

132/II



MALAWI NATIONAL EXAMINATIONS BOARD

1997 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

ADDITIONAL MATHEMATICS ®

Subject Number: M132/II

Monday, 8 September

Time Allowed: 2 hrs 30 mins
1.30-4.00 pm

PAPER II (100 marks)

This paper contains 4 pages. Please check.

Answer all six questions in Section A and any two questions from Section B.

Section A carries 60 marks and Section B carries 40 marks.

Graph paper and four-figure mathematical tables will be provided.

Non-graphic calculators may be used.

All necessary working should be shown and any numerical expression being evaluated by calculator or mathematical tables must be clearly stated; otherwise marks for method may be lost.

The final answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

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).



Section A (60 marks)

Answer all six questions in this section.

1. Triangle ABC has vertices A(1,2,-2), B(3,1,1) and C(2,1,-3).
 - a. Find the vectors $\vec{AB}$ and $\vec{AC}$. (2 marks)
 - b. Show that $\angle A$ is a right - angle. (2 marks)
 - c. Find the area of $\triangle ABC$. (3 marks)
 - d. Find the vector equation of the line through B and C. (2 marks)

2. Points X, Y and Z have co-ordinates (0,-1), (2,5) and (4,1) respectively. Find:
 - a. the equation of the straight line through X and Y. (2 marks)
 - b. the slope of the line through Z perpendicular to XY, and hence its equation. (3 marks)
 - c. the point C where the perpendicular from Z to XY meets XY. (3 marks)
 - d. the distance from Z to XY. (2 marks)

3.
 - a. A particle with an initial velocity of 5 ms^{-1} takes 4 seconds to travel 100 metres under uniform acceleration. Find
 - (i) the acceleration of the particle.
 - (ii) the final velocity of the particle. (6 marks)
 - b. A car starts from rest and accelerates uniformly to a speed of 10 ms^{-1} in 3 seconds. It then travels at a constant speed for another 3 seconds and finally comes to rest in a further 4 seconds under constant retardation. By sketching the velocity-time graph, calculate the distance travelled. (4 marks)

4. Points A, B and C have co-ordinates (1,0), (3,0) and (2,4) respectively.
 - a. Find the mid-point D, of AC. (2 marks)
 - b. Find the equation of the line through D perpendicular to AC. (4 marks)
 - c. Given that $x = 2$ is a perpendicular bisector of line AB, find the centre and radius of the circle through A, B and C and hence its equation. (7 marks)

5. a. Two dice are rolled. Find the probability that
- (i) the sum of the numbers shown is 6.
 - (ii) the sum of the numbers shown is even.
 - (iii) at least one of the numbers shown is a 6. (6 marks)
- b. A fair coin is tossed six times. Find the probability of tossing exactly two heads. (4 marks)
6. The ages of a class of school children are given in Table 1 below.

Table 1

Age	11	12	13	14	15
Number of Pupils	2	6	10	8	4

- a. Find the mean age of the pupils. (4 marks)
- b. Given that the standard deviation is now 1.4 years, what will the mean and standard deviation be in 5 years' time? (2 marks)
- c. If ten 6 year old pupils joined the class, the standard deviation would increase. Give a reason for this. (2 marks)

Section B (40 marks)

Answer any two questions from this section.

7. a. A small boat travels through water at 8 km h^{-1} . On a certain day it is being steered due east, but there is a current running south at 2 km h^{-1} and the wind is blowing in the direction 150° at 4 km h^{-1} .
- (i) Find the magnitude of the resultant velocity of the boat.
 - (ii) If the pilot wishes to move due east, in what direction should he steer while maintaining the same resultant velocity? (10 marks)
- b. The points A, B and C have co-ordinates (2,4), (8,5) and (6,1) respectively.
- (i) Show OABC is a parallelogram.
 - (ii) Find the size of $\angle AOC$.
 - (iii) Find the area of OABC. (10 marks)

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a. Find:

(i) the equation of the circle centre $(-2, 1)$ which has the x -axis as one of its tangents.

(ii) where the line $y = \frac{4x}{3}$ meets the circle in (i) and name this line.

(9 marks)

b. Triangle OAB has vertices O $(0, 0)$, A $(1, 2)$ and B $(4, 0)$. Points C, D and E are the mid-points of OB, AB and OA respectively. Show AC, OD and BE intersect in one point and find the co-ordinates of the point.

(11 marks)

A lorry of mass 10 000 kg is travelling at 30 ms^{-1} when its brakes are applied for a period of 2 s.

a. If the braking force has the constant value of 20 000 N, find the final velocity.

(9 marks)

b. After the 2 s a child runs into the road 100 metres in front of the truck. What is the minimum braking force that must be applied in order to ensure that the truck does not hit the child?

(11 marks)

a. Table 2 shows marks obtained in a test by 100 pupils:

Table 2

Marks	0-39	40-49	50-59	60-69	70-100
Number of Pupils	20	30	25	13	12

(i) Estimate the mean.

(ii) Draw a histogram to illustrate this data.

(10 marks)

b. John and Mary play a game by rolling a fair die (with faces numbered 1 to 6). The first to roll a 6 wins. If John rolls first, find the probability that

(i) John wins on his first toss.

(ii) Mary wins on her first toss.

(iii) John wins on his second toss.

(iv) If Mary starts the second game, what is the probability that John wins both games on his first toss?

(8 marks)

c. A fair coin is tossed and comes down heads five times in succession. Find the probability that it will come down heads again the next time.

(2 marks)

END OF QUESTION PAPER

This paper contains 4 pages.

