CHAMPIONS JET II, 2024

Kenya Certificate of Secondary Education

121/2 MATHEMATICS ALT. A Paper 2
JULY 2024 – TIME : 2½ HOURS

Name: ……... Adm No: …….……

Index Number: …….……... Candidate's Signature: …….……....

School: …… Stream ……..

Instructions to Candidates

(a) Write your name, Adm. Number and stream in the spaces provided at the top of this page.
*(b) This paper consists of **TWO** sections: **Section I** and **Section II**.*
*(c) Answer **ALL** the questions in **Section I** and any **five** questions from Section **II**.*
***(d)** Show all the steps in your calculation, giving your answer at each stage in the spaces provided below each question.*
(e) Marks may be given for correct working even if the answer is wrong.
*(f) **Non-programmable** silent electronic calculators and **KNEC** Mathematical tables may be used, except where stated otherwise.*
(g) This paper consists of 15 printed pages.
(h) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(i) 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** questions in this section in the spaces provided.*

1. Find two possible values of E that would make the expression given below a perfect square.

   $(33 + E)w^2 + (100 - E)w + 36$ (3marks)

2. The first and the last terms of an arithmetic progression are **-11$\frac{1}{11}$** and **-20$\frac{1}{11}$** respectively. Find the sum of all the terms of this progression, given that it has only 154 terms. (3marks)

3. A firm obtain a loan of Ksh. 30,000,000 from a bank that charged interest at the rate of r% p.a compounded quarterly. By the end of 1 ½ years, the firm cleared the loan by paying a total of Ksh.53,146,830. Calculate the rate of interest (r) (3marks)

4. The distance between two parallel chords on the opposite sides of the Centre of a circle is 8.2cm. If the diameter of the circle is 11.6cm and the length of one of the chords is 8.4cm, find the length of the other chord. (3 marks)

5. A circle whose Centre is $C(a, b)$ and radius r passes through $A(2, -4)$, B(10,8) and $D(9,3)$.
   a) Find the co-ordinates of C and the values of r (1marks)

   b) Find the equation of the circle in the form $x^2 + y^2 + ex + fy + g = 0$ where $e, f \ and \ g$ are integers (2marks)

6. Adhudha takes 7.2 minutes to mop a banking hall, Swayasuya mopping the banking hall together with Adhurudhaya take the same time as Adhudha. Working alone, Adhurudhaya takes 18 minutes to complete the work. How long does Swayusuya take to complete the work when moping alone. (3marks)

7. The table below shows Kenyan tax rates in a certain year.

Annual taxable income in Kenyan pounds	Tax rates Ksh per pound
1-8088	1
8089-16176	2
16177-24264	3.5
24265-32352	5.5
Over 32352	7

In that year Brenda earned a salary of Ksh.55885 per month. She was entitled to a monthly tax relief of Ksh. 975.

Calculate;

a) Brenda's annual salary in KE (1 mark)

b) The monthly tax paid by Brenda in Ksh. (3 marks)

8. The area of triangle ZPU is 19cm^2. The triangle is transformed using the matrix

$$\begin{pmatrix} 15 & 11 \\ -3 & -2 \end{pmatrix}$$

Calculate the area of the image of triangle ZPU (3marks)

9. The length of a road is given as 50km to the nearest 5km. Calculate
   a) The maximum and minimum length of the road (1 mark)

   b) The percentage error in this measurement (2marks)

10. Solve the equation $2\ cos\ 2\theta = 1$ for $0^o \leq \theta \leq 360^o$ (3marks)

11. a) Expand $\left(1 - \frac{1}{2}x\right)^4$ in ascending powers of x (2marks)

   b) Use the first three terms of the expression in a above to evaluate (0.995) (2marks)

12. Simplify $\frac{3}{\sqrt{5}+2} + \frac{1}{\sqrt{5}}$ leaving your answer in the form $a + b\sqrt{c}$, when a,b and c are rational numbers. (3marks)

13. Solve for x in the equation

$(\log_3 x)^2 - \frac{1}{2}\log_3 x = 3$ (3marks)

14. A coffee blender has two brands of coffee, brand A and brand B. A kilogram of brand A costs Ksh. 70 while a kilogram of brand B costs Ksh. 64. In what ratio should he mix the two brands to make a blend which costs Ksh. 68 per kilogram. (3marks)

15. The roots of a quadratic equation are $x = \frac{4}{3}, x = \frac{-1}{2}$ and $x = 1$. Form the cubic equation in the form $ax^3 + bx^2 + cx + d = 0$ where a, b, c and d are integers. (3marks)

16. Draw a line AB =6cm long, construct and show the locus of P such that <APB= 60^0 (3marks)

SECTION II (50 marks)

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

17. P and Q are two airports on latitude 50^0N. P is at longitude 40^0W and Q is 12865.10km from P a long a parallel of latitude to the east. Take $\pi \frac{22}{7}$ and R =6370km.

    a) Find the position of airport Q (3marks)

    b) Calculate the distance from point P to Q a long a great circle (3marks)

    c) A pilot leaves port P at 8:30 am flying at 750 knots to Q through the shortest distance. At what time did she arrive at Q (4marks)

18. The force of attraction F between two masses M and N varies directly as the product of the two masses and inversely as the square of the distance between them.
a) If **h** is the constant of proportionality and **d** is the distance between the masses express the relationship with an equation. (3marks)

b) Find the percentage decrease in F if M is increased by 80%, N decreased by 15% and d is doubled. (4marks)

c) Find the % change in d when M is halved, N is increased by 32% and F is decreased by 40% (4marks)

19. In a chemistry class, $\frac{1}{3}$ of the students are girls and $\frac{4}{5}$ of the boys and $\frac{9}{10}$ of the girls are right handed. The probability that a right-handed student breaks a conical flask in any practical session is $\frac{3}{10}$, and the corresponding probability for a left-handed is $\frac{4}{10}$ regardless of sex.

a) Determine the probability that a student chosen at random from the class is left-handed and does not break a conical flask. (4marks)

b) Determine the probability that a conical flask is broken in any chemistry practical session (3marks)

c) Determine the probability that a conical flask is not broken by a right-handed student (3marks)

20. A transformation M = $\begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$ followed by a transformation E = $\begin{pmatrix} 2 & 5 \\ -1 & -3 \end{pmatrix}$ is equivalent to a transformation N.

a) Find the matrix for N (3marks)

b) Find the matrix for the inverse of N (3marks)

c) Point F and G map onto F^1 (3,-10) and G^1(2, -6) respectively under the inverse of N. Determine the coordinates of F and G (4marks)

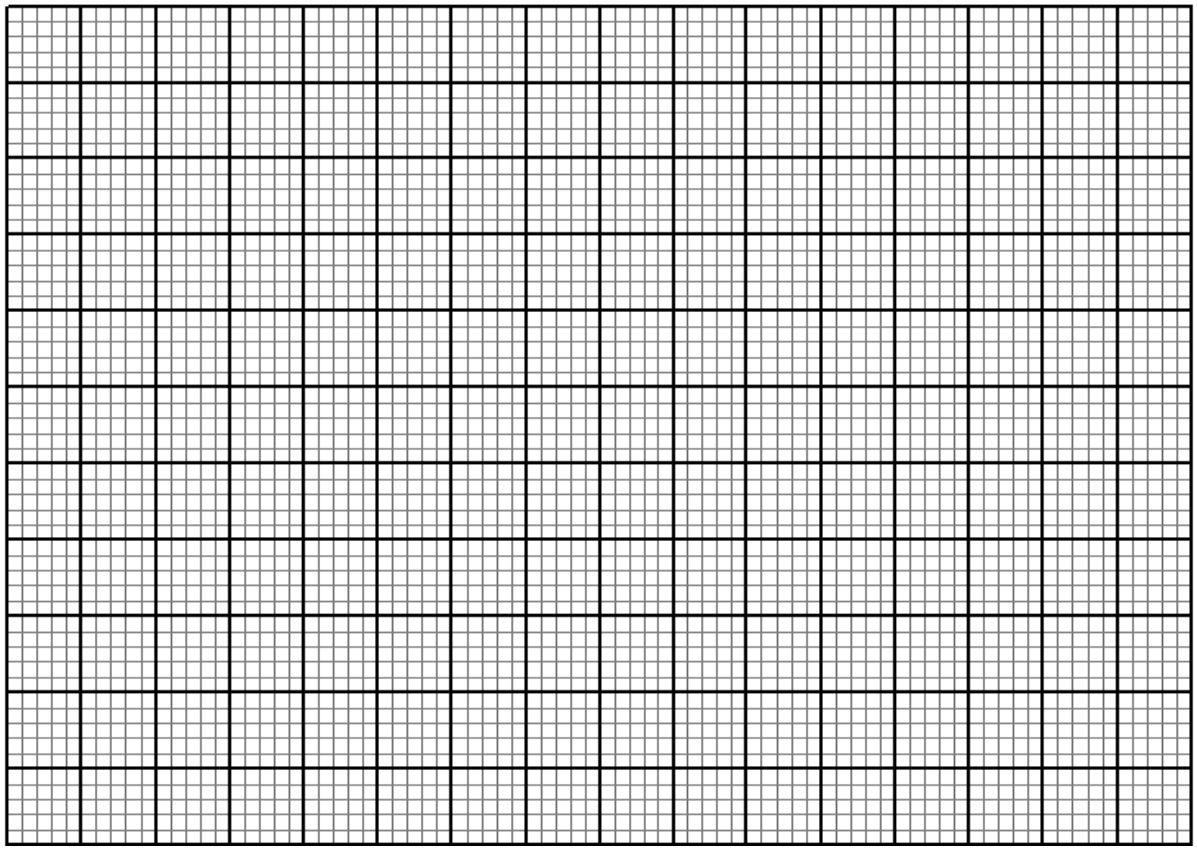
21. The table below shows the distribution of marks of some 200 candidates.

Marks (x)	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency (f)	12	21	27	72	31	13	24

a) By using assumed mean of 64.5, calculate to two decimal places the standard deviation.

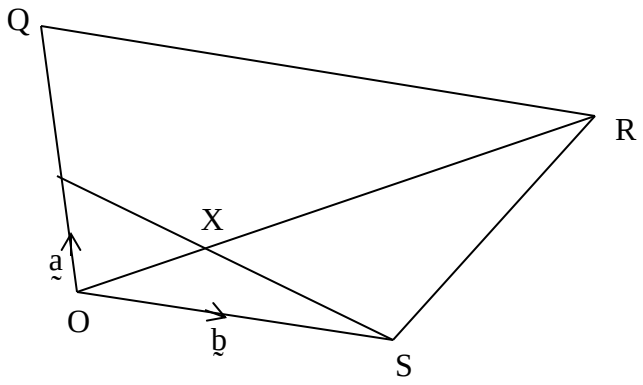
(4marks)

b) Draw an ogive to represent the data (3marks)



c) Use the ogive to determine the quartile deviation. (3marks)

22. In the diagram below, **OP= $\underset{\sim}{a}$** and **OS**= $\underset{\sim}{b}$, **SX**=hSP, **OQ = 3a** and **QR= 2b**.



Express

a) i) **SP** in terms of **a** and **b** (1mark)

ii) **OR** in terms of a and b (1mark)

b) i) Show that $OX = ha + (1-h)b$ (2marks)

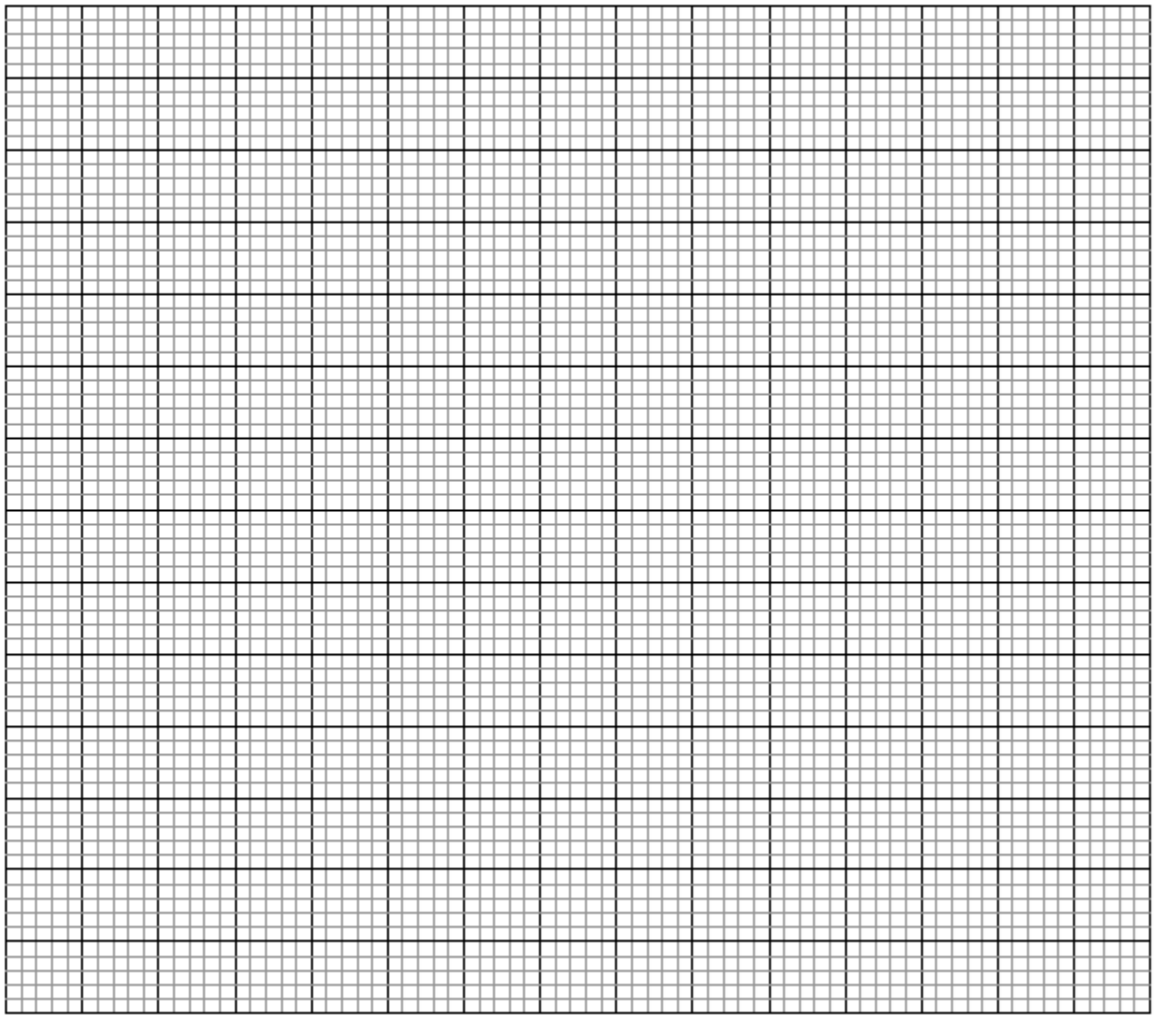
ii) Given that $OX = kOR$, find the values of h and k (5marks)

c) Determine the ratio OX: XR (1mark)

23. A draper is required to supply two types of shirts, types A and type B. The total number of shirts must not be more than 400. He has to supply more of type A than type B. However, the number of type A shirts must not be more than 300 and number of the type B shirts must not be less than 80. Let x be the number of type A shirts and y be the number of type B shirts.

a) Write down in terms of x and y all the linear inequalities representing the information above (4marks)

b) On the grid provided draw the inequalities and shade the unwanted region. (4marks)



c) The profit were as follows;Type A Ksh. 600 per shirts and Type B Ksh. 400 per shirt

i) Use the graph to determine the number of each type that should be made to maximize the profit. (1mark)

ii) Calculate the maximum profit (1mark)

24. The equation of a curve is given by $y = 2x^2 - 4x + 5$.

a) Using trapezoidal rule of 7 ordinates, estimate the area under the curve, the x-axis and the lines $x = 1 \; and \; x = 2$ (4marks)

b) Find the exact area under the curve $y = 2x^2 - 4x + 5$, the x axis and the lines $x = 1 \; and \; x = 2$ (4marks)

c) Calculate the percentage error in the approximated area (2marks)