NAME……………………………………………………….….. ADM ..……………………

SCHOOL…………………………………………STREAM…………………DATE……………………

121/2A (Alternative A)
MATHEMATICS PAPER 2
JUNE 16TH 2023.
Time: 2 ½ hours

SOUTH NYANZA MATHEMATICS

Marking Centre: Kilgoris Boys.

INSTRUCTIONS TO CANDIDATES:

a)   Write your name, admission number and school in the spaces provided
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)   All answers and working must be written on the question paper in the spaces provided below
e)   Show all the steps in your calculations giving your answer at each stage in the space below each question.
f)   Marks may be given for correct working even if the answer is wrong
g)   Use calculators and KNEC mathematical tables except stated otherwise

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

GRAND TOTAL

17	18	19	20	21	22	23	24	TOTAL

Answer All Questions in this section.

1. Simplify completely;

    (4marks)

    $$\frac{2x^2 - 98}{3x^2 - 16x - 35} \div \frac{x+7}{3x+5}$$

2. Brand **A** tea costing Kshs.80 per kg is mixed with Brand **B** tea costing Kshs.100 per kg such that the mixture is sold at Kshs.114 making a profit of 20%. Find the ratio of **A:B** (3marks)

3. The floor of a rectangle room measures 4.8m by 3m. Estimate the % error in calculating the area.   (3marks)

4. Expand $\left(1 + \frac{1}{2}x\right)^8$ up to the term x^3. Use your expansion to find the approximate value of $(1.05)^8$ correct to 2 decimal places. (4marks)

5. Without using tables or calculator evaluate

$$\frac{Log\,729 - \log 81}{Log\,3}$$

(3marks)

6. Make x the subject of the formula (3marks)

$$b = \frac{C\sqrt{x^2 - 1}}{x}$$

7. The mass, in kilogram, of 9 sheep in a pen were
13, 8, 16, 17, 19, 20, 15, 14, and 11, calculate the quartile deviation (3marks)

8. If $\dfrac{\sqrt{3}}{2-\sqrt{5}} = a\sqrt{b} + c\sqrt{d}$, find the values of **a, b, c** and **d** where they are rational numbers.
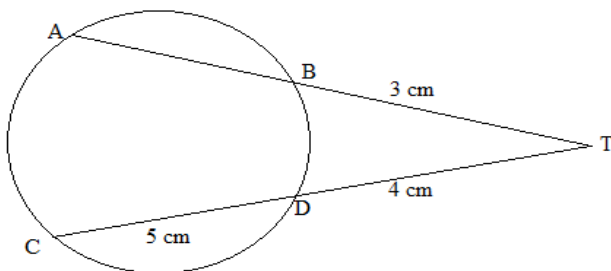
(3marks)

9. Maina bought a new laptop on hire purchase. The cash value of the laptop was Ksh. 56,000. He paid a deposit of Ksh. 14,000 followed by 24 equal monthly installments of Ksh. 3500 each. Calculate the monthly rate at which the compound interest was charged.   (3marks)

10. A point C divides the line AB with coordinates A (3, 4 ,-5) and B (-1,10,7) externally in the ratio 5 **:** 3. Find the coordinates of C   (3marks)

11. Solve for x in the equation $2 \sin^2 x - 1 = \cos^2 x + \sin x \ for \ 0° \le x \le 360°$ (4marks)

12. A student at a certain college has 60% chance of passing an examination at the first attempt. Each time a student fails and repeats the examination his chances of passing are increased by 15%. Calculate the probability that a student in the college passes an examination at the third attempt. (2marks)

13. In the figure below, the chords CD and AB intersect externally at T. DT = 4 cm, BT = 3 cm and CD = 5 cm. calculate the length AB. (3marks)

14. The gradient function of a curve is given by the expression **2x + 1**. If the curve passes

through the point **(-4, 6);** find the equation of the curve (3marks)_

15. A point P(2, -4) is mapped into P^1(4, 0) under a translation. Determine the image of point

Q(-1, 2) under the same translation (2marks)

16. Sketch the curve of the function y = x^3– 3x + 2 showing clearly minimum and maximum points
and the y – intercept. (4marks)

Answer Only Five Questions in this section.

17.   P varies directly as the cube of Q and inversely as the square root of R
   a) Given that P = 36 when Q = 2 and R = 144, find the value of P when Q = 10 and
      R = 81   (4 marks)

   b) find the value of Q when P = 100 and R = 625 to 4 s.f   (3marks)

   c) If Q increases by 20% and R increases by 44% find the percentage change in P.

                                                                                (3marks)

18. Income tax is charged on annual income at the rate shown below.

Taxable income K£ p.a.	Rate Ksh. Per £
1 – 2300	2
2301 – 6900	3
6901 – 9200	5
9201 – 11500	7
11501 and over	9

Mr. Njoroge earn a basic salary of Ksh.15000 per month and lives in a company house for which he pays a nominal-rent of Ksh.1250 per month. He enjoys personal relief of Ksh.1056 per month and insurance relief of Sh.270 per month.

(a) Taxable pay is the employee's salary + 15% of salary less his taxable income nominal rent. Calculate Njoroge's taxable income in K£ p.a. (3 marks)

(b) The amount of tax he pays per month in Kenya shillings. (5marks)

(c) His net monthly salary in shillings. (2marks)

19. A plane leaves an airport P (10^0S, 62^0E) and flies due north at 800km/h.
     (a) Find its position after 2 hours. Take $\pi = \frac{22}{7}$, Radius of the earth R= 6370 km and 1 nautical
         mile to be 1.853km)   (3marks)

(b)   The plane turns and flies at the same speed due west. It reaches longitude Q, 12^0W.
      (i) Find the distance it has traveled in nautical miles.   (3marks)

      (ii) Find the time it has taken   (2marks)

(c)   If the local time at P was 1300 hours when it reached Q, find the local time at Q when it landed
      at Q   (2marks)

20. A particle **P** moves in a straight line so that its velocity, Vm/s at time t seconds where t ≥0 is given by $v = 28 + t - 2t^2$

Find;

(a) the time when **P** is instantaneously at rest   (2marks)

(b) the speed of **P** at the instant when the acceleration of **P** is zero   (3marks)

(c) Find the acceleration of **P** when the article is instantaneously at rest   (2marks)

(d) Find the distance covered by the particle during the 3rd second, given that when t = 0,

Distance = 5m.   (3marks)

21.   (a) Complete the table given below by filling in the blank spaces   (2marks)

X	0	15	30	45	60	75	90	105	120	135	150	165	180
4cos 2x	4.00		2.00	0	-2.00	-3.46	-4.00	-3.46	-2.00	0	2.00		4.0
2 sin (2x +30º)	1.00	1.73	2.00	1.73		0	-1.00	-1.73	-2.00	-1.73		0	1.0

 (b) On the grid provided; draw on the same axes, the graphs of **y = 4cos 2x and y =2sin (2x +30º)** **for 0º ≤ $_X$ ≤180º**. Take the scale: 1cm for 15º on the **x-axis** and 1cm for 1unit on the y-axis (5marks)
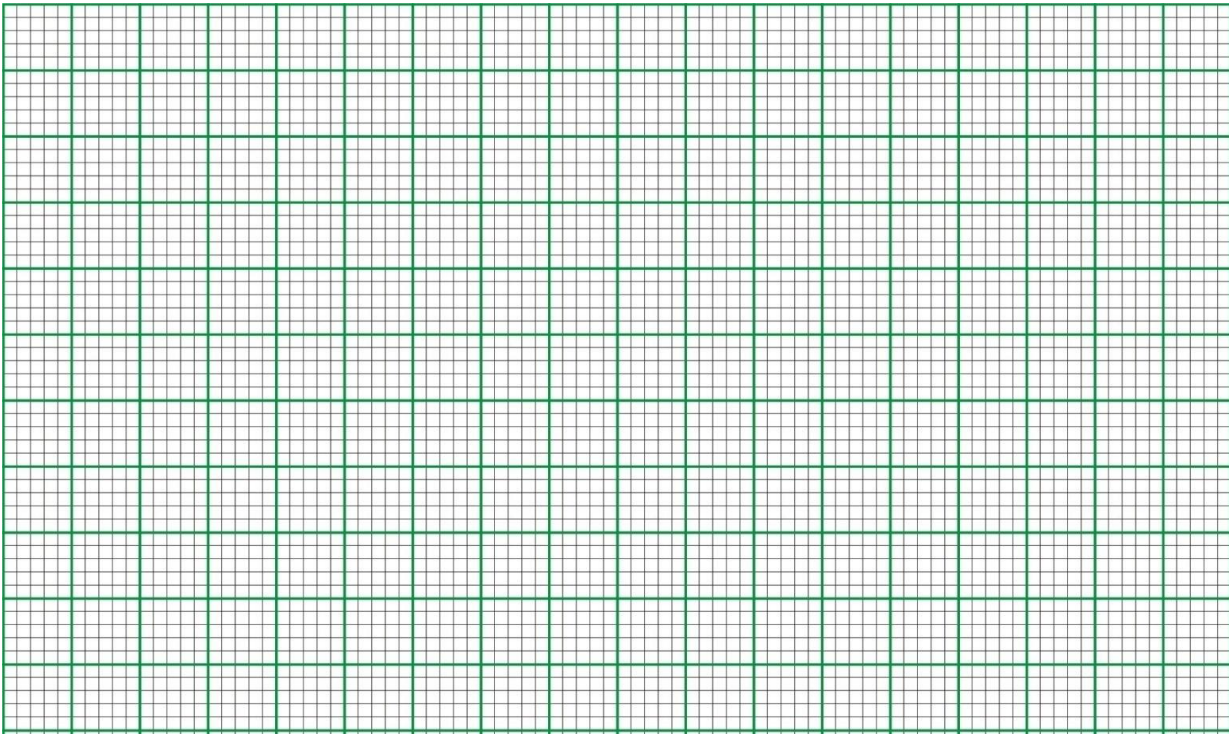
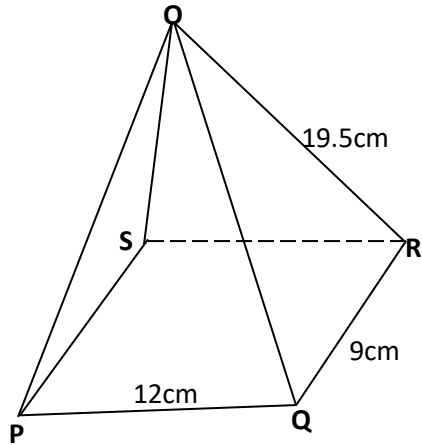(c) From your graph:-

(i) State the amplitude of **y = 4cos 2x**   **(1mark)**

(ii) Find the period of **y = 2sin (2x + 30º)**   **(1mark)**

(d) Use your graph to solve:-

4cos2x – 2sin (2x +30) = 0   (1mark)

22.   The figure below is a pyramid of a rectangular base PQRS of length 12cm and width 9cm.

The slanting edge has a length of 19.5cm

(a) Determine the height of the pyramid   (2marks)

(b) The angle PO makes with base PQRS   (2marks)

(c) The angle POS makes with QOR   (4marks)

(d) The volume of the pyramid   (2marks)

23.   Using a ruler and pair of compasses only construct triangle **ABC** in which **AB** = 6.5cm,
       BC= 5.0cm and angle **ABC** = 60^0. Measure **AC**   (3marks)

       On same side of **AB** as **C**
       i)   Determine the locus of a point **P** such that angle **APB** = 60^0 (3marks)

       ii) Construct the locus of **R** such that **AR** = 3cm.   (1mark)

       ii) By shading the unwanted part. Identify the region **T** such that **AR**≥ 3 and ∠**APB**≥ 60^0

                                                                                                   (3marks)

24.   Two identical baskets A and B contain white and red balls. Basket A contains 7 white balls and 3 red balls while basket B contains 5 white balls and 5 red balls. A bag is chosen at random and 2 balls picked from it one after another without replacement.

(a) Illustrate this information using a tree diagram.   (2marks)

(b) Find the probability that:-

(i) The 2 balls picked are of the same colour.   (2marks)

(ii) The two balls picked are of different colours.   (2marks)

(iii) Only one of the balls picked is red.   (2marks)

(iv) At least one white ball is picked.   (2marks)