

BSJE JOINT EXAMINAT-2024 -

Kenya Certificate of Secondary Education

121/2 Mathematics Alt. A Paper 2

July, 2024 TIME: 2½ Hrs

Name: Index No:

School:Signature:

121/2 - Mathematics
Tuesday, 16TH July, 2024
Morning
8.00am-10.30am

Instructions to candidates

- Write your name and index number in the spaces provided above
- Sign and write the date of examination in the spaces provided above
- This paper consists of TWO sections: Section I and only five questions form Section II
- Answer ALL the questions in Section I and only five questions from Section II
- All answers and workings must be written on the question paper in the spaces provided below each question.

Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.

- Marks may be given for correct working even if the answer is wrong
- Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.
- This paper consists of 18 printed pages
- Candidates should check the question paper to ascertain that all the pages are printed as indicted and that no questions are missing.

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	19	19	20	21	22	23	24	Total

Grand

Total

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SECTION I (50 marks)

1. Use logarithms to evaluate (4marks)

$$\sqrt{\left(\frac{\log 9 \times 0.954}{0.301 \times 4.3}\right)^{-2}}$$

2. AB is the diameter of the circle. Given that A(2, -3) and B(4, -7). Find the equation of the circle in the form $x^2 + y^2 - 2ax + 2by + c = 0$ (3 marks)

3. A quantity P varies partly as the cube of Q and partly varies inversely as the square of Q. When Q = 2, P = 108 and when Q = 3, P = 259. find the value of P when Q = 6 (4 marks)

4. (a) expand $(a - b)^5$ (2 marks)

(b) Use the first three terms of the expansion in (a) the above to find the value of 1.97^5 to two decimal place (2 marks)

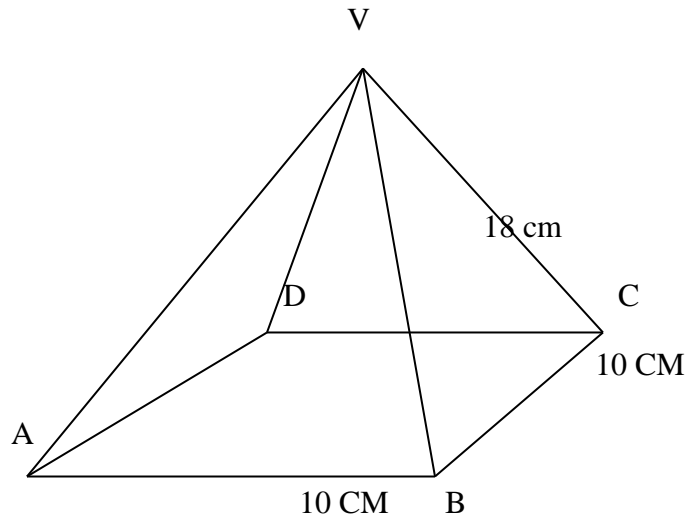
5 . Simplify without using tables or calculator

$$\text{Log}_7 49 \times \log_3 27 \quad (2 \text{ marks})$$

6. Water flows from a tap. At the rate 27cm^3 per second, into a rectangular container of length 60cm, breath 30 cm and height 40 cm. If at 6.00 p.m. the container was half full, what will be the height of water at 6.04 pm? (3 marks)

7.) Figure below shows a square based pyramid ABCD .AV=BV=CV=DV=18 cm.

AB= 10 cm. Calculate the angle between the plane BVC and AVD. (3 marks)



8.The roots of a quadratic equation are -3 and $\frac{1}{2}$. Form the quadratic equation in the form

$ax^2 + bx + c = 0$ Where a, b, and c are constants (3 marks)

9. Triangle ABC is mapped onto triangle A'B'C' by a transformation given by the matrix $N = \begin{pmatrix} 3 & 1 \\ -1 & 1 \end{pmatrix}$. If A'B' = 4 cm, find AB (3 marks)

10. Using $\log 2 = 0.3010$ and $\log 3 = 0.4771$. Evaluate $\log 45$ (3 marks)

11. The position of two towns A and B on the earth's surface are (36°N, 49°E) and (36°N, 131°W) respectively.
(a) Find the local time at A if the time at B is 12.35pm on Sunday. (1mk)

(b) Using 6370km as the radius of the earth, calculate the shortest distance between town A and B (2mks)

12. The first, the third and the seventh terms of an increasing arithmetic progression are three consecutive terms of a geometric progression. In the first term of the arithmetic progression is 10, find the common difference of the arithmetic progression. (3Mrks)

13. A two digit number is made by combining any of two digits 1,2,3,4, and 5 at random. Find the probability that the number formed is even (2marks)

14. The deviation d from the mean \bar{X} of the set of data x are given below;

X	15	18	M	23	M+6	28	30
d	-8	-5	Y	0	-y	5	7

a)

- b) Find the value of m and y (2 marks)

- c) Calculate the mean absolute deviation of the data (2 marks)

15. Make y the subject of the formula

(3 marks)

$$q = m \sqrt{\frac{r^2 - y^2}{y^2 - 3}}$$

16. Solve the equation: $3 \cos X = 2 \sin^2 X$

where $0 \leq X \leq 360$

(3marks)

Section II (50 marks) . Answer only five questions in this section in the spaces provided

17.The table below shows the analysis of examination marks scored by 160 candidates

Marks (%)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
No of candidates	2	6	15	22	36	34	20	15	6	4

a)Using an assumed mean of 45.5. calculate

I. The mean

(3 marks)

II. The standard deviation

(4 marks)

b) Calculate the minimum mark for grade A if 40 student got grade A

(3 marks)

18 .A and B are two points on latitude 40° .The two points lie on the longitude 80°W and 100°E respectively.(taking $\pi=\frac{22}{7}$ and $R =6370 \text{ KM}$) .

(a) Calculate;

(i) The distance from A to B along the parallel of latitude (3mks)

(ii)The distance from A to B along the great circle (4mks)

(b) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along the parallel of latitude ,which one arrived earlier and by how much?
Give your answer to the nearest minute. (3mks)

19. a).Complete the table below by filling in the blank spaces for the functions

$$y = \sin(x + 30^\circ) \text{ and } y = \cos \frac{1}{2}x \quad (2 \text{ marks})$$

X	0	30	60	90	120	150	180	210
$Y = \sin(x + 30^\circ)$	0.5		1		0.5			-0.87
$Y = \cos \frac{1}{2}x$	1.00			0.71			0.00	

b.) Using the scale, x-axis 1cm = 30°, y-axis 1cm = 0.5 units, draw their graphs of the functions on the same axes (5marks)

c) Use your graph to solve

i. $\sin(x + 30^\circ) - \cos \frac{1}{2}x = 0$ (1 mark)

ii. $\sin(x + 30^\circ) = 0$ (1 mark)

iii) $\cos \frac{1}{2}x = -0.25$ (1 mark)

20. The equation of a curve is $y=3x^2-4x+1$

a) Find the gradient function of the curve when $x=2$ (2 marks)

b) Determine

i) The equation of the tangent of the curve at the point (2, 5) (2marks)

ii) The angle which the tangent to the curves at the point (2,5) makes with the horizontal line (2mks)

iii) The equation of the line through the point (2, 5) which is perpendicular to the tangent in (b) i above (3marks)

21. The table shows income tax rates for the year 2023

Monthly income in Kenya shillings	Tax Rate in each shilling
0 – 10164	10%
10165 – 19740	15%
19741 – 29316	20%
29317 – 38892	25%
38893 and above	30%

In a certain month of that year an employee's taxable income in the fourth band was K£ 334.2

Tax relief of Ksh 1162 pm. Was allowed.

a) Calculate

i) The employees total taxable income in that month (3 marks)

ii) The P.A.Y.E. in that month (5 marks)

b) The employees income included taxable allowances amounting to Kshs. 14000. The employees contributed 6% of the basic salary to a co-operative society. Calculate the employee net income for that month . (3 marks)

22. The probability that Zora goes to school by boda boda is $\frac{2}{5}$ and by a matatu is $\frac{1}{4}$. If she uses a boda boda, the probability that she will be late is $\frac{2}{5}$ and $\frac{3}{10}$ if she uses a matatu. If she uses other means of transport the probability of being late is $\frac{3}{20}$

a) Draw a tree diagram to represent this information (3 marks)

b) Find the probability that she will be late for school (2 marks)

c) Find the probability that she will be late for school if she does not use a matatu (3 marks)

d) Find the probability that she will be late for school (2 marks)

23. The acceleration of a particle after passing a fixed point P is given by $a = 3t - 3$. Given that the velocity of the particle when $t = 2$ seconds is 5m/s , find:

a). Its velocity:

i). In terms of t (3 marks)

ii). When $t = 4$ (2 marks)

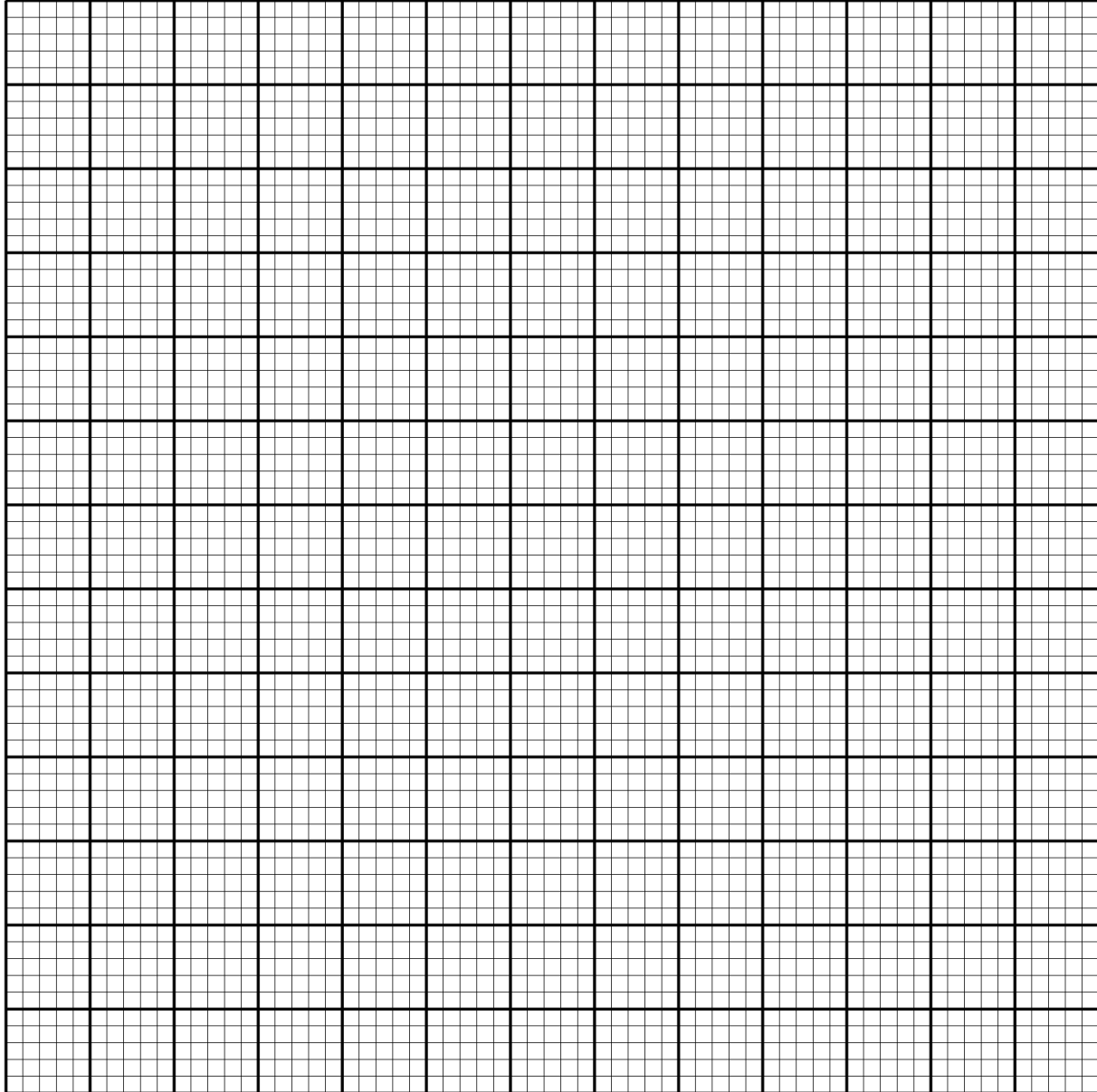
b). The maximum velocity attained by the particle. (2 marks)

c). Its displacement during the third second. (3 marks)

24. A triangle ABC with vertices A(2,0), B(4,-2) and C(4,4) is mapped onto its image $A^1B^1C^1$ under a transformation represented by the matrix $\begin{pmatrix} 1 & 1/2 \\ 0 & 1 \end{pmatrix}$

a)i) State the coordinates of $A^1B^1C^1$ (2 Marks)

ii) On the grid provided plot triangle ABC and triangle $A^1B^1C^1$ (2 marks)



iii) Describe fully the transformation represented by the matrix $\begin{pmatrix} 1 & 1/2 \\ 0 & 1 \end{pmatrix}$ (1 mark)

b) $A^{11}B^{11}C^{11}$ is the image of triangle $A^1B^1C^1$ under reflection on the line $X=0$

Plot triangle $A^{11}B^{11}C^{11}$ on the same grid and state the co-ordinates (2marks)

c) Find a single matrix that can map triangle ABC onto triangle $A^{11}B^{11}C^{11}$ (3 mks)