BULLET EXAMINATION COUNCIL.

Kenya Certificate Of Secondary Education (K.C.S.E.) 2023.

121/2 — MATHEMATICS — Paper 2

ALT A

FORM THREE END TERM 2

July. 2023—$2\frac{1}{2}$ hours

Name……. Index Number:…….……....

Candidate's Signature…… Date……..……..

Instructions to candidates

(a) Write your name and admission number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided.
(c) This paper consists of two sections: **Section I** and **Section II**.
(d) Answer all questions in **section I** and **only five** questions from section **II**.
(e) **Show all the steps in your calculations, giving the 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) **This paper consists of 18 printed pages.**
(i) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
(j) **Candidates should answer the questions in English.**

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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. Find value of x in the equation $\log_{10}(2x-1)+\log_{10}3=\log_{10}(8x-1)$. (2 marks)

2. By correcting each number to the nearest one significant figure, approximates the value of 699×0.003, hence calculate the percentage error arising for the approximation. (3 marks)

3. Simplify by rationalizing the denominator; (3 marks)

$$\frac{\sqrt{2}+\sqrt{3}}{\sqrt{6}-\sqrt{3}}$$

4. The points with the coordinates $(5,5)$ and $(-3,1)$ are the ends of a diameter of a circle centre A. Determine;

   (a) The coordinate of A. (1 mark)

   (b) The equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ when a, b and c are constants. (2 marks)

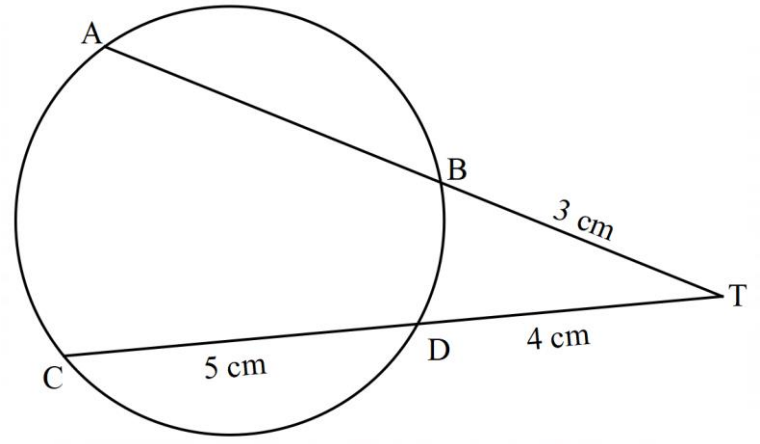
5. (a) Expand $(x + y)^4$. (2 marks)

   (b) Use your expansion to evaluate $(1.99)^4$ correct to five significant figures. (2 marks)

6. A quantity A is partly constant and partly varies inversely as a quantity B. Given that $A = -10$ when $B = 2.5$ and $A = 10$ when $B = 1.25$, find the value of A when $B = 1.5$.
(4 marks)

7. Given that $S = \frac{a(1-r^n)}{1-r}$ make n the subject of the formula. (3 marks)

8. 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. (3 marks)

9. If the area of an object is 10 square units, calculate the area of the image after a transformation whose matrix is $\begin{pmatrix} -2 & 3 \\ 5 & 1 \end{pmatrix}$. (3 marks)

10. John borrowed sh. 560000 from a bank. He was required to repay the loan with simple interest for a period of 48 marks. The repayment amounted to sh. 21000 per month. Calculate;
    (a) The interest paid to the bank. (2 marks)

    (b) The rate per annum of the simple interest. (2 marks)

11. It would take 18 men 12 days to dig a piece of land, if they work for 8 hours a day. How long will it take 24 men if they work 12 hours a day to cultivate three quarters of the same land. (3 marks)

12. Solve the equation $2x^2 + 4x + 1 = 0$ using completing square method. (3 marks)

13. Use logarithm tables to evaluate; (4 marks)

$$\sqrt[4]{\frac{0.8465 \times 12.14}{214.5 \div 9.067}}$$

14. Without using logarithm table, find the value of x in equation; (3 marks)

$$\log x^3 + \log 5x = 5\log 2 - \log\frac{2}{5}$$

15. Simplify; (3 marks)

$$\frac{3}{3-\sqrt{7}}$$

16. The length of a rectangular flour garden is 2 m less than twice its width. The area of the garden is 60 m. Calculate its length. (3 marks)

SECTION II (50 marks)

*Answer only **five** questions from this section in the spaces provided.*

17. An arithmetic progression is such that the first term is -5, the last term is 135 and the sum of the progression is 975.

(a) Calculate;

(i) The number of terms in the series. (3 marks)

(ii) The common difference of the progression (2 marks)

(b) The sum of the first three terms of a geometric progression is 27 and the first term is 36. Determine;

(i) The common ratio. (3 marks)

(ii) The sum of the first 10 terms of the series. (2 marks)

18. The table below shows the rate of taxation in the year 2023.

Monthly income in ksh.	Tax rates (%)
0 – 12298	10%
12299 – 23885	15%
23886 – 35472	20%
35473 – 47059	25%
47060 and above	30%

In that period, John was earning a basic salary of sh. 64000 per month. In addition, he was entitled to a house allowance of sh. 9000, commuter allowance of sh. 7200 and a hardship allowance of sh. 6800 per month. John contributes 12.5% of his basic salary towards a pension scheme. This contribution is exempted from taxation. A personal relief of sh. 1056 p. m. was given. He has an insurance scheme for which he pays a monthly premium of sh. 8000 for which he was entitled to a tax relief of 15% of premium paid.

(a) Calculate John's taxable income p. m. in ksh. (2 marks)

(b) Calculate how much income tax John paid per month. (6 marks)

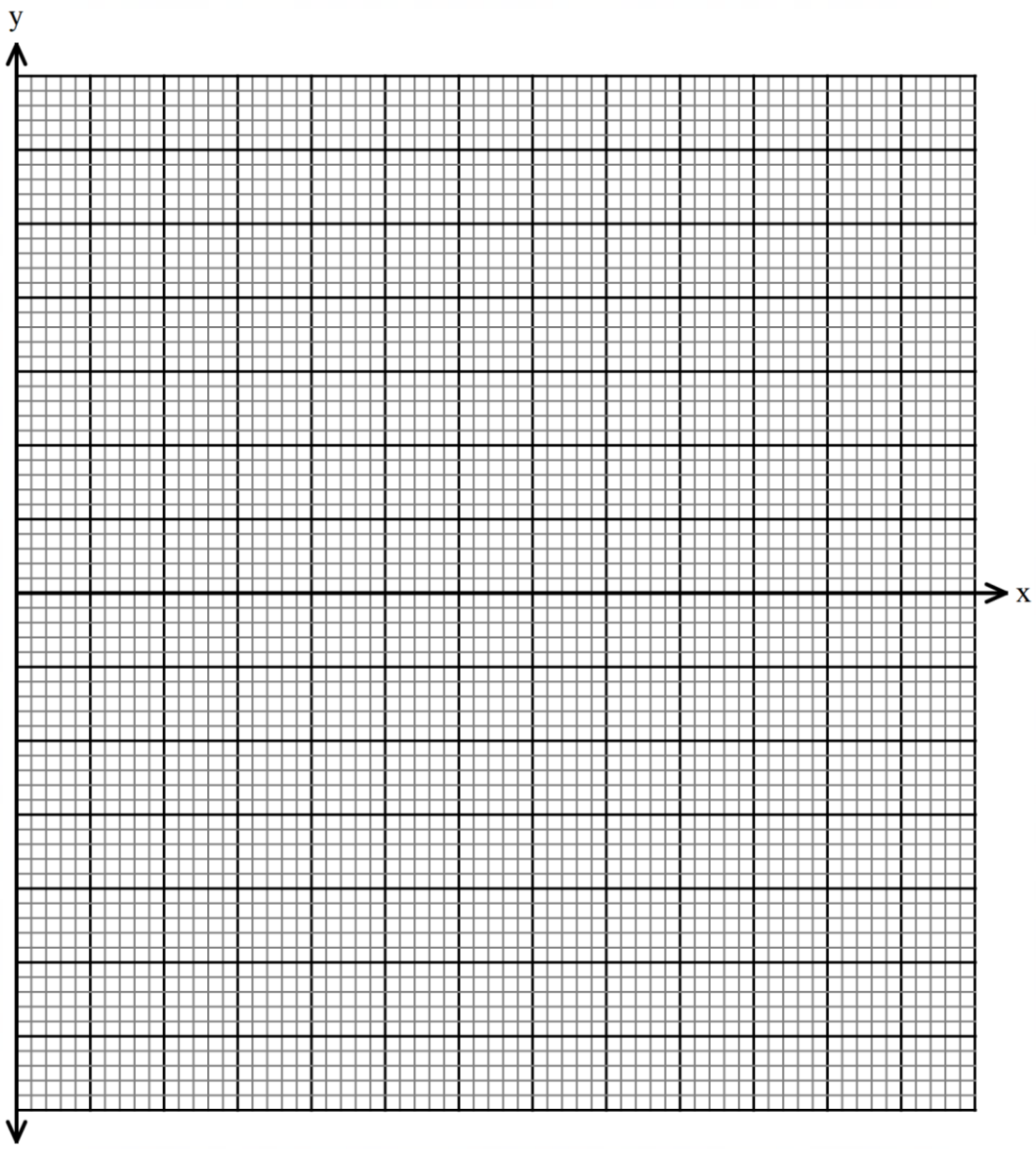
(c) John's other deductions per month loan repayment of sh. 150000 and a cooperative shares of sh. 3500. Calculate his net salary per month. (2 marks)

19. The table below shows some values of curves $y = 2\cos x$ and $y = 3\sin x$.

(a) Complete the table for values of $y = 2\cos x$ and $y = 3\sin x$, correct to 1 decimal places. (2 marks)

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$2\cos x$	2		1	0		-1.7		-1.7	-1		1	1.7	2
$3\sin x$	0	1.5		3	2.6		0		-2.6			-1.5	0

(b) On the grid provided and on the same axes, draw the graph of $y = 2\cos x$ and $y = 3\sin x$ for $0° \leq x \leq 360°$. Use the scale 1 cm to represent 30° on x − axis and 1 cm to represent 0.5 units on y − axis. (5 marks)



(c) Use the graph to find the value of x when $2\cos x = 3\sin x$. (1 mark)

(d) Use the graph to solve the equation $3\sin x = 2.5$. (2 marks)

20. A matrix P is given by $\begin{bmatrix} 4 & 7 \\ 6 & 8 \end{bmatrix}$.

(a) Find P^1. (2 marks)

(b) Two schools purchased maize and beans. Magunga county school purchased 8 bags of beans and 14 bags of maize and spends sh. 99600. Urudi School purchased 12 bags of beans and 16 bags of maize and spends sh. 120000.

(i) Form a matrix equation to represent the above information. (3 marks)

(ii) By strictly using the P^1 obtained in (a) above, determine the price of a bag of beans and a bag of maize. (4 marks)

(c) The price of beans later went up by 5% and that of maize remained constant. Magunga county schools bought the same quantities of beans and y bags of maize, and spend sh. 5016 less than the amount of money spent before on the two items. State the new ratio of beans to maize. (3 marks)

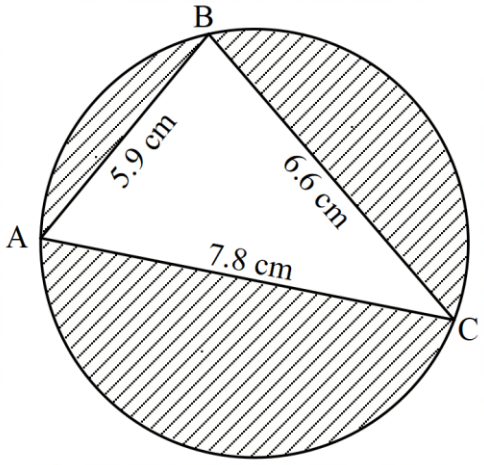
21. Three quantities P, Q and R are such that P varies directly as the cube of Q and inversely as the fourth root of Z. Given that $P = 104$ when $Q = 2$ and $R = 625$.

(a) Determine the equation connecting P, Q and R. (4 marks)

(b) Find the value of P when $Q = 6$ and $R = 4096$. (2 marks)

(c) Find the percentage change in P when Q is increased by 20% and R is decreased by 19%. (4 marks)

22. Triangle ABC is inscribed in a circle. AC = 7.8 cm, BC = 6.6 cm and AB = 5.9 cm.

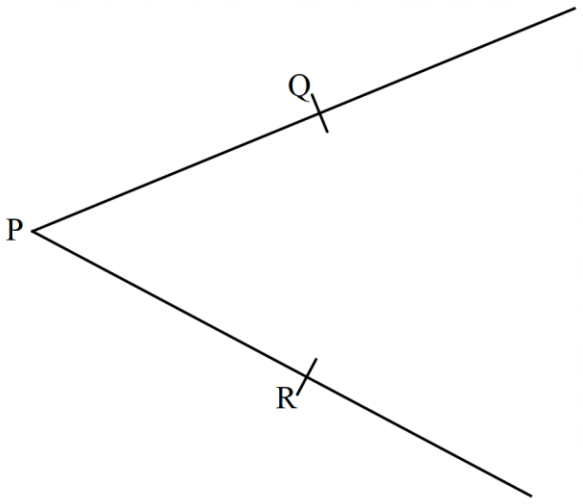


(a) Calculate the value of the largest angle correct to 2 decimal places. (3 marks)

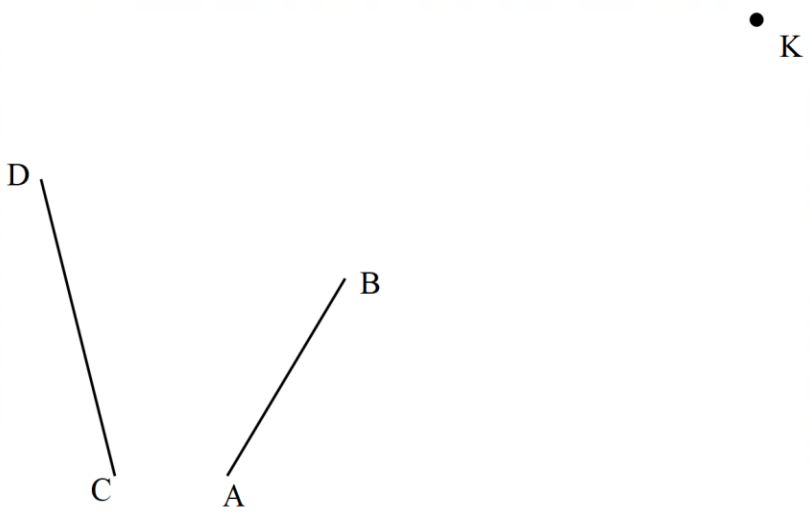
(b) Calculate the radius of the circle correct to 1 decimal places. (3 marks)

(c) Calculate the area of the shaded region correct to the nearest whole number. (Take π = 3.142). (4 marks)

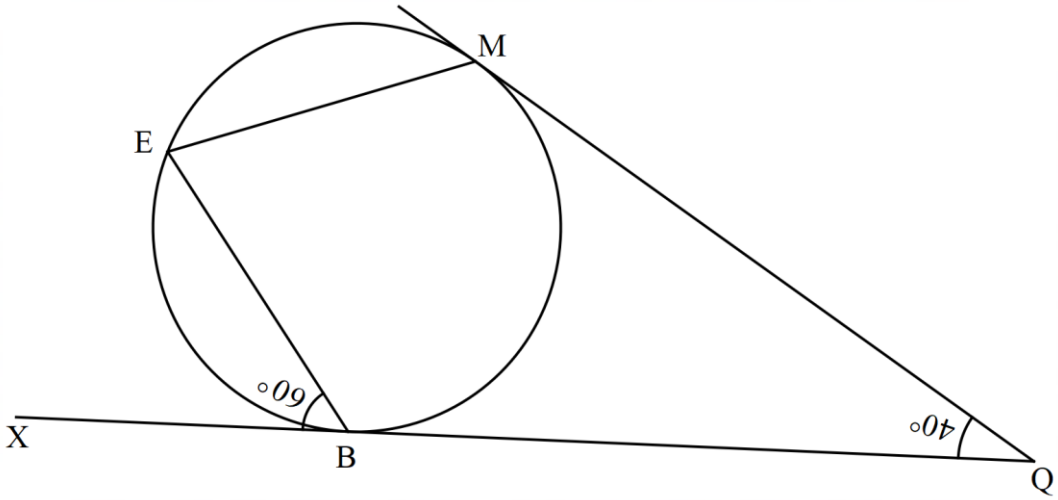
23. (a) In the figure below PQ and PR represent tangents to the circle at points Q and R. Using a pair of compasses and a ruler only to construct the circle and measure its radius.
(3 marks)



(b) The lines AB and CD are chords to the circle centre O. By construction, draw the circle. Hence draw the tangents to the circle from the external point K. (4 marks)



(c) In the figure below lines XBQ and QM are tangents to the circle at B and M respectively. $\angle BQM = 40°$ and $\angle EBX = 60°$.



By giving reasons, find the size of;

(i) $\angle QBM$. (2 marks)

(ii) $\angle QME$. (2 marks)

24. Two businessmen jointly bought a minibus which could ferry 25 paying passengers when full. The fare between two towns A and B was sh. 80 per passenger for one way. The minibus made three round trips between the two towns daily. The cost of fuel was sh. 1500 per day. The driver and the two conductors were paid a daily allowance of sh. 200 and sh. 150 respectively. A further sh. 4000 per day was set aside for maintenance and insurance.

(a) One day, the minibus was full on every trip.

(i) How much money was collected from the passengers that day? (3 marks)

(ii) How much was net profit. (3 marks)

(b) On another day, the minibus was 80% full on the average for the three round trips, how much did each businessman get if the day's profit was shared in the ratio 3: 2. (4 marks)

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