# MARANDA HIGH SCHOOL

*Kenya Certificate Of Secondary Education*

## THE 2024 MOCK EXAMINATION

**121/2 MATHEMATICS PAPER 2**

**June, 2024 TIME: 2½ Hrs**

Name: ……Admission No: ……

Stream: …….. Signature: ……..…..

**121/2 - MATHEMATICS**
Tuesday, 11th June, 2024
Morning
7:00 a.m -9.30 a.m

***Instructions to candidates***

*(a) Write your name, stream, Adm No. and sign in the spaces provided above.*
*(b) This paper consists of **TWO** sections: **Section I** and **Section II**.*
*(c) Answer **ALL** the questions in **Section I** and only five from **Section II**.*
*(d) All answers and working must be written on the question paper in the spaces provided **below each question.***
*(e) **Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.***
*(f) Marks may be given for correct working even if the answer is wrong.*
*(g) KNEC Mathematical tables may be used except where stated otherwise.*
*(h) **This paper consists of 15 printed pages.***
*(i) **Students should check the question paper to ascertain that all the pages are printed as indicated 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 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Total |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**Grand Total**

## **SECTION 1** (50 marks)

Answer **all** the questions in this section in the spaces provided:

1. In what ratio should grade **P** of tea costing sh. 900 per kg be mixed with grade **Q** of tea costing sh. 700 per kg so that a profit of 10% is made by selling the mixture at sh. 902 per kg? (3 marks)

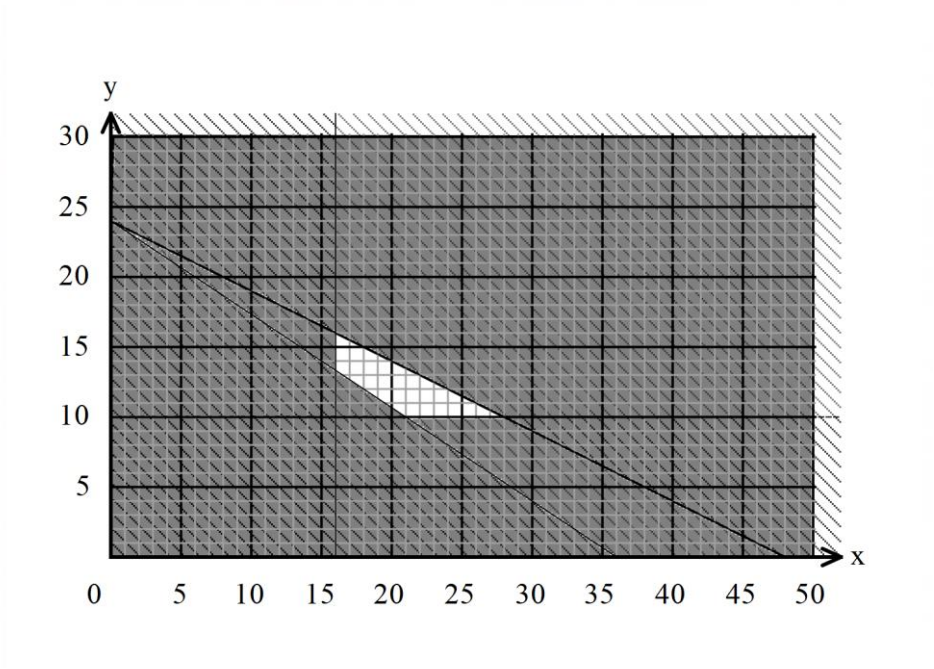
2. Use binomial to expand and simplify the expression (4 marks)

$$\left(2-\frac{1}{\sqrt{7}}\right)^4+\left(2+\frac{1}{\sqrt{7}}\right)^4$$

3. Mrs. Chebukaka bought a television set on hire purchase by paying a down payment of Ksh. 5000 and Monthly installments of Ksh. 1250 for 2 years. If the interest rate charged was 12% p.a compound interest, evaluate the carrying charge to the nearest hundreds. (4 marks)

4. Calculate the mean absolute deviation of 3, 5, 7, 9 and 11 correct to 2 decimal places. (3 marks)

5. Use the graph below to answer the question that follows:




Tarus makes a profit of Ksh. 40 on a ream paper and Ksh. 100 on calculator. Use the graph to determine the maximum profit Tarus can make by using a search line and use number of ream papers be x and calculator be y. (3 marks)

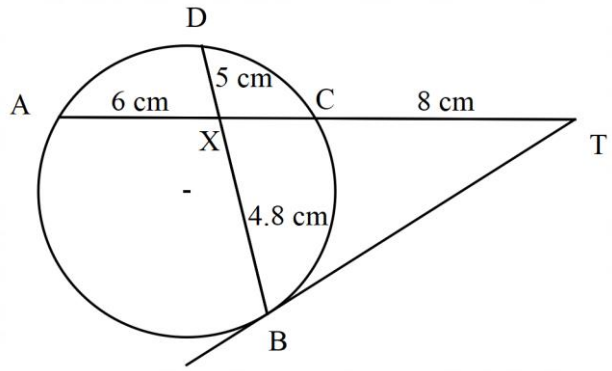
6. Make $x$ the subject of the formula.

$$A - x = \sqrt{Bx + x^2}$$ (3 marks)

7. A ball is dropped from the top of a building and its height h, metres above the ground at any time t, seconds is given by $h = 350 + 65t - t^2$.
   a) Find the velocity of the ball when t = 2 seconds (2 marks)

   b) State the time when the velocity is zero. (1 mark)

8. In the figure below, **BT** is a tangent to the circle at **B**. **AXCT** and **BXD** are straight lines. **AX =** 6cm **CT** = 8cm, **BX** =4.8cm and **XD** =5cm.

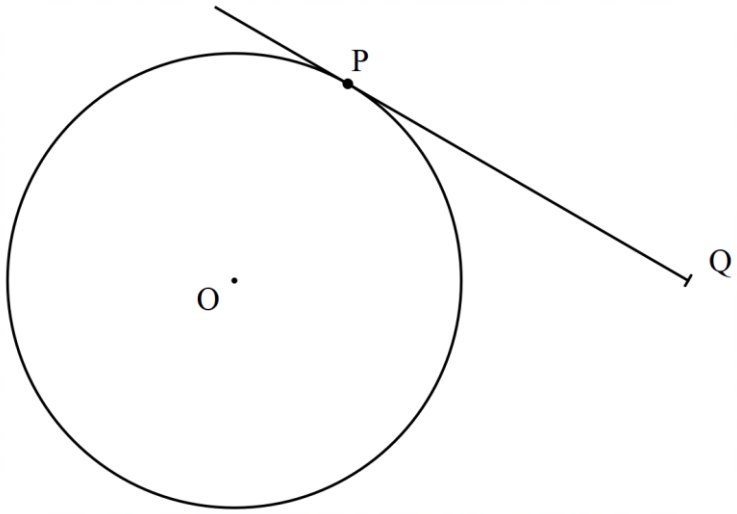



   Calculate the length of BT (3 marks)

9. Under a transformation whose matrix is A= $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ a square whose area is 10 $cm^2$ is mapped onto a square whose area is 110 $cm^2$. Find the two possible values of x. (3 marks)

10. Solve for y in the equation $\log_2 \sqrt{81} + \log_2 \left( y^2 - 3^{-1} y \right) = 1$ (3 marks)

11. In this question, use a ruler and a pair of compasses. The following figure shows a circle, centre O. A tangent to the circle at P is drawn.

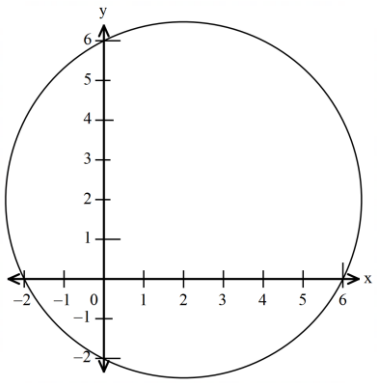



Construct another tangent to the circle to intersect the drawn tangent at an angle of $60°$.
(2 marks)

12. A school's environmental club consists of 7 boys and 5 girls. Three members are to be randomly chosen to be officials of the club. Calculate the probability that more boys were chosen to be official. (3 marks)

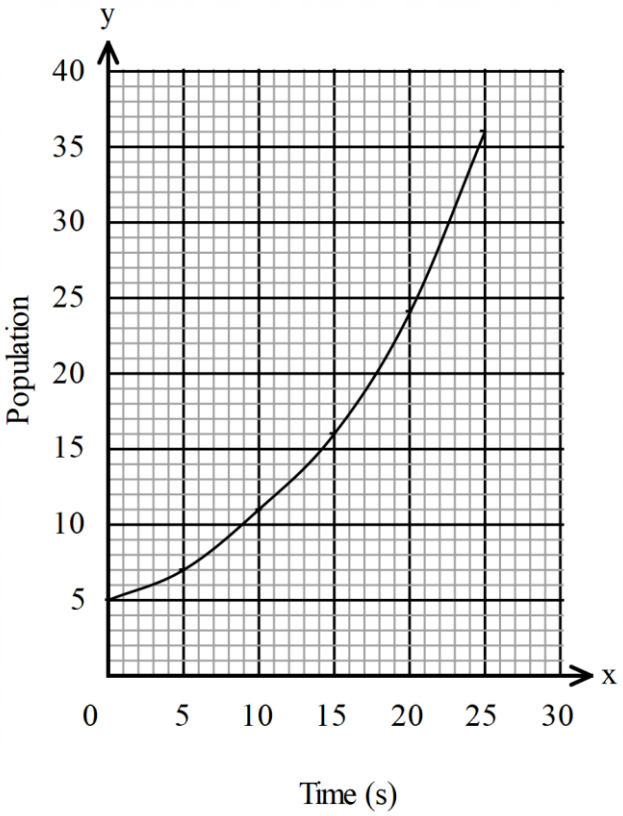
13. Solve the equation $4\sin^2\alpha = 1\frac{1}{2} - \sin\alpha$ for $0° \le \alpha \le 180°$. (4 marks)

14. In the figure below, the circle passes through the points (-2, 0), (6, 0), (0, -2) and (0, 6). Find the centre and radius of the circle and hence the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are integers. (3 marks)



15. The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. (3 marks)

16. The population growth of a colony of insects was recorded at an interval of 5 second(s) as shown in the graph below.

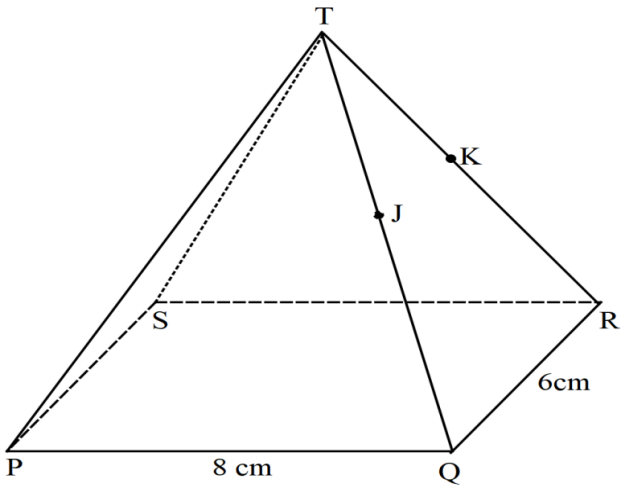



Use the graph to determine, correct to 4 significant figures, the average rate of change of the population of insect at t = 20. (3 marks)

## **SECTION II** (50 marks)

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

17. The figure below PQRST is a right pyramid with base PQ = 8cm, QR = 6cm and PT = QT = RT = ST = 13cm. J and K are mid points of QT and RT respectively,




Determine;

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

(b) The angle the length TS makes with SJ (3 marks)

(c) The angle PTS makes with the base PQRS. (2 marks)

(d) The angle between the plane PTS and the plane PJKS. (3 marks)

18. Two variables P and Q are such that P varies partly as the square of Q and partly as the inverse of Q. Given that P=10.5 when Q=2.5 and P=30.75 when Q=4.

a) Find the equation connecting P and Q (4 marks)

b) Find P when Q=1.5 (2 marks)

c) Q is directly proportional to the square root of R, and Q=3.04 when R=3.61 ,find

i) The relationship between Q and R (2 marks)

ii) The relationship between P and R. (2 marks)

19. Using a ruler and a pair of compasses only.

a) Construct triangle ABC such that AB = 9 cm, BC = 10 cm and angle BAC = 75°.
(3 marks)

b) On the same side as C, construct the locus of P such that area of triangle APB =13.5 $cm^2$
( 2 marks)

c) On the same side as C construct the locus of Q such that angle AQB = 60°.
(2 marks)

d) Locate R within the triangle, such that AR < 5cm , ∠ACR ≥ ∠BCR and $AR \leq BR$ ,by shading the wanted parts. (3 marks)

20. The weight of loads by 100 trucks at the Naivasha weighbridge was as shown in the table below.

| Weight (tonnes) | 1 – 10 | 11 - 20 | 21 - 30 | 31 - 40 | 41 - 50 | 51-60 | 61-70 | 71-80 | 81-90 | 91-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of Trucks | 2 | 10 | 13 | 17 | 18 | 14 | 10 | 6 | 6 | 4 |

a) Assuming an average load of each truck as 42 tonnes, calculate the actual average load of each truck. (3 marks)

b) Determine the range of weight of the trucks in the 3rd quarter. (5 marks)

c) 20% of the trucks were found to be overload, determine the maximum recommended weight for a truck. (2 marks)

21. The table below shows income tax rates for a certain year.

| Monthly taxable income(Ksh) | Rate of tax (%) in each Ksh |
|---|---|
| 1-10165 | 10 |
| 10166-19740 | 15 |
| 19741-29316 | 20 |
| 29317-38892 | 25 |
| Over 38892 | 30 |

Mr Obambla is an employee who earns a basic salary of Ksh y and he is entitled to a house allowance of Ksh. 5,480 per month. He is also entitled to a monthly personal relief of Ksh. 1162. Given that his employer deducts Ksh. 6075.75 as income tax each month.

a) Calculate;

i) The monthly gross tax (2 marks)

ii) His gross monthly income (6 marks)

b) Calculate Mr. Obambla's basic monthly salary (2 marks)

**22.** A jet on a mission left town **P ($60^0$N, $15^0$E)** to another town **Q ($60^0$N, $165^0$W)** on the earth surface at a speed of **300 knots** using the shortest route possible. Take $\pi = \frac{22}{7}$ **and R = 6370 km.**

a) Calculate the distance travelled in nautical miles. (2 marks)

b) After some communication, the jet turns round immediately and heads due east of town **Q** with the same speed .However, it runs into a bad weather after covering **2700 nm** and it is forced to land at town **X**. Find the position of town **X .** (3 marks)

c) If the local time at **P** is **1.30 pm** by the time the jet flew off, what is the local time of its arrival at town **X** (3 marks)

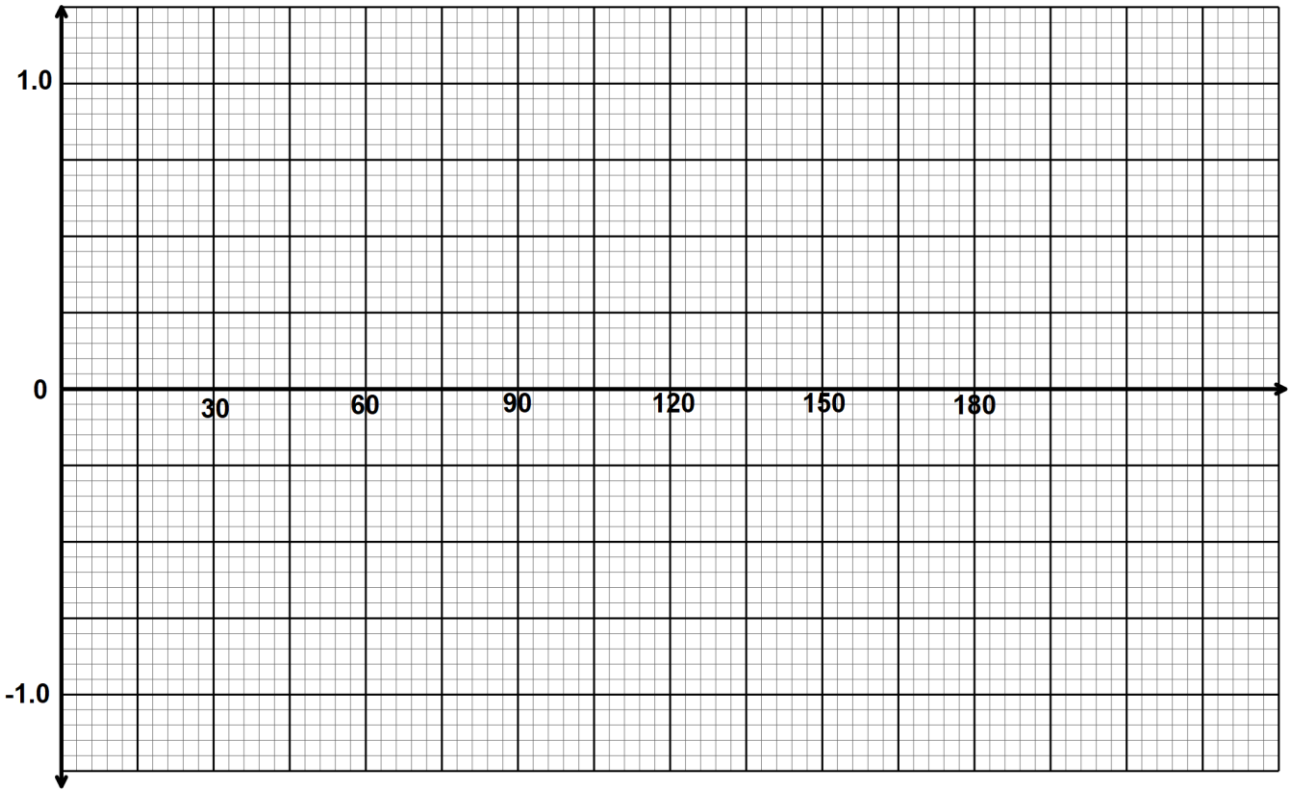
d) Calculate the radius of the latitude in which the jet followed from **Q** to **X** in nm. (2 marks)

23. a) Complete the table below giving your values correct to two decimal places. (2 marks)

| $x^0$ | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 | 165 | 180 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\sin 2x^0$ | 0.00 | 0.50 | | 1.00 | | 0.50 | 0.00 | | -0.87 | | | -0.50 | 0.00 |
| $\cos(x-30)^0$ | 0.87 | | 1.00 | | 0.87 | | | 0.26 | | –0.26 | -0.50 | | |

b) Draw on the same axes the graph $y = \sin 2x^0$ and $y = \cos(x-30)^0$ for the range $0^0 \le x \le 180^0$

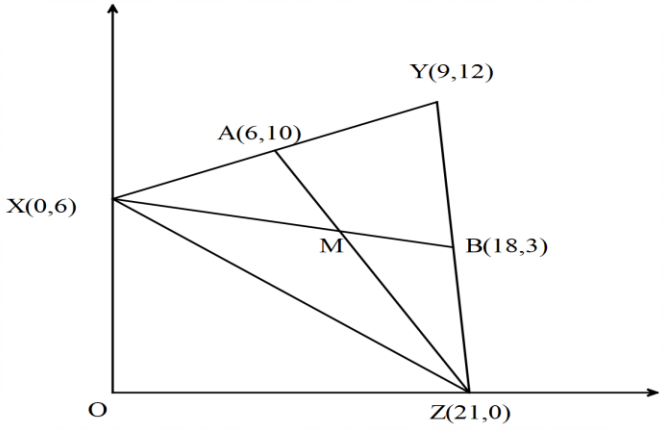
(4 marks)




c) Use the graph to solve the equation $2\sin 2x - 2\cos(x-30)^0 = 0$ (2 marks)

d) Use the graph to find the range of values of $x$ for which $\sin 2x > \cos(x-30)^0$ (2 marks)

24. In the diagram below, the vertices XYZ are X (0, 6), Y (9, 12) and Z (21, 0). Points A (6, 10) and B (18, 3) lie on lines XY and YZ respectively.




a) Find:

i) **XB** (1 mark)

ii) **ZA** (1 mark)

b) Lines XB and ZA intersect at M such that **ZM** = k**ZA** and **XM**=m**XB** where k and m are scalars.

i) By expressing **OM** in two different ways, determine the values of k and m. (5 marks)

ii) Determine the exact coordinates of point M. (2 marks)

iii) Find the ratio in which A divides line ZM. (1 mark)