NYAHOKAKIRA CLUSTER THREE EXAMINATION 2022

Kenya Certificate of Secondary Education

121/2 **MATHEMATICS ALT. A** **Paper 2**

OCTOBER, 2022 – TIME: 2½ HOURS

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

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 only 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 14 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**.*

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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: **Answer ALL questions in the spaces provided for each**

1.Use logarithms to evaluate; $\sqrt[3]{\frac{0.6873 \times 438.7}{396.8}}$ (4 marks)

2. Evaluate by rationalizing the denominator and leaving your answer in surd form. (3marks)

$$\frac{\sqrt{8}}{1+Cos45^0}$$

3. $A(50°S, 20°E)$ and $B(50°S, 160°W)$ are two points on the earth's surface. Calculate the the shortest distance between A and B in kilometer. (Take $\pi = \frac{22}{7}$ $and\ R = 6370km$). (3 Marks)

4.The ends of a diameter of a circle at circumference are $(2,3)$ and $(8,-5)$. Find the centre and radius of the circle. (3marks)

5. In a chemistry experiment a girl mixes some acid at 45% concentration with some other acid solution at 20% concentration. In what ratio should the two acids be mixed in order to get $100cm^3$ of a solution with 25% acid concentration? (3marks)

6. (a) Expand$(x - 0.2)^5$ in ascending powers of x. (2marks)

(b) Use your expansion up to the fourth term to evaluate 9.8^5. (2marks)

7. The position vectors of points A and B are $\mathbf{5i + 4j - 6k}$ and $\mathbf{2i - 2j}$ respectively. A point X divides AB in the ratio $\mathbf{5 : -3}$. Find the coordinates of X. (3marks)

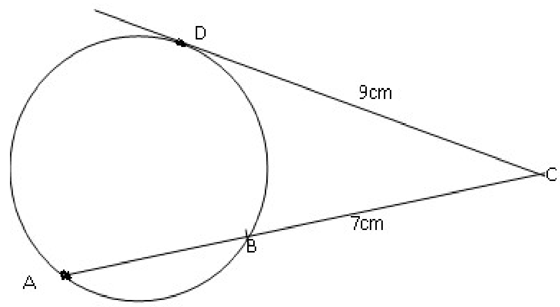
8. Using a ruler and a pair of compasses only, construct rectangle ABCD such that $AB = 5.2cm$ and $BC = 3.6cm$. On the rectangle, construct the locus L_1 of points equidistant from A and B to meet with another locus L_2 of points equidistant from AB and BC at M. (4marks)

9. A variable y varies as the square of x and inversely as the square root of z. Find the percentage change in y when x is increased by 10% and z decreased by 36%. (3 marks)

10. The dimensions of a rectangle are 40cm and 45cm. If there is an error of 5 % in the dimensions find the percentage error in calculating area of the rectangle. (3marks)

11. Given that matrix $T = \begin{pmatrix} 4x & 3 \\ x+1 & 2 \end{pmatrix}$ transforms a triangle onto a straight line, determine the value of $\boldsymbol{x}$ (2marks)

12. In the diagram below, CD is a tangent to the circle at point D. If BC = 7cm and CD = 9cm, calculate the length of the chord AB. (3marks)



13. Find the root mean square deviation of the following: 250, 258, 262 and 257 and 283.

(3marks)

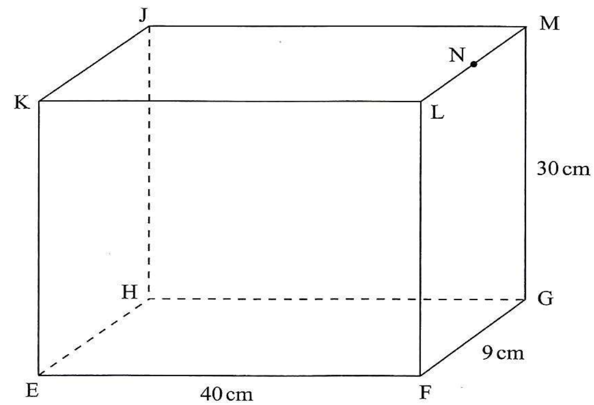
14. Find the equation of the tangent to the curve $y = \frac{1}{4}x^2 - 5$ at $(6,4)$ (3marks)

15. Solve the following quadratic equation by completing the square.
$2x^2 = 1.5 - 7x$ (3marks)

16. The following linear inequalities relates to cakes(x) and loaves of bread(y), $x > 20$, $y > 10$, and $7x + 8y \leq 280$. A profit of Ksh.50 on each cake and Ksh. 60 on each bread is made, determine the maximum profit. (3marks)

SECTION II: *Answer **only five** questions from this section*

17. The figure below represents a cuboid ***EFGHJKLM*** in which $EF = 40cm$, $FG = 9cm$ and $GM = 30cm$. ***N*** is the midpoint of ***LM***.



Calculate correct to 4 significant figures

a) The length of GL (1mark)

b) The length of FJ (2marks)

c) The angle between EM and the plane EFGH (3marks)

d) The angle between the planes EFGH and ENH (2marks)

e) The angle between the lines EH and GL (2marks)

18. a) Complete the table below for $y = 2\sin(2x + 30)$ and $y = 3\cos x$ 1 d.p. (2marks)

x^0	**0**	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**	**300**	**330**	**360**
$y = 2\sin(2x + 30)^0$	**1.0**			**-1.0**	**-2.0**				**1.0**				**1.0**
$y = 3\cos x^0$			**1.5**		**-1.5**		**-3.0**			**0**		**2.6**	

Draw the graph of $y = 2\sin(2x + 30)$ and $y = 3\cos x$ on the same axes. (5marks)

Scale: 1cm to represent 30^0 on horizontal axis and 1 cm to represent 1 unit on vertical scale.

c) Using the graph solve $2\sin(2x + 30) - 3\cos x = 0$ (2marks)

d) State the period and amplitude of the curve $y = 2\sin(2x + 30)$ (1mark)

19. The acceleration a m/s^2 of a particle passing through a fixed point O at any given time t seconds

is given as $a = \left(\frac{1}{2} - t\right) m/s^2$. Given that the initial velocity of the particle is 10 m/s;

Calculate:

(a) (i) the velocity of the particle at any given time t (2 marks)

(ii) The time at which the particle is momentarily at rest (3 marks)

(b) The maximum velocity attained by the particle (2 marks)

(c) The displacement of the particle during the 3rd second (3marks)

20. Type equation here.A bag contains 8 red balls and 6 blue balls all identical in size and shape. Jane selected 3 balls at random without replacement.

(a) Draw a tree diagram to represent this information. (2marks)

(b) Calculate the probability that she chooses

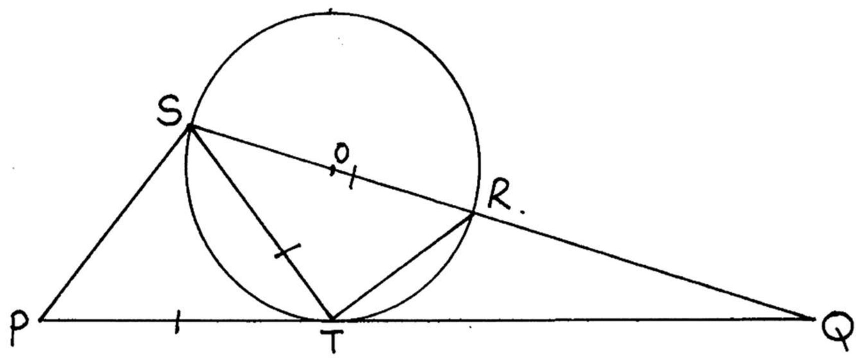
(i) two blue balls and one red ball. (2marks)

(ii) Two red balls and one blue ball. (2marks)

(iii) At least one blue ball. (2marks)

(iv) Three balls of the same colour. (2marks)

21. In the figure below O is the centre of the circle and PTQ is the tangent at T. If PT=ST and angle $SRT = 52°$. Determine the size of the angles below giving reasons:



(a) PTS (2marks)

(b) RTQ (2marks)

(c) TSR (2marks)

(d) TQR (2marks)

(e) PSQ (2marks)

22. a) The 8^{th} term of an arithmetic progression is 28. The sum of the 3^{rd} and 7^{th} term of the same arithmetic progression is 47. Find.

i) The first term and common difference (3marks)

ii) The sum of the first 20 terms of the arithmetic progression. (2marks)

b) The 2^{nd}, 12^{th} and 42^{nd} of an arithmetic progression (A.P) are the first three terms of a geometric progression (G.P). The first term of the arithmetic progression is 4. Find:

i) The common difference of the A.P. (3marks)

ii) The sum of the first 8 terms of the G.P. (2marks)

23. The table below shows the annual income rates for the year 2021

INCOME (Kenyan Pounds p.a)	TAX (Ksh/ Pound)
1 – 4,800	2
4,801 – 9,600	3
9,601 – 14,400	5
14,401 – 19,200	7
19,201 – 24,000	9
24,001 – OVER	10

Oyugi's monthly earnings were as follows:

Basic salary Ksh 54,000
House allowance Ksh 23,000
ssMedical Allowance Ksh 8000

a) Oyugi contribute 7.5% of his basic salary to a pension scheme which is exempted from taxation. Calculate his PAYE if his family relief is sh 1410 per month (6marks)

b) If Oyugi pays Ksh 500 for NHIF, Ksh 3200 for hire purchase and Ksh 25,250 for loan repayment. **Calculate** his net salary. (4marks)

24. A, B and C have coordinates (1,2), (2,4) and (4,4) respectively. Matrix $M = \begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$ maps ABC onto $A_1B_1C_1$.

a) Determine the coordinates of $A_1B_1C_1$ (3marks)

b) Matrix $N = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps $A_1B_1C_1$ onto $A_2B_2C_2$, determine the coordinates of $A_2B_2C_2$ (3marks)

c) Determine matrix P which maps ABC onto $A_2B_2C_2$ (2marks)

d) Find the matrix Q which maps $A_2B_2C_2$ onto ABC (2marks)