Name:..Adm. No......................Stream…….

Date................................Sign………………….

121/2
Mathematics Alt. A
May 2023
Form Four
Time: 2 ½ Hours

CHANIA HIGH SCHOOL
FORM FOUR SYLLABUS EXAMINATIONS, 2023

Kenya Certificate Of Secondary Education

Mathematics Alt. A
121/2
Time: 2 ½ Hours

INSTRUCTIONS TO CANDIDATES;

*(a) Write your **Name, Admission Number** and **Class** in the spaces provided.*
*(b) This paper contains **Section I** and **II.***
*(c) ` Attempt ALL questions in Section I and any **FIVE** in **Section II.***
(d) Show all your workings in the spaces provided below each question.
(e) Marks may be given for correct working even if the answer is wrong.
*(f) Use **Electronic Calculator** and **Mathematical Tables** where possible.*
(g) Candidates must check the question paper to ascertain that no pages are missing.

FOR EXAMINERS 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	25	TOTAL

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Section I: (50marks)

1.Under a transformation whose matrix is $\begin{pmatrix} x-1 & 3 \\ 1 & x+1 \end{pmatrix}$, an object of area 12cm^2 is mapped onto an image whose area is 60cm^2. Find the possible values of x. (3marks)

2.Solve for x in the equation
$-3\sin^2 x + 8\cos x = 0$ for $0^0 \leq x \leq 360^0$ (3marks)

3. Use the trapezoidal rule to approximate the area bounded by the curve $y = -x^2 - 3x + 10$ and the x-axis by using 4 trapezoids of equal width from x = -4 to x = 0 (3 marks)

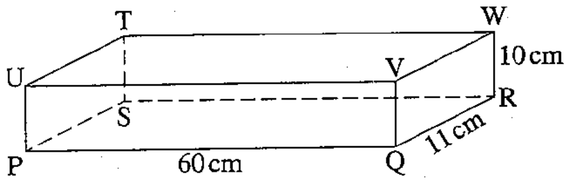
4. A point M (60^{o}N, 18^{o}E) is on the surface of the earth. Another point N is situated at a distance of 630 nautical miles east of M.Find

a) the longitude difference between M and N {2 marks}

b) the position of N. {1 mark}

5.The equation of curve; $y = x^3 + 2x + 1$. Find the equation of the tangent to the curve at point x = 1.
(3 marks

6. The figure below represents a cuboid PQRSTUVW. PQ = 60 cm, QR = 11 cm and RW = 10 cm.



Calculate the angle between line PW and plane PQRS, correct to 2 decimal places. {3 marks}

7. Calculate the standard deviation for the following set of data (use actual mean) (3marks)
9, 12, 13, 15, 16, 19.

8.Draw a line PQ = 4 cm. Indicate by shading the region within which a variable point must lie if $PA \leq 3cm$ and $PA > AQ$. **(3 marks)**

9. Complete the table below for the function $y = 3x^2 - 8x + 10$

x	0	2	4	6	8	10
y	10	6	26		138	

Hence estimate the area bounded by the curve $y = 3x^2 - 8x + 10$ and the lines $y = 0$, $x = 0$ and $x = 10$ using trapezoidal rule with 5 strips. (3marks)

10. Evaluate $\int_{-1}^{2} (2x^2 - 3x - 14)dx$ (3mks)

11. Find the area under curve $y = x^2 + 2$, between x = 2 and x = 6 by trapezium rule sing 4 strips. **(3 marks)**

12. Solve for ϑ in the equation. **(4 marks)**

$Sin(2\theta - 10) = -0.5$ for $0^0 \leq \theta \leq 360^0$

13. The table below shows the number of defective bolts from a sample of 40

No of bolts	0	1	2	3	4	5
Frequency	20	8	6	4	1	1

Calculate the standard deviation of the data above. (4mks)

14. State the amplitude, period and phase angle of $y = 2\sin\left(\frac{1}{2}x + 30^0\right)$

(i) Amplitude **(1 mark)**

(ii) Period **(1 mark)**

(iii) Phase angle **(1 mark)**

15. The marks obtained by 10 students in a maths test were:-

25, 24, 22, 23, ***x*,** 26, 21, 23, 22 and 27

The sum of the squares of the marks, $\Sigma x^2 = 5154$

Calculate the:

(a) value of ***x*** ***(2mks)***

(b) Standard deviation (2mks)

16. Solve the equation $4 - 4\cos^2 x = 4\sin x - 1$ for the range $0° \leq x \leq 360$

(3 mks)

SECTION B (50 MARKS)

*Answer any **five** questions in this section*

17.Two towns P and Q lie on the same parallel latitude such that P is due east of Q. When local time at Q is 9.50 am, the local time at P is 3.12 pm.

(a) Find the latitude difference between P and Q. **(2 marks)**

(b) Give that the longitude of P is 52^0E, find the longitude of Q. **(2 marks)**

(c)A pilot took off from town Q and flew to town P along the parallel of latitude. The pilot took 3 ¼ hours travelling at an average speed of 860km/h to reach P. Calculate to 1 d.p the latitude of town P and Q if they both lie in the northern hemisphere.
(3 marks)

(d)Two towns R and S are both on the equator and 3820nm apart. Town R is due west of town S. Find the local time at R when the local time at S is 2.20 pm. (Take R = 6370km and $\pi=\frac{22}{7}$)
(3 marks)

18.The marks of 50 students in a mathematics test were taken from a form 4 class and recorded in the table below

Marks	21-30	31-40	41 -50	51 -60	61 - 70	71 - 80	81 – 90	91 - 100
frequency	2	5	7	9	11	8	5	3

a) On the grid provided, draw a cumulative frequency curve of the data, using 1cm to represent 5 students and 1cm to represent 10 marks. (3marks)

b) From your curve in (a) above;

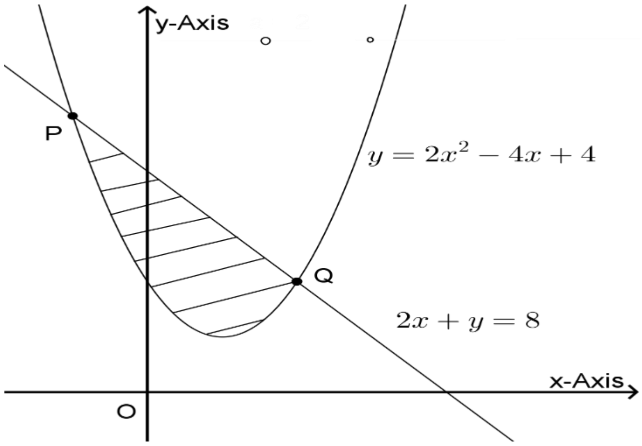
i) Estimate the median mark (1mark)

ii) Determine the interquartile deviation (2marks)

iii) Determine the 10^{th} to 90^{th} percentile range. (2marks)

c) It is given that students who score over 45 marks pass the test. Use your graph in (a) above to estimate the percentage of students that pass. (2marks)

19. The diagram below shows a straight line $2x + y = 8$ intersecting the curve $y = 2x^2 - 4x + 4$ at the points P and Q.



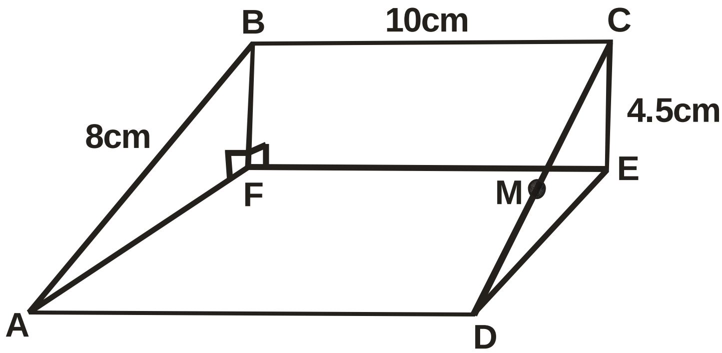
(a) Find the coordinates of P and Q.

(3 marks)

(b) Calculate the area of the shaded region. (4 marks)

(c) Find the coordinates of the stationary points on the curve $y = 2x^2 - 4x + 4$ (3 marks)

20.



The above diagram represents a wooden prism. ABCD is a rectangle. Points E and F are directly below C and B respectively. M is the midpoint of CD. AB = 8cm, BC= 10cm and CE= 4.5cm.

a) The size of angle CDE. (2 marks)

b) Calculate:

i) Length of AC. (2 marks)

ii) The angle CAE makes with the plane ADEF. (2 marks)

c) Find the:

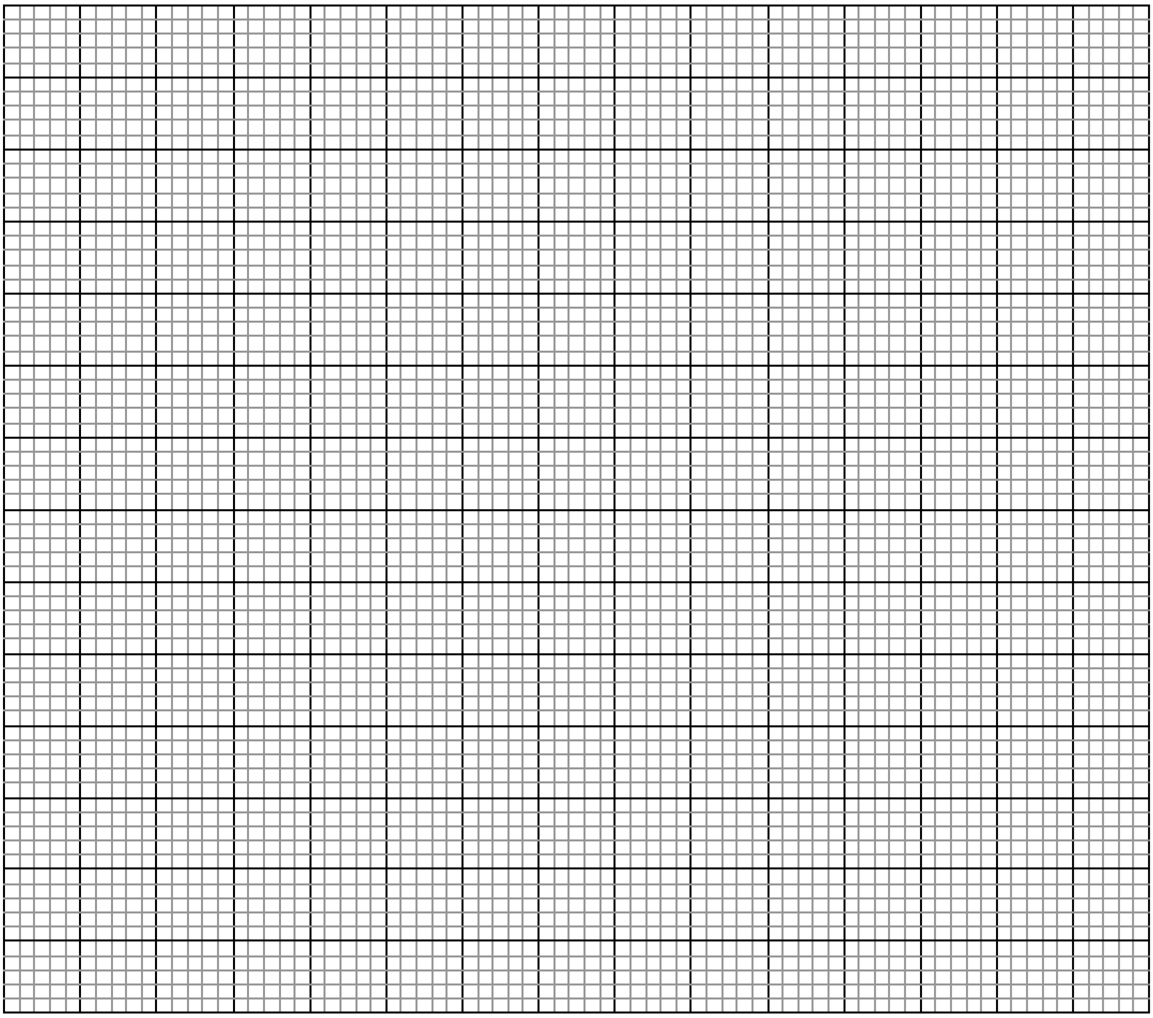
i) Length of MB. (2 marks)

ii) Angle CBM. (2 marks)

21. Complete the table below, giving the values correct to 1 decimal place. {2 marks}

x^o	0	40	80	120	160	200	240
$2 \sin (x + 20)^o$	0.7		2.0		0.0		-2.0
$\sqrt{3} \cos x$	1.7	1.3		-0.9		-1.6	

b) On the grid provided, using the same scale and axes, draw the graphs of $y = 2 \sin (x + 20)^o$ and $y = \sqrt{3} \cos x$ for $0^o \leq x \leq 240^o$. {6 marks}



c) Use the graphs drawn in (b) above to determine:

i) the values of x for which $2 \sin (x + 20) = \sqrt{3} \cos x$ {2 marks}

22. a) A triangular garden ABC is such that AB = 8cm, ∟BAC = 45^0 and ∟ABC = 75^0. Using an appropriate scale draw the garden using a ruler and pair of compasses only (3 marks)

b) A water tap P is to be mounted in the garden such that it is equal in distance from A, B and C. on the diagram in (a) show he position of point P. (3 marks)

a) A section of the plot is enclosed such that a region R is formed under the following conditions.

i) CR ≥ 1.5m (2 marks)

ii) R is more than 2m from line AB (1 mark)

iii) R is nearer to CB than CA. Shade the region R formed (1 mark)

23. The displacement S metres of a particle from a fixed point in motion at any given time (t) seconds is given by $s = 3t + {}^{3}/_{2}t^{2} - 2t^{3}$.

a) Find the initial acceleration. (3 marks)

b) Calculate

i) The time when the particle was momentarily at rest (2 marks)

ii) Its displacement by the time it comes to rest momentarily (2 marks)

iii) Calculate the maximum velocity attained (3 marks)

24. A firm has a fleet of vans and trucks. Each van can carry 9 crates and 3 cartons. Each truck can carry 4 crates and 10 cartons. The firm has to deliver not more than 36 crates and at least 30 cartons.

(a) If x vans and y trucks are available to make the delivery. Write down inequalities to represent the above information. (4 marks)

(b) Use the grid provided, to represent the inequalities in (a) above (4 marks)

(c) Given that the cost of using a truck is four times that of using a van, determine the number of vehicles that may give minimum cost (2 Marks)

25. The marks of 50 students in a mathematics test were taken from a form 4 class and recorded in the table below.

Mark (%)	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	2	5	7	9	11	8	5	3

(a) On the grid provided, draw a cumulative frequency curve of the data. (3marks)

(b) From your curve in (a) above

(i) Estimate the median mark. (1mark)

(ii) Determine the Interquartile deviation. (2marks)

(iii) Determine the 10^{th} to 90^{th} percentile range. (2marks)

(c) It is given that students who score over 45 marks pass the test. Use graph in (a) above to estimate the percentage of students that pass. (2marks)

26. A triangle ABC with vertices at A (1,-1) B (3,-1) and C (1, 3) is mapped onto triangle $A^1B^1C^1$ by a transformation whose matrix is $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

Triangle $A^1B^1C^1$ is then mapped onto $A^{11}B^{11}C^{11}$ with vertices at A^{11} (2, 2) B^{11} (6, 2) and C^{11} (2,-6) by a second transformation.

(i) Find the coordinates of $A^1B^1C^1$ (3 marks)

(ii) Find the matrix which maps $A^1B^1C^1$ onto $A^{11}B^{11}C^{11}$. (2 marks)

(iii) Determine the ratio of the area of triangle $A^1B^1C^1$ to triangle $A^{11}B^{11}C^{11}$. (3 marks)

(iv) Find the transformation matrix which maps $A^{11}B^{11}C^{11}$ onto ABC (2 marks)