NYAHOKAKIRA CLUSTER TWO EXAMINATION 2024

Kenya Certificate of Secondary Education

121/2   **MATHEMATICS ALT. A**   **Paper 2**
JULY, 2024 – 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 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***.

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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 mathematical tables and a calculator, evaluate and simplify , leaving your answer in surd form .   (3marks)

$$\frac{2}{2-sin585°}$$

2. The radius and height of a cylinder measured to the nearest centimeter are 12 cm and 8cm respectively. Find the percentage error in calculating the volume of the cylinder. (3 marks)

3. Simplify without using mathematical tables or a calculator

$$\frac{log8+log6}{log32-3log2}$$
                                                                    (3marks)

4. Given that $r = i + 2j - k, \ s = 4i + 2k - j, \ t = 2i + 3k$ and O is the origin, determine the coordinates of P if $OP = r - 3s + t$. (3 marks)

5. The data below shows the ages in months of 11 babies who attended a clinic in a certain health centre. Calculate the quartile deviation. 8, 19, 14, 20, 25, 24, 10, 6, 12, 18, 30 (3 marks)

6. Under a transformation whose matrix is $\mathbf{A} = \begin{pmatrix} a - 2 & -2 \\ a & a \end{pmatrix}$, a triangle whose area is $\sqrt{11664}$ cm^2 is mapped onto a triangle whose area is $12cm^2$. Find the possible exact values of a. (3 marks)

7. The gradient function of a curve is given by $4x - 1$, given that the curve passes through point $(2, -5)$, find the equation of the curve.   (3 marks)

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8. The initial price of a car was $Ksh.\,1,600,000.$ If the value of the car depreciated at a rate of 5% p.a. Find the value of the car after 3 years, to the nearest thousands.   (2 marks)

9. Make k the subject of the formula ; $\quad t = a + \sqrt{\dfrac{r^2 + k^2}{x}}$ (3marks)

10. The end points of the diameter of a circle are A(3,4) and B(-3,4). Determine the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are integers.   (3marks)

11. a) Expand $(9x^2 + 6x + 1)^3$ up to the fourth term in ascending powers of x.   (2marks)

b) Use your expansion in (a) above to evaluate 1.6^6 correct to five significant figures.   (2marks)

12. Find the value of k if the following quadratic expression has a repeated factor.   (3marks)

$4x^2 - 20x + 20 + k$

13. In a geometrical progression the sum of the second and third term is 12 and the sum of the third and fourth terms is -36. Find the first term and the common ratio.   (4 marks)

14. The graph below is part of a straight line whose equation is $log y = n log x + log a$. Use the graph to calculate the values of **a** and **n**. (3marks)
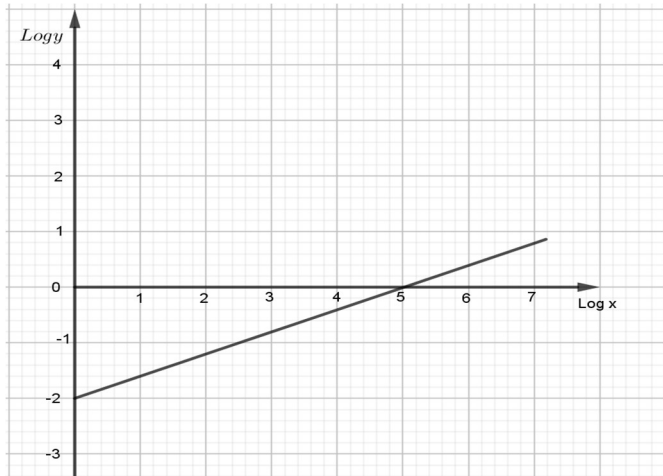
15. Solve for x in $\sin(2x - 60°) - 3\cos(2x - 60°) = 0$ for $-180° \leq x \leq 180°$ (4marks)

16. Two brands of tea costing Sh. 160 and Sh. 140 per kilogram respectively are mixed in the ration $2:3$ by mass. The mixture is sold at Sh. 240 per kilogram. Calculate, to one decimal place, the percentage profit made. (3 marks)

SECTION II (50 Marks)

Answer only five questions from this section in the spaces provided

17. A committee of three people is chosen at random from a group of six men and eight women
    (a) Draw a tree diagram to represent this information   (2marks)

    (b) Using the tree diagram, find the probability that:
        (i) the committee consisted of more men than women.   (2marks)

        (ii) no man is in the committee   (2 marks)

        (iii) two women are in the committee   (2 marks)

        (iv) at least one woman is in the committee.   (2 marks)

18. An airplane left town $P(65^0N, 15^0E)$ to town $Q(65^0N, 165^0W)$ at a speed of 200 knots using the shortest route.

(a) Find:

    (i) the distance the airplane covered in nautical miles.   (3marks)

    (ii) the time taken to travel from P to Q in hours.   (2marks)

(b) Another plane left P at 1.30 p.m. local time and travelled to town $T(65^0N, 60^0E)$ along a parallel of a latitude. Find:

    (i) the distance between P and T to the nearest kilometers.(Take $\pi = \frac{22}{7}$ and $R = 6370\ km$)   (2marks)

    (ii) the local time of arrival at town T if the plane flew at a speed of 470 km/h. (3 marks)

19. a) The cost, P of producing Q items varies partly as Q and partly as the inverse of Q. To produce two items, it costs ksh.135 and to produce three items it costs ksh.140.

Find ;

    (i) The law connecting P and Q   **(4marks)**

    (ii) The cost of producing 10 items.   (2marks)

b) Three quantities A, B and C are such that A varies as the square of B and inversely as the square root of C. If $A = 100$ when $B = 2$ and $C = 36$. What is the absolute value of B when $A = 300$ and $C = 64$?   (4marks)

20. Use a ruler and a pair of compasses only in the construction below;

(a)Construct a rhombus $ABCD$ such that $AB = 6cm$, and $< BAD=60^0$. Measure AC. (3marks)
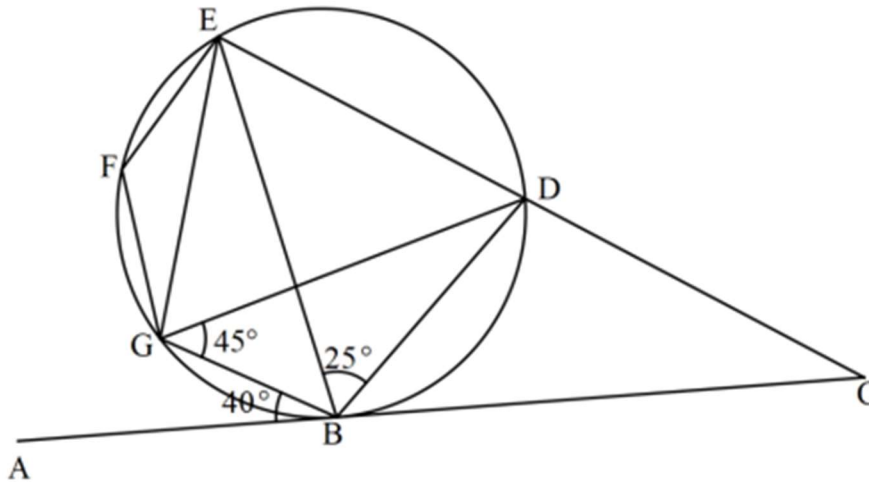
b) On the diagram:

i) locate P, the point equidistant from A,B and D.   (2marks)

ii) draw the locus of Q, on the same side of AB as D, such that angle $AQB = 60^0$.   (2marks)

iii) shade the region R, within the rhombus, such that angle $ARB \leq 60°$, $BR \geq RC$ and R is less than $4cm$ from the side AB (3marks)

21. In the figure below ABC is a tangent to the circle at B. Given that ∠ABG = 40°,
    ∠BGD = 45° and ∠DBE = 25° as shown below.


Find the sizes of the following angles giving reasons in each case;

(a) ∠BDG   (2 marks)

(b) ∠DGE   (2 marks)

(c) ∠EFG   (2 marks)

(d) ∠CBD   (2 marks)

(e) Given that the length $BC = 6cm$ and $CD = 4cm$, find the length of chord DE   (2 marks)

22. A construction company has two types of trucks A and B used to transport at least 42 tonnes of sand to a construction site. Truck A carries 4 tonnes of sand per trip while truck B carries 6 tons of sand per trip. truck A uses 2 litres of fuel per trip while truck B uses 4 litres of fuel per trip. The two trucks are to use less than 32 litres of fuel. The number of trips made by truck A should be less than three times the number of trips made by truck B. truck A should make more than 4 trips.

(a) Taking x to represent the number of trips made by truck A and y to represent the number of trips made by truck B, write the inequalities that represent the above information.   (4marks)

(b) plot the inequalities above in the graph provided below.   (4 marks)
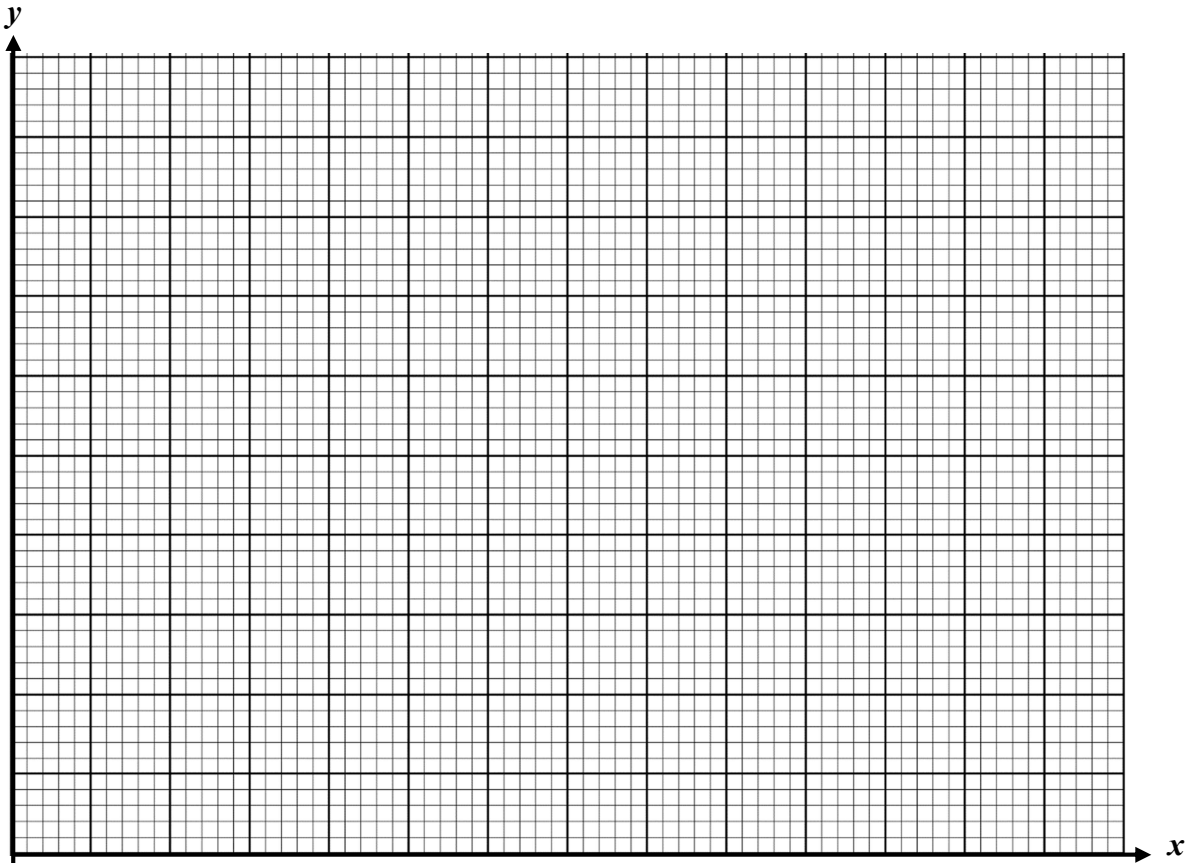

(c) If truck A makes sh.3,500 per trip and truck B makes sh.2,800 per trip. Using a search line, determine the number of trips made by truck A and by truck B to deliver the number of tonnes of sand that would maximize the profit.   (2marks)

23. Given that $y = 2\sin 2x$ and $y = 3\cos(x + 45°)$

(a) Complete the table below: (2 marks)

| x	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
$2\sin 2x$	0		1.97		0.68	−0.68	−1.73		−1.29	0
$3\cos(x + 45°)$	2.12	1.27		−0.78		−2.46			−2.72	−2.12

(b) Using the 1cm rep 20° on the x-axis and 1cm rep 1 unit on the y- axis, draw the graph of $y = 2\sin 2x$ and $y = 3\cos(x + 45°)$ for $0° \le x \le 180°$ on the same axes on the grid below. (5 marks)
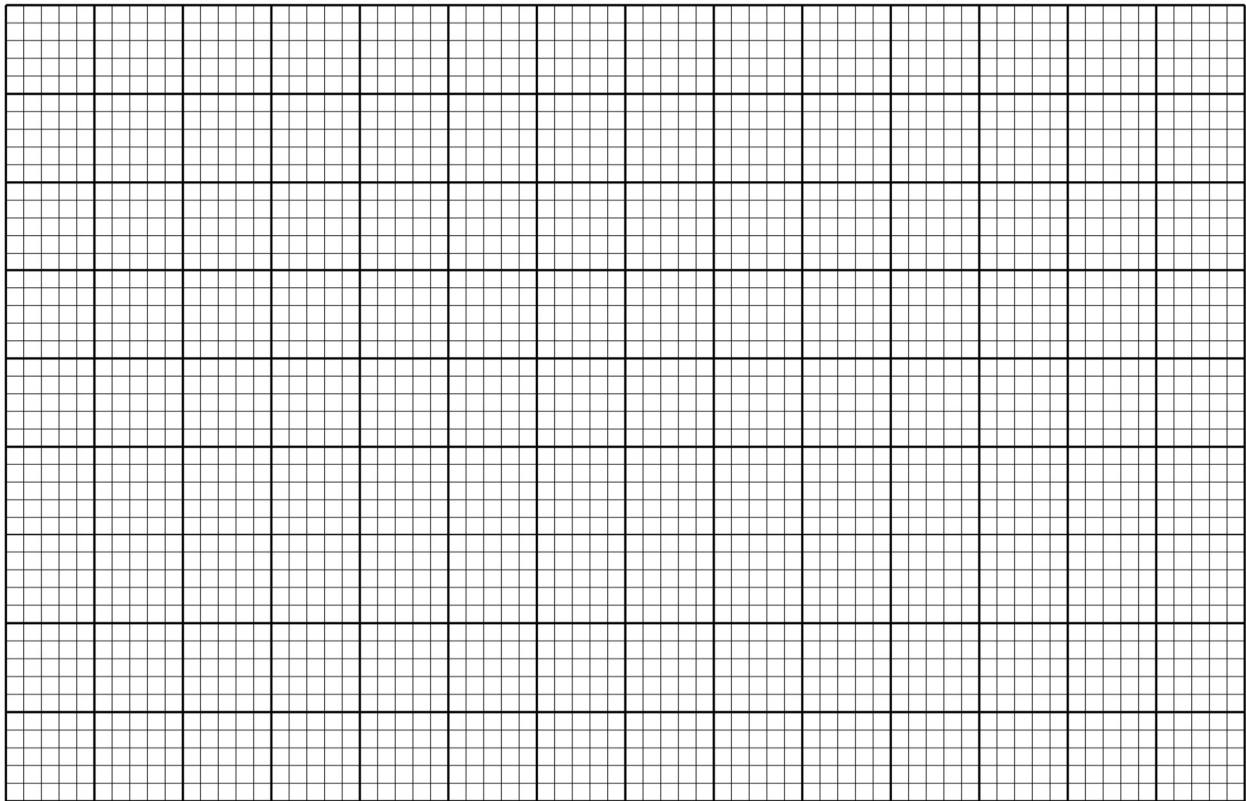
(c)Use the graph to solve the equation $2\sin 2x - 3\cos(x + 45°) = 0$ for $0° \le x \le 180°$. (1mark)

(d) State the amplitude and period of curve $y = 3\cos(x + 45°)$ (2 marks)

24. The figure below shows a right pyramid with the vertex V and edges VA, VB, VC, and VD each 10cm long. The base ABCD is a rectangle of length 8cm and width 4cm and M is the mid-point of CV.
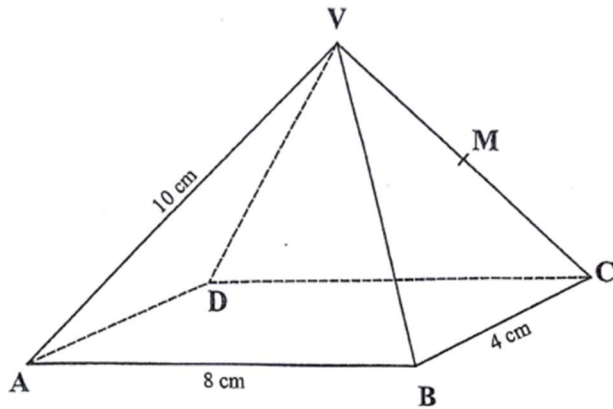
Calculate, to one decimal place:

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

(b) the angle between the line VC and the base ABCD   (3 marks)

(c) the angle between the planes VBC and VAD.   (3 marks)

(d) the length of the projection of CM on the base ABCD.   (2 marks)