ORERO HIGH SCHOOL - 2023

Kenya Certificate of Secondary Education

121/1 **Paper 1**

MATHEMATICS

-Alt. A

Feb. 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 14 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

SECTION I (50 Marks)

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

1. A number n is formed by arranging square numbers less than 10 in descending order. Another number m is formed by writing all prime numbers less than 10 in ascending order. Find:

(a) m + n; (2 marks)

(b) $\sqrt{m + n;}$ using mathematical tables. (2 marks)

2. Evaluate $2.7 \times 10^4 - 3.6 \times 10^3$. Leave your answer in standard form. (2 marks)

3. If $\frac{2x - 1}{3}$ is the reciprocal of $\frac{2}{3x + 2}$, determine the value of x. (2 marks)

4. Use logarithms, correct to 4 decimal places, to evaluate (4 marks)

$$\sqrt{\frac{(0.8524)^3 \times 24.86}{99.28 - 15.23}}$$

5. A saleswoman is paid a commission of 2% on goods sold over Kshs.100 000. She is also paid a monthly salary of Kshs.12 000. In a certain month, she sold 360 handbags at Kshs.500 each. Calculate the saleswoman earnings that month. (3 marks)

6. Simplify the expression. (3 marks)

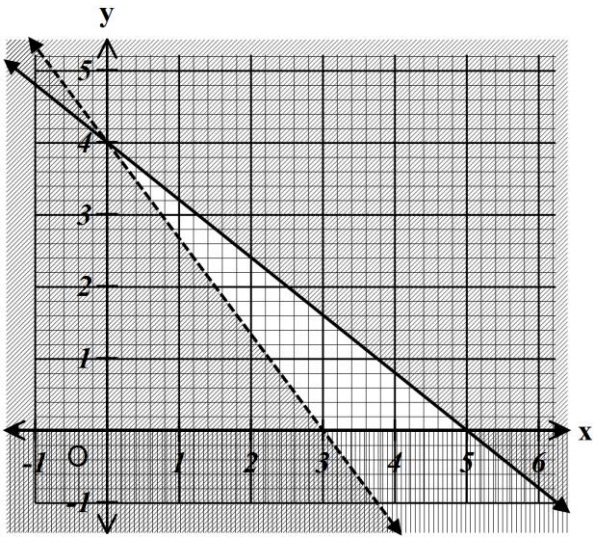
$$\frac{4x^2 - 16y^2}{6x^2 - 8xy - 8y^2}$$

7. From the top of a tower 100 m high, the angles of elevation and depression of the top of a skyscraper are 80° and 72° respectively.
Calculate the height of the skyscraper to the nearest metre. (4 marks)

8. Without using mathematical tables or calculator, evaluate (3 marks)

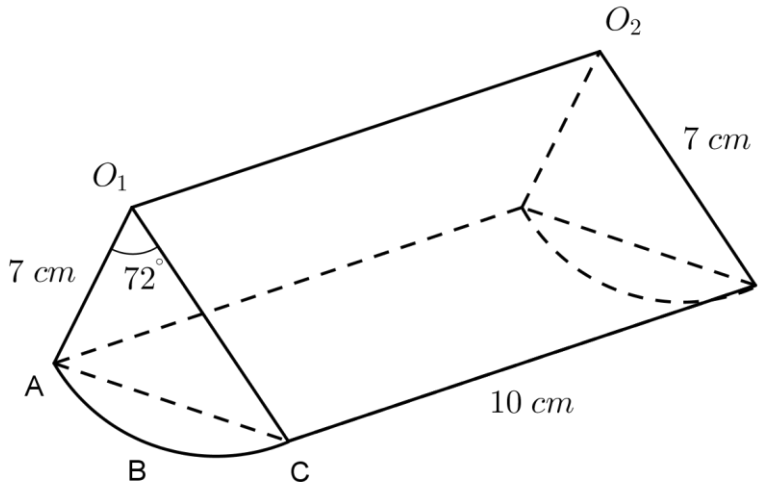
$$225^{\frac{1}{2}} \times \frac{30}{\sqrt[3]{3\,375}}$$

9. Form the three inequalities that satisfy the unshaded region in the diagram below.
(3 marks)



10. Joan had some money in two denominations only: twenty shillings coins and one hundred shilling notes. She has four times as many twenty shilling coins as one hundred notes. Altogether she has Kshs.2 160. How many one hundred shilling notes does she have? (3 marks)

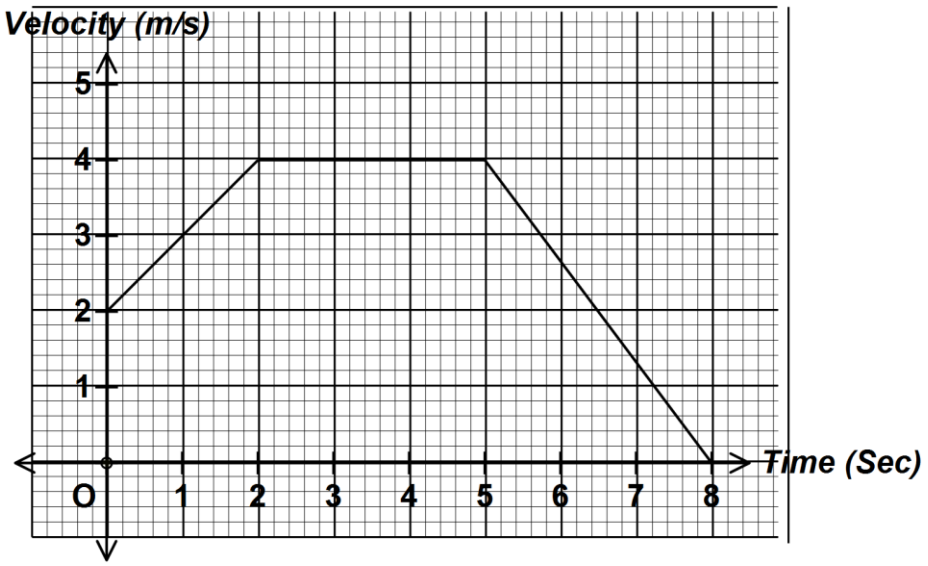
11. The figure below shows a solid in the shape of a prism whose cross section O_1ABC is the sector of a circle of radius 7 cm. $\angle AO_1C = 72^\circ$ and the solid is of length 10 cm.



If the solid were split into two prisms, one with the triangular part $O_1A\ C$ as its cross section and the other whose cross section is the segment ABC, calculate the volume of the solid whose cross section is the segment ABC. (3 marks)

12. A polygon of *n* sides has half of the interior angles 150^0 each and the rest 170^0 each. Find the value of *n*. (2 marks)

13. The graph below represents the motion of a particle in 8 seconds. Calculate the average speed of the particle. (3 marks)



14. A large rectangular tank has an internal cross – sectional area of 9.625 m^2 and holds 28 875 litres of water when full. A similar smaller tank has internal cross – sectional area of 6.16 m^2. Calculate the capacity in litres of the smaller tank. (3 marks)

15. Two straight lines L_1 and L_2 intersect at a point P. Given the equations of the two straight lines L_1 and L_2 are $x + 2y = 9$ and $-2x + 5y = 36$ respectively, determine the coordinates of the point P. (3 marks)

16. Using ruler and a pair of compasses only:

(a) Construct triangle ABC in which BC = 8cm and angle ABC = 105^0 and angle BAC = 45^o. (3 marks)

(b) Drop a perpendicular from A to meet line BC at P. Determine the area of triangle ABC. (2 marks)

SECTION II (50 marks)

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

17. Kantai runs a charity home for destitute children. In the year 2020 the cost of maintaining the home was Kshs.117 000 per month. This cost was made up of food costs, staff wages and health charges in the ratio 4 : 2 : 3 respectively. In 2021 the cost of food and staff wages rose by 10% and 20% respectively while health cost reduced by 5%.

(a) Determine the 2020 monthly cost of food. (2 marks)

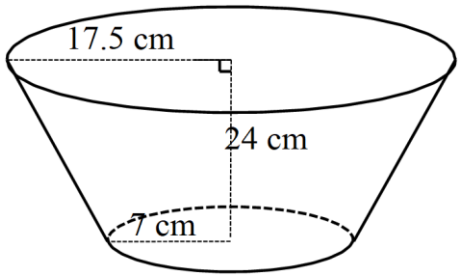
(b) Calculate the cost of maintaining the home monthly in 2021. (3 marks)

(c) In the year 2022 the cost of maintaining the home was Kshs.153 000 per month. In that year the costs of staff and health were 20% and 10% respectively more than those in 2021. Calculate

(i) The staff wages monthly costs in the year 2022. (2 marks)

(ii) The percentage increase in food cost between 2021 and 2022. (3 marks)

18. The figure below represents a bucket in the shape of a frustum of a cone. The base and the open top radii of the bucket measure 7 cm and 17.5 cm respectively and the height of the bucket is 24 cm.



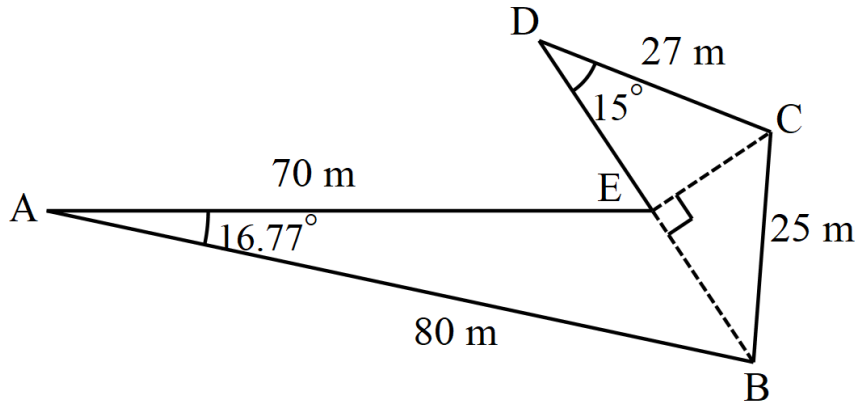
(a) Calculate the slant height of the bucket. (3 marks)

(b) Taking π to be 3.142, calculate correct to four significant figures;

(i) The surface area of the bucket. (4 marks)

(ii) The volume of the bucket. (3 marks)

19. The figure below represent a piece of land in the shape of an irregular pentagon ABCDE in which AB = 80 m, BC = 25 m, CD = 27 m, AE = 70 m, $\angle BAE = 16.77^{\circ}$, $\angle EDC = 15^{\circ}$ and angle CEB is right angle.



(a) Calculate to one decimal place;

(i) The length BE. (3 marks)

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

(b) Calculate the area of the piece of land ABCDE in hectares. (4 marks)

20. Four towns **P, Q, R,** and S are such that the town **Q** is 120 km due to East of town **P**. Town **R** is 160 km due north of town **Q**, town **S** is on a bearing of 330^0 from **Q** and on a bearing of 300^0 from **R**.

(a) Using a ruler and a pair of compass only, show the relative position of towns **P**, **Q**, **R**, and **S**. Take the scale of 1cm to rep. 50km. (5 marks)

(b) Use the drawing to determine

(i) The distance **SP** in km (2 marks)

(ii) The bearing of **S** from **P** (1 mark)

(iii) How far north S is from line **QP** produced (2 marks)

21. The following data represent the shoe sizes worn by 20 form four boys of Orero Boys High School

School. 7, 9, 8, 10, 8, 8, 9, 10, 8, 7, 9, 7, 8, 10, 9, 8, 7, 7, 8, 9

(a) Make a frequency distribution table for the data (2 marks)

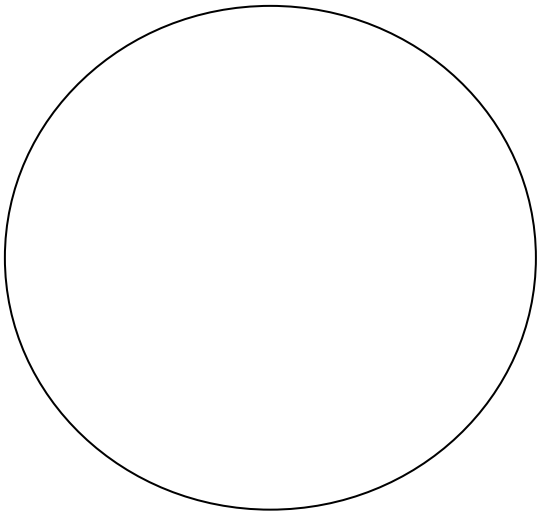
(b) Find the;

(i) mode; (1 mark)

(ii) mean; (2 marks)

(iii) median. (1 mark)

(c) Use the circle below to represent the above data in a pie chart (4 marks)



22. The position vectors of points A and B are $\mathbf{OA} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ and $\mathbf{OB} = \begin{pmatrix} 12 \\ -4 \end{pmatrix}$. A point M is on **AB** such that $\mathbf{AM} = \frac{1}{2}\mathbf{AB}$ and a point N is on **OB** such that $\mathbf{ON} : \mathbf{NB} = 1:3$.

(a) Find:

(i) **AB**; (2 marks)

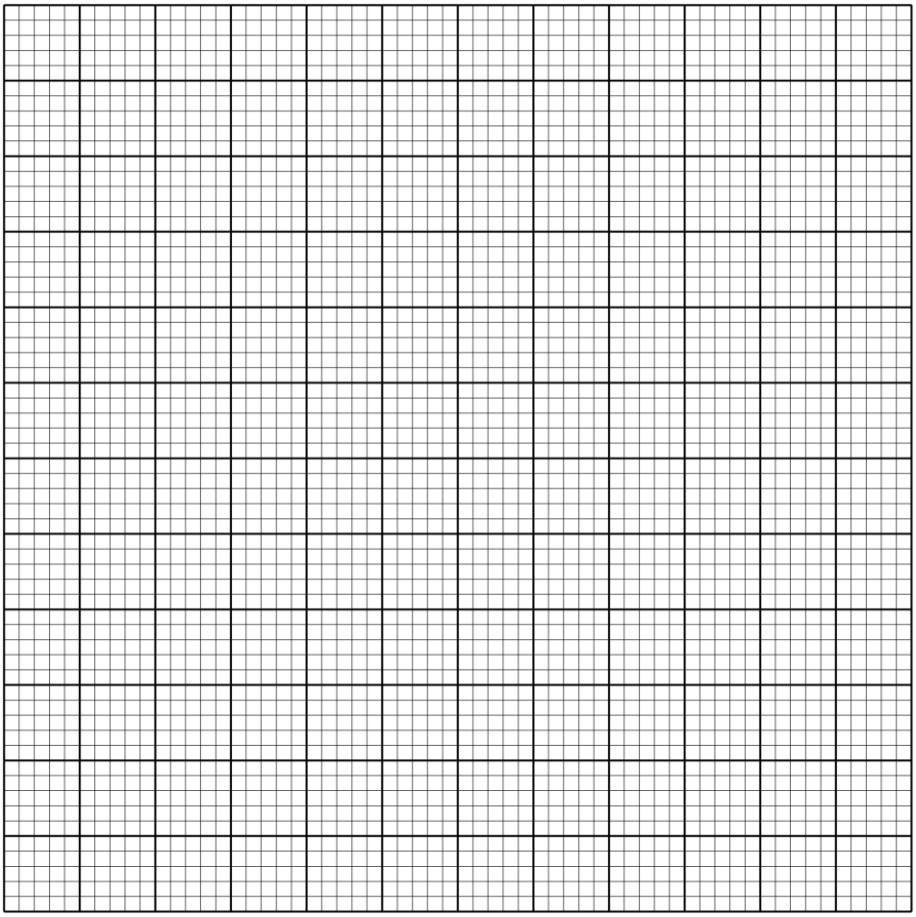
(ii) **NM**; (3 marks)

(iii) $|\mathbf{NM}|$, correct to 1 decimal place. (2 marks)

(b) A translation vector maps A onto $A'(5, -1)$. Find the coordinates of the image of B under the translation vector. (3 marks)

23. Triangle ABC has vertices $A(3,2)$, $B(6,2)$ and $C(5,5)$. The triangle $A'B'C'$ is the image of triangle ABC after translation vector $\vec{T} = \begin{pmatrix} -7 \\ 1 \end{pmatrix}$.

(a) On the grid below, draw the triangles ABC and $A'B'C'$. (2 marks)



(b) Triangle $A''B''C''$ is the image of triangle $A'B'C'$ after reflection in the line $y = x + 1$. On the same axes, draw triangle $A''B''C''$ and state its coordinates. (3 marks)

(c) Triangle $A'''B'''C'''$ is the image of $A''B''C''$ after a -90° turn about the origin (0,0). On the same axes, draw triangle $A'''B'''C'''$ and state its coordinates. (3 marks)

(d) State the type of congruence between the triangles:

(i) ABC and $A'B'C'$. (1 mark)

(ii) $A'B'C'$ and $A'''B'''C'''$. (1 mark)

24. (a) Find $\mathbf{A}^{-1}$, the inverse of matrix $\mathbf{A} = \begin{pmatrix} 6 & 5 \\ 4 & 7 \end{pmatrix}$. (2 marks)

(b) Owiye sells white and brown loaves of bread in his kiosk. On a certain day he sold 6 white loaves of bread and 5 brown ones for a total of Kshs.520. The next day he sold 4 white loaves and 7 brown ones for a total of Kshs.530.

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

(ii) Use matrix method to find the price of a white loaf of bread and that of a brown loaf of bread. (3 marks)

(c) A school canteen bought 240 white loaves of bread and 100 brown loaves of bread. A discount of 10% was allowed on each white loaf whereas a discount of 13% was allowed on each brown loaf of bread. Calculate the percentage discount on the cost of all the loaves of bread bought. (4 marks)

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