



EXAMINATION NO.: _____
THE MALAWI NATIONAL EXAMINATIONS BOARD

2024 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

ADDITIONAL MATHEMATICS

Subject Number: M132/II

Tuesday, 23 July

Time Allowed: 2 h 30 min

10:00am – 12:30 pm

PAPER II

(100 marks)

Instructions

1. This paper contains 15 printed pages. Please check.
2. Answer **all** the **seven** questions in **Section A** and any **two** questions from **Section B**.
3. **Section A** carries 60 marks and **Section B** carries 40 marks.
4. The graph paper provided at the end of the question paper can be used if required.
5. Only non programmable calculators may be used.
6. **All necessary working should be shown** and any numerical expression being evaluated by calculators or mathematical tables must be clearly stated; otherwise marks for method may be lost.
7. The **final** answer to a question requiring the use of calculators should normally be given to **three** significant figures.
8. The marks allocated to each question (or part of a question) are shown in brackets at the end of each question (or part of a question).
9. Write your **Examination Number** on top of each page of this question paper.
10. In the table provided on this page, tick against the question number you have answered.

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



Section A (60 marks)

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

1. a. Expand $\sum_{r=2}^5 (-1)^{-r} \frac{1}{r}$ in series form. (4 marks)

- b. Given that the probability of picking a blue flower from a bag of flowers is $\frac{3}{8}$ and the probability of picking a red flower and a blue flower in that order is $\frac{15}{64}$, show that the probability of picking a blue or a red flower from the bag is 1. (5 marks)



2. a. A total force of 60 000N is needed to drive an object in the direction where there is a resistance of 24 000N. Given that the acceleration of the object is 8 m/s^2 , calculate the mass of the object.

(5 marks)

- b. Find the value at which the series $\sum_{a=1}^{\infty} \frac{1}{2^a}$ converges. (4 marks)



Continued/...

3. a. The vertices of a triangle XYZ are $X(2,0,-3)$, $Y(5,-2,1)$ and $Z(7,5,3)$. Using scalar product, prove that angle $XYZ = 90^\circ$. (5 marks)

- b. The probability of obtaining a number of heads in 6 throws of

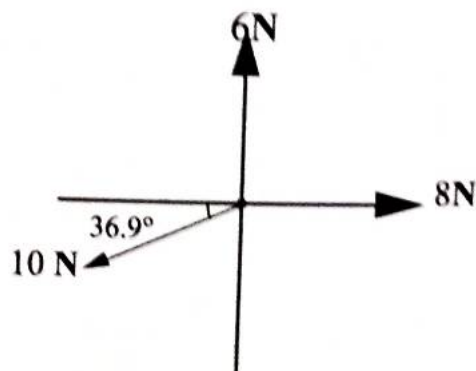
a coin was given by $C_n^6 \left(\frac{2}{3}\right)^n \left(\frac{1}{3}\right)^{6-n} = \frac{64}{243}$, where $\frac{2}{3}$

is the probability of head and $\frac{1}{3}$ is the probability of tail.

Calculate the numerical value of C_n^6 . (5 marks)



4. The figure below shows three forces acting on a 10 kg particle.



Calculate the acceleration of the particle.

(6 marks)



Continued/...

5. a. Evaluate $\sum_{d=1}^7 \left(\frac{1}{3} - 3d \right)^2$ given that $\sum_{d=1}^7 d^2 = \frac{d(d+1)(2d+1)}{6}$. (7 marks)

- b. A weather satellite orbits planet **X** such that the equation of its path can be modelled by the equation $L^2 + D^2 - 16L - 12D + 75 = 0$, where **L** and **D** are longitudinal and latitudinal distances in kilometres from the centre of **X** respectively. Find the coordinates of the centre and the radius of the orbit. (4 marks)



6. A ball is struck at an angle of 34° with an initial speed of 20m/s .
At times t_1 and t_2 , the ball is 5 m above the ground.
Calculate the values of t_1 and t_2 .

(8 marks)



7. Find the equation of the tangent to a circle with equation $x^2 + y^2 + 4x - 6y = 12$ at $T = (1, -1)$.

(7 marks)



Section B (40 marks)

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

8. a. Given that the position vector of **P** and **Q** are $\underline{p} = (4\underline{i} - 4\underline{j} + 2\underline{k})$ and $\underline{q} = (-3\underline{i} + 3\underline{j} - 6\underline{k})$, find the value of n for which $\frac{1}{2}\underline{PQ}$ is parallel to $\underline{c} = (-2.1\underline{i} + 2.1\underline{j} - n\underline{k})$. (10 marks)



Continued/...



8. (Continued)

- b. Table 1 shows examination results for a candidate.

Table 1

Subject group	Mean score	Standard deviation	Number of subjects
Humanities	63.5	13.22	4
Sciences	72.5	21.72	6

Calculate the overall standard deviation for the subjects.

(10 marks)



Continued/...



9. a. Two points **Q** and **R** are 250 m apart. A particle moving towards **R** passes point **Q** with a speed of 5m/s and with acceleration of $\frac{3}{4}$ m/s². Calculate the speed of the particle upon reaching point **R**. (10 marks)



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9. (Continued)

- b. **Table 2** shows the yields y of number of coffee trees that were recorded to the nearest kilogram.

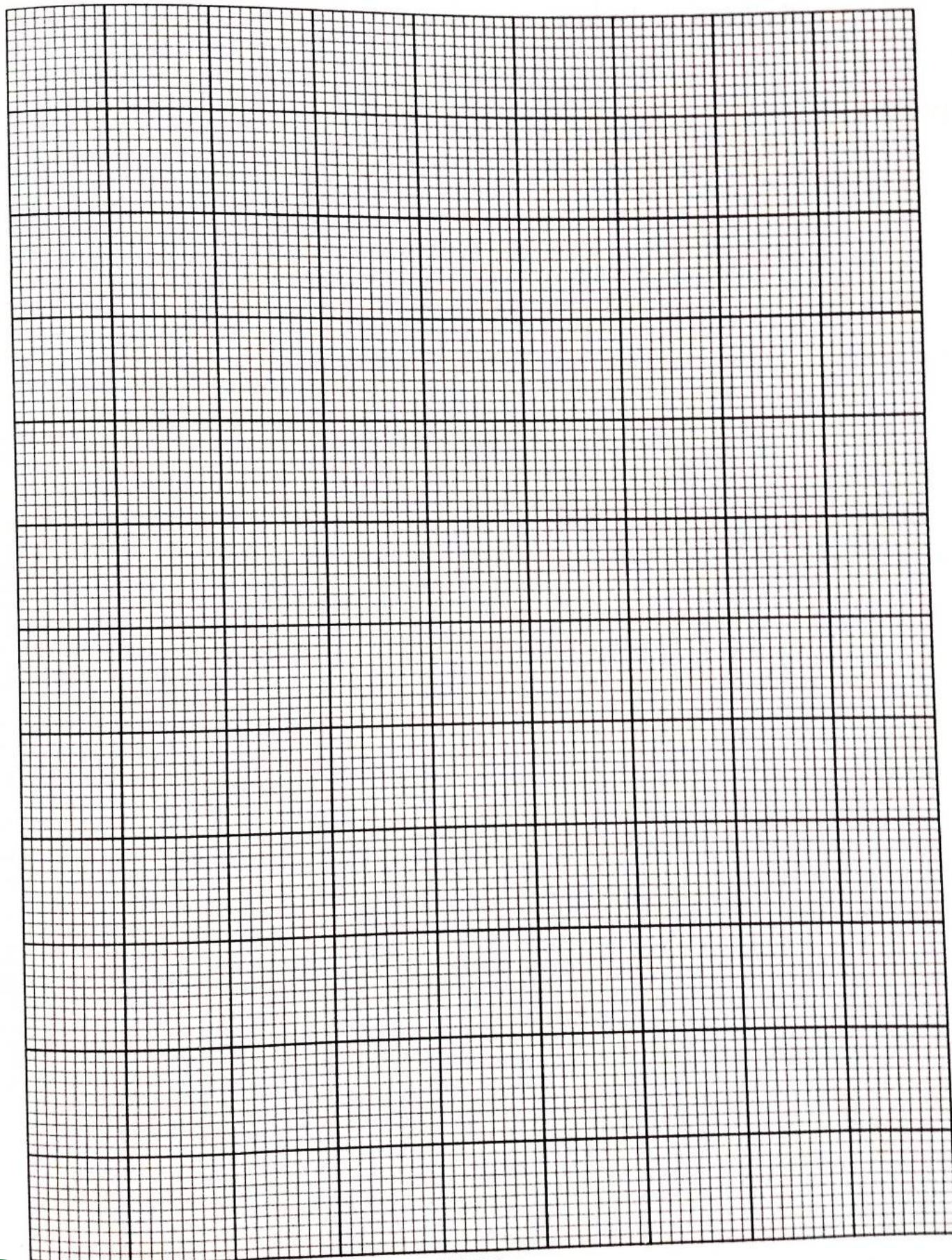
Table 2

Yield y (kg)	Frequency
$40 < y \leq 50$	1
$50 < y \leq 60$	5
$60 < y \leq 70$	7
$70 < y \leq 80$	4
$80 < y \leq 90$	2
$90 < y \leq 100$	1

- (i) Draw a cumulative frequency curve on the graph paper on **page 13**. (6 marks)
- (ii) Use the curve in (i) to find the 80th percentile. (4 marks)



9. b. (i) (Continued)



10. a. A stone is thrown vertically upwards with a velocity of 15m/s from the top of a tower 50m high. Calculate the time the stone will take to hit the foot of the tower. (10 marks)



Continued/...



10. (Continued)

b. Solve simultaneously by Matrix method the following equations

$$7x + 6y - 17 = 0$$

$$4y + 3x = 3.$$

(10 marks)

**END OF QUESTION PAPER****NB: This paper contains 15 printed pages.**