ORERO BOYS HIGH SCHOOL - 2024
Kenya Certificate of Secondary Education

FORM 3 HEADSTART EXAMS
121/1 MATHEMATICS Alt. A

Paper 1

January 2024 – 2 Hours 30 Mins

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 Without using a calculator, evaluate $\dfrac{^-2(5+3)-9\div3+5}{-3+-16\div-8\times4}$ (3 marks)

2 Solve for *x* in the equation; $64^{3x-1}\div16^{x+2}=256^{x}\times4^{2x}$ (3 marks)

3 A triangle ABC is such that AB = 11 cm, BC = 8 cm and $\angle$ ABC = 53°. Calculate the area of the triangle correct to 2 decimal places. (3 marks)

4 A line whose equation $2y - 5x - 3 = 0$ intersect with another line which passes through the points $(5,5)$ and $(-10,-1)$. Without drawing, show that the angle formed at the intersection of the two lines is 90º. (3 marks)

5 Two concentric circles are such that the ratio of their radii is 1:3. If the area of the annulus is 96.84 square units, calculate the area of the larger circle to 2 significant figures. (3 marks)

6 Simplify: $\dfrac{y^2 - 3xy + 2x^2}{xy^2 - 4x^3}$ (3 marks)

7 Find the least number such that the remainder is 71 when divided by 76 and the remainder is 47 when divided by 52. (3 marks)

8 A tourist arrived in Kenya with **M** US dollars. The money was converted into Kenya shillings in a bank which buys and foreign currencies as shown.

	Buying (Kshs)	*Selling (Kshs)*
1 *US Dolllar*	157.50	157.95
1 *Sterling Pound*	165.00	166.40

The tourist used Kshs.5 000 000 while in Kenya then converted the rest into Sterling Pound. Given that he received 5 200 Sterling Pounds, find **M**. (3 marks)

9 A regular polygon has the sum of its interior angles as 2160°.
(a) Find the number of sides of the polygon. (2 marks)

(b) How many triangles can be made by joining one of its vertices with all other vertices with straight lines? (1 mark)

10 Use reciprocal tables to evaluate; $\dfrac{5}{0.05456} - \dfrac{2}{\sqrt{68.752}}$ (3 marks)

11 If $\tan(90-\theta) = 2.4$, find the value of $\dfrac{\sin\theta - \cos\theta}{\cos\theta + \sin\theta}$ without using a calculator or tables.

(3 marks)

12 Find all the integral values of x which satisfy the equation;

$$\frac{5}{3} - 2x < 1 - \frac{2}{3}x \le 2 - x$$ (3 marks)

13 Under an enlargement of scale factor 3, the image of $Q(2,-6)$ is $Q'(0,2)$. Under the same enlargement the image of $D(x,y)$ is $D'(5,-2)$. Find the coordinates of object D.

(3 marks)

14 The sum of the digits in a three – digit number is nine. The tens 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)

15 Herbert's watch loses 3 seconds in every 5 minutes. He left home when his watch showed a correct time as 1:25:45 p.m. and cycled to the market 9 km away at an average speed of 12 km/h. Find the time by his watch when he arrived at the market. (4 marks)

16 Using a ruler and a pair of compasses only, construct a parallelogram PQRS in which PQ = 6 cm, QR = 4 cm and angle SPQ = 75º. Determine by construction the perpendicular distance between PQ and SR. (4 marks)

SECTION II (50 Marks)

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

17 A solid consist of a conical part, a cylindrical part and a hemispherical part. All the parts have the same diameter of 10 cm. The height of the cylindrical part is 15 cm and the slanting height of the conical part is 13 cm. Taking $\pi = 3.142$, calculate the;

(a) Height of the solid. (2 marks)

(b) Volume of the solid, correct to one decimal place. (4 marks)

(c) Surface area of the solid, correct to one decimal place. (4 marks)

18 The figure below represents the journey made by a leopard. It started at point A with an initial velocity of 20 m/s and accelerated uniformly for 30 seconds. It then maintained a constant velocity for 40 seconds after which it began to decelerate before coming to a halt at point B after a further 20 seconds. The total distance covered by a leopard was recorded as 5 500 m.
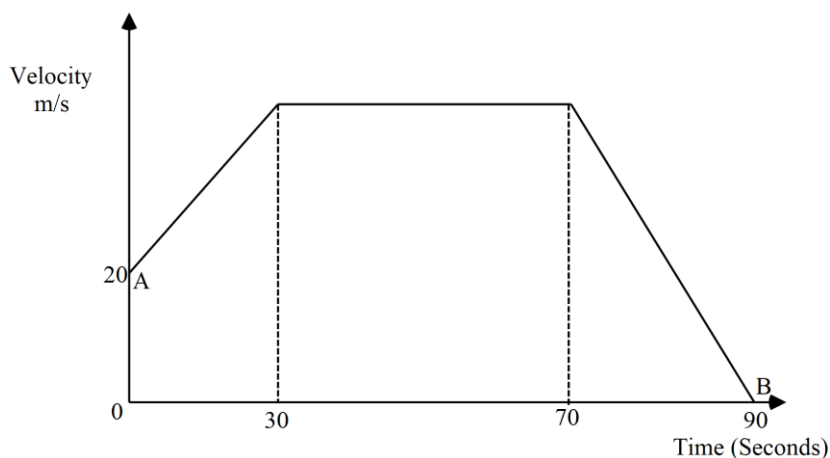
Using the information above, calculate;

(a) The maximum speed attained by the leopard in km/h.   (3 marks)

(b) The average speed of the leopard in 90 seconds.   (2 marks)

(c) The distance covered in the last 5 seconds.   (2 marks)

(d) The time it took to cover the last three quarters of the journey.   (3 marks)

19 The marks of 112 students in a certain school were recorded as follows;

38	78	33	25	60	48	63	28	65	70	66	34	60	68	88	45
46	56	59	59	33	60	70	77	45	20	24	72	82	28	32	86
78	44	50	68	70	59	83	85	56	44	91	73	55	70	80	58
81	49	75	72	43	64	90	32	72	48	86	74	92	77	49	38
89	75	83	48	39	30	54	60	40	52	53	68	40	74	68	78
92	90	69	52	59	66	79	45	59	70	59	71	62	53	58	36
25	73	36	70	55	80	28	32	81	26	66	70	90	49	61	44

(a) Starting with the lowest mark and using a class width of 10, prepare the frequency distribution table for the data. (3 marks)

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

(c) Using the table in (a) above, calculate to 1 decimal place;
   (i)   the mean mark. (3 marks)

   (ii) the median mark. (3 marks)

20 Two stations P and Q are such that Q is 600 km due East of P. Two safari rally cars M and N leave from P and Q respectively at the same time. Car M moves at 160 km/h on a bearing of N30ºE while car N moves at a speed of 280 km/h on a bearing of N45ºW. The two cars stopped after $2\frac{1}{2}$ hours. Using a scale of $\frac{1}{10^7}$;

(a) Show the positions of the cars after $2\frac{1}{2}$ hours. (5 marks)
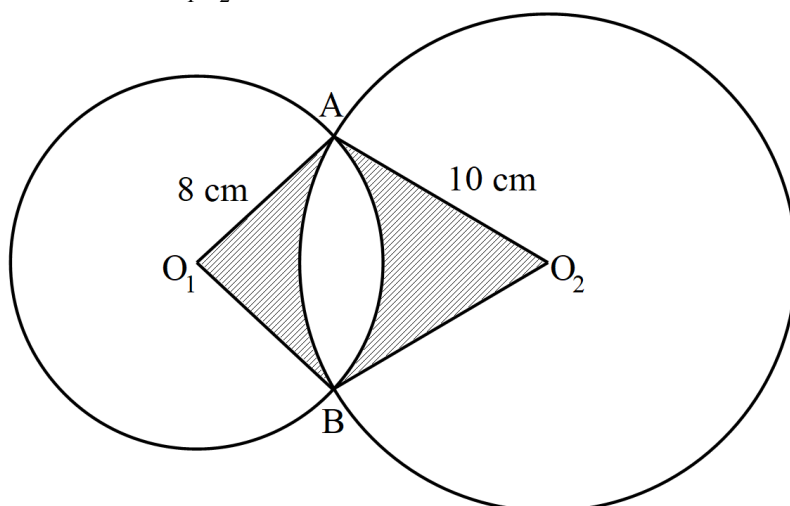
(b) Find the;

    (i)   distance between the two buses after $2\frac{1}{2}$ hours. (2 marks)

    (ii)   true bearing of M from N. (1 mark)

(c) Given that N stopped at the final destination. Find the total time car M took to reach the final destination. (2 marks)

21 The figure below shows two circles of radii 10 cm and 8 cm and with centres O_1 and O_2 respectively. The distance $O_1O_2 = 14$ cm.

Giving all answers to two significant figures, calculate;
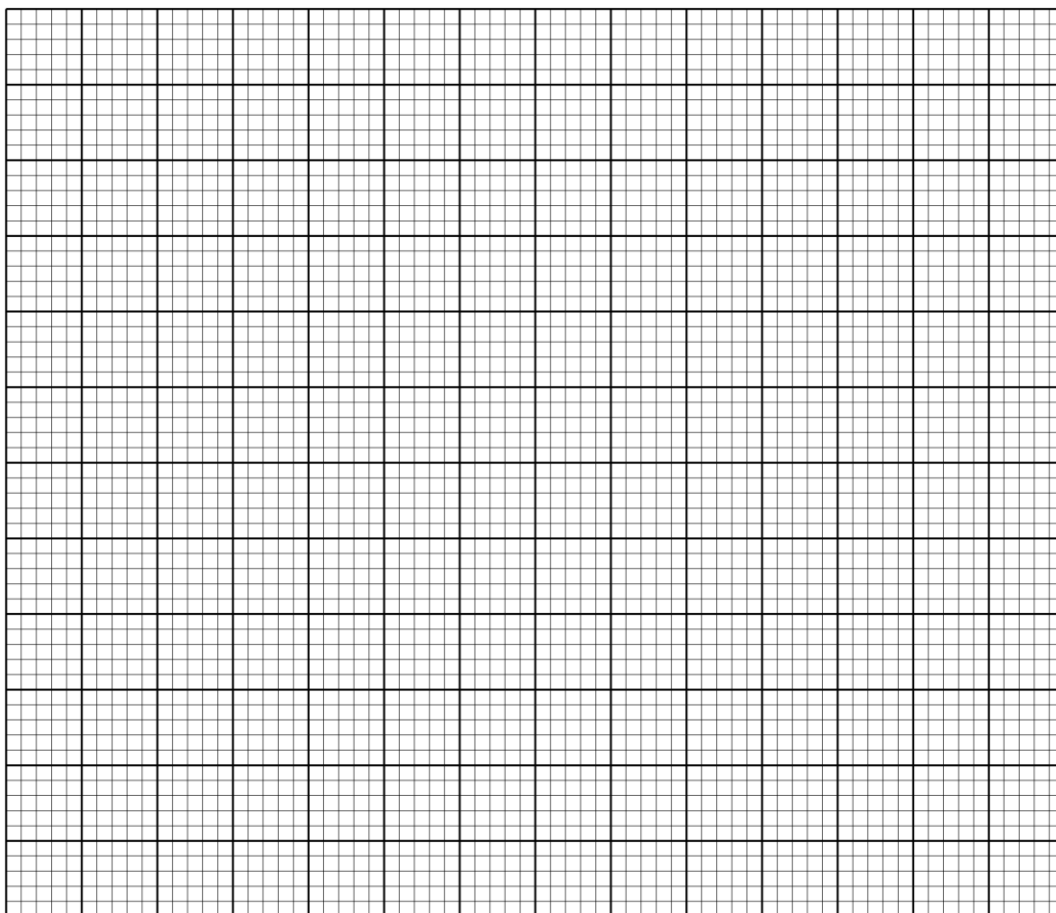(a) Angle AO_1B. (2 marks)

(b) Angle AO_2B. (2 marks)

(c) The area of the shaded part. (6 marks)

**22** (a) On the grid provided below, plot ABCD such that $A(2,6)$, $B(4,4)$, $C(2,0)$ and $D(4,0)$. (1 mark)

(b) A′B′C′D′ is the image of ABCD under a translation vector $\begin{pmatrix} -4 \\ -5 \end{pmatrix}$. Plot A′B′C′D′ and state its coordinates. (3 marks)

(c) Plot A″B″C″D″ the image of A′B′C′D′ after a rotation about $(-1,0)$ through a positive quarter turn. State its coordinates. (3 marks)

(d) A‴B‴C‴D‴ is the image of A″B″C″D″ after a reflection in the line $y = x + 2$. Plot A‴B‴C‴D‴ and state its coordinates. (3 marks)
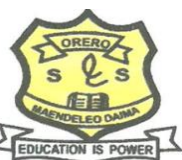
23 The figure below shows a circle centre O, which passes through the points A, B, C, D and E. Angle EAO = 28º , angle ECO = 12º and angle DEC = 32º.
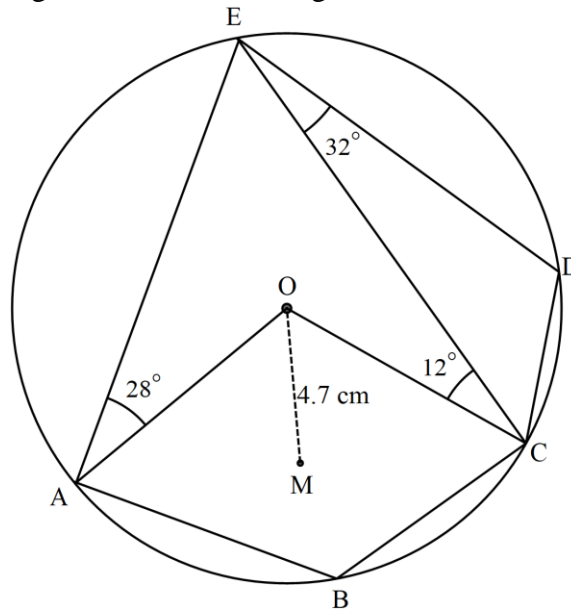
(a) Stating reasons, find the size of angles;

    (i)   ABC   (2 marks)

    (ii)   AOD Reflex.   (2 marks)

    (iii)   ADC   (2 marks)

    (iv)   OAD   (2 marks)

(b) Given that M bisects AC and OM = 4.7 cm, find the radius of the circle.   (2 marks)

24 The position vectors of points A and B are $\mathbf{OA} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$ and $\mathbf{OB} = \begin{pmatrix} -8 \\ 6 \end{pmatrix}$ respectively.

(a) Find;

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

    (ii) $\left| \mathbf{AB} \right|$ (2 marks)

(b) Points M and N are the mid – points of the lines OA and OB respectively. Find vector **MN**   (3 marks)

(c) Find the value of the scalars p and q given that $p\mathbf{OA} + q\mathbf{OB} = \mathbf{MN}$ (3 marks)

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