

Name: Index No:

School: Date: Sign:.....

121/2
MATHEMATICS ALT.A
Paper 2
DECEMBER – 2021
Time: 2 ½ HOURS

SAMIA SUB – COUNTY JOINT EXAMINATIONS
(Kenya Certificate of Secondary Education)

121/2
MATHEMATICS
Paper 2
2 ½ Hours

INSTRUCTIONS TO THE CANDIDATES

- a) Write your name and index number in the spaces provided above.
- b) Sign and write the date of examination in the spaces provided above.
- c) This paper consists of **TWO** sections; Section I and II.
- d) Answer **ALL** the questions in sections I and **ONLY FIVE** questions from section II
- e) Show all your steps in your calculations, giving your answers at each stage in the spaces provided below each question.
- f) Marks may be given for correct working even if the answer is wrong.
- g) Non – programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- h) Candidates should answer questions in **English**.

For Examiner’s Use Only

Section 1

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

This paper consists of 16 printed pages. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.



SECTION 1 (50 marks)

Answer ALL questions in this section in the spaces provided.

1. The external and internal radius of a cylindrical cement pipe are given as 20cm and 14cm respectively and its length is given as 140cm. Calculate the minimum volume of cement required to make such pipe. (Take $\pi = 3.142$) (3mks)

2. Solve for x in the equation $2\sin^2x + 3\cos x = -1$ for $0^\circ < x < 360^\circ$ (4mks)

3. A quadratic curve cuts the x – axis at points (-2, 0) and (3, 0). Find the equation of this curve in the form $ax^2 + by = c$ where a, b and c are integers. (3mks)

4. Expand $(2 + 3x)^6$ up to the term in x^3 . Hence use your expansion to estimate $(2.09)^6$
(3mks)

5. Two quantities M and N are such that M varies partly as N and partly as the square of N. Determine the relationship between M and N given that when M is 1050, N = 10 and when M = 2200, N = 20.
(3mks)

6. A dealer has two types of grades of tea, A and B. Grade A costs shs. 140 per kg while grade B costs shs.160 per kg. If the dealer mixes A and B in the ratio 3:5 to make a brand of tea which he sells at shs.180 per kg, calculate his percentage profit.
(3mks)

7. The position vectors of A and B are given as $a = 2i - 3j + 4k$ and $b = -2i - j + 2k$ respectively. Find to 2 decimal places, the length of the vector \overrightarrow{AB} . (3mks)

8. Calculate the quartile deviation in 18, 9, 14, 20, 23, 12, 16 (3mks)

9. Find the equation of a circle whose radius is 0.75 units and centre coordinates (0.75, -0.5). Leave your answer in the form;
 $x^2 + y^2 + ax + by + c = 0$ (3mks)

10. Solve for the exact value of x in the equation.

(3mks)

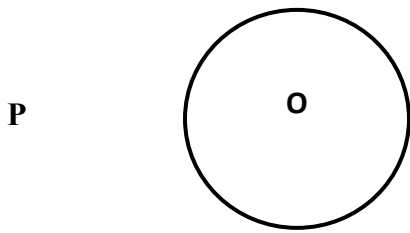
$$2\log_{10}^x + \log_{10}^5 = 1 + 2\log_{10}^4$$

11. A plane leaves an airport A (38.5°N , 37.05°W) and flies due North to a point B on latitude 52°N . The plane then flies due East to a point C 2400km from B. Determine the position of C. (Given that the radius of the earth is 6371km) (3mks)

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

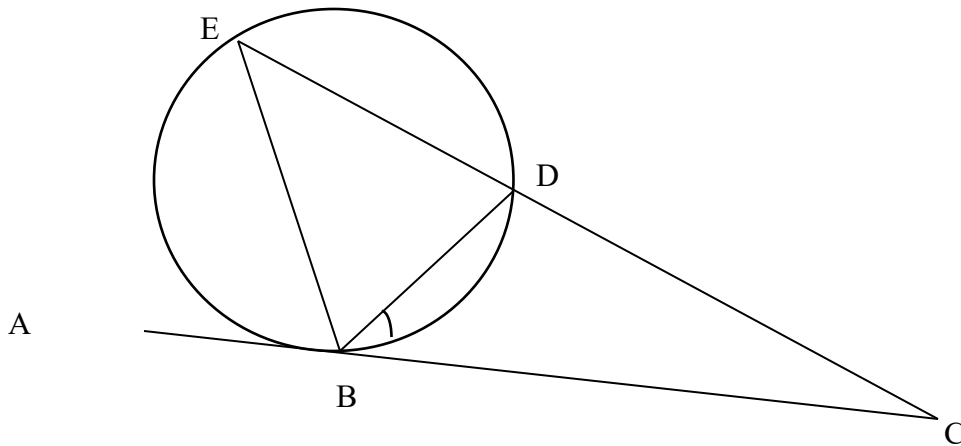
(3mks)

13. Using a ruler and a pair of compass only, construct common tangents from the point P to the circle below. (3mks)



14. Given that $\frac{3 + 3\sqrt{5}}{3 + \sqrt{5}} \cdot \frac{\quad}{3 - \sqrt{5}} = a + b\sqrt{5}$. Find the values of a and b. (3mks)

15. In the figure below angle $CBD = 37^\circ$, angle $BCD = 20^\circ$ and ABC is a tangent to the circle at B .



- (a) Find:
- (i) Angle BED (2mks)
- (ii) Angle ABE (2mks)

16. A transformation is represented by the matrix $\begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$. This transformation maps a triangle

ABC of the area 12.5cm^2 onto another triangle $A'B'C'$ of the area 12.5cm^2 onto another triangle $A^1B^1C^1$. Find the area of triangle $A^1B^1C^1$. (3mks)

SECTION II(50marks)

Answer ANY FIVE questions in this section in the spaces provided

17. A transformation represented by matrix $\begin{bmatrix} 2 & 1 \\ 1 & -2 \end{bmatrix}$ maps **A**(0,0), **B**(2,0), **C**(2,3) and **D**(0,3)

Onto **A¹B¹C¹** and **D¹** respectively

a) Draw **ABCD** and its image **A¹B¹C¹D¹** (4mks)

b) A transformation represented by $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$ maps **A¹B¹C¹D¹** on **A¹¹B¹¹C¹¹D¹¹**.

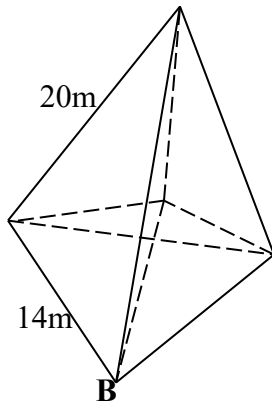
Plot **A¹¹B¹¹C¹¹D¹¹** on the same graph. (3mks)

c) Determine the matrix of a single transformation that maps **A¹¹B¹¹C¹¹D¹¹** onto **ABCD**. (3mks)

18. The diagram below shows a right pyramid with a square base **ABCD** and vertex **V**. **O** is the centre of the base. **AB** = 14m, **VA** = 20m and **N** is the midpoint of **BC**.

V

D
A
C
O



Find;

a) The lengths of **BO**, **VO** and **VN** (3mks)

b) The angle between **VO** and plane **VBC** (3mks)

c) The angle between **VB** and base **ABCD** (2mks)

d) The angle between **VDC** and **VBC** (2mks)

19. The table below shows the distribution of marks scored in a test by standard 8 pupils in one school.

Marks	No. of pupils
30 – 34	1
35 – 39	5
40 – 44	10
45 – 49	10
50 – 54	19
55 – 59	20
60 – 64	20
65 – 69	8
70 – 74	4
70 – 79	3

Using 57 as the assumed mean mark, calculate

(i) The actual mean for the grouped marks (3mks)

(ii) The 50th percentile (3mks)

(iii) The standard deviation of the marks (4mks)

20. (a) Complete the table for the function $y = \frac{1}{2} \sin 2x$, where $0^\circ \leq x \leq 360^\circ$. (2mks)

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$2x$	0°	60°	120°	180°	240°	300°	360°	420°	480°	540°	600°	660°	720°
$\sin 2x$	0^0	0.866			0^0				0.866				
$y = \frac{1}{2} \sin 2x$	0^0	0.433			0^0								

(b) On the grid provided, draw the graph of the function $y = \frac{1}{2} \sin 2x$ for $0^\circ \leq x \leq 360^\circ$ using the scale 1cm for 30° on the horizontal axis and 4cm for 1 unit of y axis. (3mks)

(c) Use your graph to determine the amplitude and period of the function $y = \frac{1}{2} \sin 2x$. (2mks)

(d) Use the graph to solve

(i) $\frac{1}{2} \sin 2x^0 = 0$ (1mk)

(ii) $\frac{1}{2} \sin 2x^0 - 0.5 = 0$ (2mks)

21. Income tax rate were charged as follows in a given year.

Income in ksh. p.m	Rate of tax in each sh.
1 – 11, 180	10%
11, 181, - 21, 714	15%
21, 715 – 32, 248	20%
32, 249 – 42, 781	25%
42, 782 and above	30%

A teacher earns a basic salary of Ksh. 48, 000. He is housed by the employer and pays a rent of Ksh. 3,000 per month. His allowances are: Commuter Ksh. 2, 500 and medical Ksh. 3,500. He is entitled to a family relief of Ksh. 1,648 per month.

Determine his:

a) Taxable income per month (2mks)

b) Net tax per month (4mks)

c) In addition the following deductions are also made

NHIF Ksh. 1,250

WCPS Ksh. 1,200

Co – operative shares Ksh. 3,000

Calculate the net salary. (3mks)



22. (a) The first term of an Arithmetic progression (AP) is 2. The sum of the first 8 terms of the AP is 156

(i) Find the common difference of the AP (2mks)

(ii) Given that the sum of the first n terms of the AP is 416, find n (2mks)

(b) The 3rd, 5th and 8th terms of another AP form the first three terms of a Geometric Progression (GP). If the common difference of the AP is 3, find;

(i) The first term of the GP; (4mks)

(ii) The sum of the first 9 terms of the GP, to 4 significant figures. (2mks)

23. A married couple intends to have 3 children. They consult an expert who tells them that the probability of a male birth is 0.55.

(a) Draw a tree diagram to represent this occurrence (2mks)

(b) Find the probability that

(i) All the three children will be female (2mks)

(ii) At least a male is born (2mks)

(iii) At least 2 will be females, giving your answer to 3 s.f. (4mks)

24. A trader is required to supply two types of sweaters, type **A** and type **B**. the total number of sweaters must not be more than 400. He has to supply more of type **A** than type **B** sweaters. However the number of type **A** sweaters must not be more than 300 and the number of type **B** sweaters must not be less than 80. Let x be the number of type **A** sweaters and y be the number of type **B** sweaters.

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

(b) On the grid provided, draw the inequalities and shade the unwanted regions.(4mks)

(c) The profits were as follows;

Type A: sh. 600 per sweater

Type B: sh. 400 per sweater

- (i) Use the graph to determine the number of sweaters of each type that he should make to maximize the profit. (1mk)

- (ii) Calculate the maximum possible profit (1mk)



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