

NYAKKIMA JOINT EXAMINATION - 2023

Kenya Certificate of Secondary Education

121/1

Paper 1



MATHEMATICS



-Alt. A

March. 2023 – 2 Hours 30 Mins

Name: Index Number:

Student's Signature: Date: Class:.....

Instructions to candidates

- (i) Write your name, Index number and class in the spaces provided above.
- (ii) Sign and write the date of examination in the spaces provided above.
- (iii) This paper consists of **two** sections: **Section I** and **Section II**.
- (iv) Answer **all** the questions in **Section I** and only **five** questions from **Section II**.
- (v) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**
- (vi) Marks may be given for correct working even if the answer is wrong.
- (vii) **Non – programmable** silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- (viii) This paper consists of 15 printed pages. **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (ix) **Candidates should answer the questions in English.**

For Examiner's Use Only

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

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SECTION I (50 Marks)

Answer *all* the questions in this section in the spaces provided.

1. Without using mathematical tables or calculator, evaluate; $\frac{-2(-3^2 + 5) - 12 \div 3 \text{ of } 4}{5^{-1} - 12 \div 10 + 6}$. (3 marks)

2. A school begins its lessons at 7:00 a.m. and has 9 periods of 40 minutes each. There is a 10 minutes break after the second lesson, a 20 minutes break after the fourth lesson and a 5 minutes break after the sixth lesson.

Lunch break comes after the ninth period. Find the time lunch begins. (3 marks)

3. Solve the equation: $27^{n-2} \times 4^{m+1} = 432$. (3 marks)

4. Simplify the algebraic expression; $\frac{15x^2y - 10xy^2}{3x^2 - 5xy + 2y^2}$. (3 marks)

5. A rectangular tank of base 2.5 m by 3.2 m and height 4 m contains 8 900 litres of water initially. Water flows into the tank through a pipe of radius 1.75 cm at the rate of 3 m/s.

Calculate the time in hours required to fill the tank. (3 marks)

6. Given that $\tan \theta = \frac{\sqrt{23}}{11}$ find the value of $\cos \theta + \sin(90 - \theta)$ without using mathematical tables or calculator. (3 marks)

7. In a rhombus PQRS, the diagonal PR is of length 8 cm, Further, $\angle SPQ = 67.5^\circ$. Use a ruler and a pair of compasses only to complete the rhombus. (3 marks)

8. Given that $\mathbf{a} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} 5 \\ 10 \end{pmatrix}$ and that $\mathbf{p} = 2\mathbf{a} - \frac{1}{2}\mathbf{b} + \frac{2}{5}\mathbf{c}$.

- (a) Express \mathbf{p} as a column vector. (2 marks)

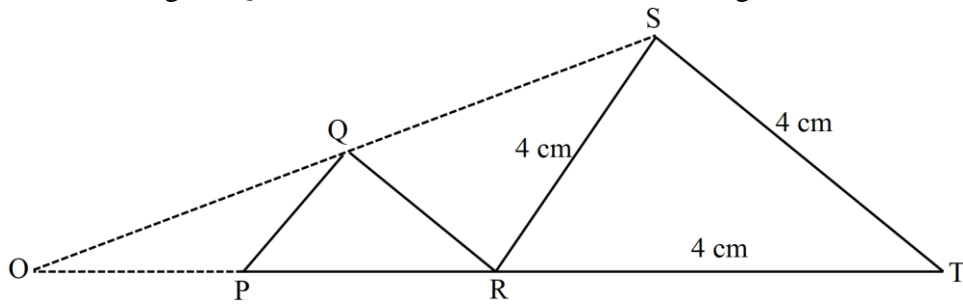
- (b) Calculate the magnitude of \mathbf{p} giving answer to 1 decimal place. (2 marks)

9. A polygon has n sides. Two of its angles are each right angled and each of the remaining angles are 144° each. Find the value of n . (3 marks)

10. Use tables of square root, reciprocal and cubes to evaluate; $\sqrt{426.8} + \frac{4}{(0.2368)^3}$. (3 marks)

11. Find the equation of a line passing through $(-5, 2)$ and is parallel to $3y + 4x - 7 = 0$ giving your answer in double intercept form. (3 marks)

12. The figure below shows the sketch of an equilateral triangle RST of side 4 cm which is an enlargement of triangle PQR under scale factor 2; centre of enlargement O.



Find the length of OS giving your answer in a simplified surd form. (3 marks)

13. A carpenter has three pieces of timber measuring 294 cm, 336 cm and 462 cm. He cuts the timber into pieces of equal lengths. Find the least number of pieces obtained. (3 marks)

14. Solve the pair of simultaneous inequalities below giving your answer as a combined inequality hence represent the solution on a number line. (3 marks)

$$4x + 1 < 2(x + 2), \quad 3x + 4 \geq \frac{4x + 1}{2}$$

15. 2.5 litres of water whose density is 1 g/cm^3 is added to 5.5 litres of alcohol whose density is 0.8 g/cm^3 . Calculate the density of the mixture. (3 marks)

16. In a certain bookshop, the price of a Geometrical Set is Kshs. x while the price of the Mathematical Table is Kshs. y . A discount of 10% is allowed on each item if more than 6 pieces of it are bought.

Mr. Masomo purchased 6 Geometrical Sets and 5 Mathematical tables at a total of Ksh.3 500 while Mrs. Makini purchased 8 Geometrical Sets and 7 Mathematical Tables at a total of Ksh.4 320. Calculate the marked price of each item. (4 marks)

SECTION II (50 Marks)

Answer **any five** questions from this section in the spaces provided.

17. A sales woman is paid a commission of 2% on goods worth up to Kshs.100 000 and a commission of 3% on goods worth over Kshs.100 000.

She is also paid a monthly salary of Kshs.14 000. In a certain month she sold 450 dresses at Kshs.800 each.

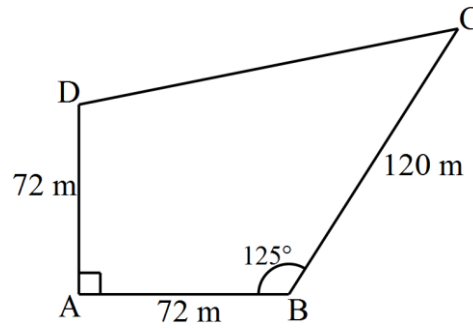
- (a) Calculate her earnings that month. (3 marks)

- (b) The following month the sales woman's monthly salary was increased by 15%. Her total earnings that month were Kshs.27 700. Calculate the:

- (i) Total amount of money received from the sales of dresses that month. (5 marks)

- (ii) Number of dresses sold that month. (2 marks)

18. In the figure below, ABCD represents a farm in which $AB = AD = 72$ m and $BC = 120$ m. Angle DAB is a right angle and $\angle ABC = 125^\circ$.



- (a) Calculate correct to 1 decimal place:

(i) The length of DC.

(4 marks)

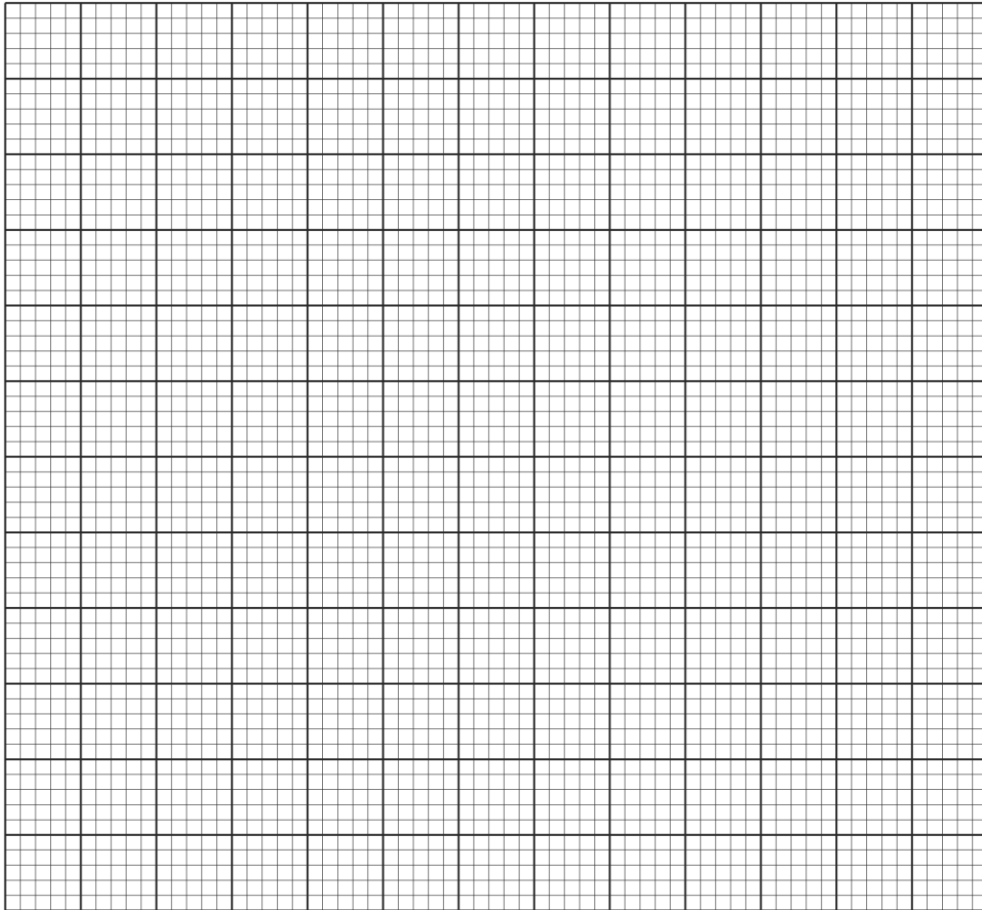
(ii) The size of angle BCD.

(3 marks)

- (b) Find the area of the farm in hectares.

(3 marks)

19. (a) On the grid provided, draw the square S whose vertices are $A(0,0)$, $B(2,0)$, $C(2,2)$ and $D(0,2)$. (1 mark)



- (b) Draw $A'B'C'D'$ the image of $ABCD$ after undergoing an enlargement scale factor -2 centre $(3,4)$ and state coordinates the coordinates of the image. (3 marks)

- (c) $A'B'C'D'$ is translated by vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ to give $A''B''C''D''$. Draw on the same grid the image $A''B''C''D''$ and state its coordinates. (3 marks)

- (d) $A'''B'''C'''D'''$ is the image of $A''B''C''D''$ under reflection in the line $y = x$. Draw $A'''B'''C'''D'''$ and state its coordinates. (3 marks)

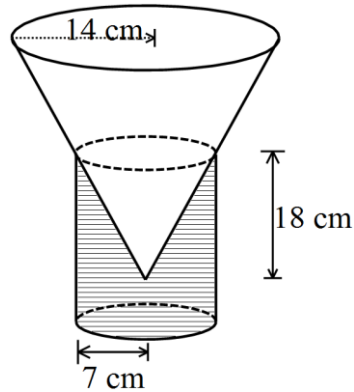
20. A truck left town X at 11.45am and travelled towards town Y at an average speed of 60km/hr. A car left town X at 2.15pm on the same day and travelled along the same road at an average speed of 100km/hr. The distance between the two towns is 500km.

(a) Calculate the time of the day when the car overtook the truck. (4 marks)

(b) The distance from Y when the car overtook the truck. (3 marks)

(c) After overtaking the bus, both vehicles continued towards Y at their original speeds. Find how long the car had to wait at town Y before the truck arrived. (3 marks)

21. A cylindrical tin of radius 7 cm contains water to a height of 19 cm. When a conical solid of radius 14 cm is fitted into the cylindrical tin to a depth of 18 cm as shown in the figure below, the water completely fills the space between the cylindrical tin and part of the cone inside the tin.



- (a) Taking π to be $\frac{22}{7}$, calculate correct to one decimal place:
- The volume of part of the cone that is not in contact with water. (3 marks)
 - The surface area of part of the cone that is not in contact with water. (4 marks)
- (b) Calculate the height of the cylindrical tin. (3 marks)

22. Three points P, Q and R are on a level ground. Q is 240° m from P on a bearing of 230° . R is 120 m to the east of P.

(a) Using a scale of 1 cm to represent 40 m, draw a diagram to show the position of P, Q and R

(3 marks)

(b) Determine;

(i) The distance of R from Q. (2 marks)

(ii) The bearing of R from Q. (1 mark)

(c) A vertical post stands at P and another at Q. A bird takes 18 seconds to fly directly from the top of the post at Q to the top of the post at P. Given that the angle of depression of the post at P from the top of the post at Q is 9° , calculate;

(i) The distance to the nearest meter, the bird covers, (2 marks)

(ii) The speed of the bird in km/h. (2 marks)

23. (a) Given that $P = \begin{pmatrix} 8 & 5 \\ 6 & 9 \end{pmatrix}$, find P^{-1} (2 marks)

(b) Matawi bought 8 T – shirts and 5 pairs of shorts at a total cost of Kshs.4 400. Had he bought 6 T – shirts and 9 pairs of shorts, he would have spent Kshs.1 000 more.

(i) Form a matrix equation to represent the above information. (1 mark)

(ii) Use the matrix method to determine the cost of a T – shirt and a pair of shorts (4 marks)

(c) Three months later the price of a pair of shorts went up. Matawi bought 5 T-shirts and 5 pairs of shorts at a total cost of Kshs.3 650. Find the percentage increase in the price of a pair of shorts. (3 marks)

24. The masses of 64 hybrid goats in a ranch in Laikipia were recorded as follows:

<i>Mass in kg</i>	15–19	20–24	25–29	30–34	35–39	40–44
<i>No. of goats</i>	9	12	21	15	5	2

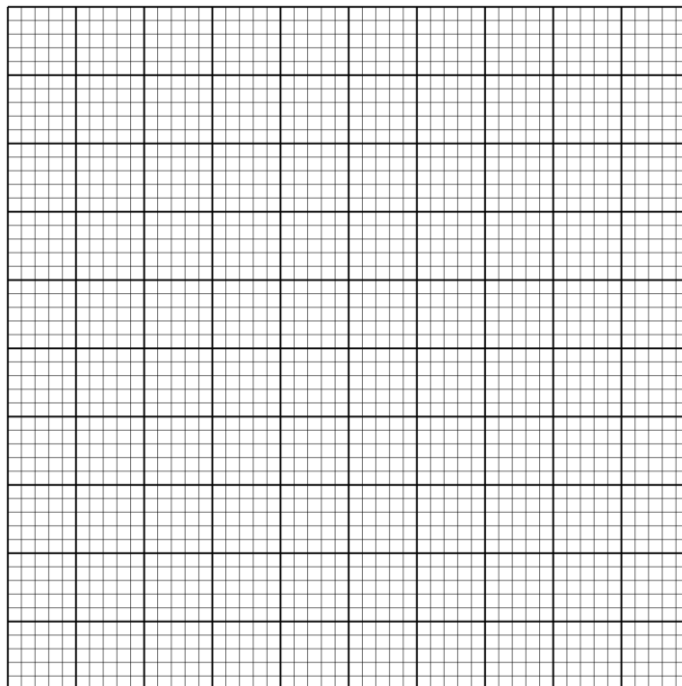
(a) State the modal frequency. (1 mark)

(b) Calculate:

(i) The mean mass; (3 marks)

(ii) The median mass. (3 marks)

(c) On the grid provided, draw a frequency polygon to represent the above information. (3 marks)



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