NATIONAL MATHS LINK JOINT EXAM - 2024
Kenya Certificate of Secondary Education

121/1   **MATHEMATICS Alt. A**   **Paper 1**

Form 3 Feb. 2024 – 2 ½ Hours

Name: ……………………………...…………… Adm Number: ………

Student's Signature: ……………… School: ……………….. Class:………

Instructions to candidates

(a) Write your name, Adm number and class in the spaces provided above.

(b) Sign and write the date of examination in the spaces provided above.

(c) This paper consists of **two** sections: **Section I** and **Section II**.

(d) Answer all the questions in Section **I** and only **five** questions from **Section II**.

(e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**

(f) Marks may be given for correct working even if the answer is wrong.

(g) **Non – programmable** silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.

(h) **This paper consists of 15 printed pages.**

(i) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

(j) **Candidates should answer the questions in English.**

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Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

| 17	18	19	20	21	22	23	24	Total

Grand Total

SECTION I (50 Marks)
*Answer **all** the questions in this section in the spaces provided.*

1. Evaluate $\dfrac{\frac{4}{5}\,of\,1\frac{1}{9}+\frac{3}{8}-\frac{7}{36}}{2\left(\frac{6}{7}-\frac{5}{14}\right)+\frac{1}{8}\,of\,\frac{20}{27}+\frac{1}{3}}$. (3 marks)

2. The sum of the digits in a three – digit number is 18. The ones digit is half the sum of the other two and the hundreds digit is half the unit digit. Find the total value of the number. (3 marks)

3. Given that $16x^2 - mx + 81$ is a perfect square, find the value of *m*. (2 marks)

4. The figure below represents a plot of land PQRS such that PQ = 65 m, QR = 63 m, RS = 60 m, SP = 44 m and angle PRQ = 90°.
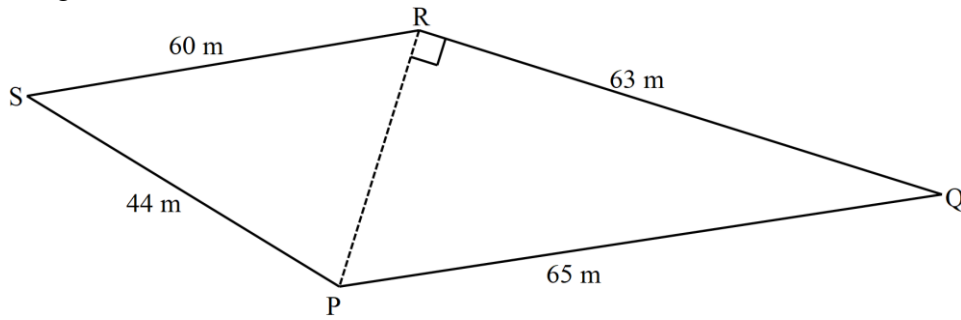
Determine the area of the plot in hectares correct to one decimal place.   (4 marks)
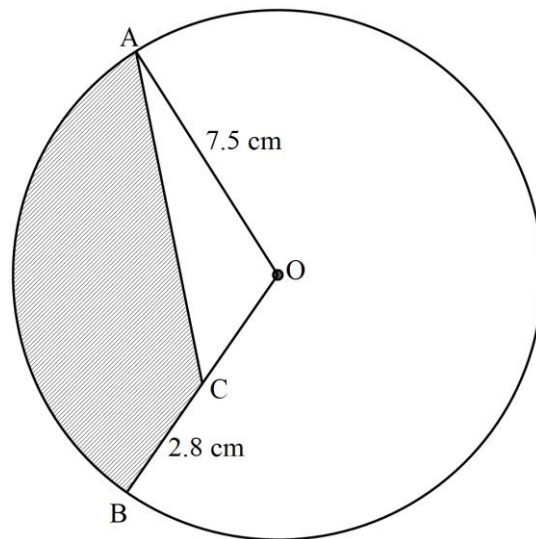
5. Solve for x in the equation; $125^{2x-5} \div 25^{x+4} = 625$ (3 marks)

6. Solve $3x - \dfrac{1}{2} < 4 \geq -1 - x$ and hence list all the integral values that satisfy the inequality.   (3 marks)

7. In the diagram, O is the centre of a circle with radius 7.5cm. The area of minor sector AOB = 15π cm^2. C is a point on OB such that BC is 2.8cm.
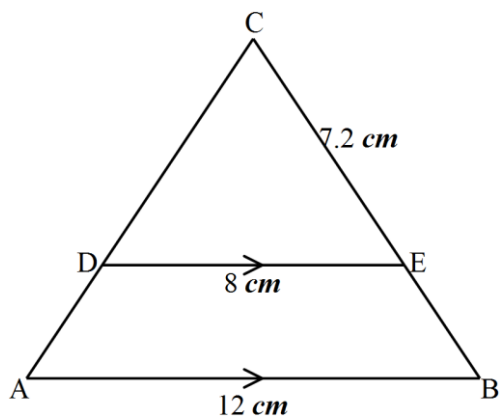

(a) Find the size of angle AOB in correct to 3 significant figures. (2 marks)

(b) Calculate the area of the shaded region. (2 marks)

8. Find the value of $\dfrac{\cos 30 . \tan 30 - \tan 45}{\tan 45 + \cos 60}$ without using mathematical table or calculator. (3 marks)

9. Simplify completely; $\dfrac{(4x+2m)^2\left(-4m^2+16x^2\right)}{\left(4m^2+16mx+16x^2\right)(-2m+4x)}$ (3 marks)

10. In the figure below, AB is parallel to DE. AB = 12 cm, DE = 8 cm and CE = 7.2 cm. Find the length of BE. (3 marks)

11. Use tables of reciprocals to work out; $\dfrac{4}{0.625}-\dfrac{3}{62.5}$ (3 marks)

12. A bus takes 40 minutes, 45 minutes and 48 minutes to travel from town P to town S via towns Q and R respectively. If the bus is to arrive in town S on Tuesday 1.13 a.m., find the time it should depart from town P. (3 marks)

13. Omega made an approximation to the value of $\dfrac{625 \times 0.7698}{42940 \times 38}$ by correcting each of the numbers and

resulting answer to one significant figure. Find the percentage error arising from the approximation.

(3 marks)

14. A point $A(-3, 6.5)$ is mapped onto $A'(6, -2.5)$ by a translation vector **T**. $B'(-8, -12)$ is the image of point B under the same translation. Find the coordinates of point B. (3 marks)

15. Water flows from a tap, at a rate of 32 cm^3 per second, into a rectangular container of length 64 cm, breadth 30 cm and height 48 cm. If at 4.00 p.m. the container was half full, what will be the height of water at 4.05 p.m.? (3 marks)

16. In a rhombus WXYZ, WX = 6 cm and angle WXY = 105º.

(a) Using a ruler and pair of compasses only, construct the rhombus WXYZ. Measure WY.

(3 marks)

(b) State the order of rotational symmetry of rhombus WXYZ. (1 mark)

SECTION II (50 Marks)

*Answer **ALL** questions from this section in the spaces provided.*

17. Two towns, A and B are 400 km apart. A motor cyclist travelling at an average speed of 60 km/h left town A for town B at 1.20 p.m. A matatu travelling at an average speed of 80 km/h also left town A for town B at 2.00 p.m.

  (a) Calculate, the:

    (i)   distance covered by the motor cyclist by 2.00 p.m.   (2 marks)

    (ii)   distance from town A in km, where the matatu caught up with the motor cyclist.   (3 marks)

    (iii)   time when the matatu caught up with the motor cyclist.   (2 marks)

  (b) A lorry travelling at an average speed of 40 km/h left town B for town A at 2.00 p.m. Determine the time when the lorry and the matatu met.   (3 marks)

18. The boundaries PQ, QR, RS and SP of a ranch are straight lines such that Q is 16 km on a bearing of 040° from P; R is directly south of Q and east of P and S is 12 km on a bearing of 120° from R.

(a) Using a scale of 1:200,000, show the above information in a scale drawing. (4 marks)

(b) From the scale drawing determine:

(i)   The distance and bearing of P from S. (2 marks)

(ii)   The distance and bearing of Q from S. (2 marks)

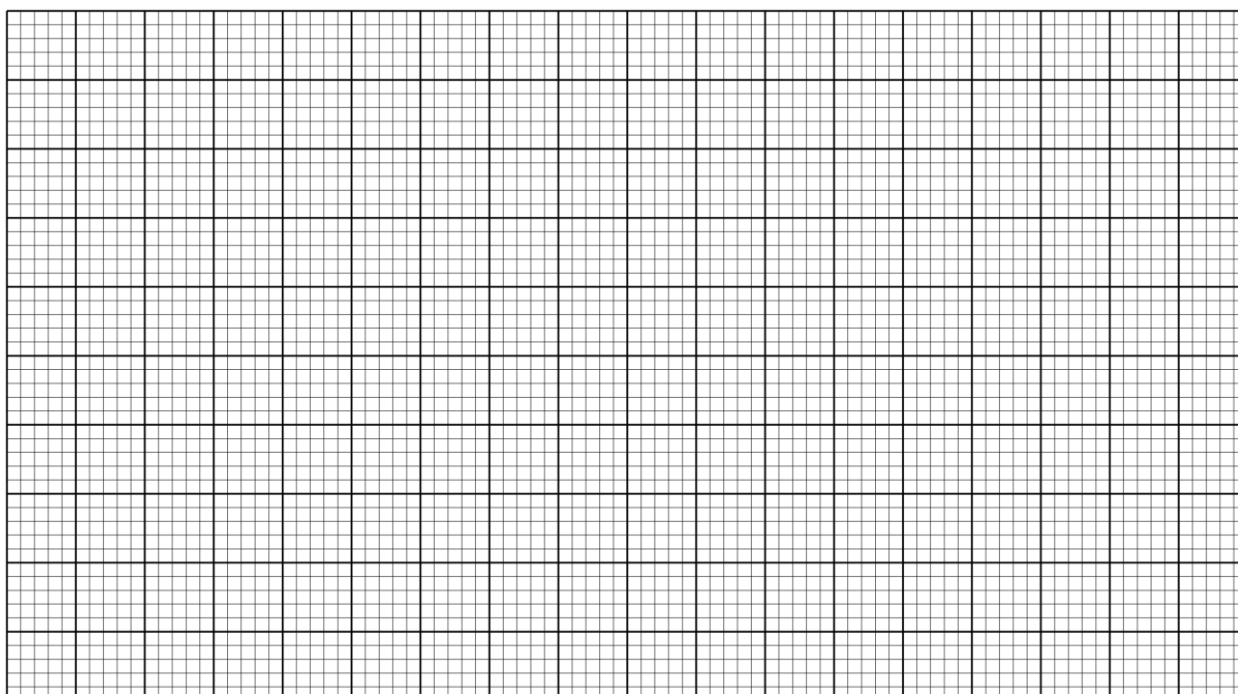(iii)   The perimeter of the ranch SRPQ. (2 marks)

19. The end of term test scores of 100 students were recorded as shown in the following table.

Scores	30 − 39	40 − 49	50 − 59	60 − 69	70 − 79	80 − 89
No. of Students	8	10	28	32	12	10

(a) State the modal frequency. (1 mark)

(b) Calculate the median score. (3 marks)

(c) On the grid provided, represent the above data using histogram. (4 marks)

(d) Use the histogram to determine the number of students who scored from 71.5 to 76.5. (2 marks)

20. A saleslady dealing in printers earns a basic salary of Kshs.32,000. In addition, she is paid commission on the sales of printers as follows.

	Commission (%)
For sales up to Kshs.200,000	0%
For sales above 200,000	
(i) For the first 150,000	4%
(ii) For the next 150,000	5%
Any amount above 500,000	10%

On a certain month she sold 18 printers marked at Kshs.32 000 a pair at a discount of $6\frac{1}{4}\%$

(a) Calculate the total sales for the month.   (2 marks)

(b) Calculate her total earnings for that month.   (3 marks)

(c) In the next month her basic salary was increased in the ratio 5:4. If she earned a total of Kshs.66 500. Calculate :
   (i)   Her total sales for the month   (3 marks)

   (ii)   The number of printers she sold that month.   (2 marks)

21. (a) A line L_1 passes through the points $(4,5)$ and $(6,-7)$. Find;

   (i)   equation of L_1 in the form $y = mx + c$ where m and c are constants.   (3 marks)

      (ii) x and y – intercepts of line L_1.   (2 marks)

(a) Another line L_2 is perpendicular to L_1 and passes through the point $(-21,7)$. Find equation the equation of L_2 in the form $ax + by = c$ where a, b and c are integers.   (2 marks)

(b) Find the point of intersection of L_1 and L_2.   (3 marks)

22. In the figure below, AD = DC = 8.1 cm, BD = 10.3 cm and $\angle CBD = 40^\circ$. BC is parallel to AD.
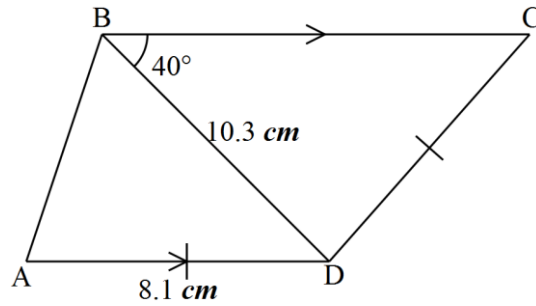
(a) Calculate to 1 decimal place:
  (i)   The length of AB.   (3 marks)

  (ii)   The size of angle BCD.   (3 marks)

(b) Calculate to 4 significant figures:
  (i)   The area of triangle ADB.   (2 marks)

  (i)   Hence find the shortest distance between B and AD.   (2 marks)

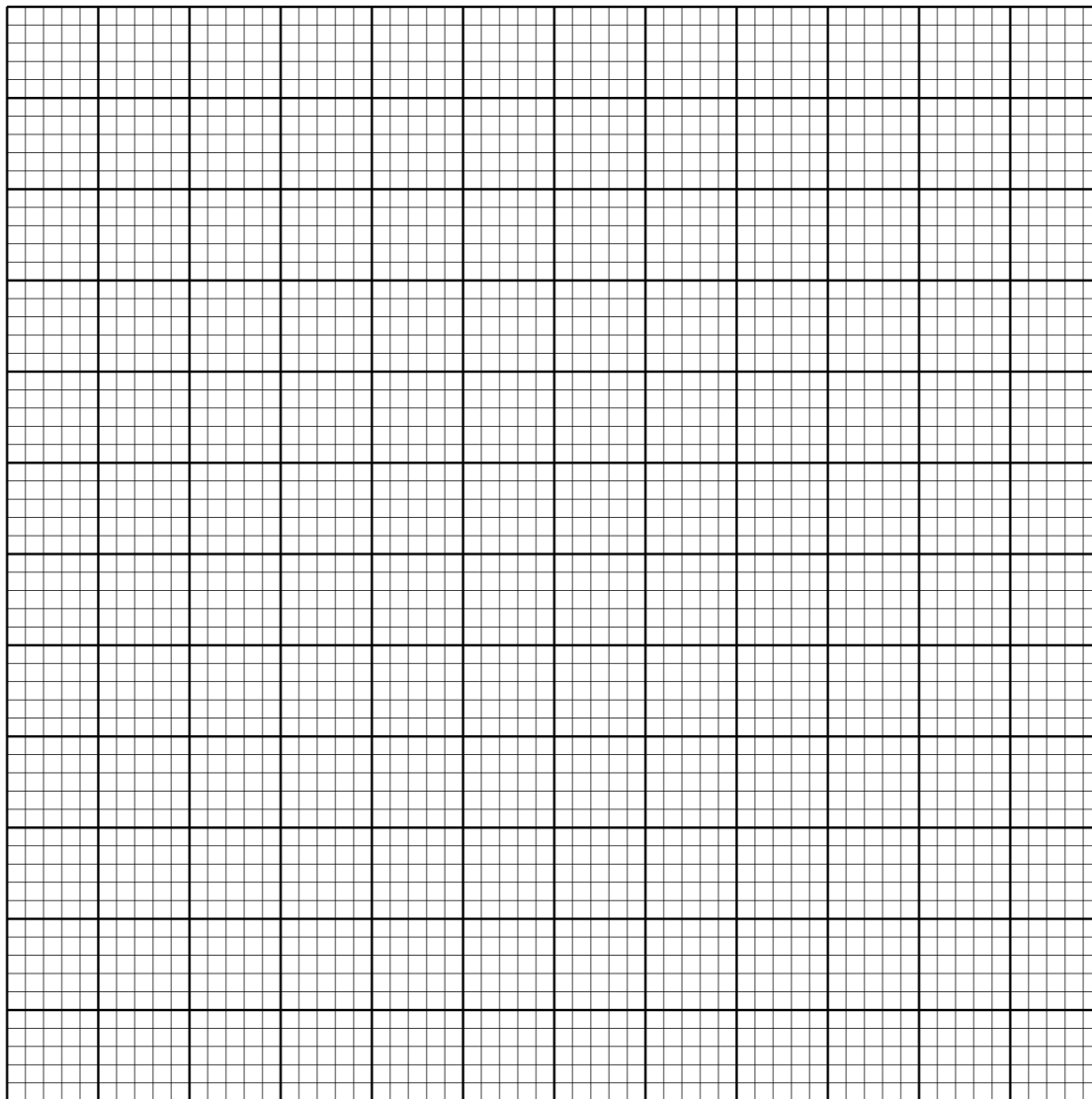**23.** The equation of a curve is given by $y = 2x^2 + x - 36$

(a) Complete the table for the integral values of y in the domain $-5 \leq x \leq 5$. (2 marks)

x	-5	-4	-3	-2	-1	0	1	2	3	4	5
y	9		-21		-35			-26			19

(b) On the grid provided below, draw the graph of $y = 2x^2 + x - 36$ for $-5 \leq x \leq 5$. Use the scale of 1 cm to represent 1 unit on the horizontal axis and 1 cm to represent 5 units on the vertical axis.
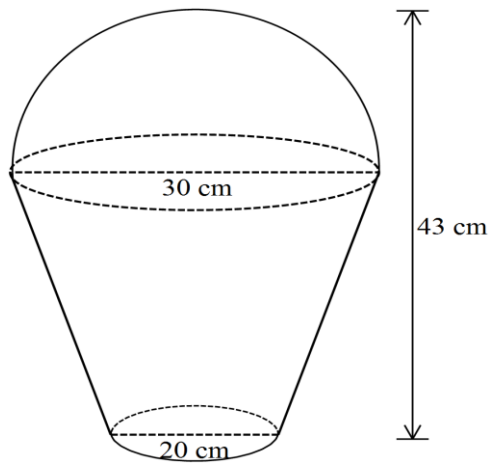
(3 marks)

(c) Using your graph:

(i) State the range of values of x that satisfy the inequality $2x^2 + x - 36 > 0$. (2 marks)

(ii) Solve the equation $x^2 - x - 12 = 0$ (3 marks)

24. The figure below shows a bucket that comprises a frustum with diameters 30 cm and 20 cm at the top and bottom respectively and a hemispherical top. The height of the bucket is 43 cm.

Find, in terms of π ;

   (a) the volume of the bucket   (4 marks)

   (b) the slant height of the bucket   (2 marks)

   (c) the surface area of the bucket   (4 marks)

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