EXAMINATION NO.: _____

THE MALAWI NATIONAL EXAMINATIONS BOARD

2023 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

MATHEMATICS

Subject Number: M131/II

Friday, 7 July

Time Allowed: 2 h 30 min
8:00 – 10:30 am

PAPER II

(100 marks)

Instructions

1. **This paper contains 19 printed pages. Please check.**
2. Answer **all** the **six** questions in Section **A** and any **four** questions from Section **B**.
3. The maximum number of marks for each answer is indicated against each question.
4. Scientific calculators may be used.
5. The blank answer sheet at the end of the question paper can be used if required.
6. **All working must be clearly shown.**
7. Write your **Examination Number** at the top of each page of your question paper in the spaces provided.
8. In the table provided on this page, **tick** against the question number you have answered.
9. At the end of the examination, hand in your paper to the invigilator.

Question Number	Tick if answered	Do not write in these columns	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Section A (60 marks)

Answer **all** the **six** questions in this section in the spaces provided.

1. a. Simplify $\frac{4x^2+28x}{(2x+3)(x+1)} \div \frac{8x^2-12x}{4x^2-9}$. **(4 marks)**

b. The radii of two similar circles are 32 m and 16 m. Find the area factor of the two circles. **(4 marks)**

2. a. Factorise completely $2x^3 - 9x^2 + 7x + 6$. **(5 marks)**

b. Given that $\underline{p} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\underline{q} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$, calculate $\frac{3}{4}\left|\underline{p} - \underline{q}\right|$. **(5 marks)**

3. a. Families of Ulimi village grow groundnuts, tobacco and maize. If 5 families grow all the crops, 27 families grow groundnuts and tobacco, 45 families grow tobacco and maize, 23 families grow groundnuts and maize, 10 families grow maize only, 20 families grow tobacco only, 30 families grow groundnuts only and 13 families grow neither of the crops, present this information in a Venn diagram.

(6 marks)

3. (Continued)

b. **Figure 1** shows a cyclic quadrilateral **KLMN** in which **TMS** is a tangent at **M.**

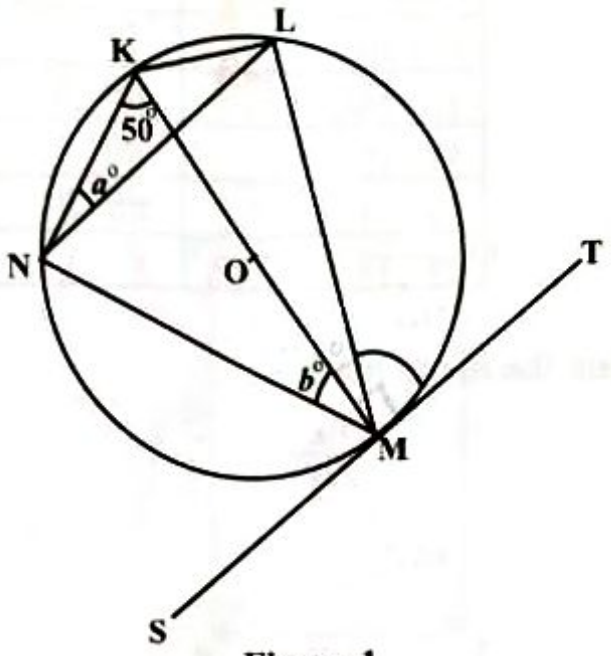

Figure 1

If angle **NKM** = 50°, angle **LNK** = $a°$ and angle **KMN** = $b°$, show that angle **NML** = 90°.

(4 marks)

4. a. The **table below** shows class intervals of marks obtained by students in a class.

Class interval	Tally
15 - 20	𝍸
21 - 26	𝍸 |||
27 - 32	𝍸
33 - 38	𝍸 ||
39 - 44	||

Calculate the mean mark. **(4 marks)**

4. (Continued)

b. **Figure 2** is an isosceles triangular prism with sides **PR** = **PQ** = 5 cm **QR** = 6 cm and **PS** = 10 cm. **PQTS, PRUS** and **QTUR** are rectangles.

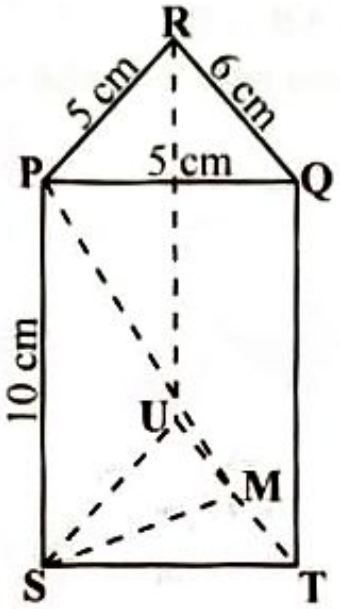

Figure 2

If **M** is the midpoint of **UT**, calculate the value of the angle between **PM** and the plane **STU**, giving the answer correct to 3 significant figures. **(5 marks)**

5. a. Using a pair of compasses and a ruler only, construct in the same diagram:

- A circle centre **O** of radius 4 cm
- A point A outside the circle and 9 cm from the centre **O**
- A tangent **AB** at **B**
- Measure and state the value of angle **OAB**.

(6 marks)

5. (Continued)

b. The maximum speed (**S**) of a vehicle is partly constant and partly varies as the engine capacity (**C**) of the vehicle. If the engine capacity is 2 000, the maximum speed is 240 km/ h and when the engine capacity is 15 000 the maximum speed is 200 km/ h, calculate the engine capacity for the vehicle with maximum speed of 300 km. **(6 marks)**

6. a. Given that x, $x + 1$ and $x + 3$ are the first three terms of a Geometric Progression, find the common ratio. **(5 marks)**

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6. (Continued)

b. **Figure 3** is a speed-time graph of a moving object.

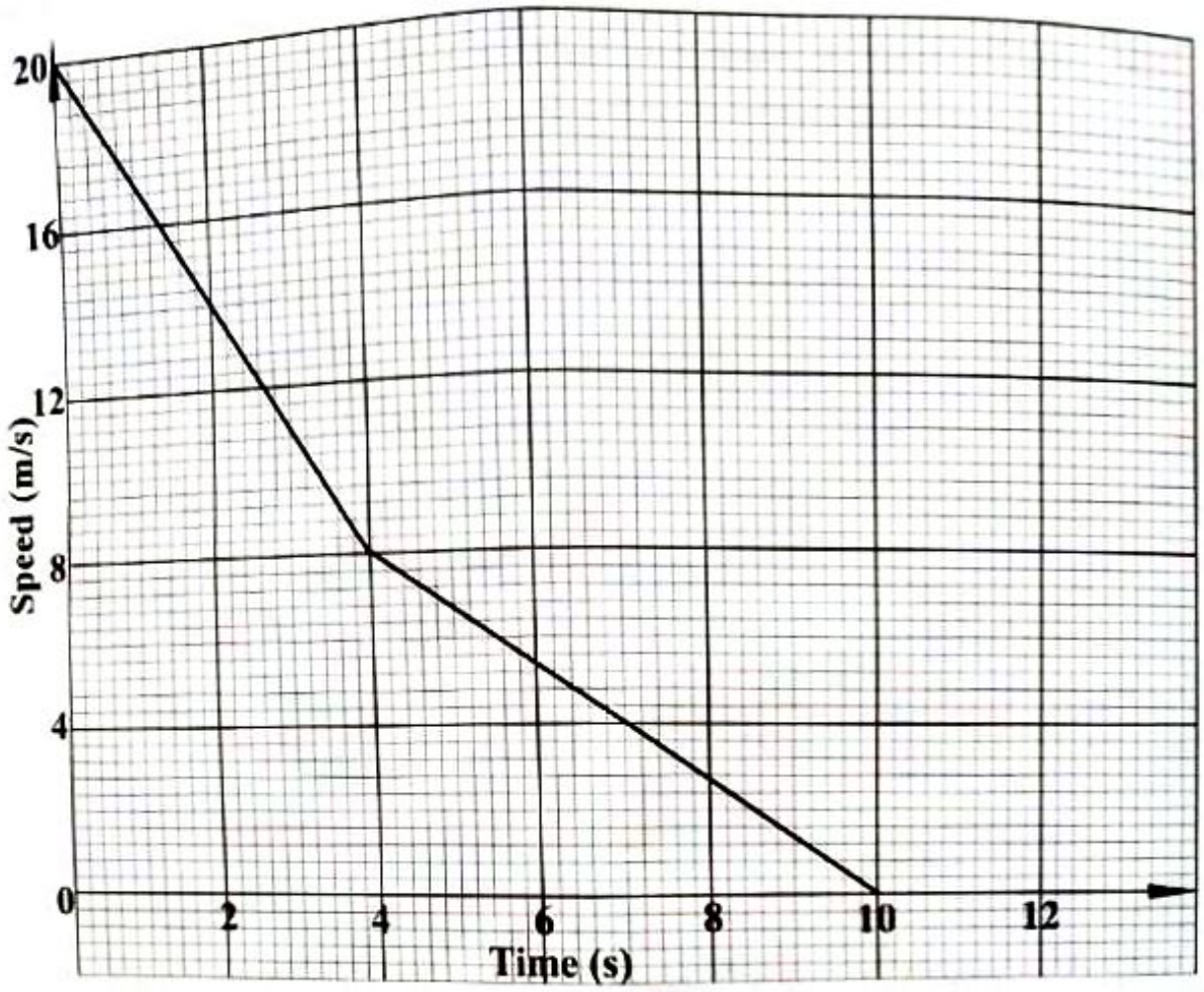


Figure 3

Calculate the average speed of the object for the 10 seconds.

(6 marks)

Section B (40 marks)

Answer any **four** questions from this section in the spaces provided.

7. Solve the equation $3^{2y} - 4\,(3^{y+1}) + 27 = 0$. **(10 marks)**

8. A bottle contains 4 red sweets and 5 blue sweets. Two sweets are picked from the bottle at random one after the other without replacement.

a. Draw a tree diagram to represent the information. **(5 marks)**

b. Find the probability of picking two sweets of the same colour. **(5 marks)**

9. Express as the log of a single number $4 \log \frac{2}{3} - 4 \log 2 + \log 27$.

(10 marks)

10. Port **P** is 70 km away from port **X** on a bearing of 060° while Port **Q** is 120km away from Port **X** on a bearing of 140°.

Calculate the:

a. distance between Port **P** and Port **Q**. **(5 marks)**

b. bearing of Port **P** from Port **Q**, giving the answer correct to the nearest degree.

(5 marks)

11. The **table below** shows some values of x and y of the function $y = -x^3 + 2x^2 + 5x - 6$.

x	-3	-2	-1	0	1	2	3	4
y	24	0		-6	0	4		-18

a. Complete the values of y in the table. **(2marks)**

b. Using a scale of 2 cm to represent 1 unit on horizontal axis and 2 cm to represent 5 units on vertical axis, draw a graph of $y = -x^3 + 2x^2 + 5x - 6$ on the graph paper provided on **page 17**. **(4marks)**

c. Use the graph drawn in **(b)** to solve the equation $-x^3 + 2x^2 + 5x - 10$. **(4marks)**

12. A businessman wishes to install two types of maize mills **A** and **B**. Type **A** maize mill needs 2 operators and occupies 4 m^2 of floor space while type **B** needs 7 operators and occupies 8 m^2 of floor space. There are at least 56 operators and 136 m^2 of floor space available. He is to install at least 3 maize mills of type **A** and not less than 5 maize mills of type **B**.

a. If x represents the number of type **A** maize mills and y represents the number of type **B** maize mill, formulate **three** inequalities in x and y that satisfy the above information in addition to $x \geq 3$.

(3 marks)

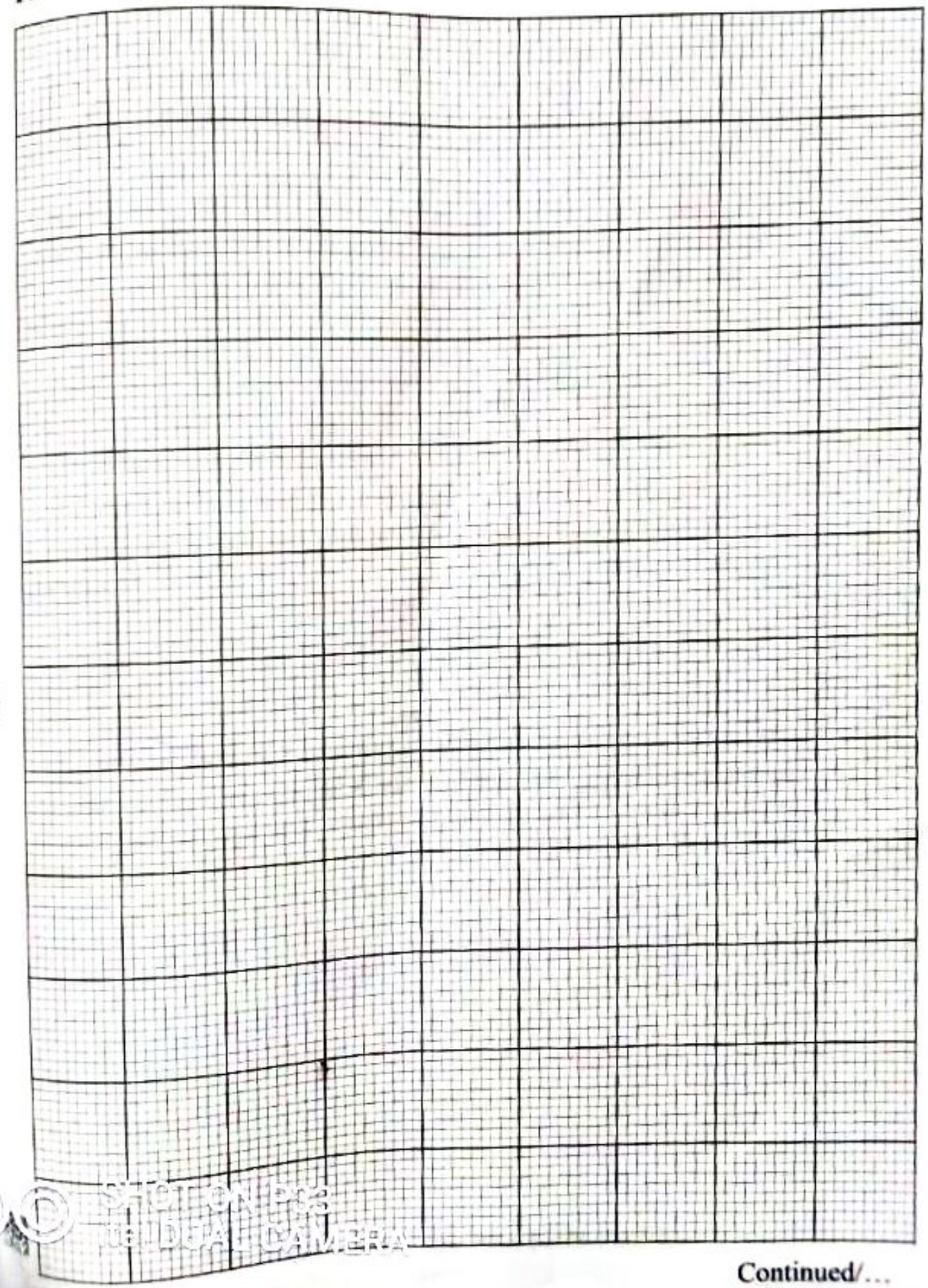
b. Using a scale of 2 cm to represent 5 units on both axes and on the same axes, draw graphs on the graph paper provided on **page 19** to show the region represented by the **four** inequalities; shade the unwanted region .

(4 marks)

c. The businessman wishes to make a profit of K30 000 per week for operating each type **A** maize mill and K50 000 per week for operating each type **B** maize mill. Using the graphs, find the maximum profit he can make for 2 weeks.

(3 marks)

11. b. **(Continued)**



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