheaper to buy the paints from and by how much? (3 marks)

14. A transformation matrix $\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ maps the vertices of a quadrilateral ABCD on to $A^I(13,8)$ $B^I(21,12)$ $C^I(33,20)$ and $D^I(25, 16)$

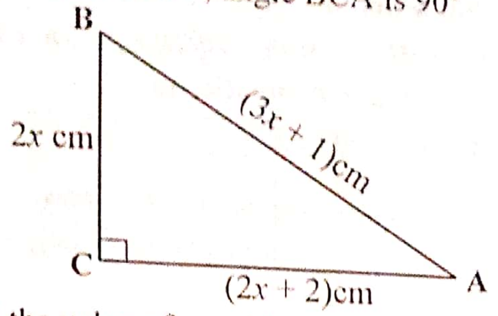
(a) Find the coordinates of ABCD. (5 marks)

(b) The image $A^IB^IC^ID^I$ is rotated through a negative quarter turn about the origin to form $A^{II}B^{II}C^{II}D^{II}$. Write down the coordinates of $A^{II}B^{II}C^{II}D^{II}$ (4marks)

(c) Find a single transformation matrix that would map quadrilateral $A^{II}B^{II}C^{II}D^{II}$ back to ABCD. (3marks)

Turn Over

15. (a) In the figure below, angle BCA is 90^0



Find the value of x and hence determine the height BC. (5 marks)

(b) The angle of elevation of the top of the cliff from Tom's home is 30^0. Tom moved from his home towards the cliff, after covering a distance of 400 m, the angle of elevation of the top of the cliff at that point is 47^0. Determine the height of the cliff. (7 marks)

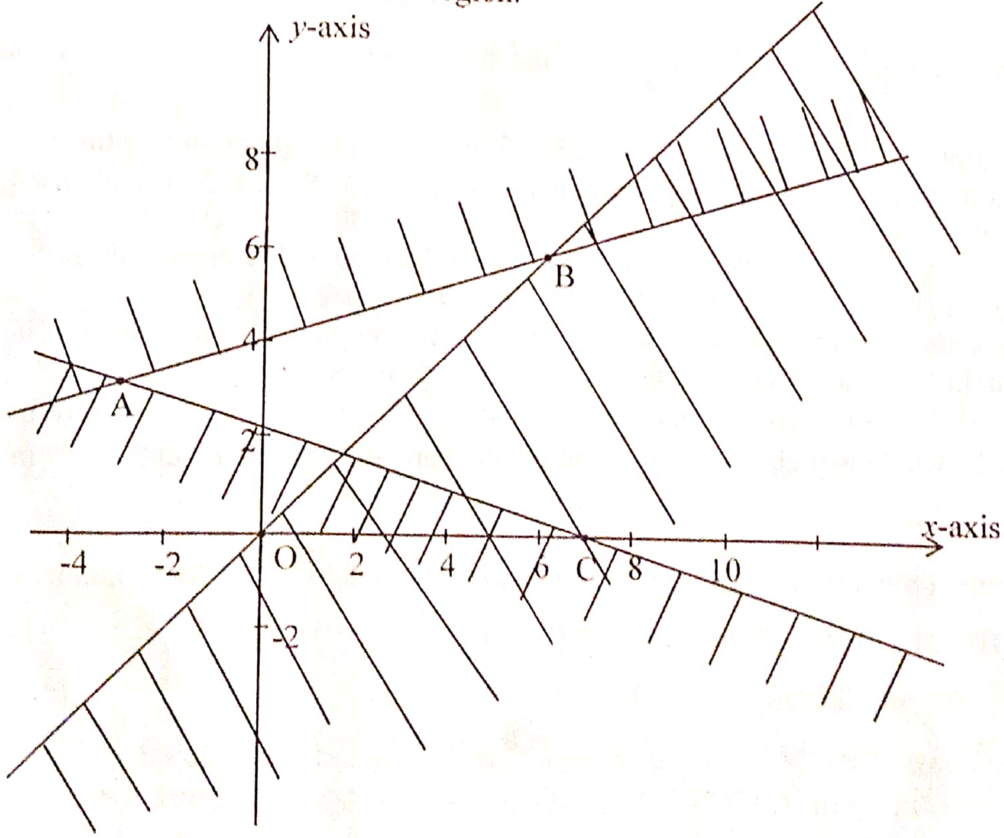
16. (a) Using a pair of compasses, a ruler and a pencil only, construct a triangle PQR where $\overline{QR} = 7.2$ cm, angle PQR $= 75^0$ and $\overline{PR} = 8.4$ cm

(b) Draw a circle to circumscribe the triangle PQR. Measure the radius of a circle and the length $\overline{PQ}$.

(c) Find the area of the circle formed, through PQR. (Use $\pi = 3.143$). Correct your answer to one decimal place.

(12 months)

17. The graph below shows a feasible region.



Use the graph above to;

(a) form inequalities representing the feasible region. (9 marks)

(b) find the maximum value of $5x + 3y$ from the feasible region. (3 marks)

END

456/2
MATHEMATICS
PAPER 2
July/August 2023
2½ hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

MATHEMATICS

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- *Answer **all** questions in section A and any five questions from section **B**.*
- *Any additional question(s) answered will not be marked.*
- *All necessary calculations **must** be done in the same answer booklet/sheets provided, with the rest of the answers. Therefore no paper should be given for rough work.*
- *Graph paper is provided.*
- *Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A (40 marks)

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

1. Express 1728 as a product of it's prime factors, hence find its cube root. (04 marks)

2. Two sets A and B are such that n(B) = 8, n(AnB) = 2, n(ε) =15 and n(AuB)' = 4.
   Find (i) $n(A \cup B)$ (02 marks)
   (ii) n(A) (02 marks)

3. Given that $f^{-1}(x) = \frac{4x}{9+x}$, Find the value of x for which f(x) is undefined. (04 marks)

4. A lorry covered 90 km at a speed of 45 km/hr and travelled the next 150 km in $1\frac{1}{2}$ hours. Determine the average speed of the lorry for the whole journey. (04 marks)

5. The position vectors of P and Q are $|\overline{OP}| = \begin{pmatrix} a \\ -5 \end{pmatrix}$ and $|\overline{OQ}| = \begin{pmatrix} 6 \\ c \end{pmatrix}$. If $|\overline{PQ}| = \begin{pmatrix} -1 \\ 13 \end{pmatrix}$
   Find (i) the values of a and c. (03 marks)
   (ii) $2|\overline{OQ}|$. (01 mark)

6. The volume of a big cylinder is 81 cm^3 and that of small cylinder is 3 cm^3. If the height of the big cylinder is 0.12 m. calculate the height of the small cylinder. (04 marks)

7. A man's gross income is Ugx 6 million per annum. He pays an income tax of 20% of his gross monthly income. Find his monthly net income. (04 marks)

8. Without using mathematical tables or calculator, evaluate; 2log 6 – log 3 – log 1.2. (04 marks)

9. A woman walks 10 km to a market at a speed of x $kmhr^{-1}$ and she returns at a constant speed of $(x + 1)$ $kmhr^{-1}$. The return journey takes 30 minutes less than the first journey. Find x.

10. The quality P is inversely proportional to the square of q. If P = 5 when q = 2, find the value of P when q = 10. (04 marks)

SECTION B (60 marks)

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

11. (a) Given that $h(x) = x^2 + 3$ and $g(x) = x - 1$, find the value of, a, for which hg(a) = gh(a). (05 marks)

    (b) Given that $h(x) = x^2 - 5x - 14$, find;
    (i) $h^{-1}(x)$
    (ii) $h^{-1}(4.75)$

    (07 marks)

12. A class of 100 students were asked whether they had ever visited the cities; Arua (A) Jinja (J) or Mbale (M). The number that had visited Jinja only is twice the number which had visited Mbale only. 55 had visited Arua, 14 had visited J and M only, 7 had visited A and M only, 20 had visited A and J only. If those who visited Arua only were 25 and 10 had not visited any of the three cities.

(a) Represent the given information on a venn diagram. (06 marks)

(b) How many students had;

(i) visited Jinja? (02 marks)

(ii) not visited Arua? (02 marks)

(c) A student is selected at random from the group. What is the probability that he had visited atmost two cities?. (02 marks)

13. In a triangle ABC, points M and N lie on AB and BC respectively such that AM : MB = 1 : 2 and $\overrightarrow{BN} = 3\overrightarrow{NC}$. Point T lies on $\overrightarrow{AN}$ such that $\overrightarrow{AT} = \frac{2}{3}\overrightarrow{AN}$.

Given that $\overrightarrow{\mathbf{AM}} = \underset{\sim}{x}$ and $\overrightarrow{\mathbf{AC}}, = \underset{\sim}{y}$,

(a) Express the following vectors in terms of $\underset{\sim}{x}$ and $\underset{\sim}{y}$.

(i) **AB** (02 marks)

(ii) **BC** (02 marks)

(iii) **AN.** (03 marks)

(b) Show that points M, T and C are collinear. (05 marks)

14. A land dealer bought 10 pieces of land at 4,000,000 shillings Each. He is to sell them on cash and hire purchase terms. A piece of land is sold at 5,000,000 shillings on cash terms and on hire purchase one makes an initial deposit of 25% of the cost price and then pays equal monthly installments for $1\frac{1}{4}$ years totaling to 4,800,000/=.

(a) Calculate the amount one pays as monthly installment if he buys on hire purchase. (02 marks)

(b) If the dealer sold $\frac{1}{5}$ of the pieces of land on cash terms and the rest on hire purchase terms, calculate the total profit after selling all the pieces of land. (10 marks)

15. (a) Solve for t:

$$3^t + 3^t = 162$$

(04 marks)

(b) Find the values of x and y in the equations below. (08 marks)

$\log_{10}(x+y) = 1$ and $\log_2 x + \log_2 y = 4$

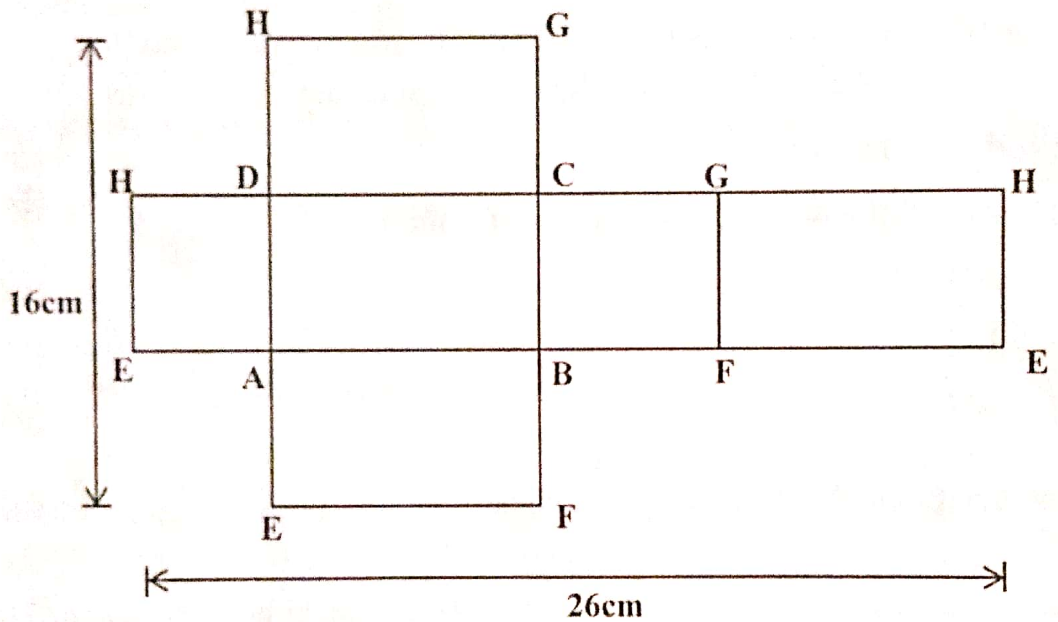
16. The cities Kampala and Mbarara via Masaka are 240 km apart. One day a cyclist started riding from Kampala at 9:45 am towards Mbarara at a steady speed of 60 $kmhr^{-1}$. On the same day a motorist started from Mbarara at 10:50 am towards Kampala at 80 $kmhr^{-1}$. Calculate the;

(a) distance from Kampala where they by passed each other. (05 marks)

(b) time when they by passed each other. (02 marks)

(c) difference in their time of arrival. (05 marks)

17. Below is a net of a cuboid ABCDEFGH, where the base dimensions AB and BC are 8cm and 6cm respectively.



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(a) Sketch the solid formed and find the height of the solid. (05 marks)

(b) Calculate the;

):45
3:00
:45

(i) volume of the solid. (03marks)

(ii) Total surface Area. (04 marks)

END

P425/1

PURE MATHEMATICS

Paper 1

3 Hours

BUIKWE DISTRICT JOINT MOCK EXAMINATIONS BOARD (BUSSHA)

MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

MATHEMATICS

Paper 1

3 Hours

INSTRUCTIONS

- *Attempt **all** the **eight** questions in section **A** and any **five** from section **B**.*
- *All additional question(s) answered will **not** be marked.*
- ***All** necessary working **must** be shown clearly.*
- ***All** working **must** be in **blue** or **black ink**.*
- *Number each answer clearly according to the numbering in the question paper*
- *Indicate the questions attempted.*
- *Where necessary, graph paper is provided.*
- *Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*

SECTION A (40 MARKS)

*(Answer **all** the questions in this section.)*

1. By using the derivative of $25x^{-\frac{1}{2}}$, find the approximate value of $\frac{25}{\sqrt{24.5}}$ to one decimal place. *(05 marks)*

2. The second and third terms of a geometric progression (G.P.) are $log_2 3$ and $log_4 81$ respectively. Find the first term. *(05 marks)*

3. Given the plane P defined by the equation $r = \begin{pmatrix}1\\-1\\2\end{pmatrix} + \beta\begin{pmatrix}1\\1\\1\end{pmatrix} + \mu\begin{pmatrix}3\\-3\\0\end{pmatrix}$ and the line L defined by equation $r = \begin{pmatrix}1-\lambda\\-1-\lambda\\2+2\lambda\end{pmatrix}$, show that L is perpendicular to P. *(05 marks)*

4. Sdve $5^y - 4 - 5^{(1-y)} = 0$. *(05 marks)*

   TOA 3 0

5. A's an acute angle and B is an obtuse angle such that $tanA = \frac{3}{4}$ and $tanB = -1$. Wthout using mathematical table or calculator, show that $\sin(A-B) = -\frac{7}{5\sqrt{2}}$. *(05 marks)*

   $L_1 = 2$ $P(1,3)$ 45

6. Tw lines L_1 and L_2 intersect at point P(1,3) such that the angle between them oppsite the x-axis is 45°. If the gradient of line L_1 is 2, find the equation of line L_2. *(05 marks)*

7. Solv $x\frac{dy}{dx} + 2y = e^{x^2}$ given that $y = 1$ when $x = 0$. *(05 marks)*

8. The isplacement, ***x* metres**, of a particle from a fixed point P after ***t* seconds** is givenby $x = t^2 - 3t + 2$. Find the velocity of the particle at the instants when it is at P. *(05 marks)*

e^{2x}

$xe^{2x}y + 2ye^{2x} = e^{x^2}e^{2x}$

SECTION B (60 MARKS)

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

9. (a) Prove that $cot\theta\left(\frac{sin4\theta+sin2\theta}{cos2\theta-cos4\theta}\right) = cosec^2\theta - 1$. *(05 marks)*

$A - B + C = 2$
$A + B + C = 10$
$-2B = -8$
$B = 4$
$A + C = 6$
$A + C = 6$

(b) Solve the simultaneous equations:

$$3sinx - cosy = 1$$
$$2cosecx + secy = 6$$

for $0^o \leq x \leq 90^o$ and $0^o \leq y \leq 90^o$ *(07 marks)*

10. Point M is the mid-point the points R(3,3) and T(-1,-1). The point N is the foot of the normal to the line $2y = x - 4$ from the point M. Without graphical construction, find the:

(a) coordinates of point N. *(09 marks)*

(b) area of triangle RTN *(03 marks)*

$3 = \frac{cosy}{sinx}$

11. Given the curve $y = \frac{x^2}{x-1}$,

(a) find the nature of the turning points. *(05 marks)*

(b) find the equation of all the asymptotes. *(02 marks)*

(c) Hence, sketch the curve. *(05 marks)*

12.(a) A student is to select four optional subjects with at least one and not more than two from each of the groups V, L and R. V has five subjects, L has four subjects and R has three subjects. Find the number of possible selections that can be made by the student. *(04 marks)*

(b) The polynomial $P(x) = x^4 + Ax^3 + Bx^2 + Cx + 1$ is divisible by $(x + 1)^2$ and leaves a remainder of 12 when divided by $(x - 1)$. Find the values of A, B and C. *(08 marks)*

13.

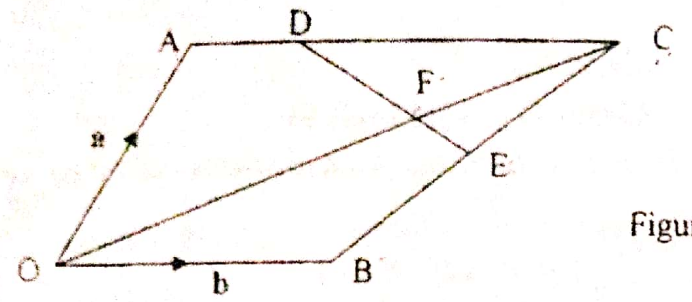


Figure 1

Figure 1 shows vectors **OA** = **a** and **OB** = **b**. **AC** = 2 **OB**, E is the mid-point of BC and $\frac{AD}{AC} = \frac{1}{3}$. F is the point of intersection of OC and DE.

(a) Express the following vectors in terms of **a** and **b**.

(i) **BC**.

(ii) **DE**.

(b) Find the ratio **OF**:**FC**.

14.(a) Given that $y = log_2\left(\frac{2^{3x}}{sin2x}\right)$, find the value of $\frac{dy}{dx}$ when $x = \frac{\pi}{4}$. (05 *marks*)

(b) Determine the Maclaurin's expansion of $\frac{x-1}{x-2}$ up to the term in x^2. (07 *marks*)

15.(a) Evaluate $(1 + i\sqrt{3})^{\frac{2}{3}}$. (06 *marks*)

(b) Given that $Z = x + iy$, show by leaving unshaded, the region $|Z - 1| > 2$ on the argand diagram. (06 *marks*)

16. Water flows out of a tank at a rate proportional to the square root of the volume of water left in the tank. If the initial volume of water is $4m^3$ and it starts flowing at $1.0 \times 10^{-4} m^3 s^{-1}$.

(a) Write down a differential equation relating volume, V and time t. (03 *marks*)

(b) Find the time taken to empty the tank. (06 *marks*)

(c) Find the volume of water left after 10 hours. (03 *marks*)

END

$\frac{dv}{dt} = 1.0 \times 10^{-4} m^3 s^{-1}$. $\frac{dv}{dt} = \frac{\delta v}{\delta t}$

$\frac{dv}{v} = \frac{\delta v}{\delta}$

$(x-1)(x-1)$ $r \div \frac{1}{2}$

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

BUIKWE DISTRICT JOINT MOCK EXAMINATIONS BOARD (BUSSHA)

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS 2023

Applied Mathematics Paper 2

Time: 3 Hours

INSTRUCTIONS TO CANDIDATES:

- Attempt **all** the **eight** questions in section A and any **five** from section **B**.
- Where necessary, acceleration due to gravity, $g=9.8ms^{-2}$.
- Any extra question(s) attempted will not be marked.

SECTION A

1. A lift of mass 15kg carries a load of mass M kg. if the tension in the hoist cable is 605N, when the lift is accelerating upwards at $1.2ms^{-2}$, find;
   (i) The value of M, (03 Marks)
   (ii) The tension in the hoist cable when the lift is decelerating upwards at $0.8ms^{-2}$. (02 Marks)

2. The table below shows the distances of towns A, B and C from town O along the same highway and their corresponding taxi-fares.

Towns	A	B	C
Distances from O	30km	45km	60km
Fare	3,500/=	5,000/=	7,000/=

   (i) Town P is 37km from O, determine its fare from O. (03 Marks)
   (ii) A passenger from town O disembarking from town Q paid 10,000/=, find how far Q is from town C. (02 Marks)

3. The probability that a school uniform supplied to a school is defective is 0.32. If a supplier brought a consignment of 400 uniforms, find the probability that more than 124 but not exceeding 134 uniforms will he defective. (05 Marks)

4. A body initially at a point (1, 3, 2)m has a velocity of $\boldsymbol{i}$-3**j**+5kms^{-1}. If it moves with a constant acceleration whose magnitude is $\sqrt{38}$ ms^{-2} and parallel to the vector 2i+3**j**+5**k**, find its position vector after 3s. (05 Marks)

5. A mass can go to work by car, motor-cycle or on foot. The corresponding probabilities of using these means are 0.5, 0.2 and 03 respectively. The probabilities of arriving early at the work place are 0.2, 0.4 and 0.1 for work, find the probability that he used a motor cycle. (05 Marks)

6. Given that x=3.11 and y=1.2 and that both numbers have been rounded to the nearest decimal places, find the percentage error in evaluating x sin y using correct to three decimal places.

(05 Marks)

7. A particle of mass 3kg rests on a rough plane inclined at an angle 38° to the horizontal under the support of a force P acting up the plane and inclined at 20° to the plane. If the angle of friction between the surfaces is 16°, find the value of P when the particle is at the point of shipping up the plane.

(05 Marks)

8. Competitors A, B,..., J were judged in two tasks and they were arranged from the best to the worst as shown below.

Task 1	A	B	C	H	F	E	D	G	J	I
Task 2	C	H	F	A	B	D	I	E	J	G

Calculate the rank correlation coefficient and comment on your result. (05 Marks)

SECTION B

9. Using trapezium rule with five strips, evaluate $\int_0^{0.5} \sqrt{(1-x^2)}\,dx$ correct to three decimal places. Hence obtain the percentage error incurred in the above approximation.

(05 Marks)

10. Machine components have lenghs which are normally distributed with mean 57.2mm. If 13% of the components have lengths greater 57.4mm, find;

(i) The standard deviation of the lengths. (06 Marks)

(ii) The probability that the mean length of 10 randomly selected components will exceed 57.12mm. (06 Marks)

11. A particle projected with a speed of $40ms^{-1}$ just clears a wall of height 5m whose base is 10m horizontally from the point of projection.

Find: (i)The possible angles of projection (06 Marks)

(ii)The distance between the points which it lands with those angles on the ground beyond the wall. (06 Marks)

12. Find the Newton-Raphson's iterative formula for finding the K^{th} root of a number N. Use your iterative formula to evaluate $\sqrt[4]{20}$ starting with $x_0=2$ correct to three decimal places. (12 Marks)

13. The table below shows the frequency distribution of the diameters of the ball bearings produced by a certain factory.

Diameter (mm)	1-4	5-8	9-12	13-16	17-20	21-24
Frequency	5	13	26	17	8	6

(a) Calculate: (i)the variance,

(ii) the mode of the distribution (07 Marks)

(b) Construct an ogive and use it to obtain the middle 60% range. (05 Marks)

14. A forces of $4i+3j$, $5i-8j$ and $-2i+6j$N act at points (3, 2), (-1, 1) and (2, -1) m respectively. Find:

(i) their resultant (02 Marks)

(ii) the equation of the line of action of the resultant force

(b)A uniform beam AB of weight 6kg and length 4m is in limiting equilibrium with end A against a rough vertical wall and B on a rough on a rough horizontal ground. The coefficients of friction are $^1/_3$ and ½ respectively; find the inclination of the beam of the horizontal. (07 Marks)

15. A random variable X has a probability density function given by:

$$f(x) = \begin{cases} \frac{1}{6}, & 0 \le x \le 3 \\ \frac{1}{2}(4-x), & 3 \le x \le 4 \\ 0 & , \text{elsewhere.} \end{cases}$$

(a) (i) Sketch the graph of the p.d.f. (03 Marks)

(ii)Obtain the expectation of X (03 Marks)

(b) Obtain the cumulative distribution function and use it to find $P(1 < X < 3.2)$.

(06 Marks)

16. (a) A pump raises 2000 ltrs of water per minute through a height of 5m and delivers it through a pipe of radius 2.5cm. Find the power of the pump. (density of water is $1000kgm^{-3}$).

(b)A bullet of mass 0.05kg travelling with a horizontal speed of 700ms-1 penetrates a fixed wooden block 30cm thick. If the bullet emerges with a speed of $50ms^{-1}$,

(06 Marks)

Find: (i) the time taken for the bullet to pass through the block (04 Marks)

(ii) the resistance of the wood to the bullet. (02 Marks)

END

P425/1
PURE MATHEMATICS
Paper 1
July/August 2023
3 hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

PURE MATHEMATICS

Paper 1

3 hours

INSTRUCTIONS TO CANDIDATES:

- *Answer* **all** *the eight questions in section* **A** *and any* **five** *questions from section* **B.**
- *Any additional question(s) answered will* **not** *be marked.*
- *Show* **all** *necessary working clearly.*
- *Begin each answer on a fresh page of paper.*
- *Silent, non programmable scientific calculators and mathematical tables with a list of formulae may be used.*

Answer **all** questions in this section.

1. If $a^3 + b^3 = 6ab(a + b)$, show that $\log\left(\frac{a+b}{3}\right) = \frac{1}{2}[\log a + \log b]$. (05 marks)

2. Given that $y = \operatorname{cosec}^{-1}(x)$. Hence prove that $\frac{dy}{dx} = \frac{-1}{x\left[\sqrt{(x^2-1)}\right]}$ (05 marks)

3. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sec^2 x}{1+\tan x}\,dx$ (05 marks)

4. Solve equation $\cos x + \sin 2x = 0$ for $0 \leq x \leq 2\pi$. (05 marks)

5. Show that the circles whose equations are $x^2 + y^2 - 4x - 5 = 0$ and $x^2 + y^2 - 8x + 2y + 1 = 0$ cut orthogonally. (05 marks)

6. Expand $\left(\frac{1+3x}{1-3x}\right)^{\frac{1}{2}}$ as far as the term in x^3.

   By putting $x = \frac{1}{7}$ in your expansion, estimate $\sqrt{10}$, correct to two decimal places. (05 marks)

7. Find the perpendicular distance of a point P(3,1,7) from the line $r = 3i + j - 2k + \lambda(2i - j + 2k)$. (05 marks)

8. An inverted cone with vertical angle 60^0 has water in it dripping out through a hole at the vertex at the rate of 9 cm^3 per minute. Find the rate at which it's level will be decreasing at an instant when the volume of water left in the cone is 9π cm^3. (05 marks)

SECTION B (60 marks)

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

9. (a) Given that; $Z = \frac{(2-i)^2(3i-1)}{(i+3)^3}$. Find;

(i) modulus of Z. (02 marks)

(ii) argument of Z. (02 marks)

Hence express Z in polar form. (02 marks)

(b) Show the region represented by $|Z+i-2| \leq 1$ on an argand diagram and state the complex number of the centre of the wanted region. (06marks)

10. (a) A and B are points whose position vectors are $\mathbf{a} = \mathbf{i} + \mathbf{k}$ and $\mathbf{b} = \mathbf{i} - \mathbf{j} + 3\mathbf{k}$ respectively. Determine the position vectors of a point P that divides line $\overline{AB}$ internally in the ratio 5:1. (04 marks)

(b) If vectors $\mathbf{a} = \mathbf{i} - 3\mathbf{j} + \mathbf{k}$ and $\mathbf{b} = 2\mathbf{k} - \mathbf{i} - 3\mathbf{j}$ are parallel to a plane containing point (1, −2, 3). Determine;

(i) the equation of the plane. (04 marks)

(ii) the angle the line $\frac{x-4}{4} = \frac{y}{3} = \frac{Z-1}{2}$ makes with the plane in (i) above. (04 marks)

11. The curve is given parametrically by the equations $x = \frac{t}{1+t}$ and $y = \frac{t^2}{1+t}$

(a) Find the Cartesian equation of the curve. (02 marks)

(b) Determine the turning points of the curve. (05 marks)

(c) Sketch the curve. (05 marks)

12. (a) If $y = e^{2x}\sin 3x$, Prove that $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = 0$ (06 marks)

(b) By using a suitable substitution $x = \sin\theta$,

evaluate $\int_0^{\frac{\sqrt{3}}{2}} \left(\frac{x^3}{\sqrt{(1-x^2)}} \right) dx$ (06 marks)

Turn Over

13. (a) Prove that $\sin\left[2\sin^{-1}(x)+\cos^{-1}(x)\right] = \sqrt{(1-x^2)}$. (05 marks)

(b) Show that $\sin 3x = 3\sin x - 4\sin^3 x$. Hence solve the equation $8t^3 - 6t + 1 = 0$ correct to 4 significant figures. (07 marks)

14. If the line $y = mx + c$ is a tangent to an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, prove that $c^2 = b^2 + a^2m^2$. (04 marks)

Hence determine:

(i) equations of four common tangent to the ellipses $\frac{x^2}{23} + \frac{y^2}{3} = 1$ and $\frac{x^2}{14} + \frac{y^2}{4} = 1$ (04 marks)

(ii) the equations of the tangents at the point (-3, 3) to ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ (04 marks)

15. (a) The eighth term of an arithmetic progression is twice the third term and the sum of the first eight terms is 39. Find the first three terms of the progression and show that its sum to n term is $\frac{3n}{8}(n+5)$.

(06marks)

(b) Find how many terms of the series $1+\frac{1}{5}+\frac{1}{25}+\frac{1}{125}+......$ must be taken so that the sum will differ from the sum to infinity by less than 10^{-6}.

(06 marks)

16. On 1st march 2020. There were 60 female antelopes kept a side to feed lions. It was discovered that the rate at which the antelopes were eaten was proportional to sum of 5 and the number of antelopes present at any given time per month. On 31st August, 40 antelopes were present.

(a) Form a differential equation and solve it. (09 marks)

(b) How many antelopes were left by end of 15th November, 2020? (Assume each month is 30 days and none of antelope dies on itself on.) (03 marks)

END

P425/2
APPLIED MATHEMATICS
PAPER 2
July/August 2023
3hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

- *Attempt* **all** *questions in section* **A** *and any* **five** *questions from section* **B**.
- *Any additional question(s) answered will* **not** *be marked.*
- **All** *working must be shown clearly.*
- *Begin each answer on a fresh sheet of paper.*
- *Silent non programmable scientific calculators and mathematical tables with a list of formulae may be used.*
- *In numerical work, take g to be* $9.8ms^{-2}$.
- *State the degree of accuracy at the end of the answer to each question attempted using a calculator or table and indicate* **Cal** *for calculator, or* **Tab** *for mathematical tables.*

SECTION A (40 MARKS)

Answer **all** questions in this section.

1. Events A and B are such that $P(B) = {}^1/_6$, $P(AnB) = {}^1/_{12}$, and $P(B/A) = {}^1/_3$.
   (a) Find (i) P(A). (02 marks)
   (ii) $P(A/B^1)$. (02 marks)
   (b) State with a reason whether events A and B are independent or not. (01 mark)

2. The table below shows variation of temperatures of cooling water with time.

Time (s)	0	120	240	360	450	600
Temperature (^{0}C)	100	80	75	69	54	46

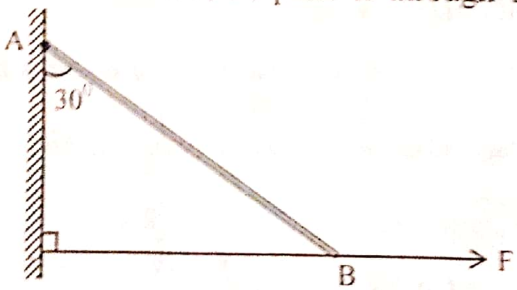
   Use linear interpolation or extrapolation to find the;
   (i) temperature of water after 300 seconds. (03 marks)
   (ii) time at which the temperature is 42^0C. (02 marks)

3. A driver of a car traveling at 72 kmh^{-1} on a high way notices an accident 800 m ahead and suddenly applies the breaks which reduced the speed by half. For how long did the driver apply the breaks? (05 marks)

4. In the year 2021, the price index of an item using 2000 as the base year was 90. In the year 2022, the index using 2021 as the base year was 120. Calculate the price of the item in 2022 given that the item costed Shs. 200,000 in year 2000. (05 marks)

5. Use trapezium rule to estimate $\int_1^2 x\sin x dx$ using six ordinates to 3 decimal places. (05 marks)

6. The diagram below shows a uniform rod AB of length 4 m and mass 2 kg freely hinged at A. A horizontal force, F, pulls it through an angle of 30^0 from the vertical.



   Calculate the:
   (i) value of F. (03 marks)
   (ii) magnitude of the reaction at the hinge. (02 marks)

7. Three people Jane, Mary and Alice are rolling a die. The winner is the first person to roll a six. If the die is unbiased and they roll a die in the order Jane, Mary and Alice, find the probability that;
   (a) Alice wins on first attempt. (02 marks)
   (b) Jane wins the game. (03 marks)

8. A particle of mass 2 kg is attached to one end of a light elastic string of natural length 1 m. The other end of the string is fixed to a point A.
   Initially the particle is held at A and when released, it falls vertically downwards and comes to rest at point 1.5 m below point A.
   Find the modulus of elasticity of the string. (05 marks)

SECTION B (60 marks)

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

9. The height (in cm) of a certain tree plantation were recorded as below.

Height (cm)	No. of trees
120 - 124	5
125 – 129	17
130 – 134	20
135 – 139	25
140 – 144	15
145 – 149	6
150 - 154	2

(a) Estimate the mean height and standard deviation of the trees. (06 marks)

(b) Plot a cumulative frequency curve (Ogive). (03 marks)

(c) Use your graph in (b) above to estimate;

(i) median height. (01 mark)

(ii) middle 60% height range. (02 marks)

10. (a) Show that the iterative formula for finding the fourth root of a number N is given by; $3\left[\frac{x_n}{4}+\frac{N}{12x_n^3}\right]$: n = 0, 1, 2,..... (04 marks)

(b) Draw a flow chart that;

(i) reads the initial approximation x_0 and N.

(ii) computes and prints the fourth root of N after three iterations and gives the root correct to 2 decimal places.

(c) Perform a dry run for N = 99 and x_0=3. (08 marks)

11. Four forces of magnitudes 3 N, 10 N, 6 N and 7 N act along sides AB, BC, DA and DB respectively. The direction of the forces being indicated by the order of the letters, of a rectangle ABCD with sides $\overline{AB}$ = 12 m and $\overline{BC}$ = 5 m.

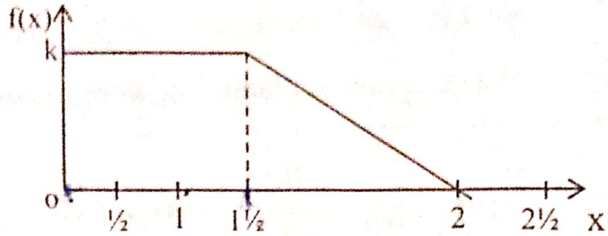
Taking AB and AD as x and y axes respectively;

(a) find the magnitude and direction of the resultant of the forces. (06 marks)

(b) If the line of action of the resultant of the forces cuts AB produced at point M, find the length MC. (06 marks)

Turn Over

12. The probability density function, f(x) of the random variable, X, takes on the form as shown below.



Find the:

(i) Value of k. (02 marks)

(ii) Probability density function, f(x). (04 marks)

(iii) $P(\frac{1}{2} \le X \le 1\frac{3}{4})$. (03 marks)

(iv) Expectation, E(X) of X. (03 marks)

13. (a) Two positive numbers y_1 and y_2 are rounded off to give x_1 and x_2 respectively with errors e_1 and e_2. Find informs of x_1 and x_2 the maximum relative errors made by using $x_1\, x_2$ as an approximation of $y_1\, y_2$. (06 marks)

(b) The number; 2.675, 4.800, 15.2 and 0.92 have been rounded off to the given number of decimal places. Find the range of values within which the exact value of $2.675\left(4.800 - \frac{15.2}{0.92}\right)$ can be expected to lie, correct to 3 decimal places. (06 marks)

14. (a) A particle of mass 3 kg is moving on the curve described by $\underset{\sim}{r} = (4\sin 3t\, \underset{\sim}{\hat{i}} + 8\cos 3t\, \underset{\sim}{j})m$ where $\underset{\sim}{r}$ is the position vector of the particle at any time t.

(i) Determine the position and velocity of the particle at the time, t = 0s.

(ii) Show that the force acting on the particle is $^{-}27\, \underset{\sim}{r}$.

(08 marks)

(b) A pump draws water from the tank and supplies it at a speed of 10 ms^{-1} from the end of a hose of cross-sectional area 5 cm^2, situated 4 m above the level from which the water is drawn. Find the rate at which the pump is working.

(04 marks)

15. A total population of 350 students in a certain school sat for Mathematics test for which the pass mark was 50. Their marks were normally distributed. 14 students scored below 40 marks while 21 students scored above 60 marks.

(a) Find the mean mark and standard deviation of the students' scores.

(b) What is the probability that a student chosen at random passed the test?

(c) Suppose the pass mark is reduced by 3 marks, how many more students will pass?

(12 marks)

16. A ship, A, moving at a constant speed of 24 kmh^{-1} in the direction $N40^0E$ is initially 10 km from a second ship B. The bearing of A from B is $N30^0W$. If B moves with a constant speed of 22 kmh^{-1}, find;

(a) The course that B must set in order to pass as close as possible to A.

(b) The distance between the ships when they are closest.

(c) The time taken (to the nearest minutes) for this to occur.

(12 marks)